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Background on the Program Management Office for the National Health Security Preparedness Index at the University of Kentucky

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THE UNIVERSITY OF KENTUCKY'S NHSPI TEAM

The University of Kentucky's National Health Security and Preparedness Index (NHSPI) Program Management Office is a consortium of four of the university's leading research centers that collaborate in producing, translating, and disseminating data and analyses to mobilize improvements in health and wellbeing: (1) the National Coordinating Center for Public Health Services & Systems Research (PHSSR) within the College of Public Health, (2) the Center for Business and Economic Research (CBER) within the College of Business and Economics; (3) the Division of Risk Sciences within the College of Communication and Information; and (4) the campus-wide Dissemination and Implementation Sciences Consortium (DISC). Brief descriptions of these inter-related centers and their key personnel, who form the core of the NHSPI Program Management Office, appear below along with links to examples of their relevant research.

THE NATIONAL COORDINATING CENTER FOR PHSSR

The National Coordinating Center for PHSSR has served as a national leader for the study of public health delivery in the United States since 2004, working closely with a broad array of governmental and private stakeholders that comprise public health delivery systems at local, state, and national levels. As a National Program Office of the Robert Wood Johnson Foundation (RWJF), the Center maintains infrastructure that supports scientific and administrative direction for two complimentary RWJF national programs. The Public Health Services and Systems Research Program encompasses both extramural and intramural research studies designed to produce new knowledge about how best to organize, finance, and deliver public health strategies in different institutional and community contexts. More than 100 studies have been launched through this program to date. The Public Health Practice-Based Research Networks (PBRN) Program cultivates academic-practitioner partnerships designed to address real-world evidence needs and to study naturally-occurring innovations in public health practice and policy through collaborative research project development, implementation, and translation. This program engages more than 2000 state and local public health agencies and more than 50 academic research centers in 31 states in PBRN research networks that conduct applied research and analysis projects on public health organization, financing, and delivery.

Glen Mays, PhD, MPH (Director, NHSPI Program Management Office) is director of the National Coordinating Center and the Scutchfield Endowed Professor of Health Services and Systems Research at the University of Kentucky College of Public Health, in the Department of Health Management and Policy. He studies strategies for organizing and financing public health, preventive services, and prevention policy, with a focus on estimating the health and economic effects of these efforts. He is also the founding director of the RWJF-supported Public Health Practice-Based Research Networks Program. Mays' work includes the National Longitudinal Survey of Public Health Systems, which since 1998 has followed a nationally representative cohort of U.S. communities to examine the implementation and impact of multi-organizational public health strategies. Dr. Mays cultivates a considerable record of scholarship in measurement development and validation, analytic model development and estimation, and simulation analysis applied to public health programs and policies, including emergency preparedness research. He serves as a member of the scientific advisory committee for the America's Health Rankings program supported by the United Health Foundation, and has also served as a scientific consultant for the RWJF-supported County Health Rankings program. Dr. Mays chaired the 2008 expert panel for the U.S. Department of Health and Human Services that developed the Federal Research Agenda on Emergency Preparedness and Public Health

Systems, and serves as a member of another HHS expert panel formed in 2013 to develop Methods for Cost Estimation of Emergency Preparedness Capabilities. He served as a member of the Institute of Medicine Committee on Public Health Strategies to Improve Health, which developed the 2010 report *For the Public's Health: Using Measurement to Drive Action and Accountability.* He also served as a member of the External Advisory Board for UCLA's CDC-funded Preparedness and Emergency Response Research Center (PERRC), and served as a project PI for the PERRC based at UNC-Chapel Hill. Dr. Mays earned his undergraduate degree in political science from Brown University, MPH and PhD degrees in health services research from UNC-Chapel Hill, and completed a postdoctoral fellowship in health economics at Harvard Medical School. Examples of his work include:

- Improving public health preparedness capacity measurement: development of the local health department preparedness capacities assessment survey. (Disaster Medicine and Public Health Preparedness 2014).
- Evidence links increases in public health spending to declines in preventable deaths. (*Health Affairs* 2011).
- <u>Understanding the organization of public health delivery systems: an empirical typology</u>. (*Milbank Quarterly* 2010).
- <u>Geographic variation in public health spending: correlates and consequences</u>. (*Health Services Research* 2009).

Anna Goodman Hoover, Ph.D. (Deputy Director, NHSPI Program Management Office) is deputy director of the National Coordinating Center and studies the use of participatory and convergent communication strategies to support decision-making for evidence-based public health, preparedness, and public planning initiatives. She has received support for these efforts from the National Institute of Environmental Health Sciences, the U.S. Environmental Protection Agency, the U.S. Department of Energy, and the Kentucky Division of Water. As deputy director of the National Coordinating Center for PHSSR and Public Health PBRNs, Dr. Hoover works closely with intramural and extramural investigators, Public Health PBRNs, potential research end-users, and other translational partners to ensure that study findings positively impact the real-world organization, financing, and delivery of public health Management and Policy, Dr. Hoover is a founding member of the University of Kentucky Dissemination and Implementation Sciences Consortium and an active partner in federally-funded participatory risk communication projects managed by the Division of Risk Sciences. Examples of her work include:

- When people outside the organization need information: strategically communicating with external stakeholders (Workplace Communication for the 21st Century 2013).
- Public health research implementation and translation: lessons from practice-based research networks (American Journal of Preventive Medicine 2013).

THE CENTER FOR BUSINESS AND ECONOMIC RESEARCH

The Center for Business and Economic Research (CBER) at the University of Kentucky brings expertise in translational research with key business and economic stakeholders on issues that are central to the future development of NHSPI, including economic development, housing, transportation, tourism, labor and human resources, and public financing. CBER is the applied economic research branch of the Carol Martin Gatton College of Business and Economics, housed within the Department of Economics for over 30 years. CBER has a long history of conducting applied economic studies and is the leading source of economic measures and information for state policy makers. Its purpose is to disseminate economic information and provide economic and policy analysis to assist decision makers in both the public and private sectors. CBER performs research projects for federal, state, and local government agencies, as well as for private-sector clients nationwide. Its projects reveal the Center's close engagement with the business and policy communities, evidenced by studies on manpower, labor and human resources; tourism economics; transportation economics; health economics; regulatory reform; public finance; technology use and adoption; education policy; and economic growth and development.

Chris Bollinger, Ph.D. (Analytic Consultant for the NHSPI Program Management Office) is the director of CBER and the Gatton Professor of Economics at the University of Kentucky Gatton College of Business and Economics, where his research focuses on measurement and estimation of microeconomic models that analyze a wide range of U.S. social and economic endeavors, including specifically urban economics and labor economics issues. A widely recognized expert in econometric modeling and analysis, his work has been published in such journals as the *Journal of Urban Economics*, the *Journal of Labor Economics*, the *Review of Economics and Statistics*, the *Journal of the American Statistical Association*, and the *Journal of Econometrics*. Examples of his work include:

- Education and Unemployment
- <u>The Changing Nature of Manufacturing</u>
- Down from the Mountain: Wage Structure in Appalachia and the U.S.
- Food Stamp Program Participation among Immigrants and Refugees

Michael Childress, M.A. (Program Manager for the NHSPI Program Management Office) is a research associate at the Center for Business and Economic Research at the Gatton College of Business and Economics and is a founding member of the Dissemination and Implementation Sciences Consortium, both at the University of Kentucky. He previously served 17 years as executive director of the Kentucky Long-Term Policy Research Center, a state government agency created by the Kentucky General Assembly to bring a future-oriented perspective to decision-making in the Commonwealth. The work of the Center included research, policy analysis, communications with all branches of government, and public outreach. In this capacity he directed the Center, Mr. Childress served as an analyst at the RAND Corporation in Santa Monica, California. Examples of his work at CBER include:

• The <u>Annual Kentucky Economic Report</u>, a statutorily required report of state economic activity and performance.

- <u>Increasing Returns to Kentucky's Investments in Education</u>, including <u>index</u> of obstacles to cost-effective educational spending, and a <u>50-state ranking</u> of education systems:
- Issue Brief: Internet Access and Use in Kentucky.
- <u>Child Care in Kentucky</u>.
- Estimating Kentucky's Undocumented Population.
- Bridging the Achievement Gap: Alternative Scenarios and Approaches

THE DIVISION OF RISK SCIENCES

Located in the University of Kentucky College of Communication and Information, the Division brings together researchers across disciplines to provide broader, more systemic and interdisciplinary approaches for understanding how to manage risks and crises. Initiatives include media tracking for organizations and government agencies that need to know how messages are being communicated by the media and received by the public; participatory community-based research to develop messages most relevant to audiences; and network analyses to describe how relationships in groups or organizations affect safety practices.

Timothy Sellnow, Ph.D. (Risk Communication Consultant for the NHSPI Program Management Office) is theme leader for Risk Communication Research for the National Center for Food Protection and Defense, a national center of excellence sponsored by the Department of Homeland Security. A professor of communication at the University of Kentucky and a past editor of the National Communication Association's Journal of Applied Communication Research, he has conducted funded research for the Department of Homeland Security, the United States Department of Agriculture, and the Centers for Disease Control and Prevention. Dr. Sellnow has published numerous journal articles and chapters and has co-authored four books on risk and crisis communication. Examples of his work include:

- Expanding the Concept of Significant Choice through Consideration of Health Literacy During Crises (Health Promotion Practice 2013).
- <u>Message Convergence as a Message-Centered Approach to Analyzing and Improving Risk</u> <u>Communication</u> (*Journal of Applied Communication Research*, 2013).
- <u>Lessons Learned about Protecting America's Food Supply</u> (USDA Cooperative State Research, Education, and Extension Service 2009).
- Crisis and Emergency Risk Communication as a Theoretical Framework for Research and Practice (Health Promotion Practice 2008).

THE DISSEMINATION AND IMPLEMENTATION SCIENCES CONSORTIUM

The <u>Consortium</u> conducts evidence-based, transdisciplinary research designed to accelerate the uptake of research findings into practice and policy in a wide array of human endeavors. The Consortium builds capacity to strengthen the innovation infrastructure of scientists and practitioners in diverse disciplines and contributes to the building of research and organizational capacity for dissemination and implementation. The Consortium is closely linked with the University of Kentucky's NIH-supported <u>Center for Clinical and Translational Science</u> (<u>CCTS</u>), and engages research faculty and staff across campus. Dr. Hoover and Mr. Childress named above are active participants in the Consortium, and Dr. Mays leads the Comparative Effectiveness Research program of the CCTS.

APPENDIX - RELEVANT PUBLICATIONS

ORIGINAL RESEARCH

Improving Public Health Preparedness Capacity Measurement: Development of the Local Health Department Preparedness Capacities Assessment Survey

Mary V. Davis, DrPH, MSPH; Glen P. Mays, PhD, MPH; James Bellamy, PhD, MPH; Christine A. Bevc, PhD, MA and Cammie Marti, PhD, MPH

ABSTRACT

- **Objective:** To address limitations in measuring the preparedness capacities of health departments, we developed and tested the Local Health Department Preparedness Capacities Assessment Survey (PCAS).
- **Methods:** Preexisting instruments and a modified 4-cycle Delphi panel process were used to select instrument items. Pilot test data were analyzed using exploratory factor analysis. Kappa statistics were calculated to examine rater agreement within items. The final instrument was fielded with 85 North Carolina health departments and a national matched comparison group of 248 health departments.
- **Results:** Factor analysis identified 8 initial domains: communications, surveillance and investigation, plans and protocols, workforce and volunteers, legal infrastructure, incident command, exercises and events, and corrective action. Kappa statistics and *z* scores indicated substantial to moderate agreement among respondents in 7 domains. Cronbach α coefficients ranged from 0.605 for legal infrastructure to 0.929 for corrective action. Mean scores and standard deviations were also calculated for each domain and ranged from 0.41 to 0.72, indicating sufficient variation in the sample to detect changes over time.
- **Conclusion:** The PCAS is a useful tool to determine how well health departments are performing on preparedness measures and identify opportunities for future preparedness improvements. Future survey implementation will incorporate recent Centers for Disease Control and Prevention's Public Health Preparedness Capabilities: National Standards for State and Local Planning. (*Disaster Med Public Health Preparedness*. 2013;7:578-584)

Key Words: preparedness measurement, instrument development

ocal health departments (LHDs) are essential to emergency preparedness and response activities. They have statutory authority to perform key functions including community health assessments and epidemiologic investigations, enforcement of health laws and regulations, and coordination of the actions of the agencies in their jurisdictions that comprise the local public health system.¹ However, preparedness also involves specialized functions in incident command, countermeasures and mitigation, mass health care delivery, and management of essential health care supply chains.² Moreover, effective emergency preparedness and response may require the performance of routine public health activities under unusual time pressure and resource constraints. Consequently, the ability of an LHD to perform routine public health activities under usual conditions may not predict its capacity for performing emergency preparedness and response activities.³

Federal, state, and local public health agencies have made substantial investments to improve the preparedness capacities and capabilities of state and local public health agencies.⁴ A lack of valid and reliable data collection instruments, however, has made it difficult to determine whether the investments have improved state and local public health capacities to effectively prevent, detect, or respond to public health emergencies. Although a number of instruments collect self-reported data on the preparedness of state and local public agencies, few of these instruments have been subjected to formal validity and reliability testing.³

Existing conceptual models of public health system performance, which are grounded in organizational sociology and industrial organization economics, stress the importance of structural characteristics of public health agencies and their relationships with other organizations in the public health system.⁵⁻⁷ These structural characteristics determine the capacity of the system to respond to public health threats, including statutory authority, financial and human resources, governance structures, and interorganizational relationships with both governmental and private organizations that have relevant resources and expertise.

Valid, reliable measures of LHD preparedness can be used to determine performance levels and identify performance gaps and potential sources of performance variation. Addressing these gaps and reducing unwarranted variation are critical to assuring an appropriate public health response to a variety of public health threats, such as pandemic influenza.⁸ To date, one critical road block to developing valid, reliable instruments to measure preparedness capacities has been the lack of consensus on a definition of LHD preparedness.² Further, using a structure–process–outcome framework, measurement has been limited to structure and process, with little measurement of outcomes.^{2,9} Finally, although some preparedness measures have examined nationwide performance, most measurements and assessments have been made at the state level only.⁴

When viewed through the classic structure–process–outcome framework, conceptual challenges for measuring public health emergency preparedness among LHDs include a lack of widely accepted standards for preparedness and a weak evidence base linking structures and processes to outcomes. To address these limitations in measuring LHD preparedness capacities, the North Carolina Preparedness and Emergency Response Research Center developed and tested the Local Health Department Preparedness Capacities Assessment Survey (PCAS) from 2008 to 2010.

METHODS

Instrument Development

The PCAS drew on elements from several instruments that offered reasonable clarity in measurement, a balance between structural and process measures, and support from prior, although limited, validity and/or reliability testing on several of the instruments. The instruments used in survey development included the following:

- The Public Health Preparedness and Response Capacity Inventory developed by the Centers for Disease Control and Prevention (CDC).¹⁰ This instrument contains 79 questions and approximately 700 subquestions that measure capacity in 6 preparedness domains, including planning and assessment, laboratory capacity, general communications and information technology, risk communication and dissemination, and education and training.¹¹
- The National Public Health Performance Standards Program, Local Instrument (version 2.0) developed through a partnership between the CDC and other national public health organizations. This instrument contains 27 items in

the performance standard devoted to emergency preparedness, investigation, and response. $^{1,12\text{-}15}$

- The CDC's Public Health Preparedness Cooperative Agreement Performance Measures. Reporting guidance includes 6 items related to detection and reporting, communication and control, and after-action improvement.¹⁶
- The Connectivity in Public Health Preparedness Measurement Tool developed to measure connectivity among preparedness-related organizations and personnel.¹⁷ This instrument contains 28 items on information exchange, communication, and interaction at system, organizational, and interpersonal levels.¹⁷⁻¹⁹

We used a modified 4-cycle Delphi panel process to select items from each instrument to create an instrument with content and face validity.²⁰ This strategy is used to gain consensus among a panel of experts through multiple rounds of questionnaires and feedback. The 4 panel members had expertise in public health preparedness research and practice. The Delphi panel process was conducted through email and a series of conference calls. From this process, we developed a public health emergency preparedness instrument that included 116 items.

The items were organized into a web-based, self-administered instrument for pilot testing with diverse LHDs. Pilot testing requested each LHD to complete 1 survey by involving key administrative and preparedness staff. Following survey completion, cognitive interviews with staff who completed the survey were conducted to (1) explore the process that individuals and LHDs used to complete the instrument, (2) obtain feedback on instrument content and structure, and (3) identify items on which individuals within an agency disagreed.

The research team revised the instrument based on pilot testing and cognitive interviews, as well as a study on health department response to the H1N1 epidemic.²¹ The final instrument contains 58 questions with 211 subquestions. The questions ask LHDs to report if they have a specific capacity, with related subquestions to determine whether they have specific elements associated with the particular capacity. See Table 1 for a summary of instrument domains and description of capacities measured.

In 2010, the research team fielded the final instrument with the 85 North Carolina (NC) LHDs and 247 comparison health departments, which were identified using a propensity score matching methodology (referred to here as survey wave 1) as part of a study to examine differences between a state with LHDs exposed to an accreditation program (NC) and those in states without an accreditation program. Approximately 1900 local public health agencies were eligible for possible matching with NC agencies. Matching was based on data from the 2008 National Association of

Summary of Preparedness Capacities Assessment Survey Domains and Capacities

Domain	Description of Capacities Measured
Surveillance and investigation	Handling of urgent case reports Access to public health surveillance system Electronic storage of local case report data Specimen transportation system
Plans and protocols	Capability and components of surge capacity Formal case investigation components and protocol All-hazards emergency preparedness and response plan
Workforce and volunteers	Type and maintenance of volunteer registry Identification and training of emergency preparedness staff Assessment of emergency preparedness workforce
Communication and information dissemination	Emergency communication plans and procedures Capacity and assessment of communication technologies Use of health alert network
Incident command	Use of emergency operations center Local incident command structure
Legal infrastructure and preparedness	Review of legal power and authority in emergency preparedness and response Access and use of legal counsel Extent of legal power and authority in emergency preparedness and response
Emergency events and exercises Corrective action activities	Determination of emergency events and exercises Debriefing activities Evaluation activities Reporting activities

County and City Health Officials National Profile of Local Health Departments survey, containing measures of the organizational, financial, and operational characteristics of LHDs and their service areas. Propensity scores were estimated from a logistic regression equation that modeled the likelihood of exposure as a function of 14 public health agency characteristics and community or system characteristics. This model's empirical specification reflected the approach used in previous studies of public health system performance, including controls for public health agency staffing levels, scope of services delivered, annual agency expenditures per capita, population size served, socioeconomic characteristics of the community, and other health resources within the community.^{14,22} The nearest neighbor method was used to pair each NC LHD with a comparison agency from another state (1:1, best match), with random selection used to choose among comparison LHDs having the same propensity score.^{23,24} To ensure adequate response rate, additional comparison LHDs were included in the sample.

The instrument was programmed for web-based administration with an option for paper completion. Letters of invitation containing information about the study's purpose and instructions to complete the survey were sent to the director and emergency preparedness coordinators of each selected LHD. Postcard and telephone reminders were sent to nonresponding LHDs to achieve a targeted response rate of 80%.

Analysis

Pilot test data were analyzed using exploratory factor analysis to examine the underlying dimensions of preparedness that are reflected in the specific preparedness activities measured. A varimax (orthogonal) rotation method was used to ensure the most parsimonious and robust solution. However, we tested the sensitivity of results to this assumption by recomputing factor loadings using promax (oblique) rotation. Guided by this analysis, we then constructed a principal factor composite variable for each underlying preparedness domain (factor) by computing the unweighted mean and standard deviation of the subset of activity measures that were correlated in each dimension. Reliability measures include kappa statistics with associated z scores, and probabilities were calculated to examine rater agreement within items in domains and agencies.^{25,26} With the larger sample of survey wave 1 data, we assessed the internal correlation of each domain through interclass correlation coefficients and interrater reliability.

RESULTS

Eleven public health agencies in 3 states (Missouri, Kentucky, and Tennessee) completed the pilot test survey and participated in cognitive interviews. Survey respondents and cognitive interview participants included 12 emergency preparedness personnel, 6 health directors, 4 epidemiologists, and 6 individuals in other job classifications. Themes from cognitive interviews emphasized that emergency preparedness

Pilot Test Inter-Rater Reliabilit	y of Preparedness	Capacities Assessment	Survey Preparedno	ess Measures
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Measure	Agreement, %	Expected Agreement, %	Weighted kappa	SE	Z	P> <i>z</i>
All measures	98.73	95.37	0.7262	0.0299	24.29	0
Measures by domain						
Surveillance and investigation	96.41	93.06	0.4822	0.0703	6.86	0
Plans and protocols	96.81	90.29	0.6719	0.0589	11.4	0
Workforce and volunteers	91.47	90.06	0.1417	0.0991	1.43	.0763
Communication	96.97	90.21	0.6903	0.0744	9.27	0
Legal infrastructure	81.82	70.18	0.3902	0.1338	2.92	.0018
Events and exercises	98.48	92.69	0.7927	0.0578	13.72	0
Measures by agency						
Agency 1	99.09	95.14	0.8125	0.0983	8.26	0
Agency 2	98.34	95.42	0.6371	0.0967	6.59	0
Agency 3	98.58	93.87	0.7677	0.0981	7.82	0
Agency 4	98.50	95.19	0.6873	0.0994	6.92	0
Agency 5	96.72	92.72	0.5493	0.0961	5.72	0
Agency 6	98.13	91.71	0.7745	0.0979	7.91	0
Agency 7	99.33	95.21	0.8595	0.0995	8.64	0
Agency 8	96.26	89.83	0.6323	0.0991	6.38	0
Agency 9	98.08	93.43	0.7081	0.0993	7.13	0
Agency 10	95.49	90.80	0.5097	0.0961	5.3	0
Agency 11	97.96	93.43	0.6894	0.0968	7.12	0

is a team effort in which different health department personnel have a different working knowledge of facets of preparedness. Health directors have a broad knowledge of emergency preparedness, epidemiologists have in-depth knowledge in a certain area, and preparedness coordinators have the most all-around knowledge. Thus, the research team concluded that the final instrument should be completed by multiple health department staff and should be provided to health departments in a way to facilitate completion by multiple staff.

The larger survey wave 1 includes 264 respondents (RR = 79.3%), a majority (61.6%) of whom are governed by a local board of health. The sample is evenly distributed between LHDs within metropolitan statistical areas (MSAs) (51.7%) versus those in non-MSAs (48.3%). LHDs responding to the survey reported an average of 96 full-time employees (FTEs) (median = 54), with some LHDs providing services with as few as 2 FTEs and others with upward of 1025 FTEs in their department. These LHDs and their FTEs serve between 4000 and 1 484 645 residents in their respective counties, with a median population of 54 261 (mean = 109803). The percentage of residents within these counties living at or below the poverty line ranges from 2.9% to upward of 26.5%, with an average of 12.7%. On average, responding LHDs spend \$68.86 per capita (adjusted expenditures) (range: 0.68-358.97, median = 53.12). There were no significant differences in the characteristics of responding LHDs when compared with the total sample based on a Welch 2-sample t test between total sample and respondents.

Psychometric Testing

Based on pilot test data, factor analysis was used to identify 8 initial domains measuring capacities and capacity-related elements; 7 of these domains performed well on the psychometric measures (Cronbach $\alpha > 0.6$) with sufficient variation in mean scores to differentiate health departments. We identified these domains as communications, surveillance and investigation, plans and protocols, workforce and volunteers, legal infrastructure, incident command, and exercises and events. The eighth domain, partnerships, had insufficient variation to merit measurement. To the 7 domains, we revised and increased the number of items to assess corrective actions and quality improvement activities. Table 1 outlines and describes the domains and capacities measured within them.

For 3 of the domains—communication, plans and protocols, events and exercises—kappa statistics ranged from 0.67 to 0.79, indicating substantial agreement among raters with statistically significant z scores (Table 2). For surveillance and investigation and legal infrastructure domains, kappa statistics 0.48 and 0.39, respectively, indicated moderate to fair agreement with statistically significant z scores. For the workforce and volunteers domain, the kappa statistic of 0.14 indicated slight agreement, although the z score is not statistically significant. Kappa statistics were also calculated to examine the agreement of raters within agencies. Within agencies, kappa values ranged from 0.51 to 0.85, indicating moderate to strong agreement among raters, with statistically significant z scores.

Internal Consistency Reliability of Preparedness Capacities Assessment Survey Preparedness Measures, Survey Wave 1

Measure	Items	α	Average Item Covariance
All measures (total preparedness) Measures by domain	144	0.933	0.018
Surveillance and investigation	20	0.762	0.031
Plans and protocols	25	0.855	0.044
Workforce and volunteers	21	0.596	0.019
Communication	33	0.082	0.028
Incident command	5	0.703	0.446
Legal infrastructure	8	0.605	0.041
Events and exercises	4	0.629	0.050
Corrective action	28	0.929	0.074

TABLE 4

Preparedness Capacities Assessment Survey Wave 1 Validation Study

Composite Variable	Items	Mean	SD	
Surveillance and investigation	20	0.4398	0.1759	
Plans and protocols	25	0.6116	0.2106	
Workforce and volunteers	21	0.4161	0.1352	
Communications	33	0.5609	0.1688	
Incident command	5	0.7242	0.2955	
Legal infrastructure	8	0.6823	0.2021	
Events and exercises	4	0.9413	0.1833	
Corrective action	28	0.6268	0.2729	

Table 3 presents results of internal consistency and general reliability tests of PCAS preparedness measures from the survey wave 1 sample. The number of items in each domain ranged from 5 to 33. The Cronbach α coefficients ranged from 0.605 for legal infrastructure to 0.929 for corrective action. Overall, the resulting α values indicated a high level of internal consistency among items. In addition, Table 3 presents the average inter-item covariance among the items, which show a very low variance among the measures.

Table 4 presents the survey wave 1 means and standards deviations for each of the domains, calculated from a simple additive index measure of corresponding preparedness capacities. The resulting means ranged from 0.41 for workforce and volunteers to 0.94 for events and exercises. The mean score for incident command was also quite high (0.72). Mean scores were in the mid-range (0.41-0.56) for 3 domains and moderately high (0.61-0.72) for 4 domains, indicating that variation in the sample on these measures is sufficient to allow detection of variation on key domains and improvement over time.

DISCUSSION

We used multiple processes to construct a valid and reliable survey instrument to measure preparedness capacities of LHDs. Processes included identifying appropriate instruments from which to draw items, identifying critical practices through engaging experts in a Delphi process, and conducting a thorough pilot test of the draft instrument with cognitive interviewing. The resulting instrument demonstrated face and content validity, along with strong internal consistency and general reliability.

The final 8 survey domains reflected LHD standard preparedness practice.^{2,27} Survey wave 1 LHDs had high mean scores on events and exercises and incident command. This finding may have reflected funding and standard practice during the years preceding the survey. Mean scores on the remaining domains were moderate, indicating that there is variation in practice. Measurement with report feedback to LHDs could provide them with improvement opportunities. We provided customized reports to each responding LHD designed to facilitate LHD benchmarking and improvement processes. Several LHDs have reported that they found these customized reports to be very useful for these purposes as well as for strategic planning and workforce development.

Limitations

Several limitations to these results are worth noting. First, as with most survey research, data are self-reported and may contain potential response bias. Some authors have advocated verifying self-report through a site visit or having external observers measure performance,²⁸ vet the resources needed to verify self-reports on a national scale could be prohibitive. Second, given the simple additive nature of the domains and the diversity of capacities measured in them, findings can only be meaningfully presented at the domain level. With strong interest in index measures, it is important for future discussions to more clearly communicate the extent to which creating a single measure or index of indicators can truly measure the entire construct of preparedness. Third, as designed, these capacities are implicitly weighted equally. However, given the lack of evidence connecting capacities, capabilities, and performance, there is a persistent debate surrounding the measurement and assessment relationships in public health preparedness.²⁷ In the present discussion, the focus is directed toward the development process associated with the PCAS instrument. In the perpetual effort to introduce valid and reliable measurement instruments, this study used the rigorous analytic methods necessary to support the measurement of public health preparedness.

CONCLUSION

Results from the survey wave 1 participants in this study add to the few that have assessed public health preparedness and response and support the assertion that wide variations exist in capacity and practice across communities.²⁸ The causes of variation and deficiency in public health preparedness are likely to parallel those of undesirable variation in routine public health system performance, although with some key differences. The evidence about what constitutes effective public health preparedness is extremely thin, which means that professional uncertainty is greater in this arena than in routine practice.³ Similarly, a number of different performance standards for preparedness have been developed by various agencies and organizations, resulting in overlapping and sometimes inconsistent recommendations and program requirements. At the same time, heterogeneity in the composition and structure of public health systems is an important source of variation in preparedness, as in other aspects of public health practice.²⁹

In several areas of public health, evidence-based or consensus-based guidelines, including preparedness, do not yet exist, suggesting a need for more research to identify effective practices.^{30,31} Studies suggest that professionals may not be aware of existing guidelines or they may lack the financial resources, staff, or legal authority needed to adhere to the guidelines.³²⁻³⁵ Since 2011, state and local health departments have become increasingly aware and educated on the Public Health Preparedness Capabilities: National Standards for State and Local Planning, released by the CDC, which consists of 15 preparedness capabilities and associated functions intended to assist in strategic planning (http://www.cdc.gov/phpr/capabilities/ Accessed January 28, 2013). Our comparison of the present PCAS measures and CDC capabilities yielded an overlap slightly greater than 60%.36 While there is a present shift from capacities to capabilities, the elements underpinning the present public health emergency preparedness capabilities reflect the essential and vital capacities for local and state health departments to effectively build and maintain their preparedness capabilities. In a dynamic policy environment, it is important to maintain a more fundamental understanding of the capacities and elements that contribute to levels of local preparedness. This resulting instrument and the process used to generate it will be a useful tool to help federal, state, and local health departments determine how well public health agencies are performing on preparedness measures and identify opportunities for future preparedness improvements.

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By Glen P. Mays and Sharla A. Smith

Evidence Links Increases In Public Health Spending To Declines In Preventable Deaths

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ABSTRACT Public health encompasses a broad array of programs designed to prevent the occurrence of disease and injury within communities. But policy makers have little evidence to draw on when determining the value of investments in these program activities, which currently account for less than 5 percent of US health spending. We examine whether changes in spending by local public health agencies over a thirteen-year period contributed to changes in rates of community mortality from preventable causes of death, including infant mortality and deaths due to cardiovascular disease, diabetes, and cancer. We found that mortality rates fell between 1.1 percent and 6.9 percent for each 10 percent increase in local public health spending. These results suggest that increased public health investments can produce measurable improvements in health, especially in low-resource communities. However, more money by itself is unlikely to generate significant and sustainable health gains; improvements in public health practices are needed as well. Glen P. Mays (gpmays@ uams.edu) is a professor in and the chairman of the Department of Health Policy and Management at the Fay W. Boozman College of Public Health, University of Arkansas for Medical Sciences, in Little Rock.

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espite devoting far more resources to health than any other country in the world, the United States continues to lag behind many other industrialized nations in health outcomes, including morbidity and mortality.¹ Although there are many factors that contribute to this gap between resources and outcomes, one possible contributor is the relatively limited investment in public health activities that are designed to promote health and prevent disease and disability.²⁻⁵ These activities include efforts to monitor community health status; investigate and control disease outbreaks; educate the public about health risks and prevention strategies; enforce public health laws and regulations such as those concerning tobacco use; and inspect and ensure the safety and quality of water, food, air, and other resources necessary for health.6

Although national data on public health spending are scarce and imperfect, estimates

consistently indicate that less than 5 percent of national health spending is devoted to public health activities.⁷⁻⁹ In fact, the United States spends more on administrative overhead for medical care and health insurance than it does on public health activities.¹⁰

The resources invested in public health strategies within the United States vary widely across states and communities, yet the effects of this variation on population health remain poorly understood. Consequently, public health officials and policy makers face considerable uncertainty regarding the appropriate levels and targets of investing in public health activities.

The Affordable Care Act of 2010 authorized the largest expansion in federal public health spending in decades—a projected \$15 billion in new spending over ten years—with the goals of improving population health, reducing health disparities, and helping to "bend the cost curve" by moderating growth in medical care spending. However, uncertainties regarding the expected effect and value of these public health investments have contributed to the political controversy surrounding the Affordable Care Act.^{11,12} Meanwhile, a persistent economic downturn has precipitated large cuts in state and local government support for public health activities, which has raised concerns about future adverse consequences for population health.

To shed light on these uncertainties, this study uses measures of public health spending from local public health agencies over a thirteen-year period to estimate the effects of this spending on preventable mortality rates.

Background

Public health activities in the United States are supported through a patchwork of funding sources and financing arrangements that vary widely across states and communities and that are relatively unstable over time.^{13,14} These arrangements result in large geographic differences in spending for public health activities, even among communities with relatively similar population characteristics and health needs.¹⁵

At the state level, per capita public health spending varied by a factor of more than thirty in 2010, ranging from a low of less than \$4 in Nevada to a high of more than \$171 in Hawaii.⁹ Local variation in public health spending was even larger, ranging from less than \$1 per capita to more than \$200 per capita in 2008; among local public health agencies the median spent was about \$36 per person.¹⁶ Many communities depend heavily on local tax bases to support public health programs, making it difficult for economically disadvantaged communities to support a comprehensive array of activities.¹⁷ Because only 16 percent of funding for public health activities is derived from the federal government,⁷ federal spending is insufficient to equalize large differences in funding-from taxes-of public health programs across localities.18

The amount of resources expended on public health activities in a given community is determined through a complex interaction of economic conditions and fiscal capacities, community health needs, policy priorities, and delivery system characteristics.¹⁵ Community-level variation in public health spending may result from differences in the mix of activities produced; differences in the volume, intensity, and quality of activities produced; and differences in the production and delivery costs incurred.

Higher levels of spending may contribute to improved population health if resources are allocated to activities that are effective in reducing health risks, and if these activities are targeted successfully to population groups at risk. However, communities may vary considerably in how effectively and efficiently resources are used to address community health needs, thereby weakening the effect of spending on population health. Research has documented such disconnects between spending and outcomes in local medical care delivery.¹⁹

On balance, there is very little empirical evidence about the extent to which differences in public health spending levels contribute to differences in population health.²⁰ Several crossnational studies have found weak and conflicting associations between spending and health outcomes at a national level.^{21–23} In the United States, several time-series studies have examined associations between spending levels and health outcomes for specific types of programs such as those targeting HIV prevention, sexually transmitted disease prevention, and tobacco control, finding that disease incidence and/or harmful behaviors declined as expected in response to funding increases.^{24–28}

However, very little attention has been paid to the value of investments in the public health system as a whole, leading to persistent questions about whether the nation's current spending levels are worth the opportunity costs. Better evidence about the consequences of these spending patterns is likely to help policy makers at all levels of government make informed decisions about how to allocate scarce health resources.

To this end, we assembled a unique longitudinal database that included local government public health spending, population characteristics, and community mortality rates, in order to estimate how changes in public health spending influence population health. We used the considerable natural variation in public health spending levels across communities, and the considerable change in these levels over time, to estimate health effects.

This study focuses on spending and health at the local level because local public health agencies—rather than their state and federal counterparts—assume primary responsibility for directly implementing public health activities in most communities.²⁹ Most federal and state funding—and large amounts of private philanthropic funding—for public health activities is channeled through local public health agencies. The local agencies also mobilize and coordinate the public health activities of hospitals, health plans, and community-based organizations.³⁰ Thus, these agencies provide valuable settings in which to study the health consequences of public health spending in the United States.

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Study Data And Methods

We analyzed changes in spending patterns and mortality rates within the service areas of the nation's nearly three thousand local public health agencies over a thirteen-year period. The study population included all organizations that met the National Association of County and City Health Officials' definition of a local health department: a unit of a local or state government that has responsibility for performing public health functions for a geopolitical jurisdiction smaller than a state.¹⁶ In 2005 approximately 73 percent of these agencies served county jurisdictions or combined city and county jurisdictions, and the remaining agencies served city or township jurisdictions (16 percent), or multicounty or regional jurisdictions (11 percent).

DATA SOURCES AND MEASURES The National Association of County and City Health Officials collected spending data along with organizational and operational characteristics of local public health agencies through census surveys conducted in 1993, 1997, and 2005. Key variables reflecting annual agency spending, service offerings, and staffing levels were collected in each year of the survey. We linked the survey data with contemporaneous county-level data on population characteristics and health resources from the Health Resources and Services Administration's Area Resource File (a national county-level health resource information database), federal and state spending estimates from the Census Bureau's Consolidated Federal Funds Report and Census of Governments, and cause-specific mortality rates from the Centers for Disease Control and Prevention's Compressed Mortality File.

As outcome measures, we used mortality rates that were expected to be sensitive to public health interventions over the thirteen-year period of study,^{31,32} including the age-adjusted all-cause mortality rate, the infant mortality rate, and the age-adjusted mortality rates for heart disease, cancer, diabetes, and influenza. Two additional mortality measures were selected as control conditions based on the expectation that they would not be influenced by public health resources and interventions during the study period. These measures included mortality from Alzheimer's disease and a measure of residual mortality indicating deaths not attributable to heart disease, cancer, diabetes, chronic obstructive pulmonary disease, influenza, cerebrovascular diseases, or unintentional injuries.

The primary independent variable of interest in this analysis is the measure of per capita local public health spending, defined as the total annual spending of the local public health agency, divided by the total population residing within the jurisdiction of the agency. We also constructed measures of direct state and federal public health spending that were not passed through to local public health agencies. Other measures reflecting community demographic and socioeconomic characteristics and area health resources are used as control variables in the analysis (Exhibit 1).

ANALYTIC METHODS Multivariate regression models for panel data were used to estimate the effect of local public health spending on each mortality measure while controlling for the effects of other community characteristics that influence population health. Time-trend variables were used in the models to account for general downward trends in mortality that occurred independently of spending.

An important methodological complication arises in this analysis because local public health spending levels may be influenced by unobserved community characteristics that simultaneously influence mortality. For example, deteriorating local economic conditions may cause public health spending to decline and mortality risks to rise, resulting in incorrect inferences about how spending influences mortality.

To address this possible source of bias, we used instrumental variables methods to distinguish the effects of spending on mortality from the effects of unmeasured characteristics that simultaneously influence spending and mortality.^{33,34} This methodology requires the identification of variables that influence local public health spending but have no direct effects on community mortality rates. We used measures of local public health decision-making structures for this purpose, including whether the agency is governed by a local board of health with policy making authority, and whether the agency operates under the centralized administrative control of state government. Theory and previous studies indicate that these characteristics influence the ability and inclination of local public health agencies to secure external funding sources for their work.^{15,35-37}

Specification tests³⁸ confirm that the structural characteristics meet the requirements for instrumental variables (see the Appendix).³⁹ Using a two-step process, we first estimated the effect of the instrumental variables on spending levels, and then used the natural variation in spending produced by these variables to estimate how spending affects mortality.

LIMITATIONS Several limitations of this analysis are worthy of emphasis. Although we used strong statistical controls to address possible sources of bias,^{34,35} it remains possible that factors distinct from, but closely correlated with, public health spending may explain some of the observed associations between spending

EXHIBIT 1

Characteristics Of The Study Communities, 1993 And 2005

Variable	1993 mean	1993 SD	2005 mean	2005 SD
PUBLIC HEALTH AGENCY CHARACTERISTICS				
Per capita public health spending Agency governed by local board of health Agency operates as centralized unit of state agency	\$34.68 64.41% 10.27%	\$33.08	\$40.84 57.42% 7.83%	\$42.52
COMMUNITY CHARACTERISTICS				
Population size (1,000s) Population per square mile (1,000s) Community located within a metropolitan area Percent of:	108.63 475.08 51.05%	340.60 1,841.46	131.44 484.04 50.48%	426.42 1,842.57
Population nonwhite Population 65 or older Population with college degree Population unemployed Population below federal poverty level Population non-English speaking Population uninsured	14.33 14.39 15.85 6.21 15.65 1.07 13.66	17.93 3.91 8.25 2.42 7.04 1.77 4.65	19.27 14.07 19.59 5.64 11.92 1.73 13.52	17.36 4.00 9.53 2.26 4.79 2.32 4.50
MEDICAL CARE RESOURCES				
Active physicians per 100,000 population Hospital beds per 100,000 population Federally qualified health center serves community	138.04 384.16 48.33%	133.83 320.51	169.24 320.60 46.57%	159.23 372.81
HEALTH OUTCOMES				
Infant deaths per 1,000 live births Deaths per 100,000 population from:	8.76	3.50	7.03	3.22
Influenza Cancer Heart disease Diabetes	36.11 215.46 225.02 23.47	17.66 56.16 78.87 10.58	27.28 219.49 194.09 28.67	15.52 57.99 76.95 14.41
Number of observations	2,026	200.59	2,300	270.68

SOURCE Authors' analysis of linked data from the National Association of County and City Health Officials' National Profile of Local Health Departments, the Census Bureau's Census of Governments and *Consolidated Federal Funds Report*, the Health Resources and Services Administration's Area Resource File, and the Centers for Disease Control and Prevention's Compressed Mortality File. **NOTE** SD is standard deviation.

and mortality. In addition, our analysis focused on selected mortality rates as measures of population health, not on other indicators of disease burden or quality of life.

Local public health activities may have important and perhaps more immediate effects on these other indicators of health. Moreover, the thirteen-year time period used in this study is insufficient for observing the complete, longterm effects of public health interventions on chronic disease mortality rates. Consequently, this analysis may underestimate the health consequences of changes in local public health spending.

Study Results

VARIATION IN SPENDING AND MORTALITY A general secular trend of growth in public health spending and reductions in selected mortality rates during the 1993–2005 period masked significant community-level differences. Local pub-

lic health spending in the average community reached \$40.84 per capita in 2005, up from \$34.68 per capita in 1993 (Exhibit 1). However, only 65 percent of agencies experienced positive growth in per capita public health spending during the 1993–2005 period, while 35 percent of agencies experienced spending reductions.

The degree of change in per capita spending varied widely across communities. The top 20 percent of agencies experienced growth of nearly 150 percent, while the bottom 20 percent of agencies experienced reductions of nearly 45 percent during the study period. Meanwhile, infant mortality and heart disease mortality rates declined moderately during the same period, continuing a longer-term secular trend downward, while cancer and diabetes mortality rose slightly (Exhibit 1).

The rates of change in these outcomes varied widely among communities. For example, the top 20 percent of communities experienced a reduction in age-adjusted heart disease mortality of 104 deaths per 100,000 people, while the bottom 20 percent of communities saw mortality increase by forty-three deaths per 100,000 people. Overall, population size, educational attainment, physician availability, and number of people above the federal poverty level increased in the average community during this period.

DETERMINANTS OF PUBLIC HEALTH SPENDING Local decision-making structures influenced public health spending levels considerably. Per capita spending was more than 17 percent higher in communities governed by a local board of health, compared to communities without such boards (p < 0.001) (Exhibit 2). Moreover, spending was 24 percent lower among agencies that operated under the centralized administrative control of state agencies, as compared to independent local agencies.

Public health spending increased with social indicators of community health need, including the unemployment rate, the uninsured rate, and the nonwhite racial composition of the community, whereas spending decreased with the availability of selected medical resources in the community (Exhibit 2).

EFFECTS OF SPENDING ON MORTALITY Increases in public health spending were associated with statistically significant reductions in mortality for four of the six mortality rates we examined (Exhibit 3). The strongest effects were found for infant mortality and cardiovascular

disease mortality, indicating that mortality rates fell by 6.9 percent and 3.2 percent for each 10 percent increase in spending (p < 0.05). Diabetes mortality fell by 1.4 percent and cancer mortality fell by 1.1 percent for each 10 percent increase in spending (p < 0.05).

Influenza mortality and total mortality changed in the expected direction, but did not reach statistical significance. Public health spending showed no association with the two control conditions, Alzheimer's mortality and residual mortality, helping us to rule out the possibility of spurious associations between spending and mortality.

Overall, public health spending emerged as one of the most consistent determinants of community-level preventable mortality. Most of the other variables that were consistently associated with reductions in mortality reflected social determinants of health, including educational attainment, percentage of the population above the federal poverty level, and percentage of the population that was white (see the Appendix).³⁹ Medical resource variables were not consistently associated with mortality after controlling for the effects of other variables in the analysis.

Discussion

Communities with larger increases in public health spending experienced larger reductions

EXHIBIT 2

Influence Of Selected Characteristics On Local Public Health Spending

Characteristic	Percent change in spending
PUBLIC HEALTH AGENCY CHARACTERISTICS	
Agency governed by local board of health Agency operates as centralized unit of state agency	0.169**** -0.240****
COMMUNITY CHARACTERISTICS	
Population per square mile (1,000s) Community lies within a metropolitan area Percent of population nonwhite Percent of population 65 or older Percent of population with college degree Unemployment rate Percent of population below federal poverty level Percent of population non–English speaking Percent of population uninsured	0.001 -0.388*** 0.008*** 0.010 -0.011*** 0.013** 0.005 -0.068*** 0.037***
MEDICAL CARE RESOURCES	
Active physicians per 100,000 population Hospital beds per 100,000 population Federally qualified health center serves community	0.002 -0.002**** -0.174****

SOURCE Authors' analysis of linked data from the National Association of County and City Health Officials' National Profile of Local Health Departments, the Census Bureau's Census of Governments and *Consolidated Federal Funds Report*, the Health Resources and Services Administration's Area Resource File, and the Centers for Disease Control and Prevention's Compressed Mortality File. **NOTE** This table shows coefficient estimates from a semilogarithmic regression model that controls for demographic, socioeconomic, and health resources characteristics and community-specific random effects. **p < 0.05 ***p < 0.01

in mortality from leading preventable causes of death over a thirteen-year period. This relationship was consistent across several different mortality measures, and it persisted after accounting for differences in demographic and socioeconomic characteristics, medical resources, and unobserved community characteristics that jointly influence spending and health. These findings are consistent with recent time-series studies estimating that, nationally, as much as 50 percent of the gains in life expectancy experienced in the United States since 1950 are attributable to public health attention to diet, tobacco exposure, and other measures.^{40–44}

Although our study does not establish a definitive causal link between spending and mortality because of the observational research design we used, it nevertheless provides compelling evidence that differences in public health investments may contribute to differences in community health outcomes. Consequently, efforts to improve community health and reduce geographic disparities in mortality are likely to require attention not only to local medical resources and interventions, but also to the resources invested in local public health activities.

The findings imply that the mortality reductions attributable to increases in public health spending are sizable, and may exceed the reductions achievable through similar expansions in local medical care resources. For example, our estimates suggest that a 10 percent increase in public health spending could achieve a 3.2 percent reduction in cardiovascular mortality. This spending increase would require an additional \$312,274 in annual funding in the average metropolitan community included in our analysis. Achieving this same mortality reduction by increasing the number of primary care physicians would require an additional twenty-seven physicians in the average metropolitan community, based on a recent analysis of physician supply.⁴⁵ Increasing the physician supply by this amount would probably require new spending considerably in excess of the amount needed to achieve the mortality reduction through public health spending. The potential for substitution and synergy between public health and medical care resources is an important area for further study.

The strongest associations between spending and mortality were observed for infant mortality, cardiovascular disease, diabetes, and cancer four of the preventable health conditions most commonly targeted by public health agencies. In 2005, 73 percent of the nation's local health departments maintained screening and/or riskreduction programs for cardiovascular disease or high blood pressure, 74 percent delivered maternal and infant health programs involving nutrition and/or prenatal care, and 69 percent performed activities to reduce tobacco exposure—a risk factor for all four causes of death.¹⁶

Evidence-based public health interventions are known to address risk factors for these causes of death.⁴⁶⁻⁴⁸ The observed associations between spending and mortality are consistent with the expectation that higher levels of spending allow public health agencies to implement these types of risk-reduction activities more effectively within their communities.

Influenza mortality and total mortality did not appear sensitive to public health spending in our analysis. A combination of factors may explain

EXHIBIT 3

Effects Of Local Public Health Spending On Community Mortality Rates

Mortality rate Infant deaths per 1,000 live births	Percent change per 10% increase in spending -6.85***
Heart disease deaths per 100,000 population	-3.22**
Diabetes deaths per 100,000 population	-1.44**
Cancer deaths per 100,000 population	-1.13**
Influenza deaths per 100,000 population	-0.25
All-cause deaths per 100,000 population	-0.29
Alzheimer's deaths per 100,000 population	0.25
Residual deaths per 100,000 population	0.18

SOURCE Authors' analysis of linked data from the National Association of County and City. Health Officials' National Profile of Local Health Departments, the Census Bureau's Census of Governments and *Consolidated Federal Funds Report*, the Health Resources and Services Administration's Area Resource File, and the Centers for Disease Control and Prevention's Compressed Mortality File. **NOTE** This table shows coefficient estimates obtained from instrumental variables estimation of semilogarithmic regression models for panel data that control for demographic, socioeconomic, and health resources characteristics and community-specific random effects. **p < 0.05 ***p < 0.01

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the influenza result, including the dearth of effective community-based interventions for achieving high vaccination rates, random variation in influenza lethality, and inconsistencies in how deaths are attributed to influenza.⁴⁹ For total mortality, the lack of a significant spending effect probably stems from the heterogeneous disease processes reflected in this broad mortality measure and the many factors beyond public health interventions that influence these processes.

Our results suggest that additional spending, such as the \$15 billion in new federal funds authorized under the Affordable Care Act's Prevention and Public Health Fund, would be expected to generate substantial improvements in population health over time. At the same time, our results suggest that the recent recession-driven reductions in state and local support for public health activities are likely to have adverse health consequences over time unless they are offset with new spending. Additional research is urgently needed to track the downstream effects of these ongoing, unprecedented spending shocks in public health. Our study provides a foundation for these future investigations.

The mortality reductions attributable to public health spending in this study represent average effects across all US local public health agencies and across all categories of local governmental public health spending. Unfortunately, because our analysis of spending was carried out at an aggregate level, our results do not suggest how future funding increases and reductions should be allocated among the many programs and services maintained at the local level.

The aggregate nature of our analysis may also

explain the relatively modest mortality effects we observed. By measuring spending levels in specific programmatic areas such as tobacco control, nutrition, and physical activity, it may be possible to identify more precise relationships between investments and health outcomes and to examine the comparative effectiveness of each type of spending. Such targeted studies will require much more detailed spending data than are currently available for local public health agencies nationwide, which calls attention to the need for improved data systems to track public health spending.

Our analysis supports the contention that spending on local public health activities is a wise health investment. Increasing such investments in communities with historically low levels of spending may provide an effective way of reducing geographic disparities in population health. However, more money by itself is unlikely to generate significant and sustainable health gains.

A growing body of evidence suggests that the quality and efficiency of public health practice within the United States have considerable room for improvement, and progress in these areas could greatly increase the value of additional public health spending.^{35,50-54} Better systems for tracking data on trends in public health spending and the use of funds at local, state, and national levels are needed to ensure that resources are allocated wisely. Moreover, the resulting estimates of spending and their health consequences must be accessible to public health officials, policy makers, and the public at large to support informed decision making about societal investments in public health activities.

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Understanding the Organization of Public Health Delivery Systems: An Empirical Typology

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Context: Policy discussions about improving the U.S. health care system increasingly recognize the need to strengthen its capacities for delivering public health services. A better understanding of how public health delivery systems are organized across the United States is critical to improvement. To facilitate the development of such evidence, this article presents an empirical method of classifying and comparing public health delivery systems based on key elements of their organizational structure.

Methods: This analysis uses data collected through a national longitudinal survey of local public health agencies serving communities with at least 100,000 residents. The survey measured the availability of twenty core public health activities in local communities and the types of organizations contributing to each activity. Cluster analysis differentiated local delivery systems based on the scope of activities delivered, the range of organizations contributing, and the distribution of effort within the system.

Findings: Public health delivery systems varied widely in organizational structure, but the observed patterns of variation suggested that systems adhere to one of seven distinct configurations. Systems frequently migrated from one configuration to another over time, with an overall trend toward offering a broader scope of services and engaging a wider range of organizations.

Conclusions: Public health delivery systems exhibit important structural differences that may influence their operations and outcomes. The typology developed through this analysis can facilitate comparative studies to identify which delivery system configurations perform best in which contexts.

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UBLIC HEALTH HAS UNDERGONE A NOTABLE RESURGENCE IN visibility among both policymakers and the public at large. Concerns about gaps in the availability and quality of public health services have grown rapidly in response to both new and persistent health risks, including infectious diseases like SARS and pandemic influenza, the threat of bioterrorism, natural disasters like the 2005 Gulf hurricanes, and the rapid advance of obesity and preventable chronic diseases. Policy discussions about strategies for reforming the U.S. health care system to control costs and improve health outcomes increasingly acknowledge the need to strengthen its capacities for delivering public health services (Levi et al. 2008). These services include an array of activities designed to detect and investigate community health threats, promote healthy lifestyles, prevent disease and injury, prepare for emergencies and disasters, and ensure the quality of water, food, air, and other resources necessary for health (Baker et al. 1994). Unfortunately, studies from the past three decades have found evidence of wide variation in the delivery of these types of services at both the state and local level (IOM 1988; Mays et al. 2004; Turnock and Handler 1997; Turnock et al. 1994). Gaps in the delivery of effective, evidence-based interventions have been found in a wide range of service areas, including nutrition and physical activity programming (Brownson, Ballew, Brown, et al. 2007; Brownson, Ballew, Dieffenderfer et al. 2007; Slater, Powell, and Chaloupka 2007), tobacco control (Mueller et al. 2006), emergency preparedness (Beitsch, Kodolikar et al. 2006; Lurie et al. 2004), food safety, and communicable disease control (Gilbert et al. 2005; Harris 2009).

Analysts often have speculated that an important source of the variation in public health practice observed across states and communities derives from how public health services are organized and delivered (IOM 1988; Scutchfield et al. 2009). In the United States, public health services are delivered through the collective actions of governmental and private organizations, which vary widely in their resources, missions, and operations (Halverson et al. 1996; Mays, Halverson, and Stevens 2001; Mays, Miller, and Halverson 2000). Although governmental public health agencies are central to these delivery systems, most agencies rely heavily on their abilities to inform, influence, communicate, and collaborate with numerous external organizations that contribute to public health services (Halverson 2002). The range of organizations involved in the delivery of public health and the division of responsibility between governmental and private sectors varies widely across communities (IOM 2002; Mays, Halverson, and Kaluzny 1998a; Mays et al. 2004). The statutorily defined powers and duties of the government's public health agencies differ, as does the extent to which these powers are exercised at the state level or delegated to the local level (Beitsch, Brooks, et al. 2006).

This intricate interorganizational and intergovernmental structure has complicated efforts to conduct comparative studies identifying the strengths and limitations of alternative delivery system configurations (Mays et al. 2009). As the Institute of Medicine (IOM) recently noted, we currently have very little evidence concerning the structure and operation of public health delivery systems (IOM 2002). Consequently, policymakers and administrators have very little information on which to base decisions about the organization of responsibilities and the allocation of resources in public health (Scutchfield et al. 2007). Obtaining a better understanding of delivery system configurations thus is critical to comparative effectiveness research in public health on strategies to improve the availability and quality of public health services.

In other areas of health services, researchers and policy analysts rely on typologies to classify heterogeneous organizations and delivery systems in order to compare performance and outcomes. For example, the typologies of managed care organizations first developed by Harold Luft and refined by others over time have guided a robust body of research on health plans and their effects on health care delivery (Brach et al. 2000; Grembowski et al. 2000; Luft 1981; Weiner and de Lissovoy 1993; Welch, Hillman, and Pauly 1990). Similarly, typologies of hospital networks and delivery systems have informed the development of policy and administrative approaches to improving hospitals' quality and efficiency (Bazzoli et al. 1999, 2000; Dubbs et al. 2004; Shortell et al. 2000). Other prominent examples of delivery system typologies are those pertaining to physicians' organizations (Alexander et al. 1996), mental health services (Rosenthal et al. 2006), and community health partnerships (Mays, Halverson, and Kaluzny 1998b; Mitchell and Shortell 2000).

Our article looks at an empirical method of classifying and comparing public health delivery systems that can be used for research, policy, and practice. We use the Institute of Medicine's definition of a public health delivery system that includes all the governmental and nongovernmental organizations contributing to the delivery of public health services for a defined community (IOM 1988). We define public health services as all the programs, policies, and activities designed to promote a population's health and prevent disease and injury, including activities that identify and investigate health threats, promote healthy lifestyles, prepare for emergencies and disasters, and ensure the quality of water, food, air and other resources necessary for good health (Baker et al. 1994). We focus on those local delivery systems responsible for directly implementing public health services in most communities (DeFriese et al. 1981; Halverson et al. 1996).

Conceptual Framework

Constructs from organizational sociology and industrial organization economics provide a foundation for identifying the structural attributes of complex enterprises like public health delivery systems that are likely to influence their performance and outcomes. Bazzoli and colleagues (1999) identified three general classes of these attributes that apply specifically to multiorganizational health care delivery systems: differentiation, integration, and centralization. With modest adaptations, these attributes also apply to public health delivery systems. Differentiation describes the different programs and activities delivered through the system. Highly differentiated public health systems perform a broad array of activities considered to be the core functions of public health (IOM 1988). Less differentiated systems specialize in a narrower scope of these activities. A particular community's specific mix of public health services is likely the result of the interaction of demand-side factors that influence the community's service needs and preferences, as well as the supply-side factors that determine the ability and willingness of organizations to provide these services (Dranove and Satterthwaite 2000; Mays, Halverson, and Kaluzny 1998a; Mays et al. 2000). These factors are population health status and risks, available human and financial resources, prevailing laws and policy priorities, and public and professional expectations of the effectiveness and value of specific public health interventions. Although earlier studies have found wide variation in the activities produced by local public health systems, the sources of this variation are not clear (Mays et al. 2004, 2006; Mays, Miller, and Halverson 2000; Turnock and Handler 1997; Turnock et al. 1994).

We define a second delivery system attribute, integration, as the extent to which services are provided through relationships with other organizations. Highly integrated public health systems rely on many organizational partners to perform public health activities. In many applications, the construct of integration reflects both the number of ties among organizations and the strength of these ties within a system. Tightly integrated relationships may share decision making, financial risk, and/or codependent operations (Alexander et al. 1996; Lorange and Roos 1993). How well a public health system is integrated depends on the density of organizations in the community and their ability and willingness to contribute to public health activities (Mays, Halverson, and Kaluzny 1998a; Zahner 2005). Some activities may offer economic incentives that encourage private-sector organizations to contribute voluntarily, such as the opportunity to gain revenue, reduce costs, or achieve visibility and recognition that convey a political or marketing advantage (Dranove and Satterthwaite 2000; Mays et al. 2000). Some organizations also may have noneconomic motivations to contribute, such as an altruistic mission to improve health and social welfare (Lakdawalla and Philipson 2006). Like other public goods, however, public health activities often do not have enough incentives to ensure that they will be fully provided through private, voluntary action (Carande-Kulis, Getzen, and Thacker 2007). Moreover, noncontributing organizations may benefit from the public health activities performed by others. This free-rider problem arises, for example, in communities where private health insurers save on medical costs because of publicly supported tobacco cessation programs or immunization programs, without contributing proportionately to these efforts (Halverson et al. 1997). A traditional role for governmental public health agencies is to provide beneficial activities not sufficiently covered by private contributors while also stimulating and coordinating the contributions made by other organizations so as to minimize duplication and free-rider problems (IOM 1996). An agency's success here will necessarily influence the integration of the delivery system.

The potential benefits of integration, such as sharing resources and information, may be offset by the coordination problems, transaction costs, and loss of control associated with multiorganizational activities (Lorange and Roos 1993). Empirical studies of integration in public

health suggest that partnerships and coalitions have the advantage of expanding the reach of governmental public health agencies (Roussos and Fawcett 2000; Zahner 2005). Earlier research indicates that a congruent mission facilitates the formation of beneficial public health partnerships, which are more likely among government agencies, nonprofit organizations, and faith-based organizations than among their for-profit counterparts (Halverson, Mays, and Kaluzny 2000; Mays, Halverson, and Kaluzny 1998a; Nelson et al. 1999; Zahner 2005). Health care institutions like hospitals, physicians' practices, and health insurers also are apt to join public health partnerships, particularly those addressing issues requiring both medical and public health interventions such as communicable disease control, chronic disease prevention, and vulnerable populations' access to care (Elster and Callan 2002; Lasker 1997). In the past in most communities, private businesses and employers have rarely formed public health partnerships, but several studies suggest that this involvement has expanded in recent years, particularly regarding such issues as employee health promotion and emergency preparedness (Buehler, Whitney, and Berkelman 2006; Davies 1999; Simon and Fielding 2006).

A third delivery system attribute, centrality, reflects the concentration or distribution of responsibility and effort among organizations within the system. Whereas integration indicates the range of organizations participating in the delivery system and the strength of their ties, centrality indicates how public health responsibilities are distributed among these participating organizations. The concept of centralization in public health is often used to describe the "vertical" intergovernmental relationship between a state public health agency and its local government counterparts. In vertically centralized systems, local public health agencies operate under the state agency's direct authority and control, whereas in vertically decentralized systems, local agencies operate independently of the state (DeFriese et al. 1981). A broader interpretation of the centrality construct, however, recognizes both vertical and horizontal relationships within a delivery system (Bazzoli et al. 1997; Halverson et al. 1996; Mays, Halverson, and Kaluzny 1998a). In keeping with conventional terminology in public health research and practice, we use the term *centralization* for the distribution of authority between the state and local public health agencies and a related but more general term, concentration, for the distribution of authority and effort among all the organizations contributing to local public health services. We use the local governmental public health agency as the reference point for this construct. In highly concentrated systems, the local public health agency shoulders the bulk of responsibility and effort for delivering public health services within the system. Conversely, in low-concentration (distributed) systems, organizations other than the local public health agency are responsible for much of this effort.

Earlier studies of public health systems focused primarily on vertical centralization between governments rather than on the more general construct of centrality or concentration (Beitsch, Grigg, et al. 2006; De-Friese et al. 1981). One theory of political economy suggests that decentralized governmental relationships may provide superior public services because local governments, as opposed to state administrative units, are often more familiar with and more responsive to local community needs (Gordon 1983; Stigler 1957; Tiebout 1956). Other theories maintain that a centralized provision of services may be more effective and efficient because central state governments can coordinate resources and activities across local jurisdictions and thus resolve any spillover effects and inequities in resources across communities (Akin, Hutchinson, and Strumpf 2005). Empirical evidence regarding public health intergovernmental relationships is limited but indicates possible advantages in decentralization (Mays et al. 2004; Wholey, Gregg, and Moscovice 2009).

Organizational theory predicts that public health agencies will pursue differentiation, integration, and concentration within their delivery systems so as to improve the community's health, based on their specific resources, priorities, and incentives (Gillies et al. 1993; Lawrence and Lorsch 1967; Van De Ven, Delbecq, and Koenig 1976). Consequently, we expect to find substantial differences across communities in the structural characteristics of local public health delivery systems, consistent with the diversity of local communities. We also expect that these systems' structural characteristics will evolve over time as organizations improve their performance in the face of changing health risks, market incentives, and policy priorities. Based on these theoretical constructs, this study seeks to (1) determine the variation in public health delivery systems' organizational structures based on the constructs of differentiation, integration, and concentration; (2) classify public health delivery systems into separate, homogenous groups based on their observed structural characteristics; and (3) gauge the extent to which these structural classifications of public health systems change over time. The resulting empirical typology of public health delivery systems provides

a framework for comparing public health systems and finding ways of improving them.

Methods

We used a longitudinal cohort design to examine variation and change in the organizational characteristics of local public health delivery systems in the United States. Our unit of analysis is the local public health delivery system, which we defined geographically as the service area of one of the nation's nearly 2,900 local governmental public health agencies. Local public health agencies were identified using the National Association of County and City Health Officials (NACCHO) definition: "an administrative or service unit of local or state government that is concerned with health and carries out some responsibility for the health of a jurisdiction smaller than the state" (NACCHO 2006). A total of 2,864 U.S. agencies met this definition as of 2005. Nearly three-quarters of these agencies served an area corresponding to a county or a combined city and county jurisdiction; 16 percent served a city or township jurisdiction; and 10 percent served a multicounty area or region.

Study Population

Our study population covered all local public health delivery systems serving a population of at least 100,000 residents. We limited the study to these large systems because they serve the vast majority of the U.S. population and because they achieve a scale of operations that makes them more directly comparable to one another. Small and rural public health delivery systems are examined in a separate study (Wholey, Gregg, and Moscovice 2009).

NACCHO identified 497 local public health agencies that reported serving jurisdictions of at least 100,000 residents during 1996/1997. These organizations represented approximately 17 percent of all U.S. local agencies but served jurisdictions that contained approximately 70 percent of the total U.S. population. We surveyed these agencies in 1998 and again in 2006 to collect information about the public health delivery system in which they operated. In August 1998, we mailed a self-administered survey to the director of each agency, plus one additional mailing, two postcard reminders, and two telephone reminders to those agencies that had not responded. Seventy-eight percent of the agencies responded between August and November 1998. We then readministered the survey to the same agencies during May through August 2006, achieving a 70 percent response rate. The analysis presented in this article covers those agencies reporting data in both time periods. In more than a third of the cases, the individual responding on behalf of the agency changed between 1998 and 2006 owing to leadership turnover, but these changes were not likely to affect the results, because of the survey instrument's interrater reliability (Mays, Miller, and Halverson 2000; Miller et al. 1995). Collectively, the agencies included in this analysis served more than 65 percent of the U.S. population in 2006.

Delivery System Measures and Data Sources

We measured the attributes of local public health delivery systems using the Local Public Health System Assessment instrument developed through a series of research projects sponsored by the U.S. Centers for Disease Control and Prevention (Halverson et al. 1996; Miller et al. 1995; Turnock and Handler 1997; Turnock et al 1994). Using expert panel processes, evidence reviews, case studies, and surveys, these projects identified services and activities regarded as important to protecting and improving communities' public health. The resulting instrument consists of a set of twenty public health activities, each of which was derived from one of the three core public health functions of assessment, policy development, and assurance identified by the Institute of Medicine in 1988 (see table 1).

For each of the twenty activities, the instrument asks local public health agency directors to indicate whether the activity is performed at all in their jurisdiction and, if so, which types of organizations contribute to the activity. The instrument also asks two perception-based questions about each public health activity: (1) what proportion of the activity is contributed by the local public health agency, and (2) how effectively the activity is performed, using a 5-point Likert scale. Earlier validation studies confirmed that the items on the instrument had high face validity as indicators of local public health system performance

Local Public Health Activities Examined in the Analysis

Assessment Activities

- 1. Community needs assessment process that describes the prevailing health status in the jurisdiction
- 2. Survey of the population for behavioral risk factors
- 3. Investigation of adverse health events, including communicable disease outbreaks and environmental health hazards
- 4. Laboratory services to support investigations of adverse health events and meet routine diagnostic and surveillance needs
- 5. Analysis of the determinants of and contributing factors to priority health needs, and the population groups most affected
- 6. Analysis of age-specific participation in preventive and screening services

Policy Development Activities

- 7. Network of support and communication relationships that includes health-related organizations and the media
- 8. Activities to inform elected officials about the potential public health impact of decisions under their consideration
- 9. Process to prioritize community health needs
- 10. Development of community health action plan with community participation
- 11. Process to allocate resources in a manner consistent with community health priorities
- 12. Implementation of community health initiatives consistent with established priorities

Assurance Activities

- 13. Deployment of resources to address priority health needs
- 14. Organizational assessment of the local public health agency
- 15. Activities that link people to services that address age-specific priority health needs
- 16. Regular evaluations of the effects of public health services on community health status
- 17. Use of recognized process and outcome measures to monitor public health programs
- 18. Process to provide public information about community health status, needs, behaviors, and policy issues
- 19. Reports on community health issues regularly provided to the media
- 20. Failure to implement a public health program or service mandated by federal, state, or local law

(Turnock, Handler, and Miller 1998) and that agency directors provided reasonably unbiased information about the activities performed within the jurisdictions served by their agencies (Mays, Miller, and Halverson 2000; Miller et al. 1995).

We used survey responses to construct four types of delivery system measures for each system/jurisdiction. First, we measured differentiation as the proportion of the twenty public health activities performed within the delivery system. Second, we measured integration by calculating the proportion of public health activities contributed by each type of organization in the system and then by computing the average of this proportion across all types of organizations represented in the system. Third, we computed a measure of concentration as the average level of effort contributed by the local public health agency across all activities performed in the jurisdiction. Finally, we calculated a perceived effectiveness measure as the average score on the effectiveness scale across all activities performed in the jurisdiction.

Statistical Analysis

We used hierarchical cluster analysis methods to place local delivery systems into mutually exclusive categories based on the structural measures of differentiation, integration, and concentration. We standardized the three structural measures into z-scores and then grouped the systems into categories, or clusters, based on similarity across the three measures. The stepwise Ward method was used to assign systems to clusters, with a squared Euclidean distance specification used to assess similarity (Ward 1963). We used a visual inspection of the clusters and their distance measures (dendograms) to determine a parsimonious number of well-defined clusters. A seven-cluster solution was found to provide a good fit with the data and produce clusters that were conceptually distinct from one another. We performed the cluster analysis first using data from the 1998 survey and then used Duncan multiple-range tests to determine boundary values of differentiation, integration, and concentration that characterized each cluster. We then repeated the cluster analysis, using data from the 2006 survey and using Euclidean distance centroids from the 1998 survey, to test the reliability and stability of the cluster solutions. The boundary values of the clusters identified in 1998 closely matched the values of the clusters identified in 2006, suggesting

that the method of grouping public health systems was longitudinally consistent. Transition probabilities were calculated for each of the seven clusters in 1998 and 2006 in order to characterize the patterns of change from one system classification to another.

Results

Sample Characteristics

The delivery systems included in our study showed considerable heterogeneity with respect to community and public health agency characteristics (see table 2). The systems served populations from 100,000 to nearly 10 million residents, with an average size of just under 500,000. Almost all the systems were located in metropolitan areas, with the exception of the 5 percent of systems located in smaller micropolitan areas, defined as the urbanized zones surrounding towns and cities of between 10,000 and 25,000 residents. Racial minority groups, on average, comprised 27 percent of the population served, but racial composition varied widely across the systems, as did socioeconomic status and health resources. The local public health agencies operating within these systems were equally diverse, with expenditures from less than \$1 to nearly \$200 per capita, and staffing levels from 4.5 full-time equivalent (FTE) positions to nearly 250 FTE positions per 100,000 residents. Nearly three-quarters of these agencies operated as decentralized units from their state health agencies.

Variation and Change in System Attributes

Our measures of system differentiation indicated that on average, the scope of activities performed in public health systems increased between 1998 and 2006. Approximately 64 percent of the public health activities we examined, or thirteen of the twenty activities, were performed in the average system in 1998 (see table 3). By 2006, 70 percent of these activities were performed in the average system, an increase equivalent to one additional activity (p < 0.05). Assessment activities were somewhat more likely to be performed than policy or assurance activities, but these differences narrowed between 1998 and 2006. Although differentiation increased on average, there was substantial variation across systems in

Variable (Scale)	Mean	Std. Dv.	Min.	Max.
I. Community Characteristics				
Population size (1000s)	496.38	967.63	100.32	9,998.37
Nonwhite race (%)	27.24	16.97	4.03	81.77
Age 65 years and older (%)	12.04	3.65	4.55	28.96
Below poverty level (%)	10.73	3.93	2.95	27.77
Non-English speaking (%)	2.45	2.78	0.32	18.87
Completed college degree (%)	24.74	9.13	8.40	54.56
Income per capita (\$1000s)	30.70	7.81	9.32	84.04
Active physicians per 100,000 residents	267.05	200.25	27.19	1,598.09
Hospital beds per 100,000 residents	292.78	183.07	0.00	1,613.85
Metropolitan area (0, 1)	0.95	0.21	0.00	1.00
Micropolitan area (0, 1)	0.05	0.21	0.00	1.00
II. Local Public Health Agency Ch	aracteristic	s		
Expenditures per capita (\$)	41.85	30.13	0.80	198.58
Revenue from clinical services (%)	13.09	12.31	0.00	64.00
Staff FTE per 100,000 residents	54.22	35.11	4.48	247.98
Governed by local board of health (0, 1)	0.72	0.45	0.00	1.00
Type of public health jurisdiction ((0, 1)			
County	0.60	0.32	0.00	1.00
City or township	0.07	0.26	0.00	1.00
Combined city and county	0.16	0.37	0.00	1.00
Multicounty/special district	0.17	0.37	0.00	1.00
Administrative relationship with s	tate agency	(0, 1)		
Decentralized local control	0.73	0.21	0.00	1.00
Centralized state control	0.13	0.33	0.00	1.00
Shared control	0.14	0.35	0.00	1.00

TABLE 2 Characteristics of Communities and Local Public Health Systems, 2006

the direction and magnitude of change, with 41 percent of systems reporting a reduction in the scope of activities performed between 1998 and 2006.

Our measures of system integration showed that the breadth of organizations contributing to public health activities increased moderately between 1998 and 2006. Large majorities of local public health systems
	199	98	200	06	
Variable	Mean/ Pct.	Std. Dv.	Mean/ Pct.	Std. Dv.	Signif.
I. Differentiation: Proportion of Public	Health .	Activit	ies Perfo	rmed in	the
Jurisdiction (Mean)					
Assessment activities	0.67	0.22	0.74	0.20	*
Policy activities	0.60	0.28	0.68	0.26	*
Assurance activities	0.64	0.22	0.69	0.20	
All activities	0.64	0.19	0.70	0.18	*
II. Integration: Proportion of Systems 7	Гhat Incl	ude Co	ntributio	ons from	n the
Following Types of Organization	IS				
State agencies	0.98		0.99		
Local agencies (excluding LPHA ^a)	0.92		0.97		
Federal agencies	0.44		0.61		*
Hospitals	0.97		1.00		
Physicians' organizations	0.85		0.93		
Community health centers	0.51		0.84		*
Health insurers	0.45		0.53		**
Other nonprofit organizations	0.95		0.95		
Educational institutions	0.66		0.78		*
Other	0.77		0.77		
III. Integration: Proportion of Public H	Iealth Ac	tivities	s Contrib	outed by	y Each
Type of Organization (Mean)					
State agencies	0.37	0.21	0.47	0.21	*
Local agencies (excluding LPHA ^a)	0.32	0.22	0.51	0.25	*
Federal agencies	0.07	0.12	0.12	0.15	
Hospitals	0.37	0.21	0.41	0.19	
Physicians' organizations	0.20	0.18	0.24	0.18	
Community health centers	0.12	0.18	0.29	0.22	*
Health insurers	0.09	0.14	0.10	0.14	
Other nonprofit organizations	0.32	0.20	0.34	0.20	
Educational institutions	0.16	0.18	0.22	0.20	
Other	0.09	0.14	0.09	0.14	
IV. Concentration: Proportion of Effort Agency (Mean)	Contrib	uted by	v Local P	ublic H	lealth
Assessment activities	0.38	0.18	0.40	0.15	
Policy activities	0.34	0.19	0.30	0.18	**
Assurance activities	0.94 0.40	0.19	0.57 0.40	0.10	
	0.40	0.21	0.40	0.14	

TABLE 3 Measures of System Differentiation, Integration, Concentration, and Perceived Effectiveness, 1998 and 2006

	199	98	200)6	
Variable	Mean/ Pct.	Std. Dv.	Mean/ Pct.	Std. Dv.	Signif.
V. Perceived Effectiveness: Met (Mean)	Extent to W	Vhich Nee	ed for Activ	ity Is Full	y
Assessment activities	0.41	0.15	0.52	0.17	*
Policy activities	0.27	0.17	0.42	0.20	*
Assurance activities	0.38	0.16	0.41	0.20	*
All activities	0.35	0.13	0.45	0.16	*

TABLE 3—Continued

Notes: *Difference between 1998 and 2006 is significant at p < 0.05.

**Difference between 1998 and 2006 is significant at p < 0.10

^aThis organizational category excludes the designated local public health agency (LPHA).

reported contributions by state and local government agencies, hospitals, and community-based organizations in both time periods. The largest increases in contributions to at least one activity were observed for community health centers, federal agencies, and educational institutions. Community health centers, for example, contributed to one or more public health activities in 84 percent of the systems in 2006, up from 51 percent in 1998. The largest increases in the scope of activities contributed were observed for local and state government agencies and community health centers. Local government agencies (excluding the local public health agency) contributed to 51 percent of the public health activities performed in the average system in 2006, up from 32 percent in 1998, an increase equivalent to contributions in three additional activities.

Measures of concentration remained relatively stable on average across the eight-year period of study. Local public health agencies were reported to contribute an average of 40 percent of the total effort expended to perform public health activities in 2006, statistically unchanged from the 38 percent effort reported in 1998. The change in this measure, however, varied considerably across systems. The concentration of effort declined in nearly half the systems, with an average reduction of 10 percentage points.

Measures of perceived effectiveness centered on the lower half of the scale but rose significantly between 1998 and 2006 (table 3). The average effectiveness rating across all systems was 45 percent of the maximum possible score in 2006, up from 35 percent in 1998 (p < 0.05). The largest increases in perceived effectiveness were reported for policy activities and assessment activities, with assurance activities remaining statistically unchanged. The perceived level of effectiveness was lower in 2006 than in 1998 for less than 30 percent of systems.

System Configurations

The cluster analysis of the system measures revealed seven distinct organizational configurations for public health delivery systems, which could be grouped into three tiers based on their level of differentiation. Three of the seven system configurations were identified as highly differentiated, meaning that they offered a broad and encompassing scope of activities (see table 4). These systems generally performed more than two-thirds of the activities in each of the three Institute of Medicine (IOM) domains of assessment, policy development, and assurance. As such, these systems were labeled comprehensive in their scope of activities. Another two system configurations were identified as moderately differentiated because they performed about half the activities in each IOM domain. These systems were labeled *conventional* in differentiation because they aligned closely with the average scope of services performed in local communities. The final two system configurations performed a relatively narrow scope of activities and therefore were labeled *limited* in differentiation. The attributes of each configuration are summarized in table 4 and detailed later.

Comprehensive Systems

Configuration 1: Concentrated Comprehensive Systems. Systems in this first group performed a broad scope of public health activities and involved a wide range of organizations, with the governmental public health agency shouldering much of the effort. Accordingly, these systems appeared both highly integrated and highly concentrated in structure. Although many different organizations helped deliver public health services, the governmental agency assumed most of the responsibility and effort. In these systems, governmental agencies tended to partner with other organizations, primarily through low-effort mechanisms like advisory committees and planning groups that required relatively little

	Preva	lence	Perceived Effectiveness
Configuration Type and Description	1998	2006	Mean (95% CI)
Tier I: Highly Differentiated Systems 1. Concentrated Comprehensive System Broad scope of activities performed. Wide range of organizations contribute.	12.5%	21.4%	0.63 (0.59, 0.67)
 Local public health agency shoulders much of the effort in performing activities. 2. Distributed Comprehensive System Broad scope of activities performed. Wide range of organizations contribute. Effort in performing activities is distributed 	5.1%	3.9%	0.61 (0.54, 0.68)
across participating organizations. 3. Independent Comprehensive System Broad scope of activities performed. Narrow range of organizations contribute. Local public health agency shoulders much of the effort in performing activities	6.6%	11.6%	0.52 (0.47, 0.56)
 Tier II. Moderately Differentiated Systems 4. Concentrated Conventional System Moderate scope of activities performed. Moderate range of organizations contribute. Local public health agency shoulders much of the effort in performing activities. 	3.4%	3.0%	0.43 (0.33, 0.54)
 Highly transitory system. 5. Distributed Conventional System Moderate scope of activities performed. Moderate range of organizations contribute. Effort in performing activities is distributed across participating organizations. Most prevalent configuration. 	46.7%	30.9%	0.30 (0.28, 0.33)
Tier III. Limited-Differentiation Systems 6. Concentrated Limited System Narrow scope of activities performed. Limited range of organizations contribute. Local public health agency shoulders much of	12.3%	18.0%	0.41 (0.38, 0.44)
 Distributed Limited System Narrow scope of activities performed. Moderate range of organizations contribute. Effort in performing activities is distributed across participating organizations. 	13.4%	11.2%	0.45 (0.42, 0.49)

TABLE 4 Characteristics of Local Public Health System Configurations

investment in resources. Approximately 21 percent of the nation's large public health systems fell into this category in 2006, up from 13 percent in 1998.

Configuration 2: Distributed Comprehensive Systems. A second group of public health systems provided a broad scope of public health activities and involved a wide range of organizational partners. These systems differed from the first system configuration in that the effort expended in delivering public health activities was less concentrated in the governmental public health agency and more widely distributed across organizational partners. This category represented approximately 4 percent of the local public health systems studied in 2006, down slightly from 5 percent in 1998.

Configuration 3: Independent Comprehensive Systems. A third category of systems performed a broad scope of services but involved a relatively narrow range of organizations in their delivery. Like configuration 1, these systems relied on the governmental public health agency to provide much of the effort in performing public health services. These systems tended to serve relatively small communities with a limited supply of physicians, hospitals, and other organizational resources. This category represented approximately 12 percent of the systems studied in 2006, up from 7 percent in 1998.

Conventional Systems

Configuration 4: Concentrated Conventional Systems. Two categories of local public health systems were classified as moderately differentiated, or *conventional*, based on delivering an intermediate scope of services. The smallest category of conventional systems relied on the governmental public health agency to provide much of the effort in performing public health services. These systems were accordingly classified as concentrated in structure. These systems represented less than 5 percent of systems in both 1998 and 2006. Moreover, this group of systems appeared highly transitory in nature, with all the systems of this type in 1998 moving to a different configuration by 2006. Most of the systems migrating out of this category did so by either expanding their scope of services to become an independent comprehensive system (configuration 3) or narrowing their scope of services to become a concentrated limited system (configuration 6). Configuration 5: Distributed Conventional Systems. The second group of conventional public health systems was the most prevalent type of system identified in the analysis. These systems provided an intermediate scope of public health services and distributed the effort of performing these services across various contributing organizations. Generally fewer organizations were involved in delivering public health services than was the case among comprehensive systems. This category represented approximately 31 percent of public health systems in 2006, down from 47 percent in 1998.

Limited Systems

Configuration 6: Concentrated Limited Systems. The final two categories of local public health systems were classified as limited in differentiation based on their relatively narrow scope of public health activities. The systems in configuration 6 covered relatively few organizations in the delivery of public health services, and they relied heavily on the governmental public health agency to provide much of the effort. These concentrated systems accounted for 18 percent of public health systems in 2006, up from 12 percent in 1998.

Configuration 7: Distributed Limited Systems. The systems in configuration 7 used somewhat more organizations in the delivery of public health services compared with configuration 6, and they distributed more of the effort among these contributing organizations. Likewise, the proportion of effort contributed by the governmental public health agency was generally lower in these systems than in more concentrated systems. Approximately 11 percent of the public health systems were classified into this category in 2006, down slightly from 13 percent in 1998.

Perceived Effectiveness and System Configurations

The ratings of the perceived effectiveness of public health activities were significantly higher in comprehensive public health systems (configurations 1 through 3) compared with those in other types of systems (table 4). Among comprehensive systems, the average effectiveness ratings were highest for integrated systems (configurations 1 and 2,

58 percent) and somewhat lower for independent systems (configuration 3, 45 percent). The lowest effectiveness ratings were reported in conventional systems (configurations 4 and 5), whose ratings averaged less than 30 percent. By contrast, the perceived effectiveness of the limited systems (configurations 6 and 7) ranged from 38 to 41 percent. These differences in perceived effectiveness across system configurations remained statistically significant after adjusting for population demographics, socioeconomic status, and community health resources.

Transitions in System Configurations

The local public health systems included in each type of configuration changed substantially between 1998 and 2006 (see table 5), indicating a high degree of structural fluidity during this time period. Transition probabilities indicated that the concentrated comprehensive systems (configuration 1) were the most stable over time, so that 50 percent of the systems in this category in 1998 remained in it in 2006. Of the remainder, more than half these systems moved into a limiteddifferentiation system (configurations 6 and 7) by 2006. Among the distributed comprehensive systems (configuration 2), more than 40 percent remained in one of the highly differentiated configurations as of 2006, but a third of these systems shifted to a moderately differentiated system (configuration 5), and another 25 percent moved to a limiteddifferentiation system. Only 15 percent of the independent comprehensive systems (configuration 3) remained in a highly differentiated category by 2006, while most of these systems moved to a moderately differentiated structure.

As noted previously, the concentrated conventional systems (configuration 4) appeared highly transitory in structure, and all the systems in this category in 1998 shifted to a different structure by 2006. Most of these systems appeared to move either by (1) distributing more of their effort to other organizations within the system (configuration 5) or (2) narrowing the scope of activities performed within the system (configuration 6). The distributed conventional systems (configuration 5) remained the most prevalent type of system throughout the period of study and proved to be the second-most stable type of system after configuration 1. More than a third of the systems in this category as of 1998 were still in this category in 2006; another third moved to a

	rentiation	Cluster 7 $(n = 32)$	25.0	3.1	12.5	0.0	25.0	15.6	18.8	100.0
	Limited Diffe	Cluster 6 (n = 32)	28.1	3.1	21.9	3.1	25.0	9.4	9.4	100.0
SUC	erate Itiation	Cluster 5 $(n = 105)$	13.3	3.8	9.5	4.8	37.1	22.9	8.6	100.0
98 Configuratic	Mode Differer	Cluster 4 $(n = 7)$	14.3	0.0	0.0	0.0	42.9	42.9	0.0	100.0
199	ion	Cluster $\frac{1}{3}$ ($n = 13$)	0.0	0.0	15.4	7.7	46.2	15.4	15.4	100.0
	gh Differentiat	Cluster 2 $(n = 12)$	16.7	8.3	16.7	0.0	33.3	8.3	16.7	100.0
	Hi	Cluster 1 $(n = 30)$	50.0	3.3	6.7	0.0	13.3	13.3	13.3	100.0
			Cluster 1 ($n = 49$)	Cluster 2 ($n = 8$)	Cluster 3 ($n = 27$)	Cluster 4 ($n = 7$)	Cluster 5 ($n = 72$)	Cluster 6 ($n = 42$)	Cluster 7 ($n = 26$)	Total
				suo	atio	JUS	Зцı	10Ü	90	50

Note: Probabilities are scaled to range from 0 to 100.

limited-differentiation system; and more than 25 percent moved to a highly differentiated system.

The limited-differentiation systems in 1998 frequently shifted to structures with higher differentiation by 2006. Nearly half these systems moved into one of the highly differentiated categories by 2006 (configurations 1 through 3), and another 25 percent of these systems adopted a distributed conventional structure (configuration 5).

Discussion

This analysis confirms that local public health delivery systems vary widely in their organization and scope of activity, but it contradicts the often-cited anecdote that "if you've seen one health department, you've seen one health department." Rather, the patterns of variation we found suggest that systems cluster around a few different structural configurations. Three of these configurations deliver a highly differentiated scope of public health activities, and thus they may be preferred to other models on the basis of their comprehensiveness. Moreover, the three comprehensive configurations are perceived to perform public health activities more effectively than other types of systems, an advantage that is particularly pronounced for comprehensive systems with high levels of integration. Taken together, our findings suggest that multiple organizational configurations support a broad and diversified scope of public health activities. One of these configurations relies heavily on the work of governmental public health agencies, while two other configurations delegate considerable responsibility to other organizations. The optimal structure for a particular community is likely to hinge on local circumstances that shape the ability and willingness of other organizations to engage in public health activities.

The correspondence between differentiation and perceived effectiveness was not uniform across the seven public health system configurations identified in this study. Instead, we found a U-shaped relationship between these two constructs, with the lowest ratings of effectiveness occurring not among the least differentiated systems but among the conventional systems that delivered an intermediate scope of activities. One explanation for this finding is that limited systems concentrate their efforts on a relatively narrow range of high-priority public health activities, thereby bolstering their effectiveness. This form of specialization may offer advantages to communities with few human, financial, and organizational resources (Skinner 1974).

Our findings also suggest that the organizational structures of public health delivery systems are much more dynamic than is commonly recognized. Public health agencies are often perceived as bureaucratic and administratively inflexible organizations, because of the tightly controlled personnel systems, funding mechanisms, and purchasing and contracting rules frequently found in local and state governments (Mays, Miller, and Halverson 2000). Despite these constraints, the delivery systems in which these agencies operate changed significantly over the eight-year period of this study, with an overall trend toward offering a broader scope of services and engaging a wider range of organizations. These changes may reflect the efforts of public health agencies to use external relationships to compensate for their own organizations' administrative and financial constraints (Iacobucci and Zerrillo 1997). The structural changes we observed may also reflect the complex array of epidemiological, economic, political, and policy shifts that occurred over the eight-year study period. Heightened concerns about bioterrorism and emerging infectious diseases, increased awareness of the obesity epidemic and related chronic disease risks, new federal and state funding for public health infrastructure development, and implementation of federal and state performance standards and performance measurement systems for public health agencies are just a few of the events occurring over this period that may have precipitated and enabled delivery system changes. Overall, the frequency and types of structural change observed in this study suggest that public health delivery systems are highly adaptable enterprises. Developing a better understanding of the causes and consequences of these changes represents an important area for future research.

Our analysis did not attempt to identify an optimal organizational configuration for public health delivery systems, nor did it identify the circumstances in which a given configuration would perform best. Understanding how delivery systems are shaped by their demographic, socioeconomic, institutional, and political environments remains an important area of inquiry. The delivery system typology we identified through this analysis provides a starting point for conducting the comparative research needed to produce these types of evidence. Researchers can use the typology to compare the adoption, implementation, and impact of public health interventions in different types of delivery systems, thereby adding to the evidence regarding which public health practices work best in which types of settings and why. Structural measures from the typology can serve as the dependent variables of interest for studying the effects of exogenous policy changes, economic shocks, or organizational reconfigurations on public health delivery systems. Similarly, the typology measures can serve as the primary independent variables of interest for determining any systematic differences in quality and efficiency across various types of local public health systems. Collectively, these types of studies will provide a clearer understanding of the relative strengths and weaknesses of different approaches to organizing and delivering public health services, along with the political, economic, and institutional contexts in which these approaches appear to function best.

Along with its research applications, the typology developed through this study can be used by policymakers and public health administrators to decide which service delivery models may be the most feasible and desirable in their state or community, given the current and potential organizational participants in their systems. By moving the typology from less differentiated to more differentiated structural models, decision makers can chart a path of structural change toward more comprehensive service delivery. In addition, administrators can use the typology to identify "peer groups" of similarly structured local public health systems that may be appropriate for benchmarking, networking, and quality improvement projects. The typology also can provide the foundation for classifying systems into relatively homogenous groupings to judge performance and monitor programs. In these ways, the typology directly responds to the IOM's recent call for research that can be used to guide policy decisions that shape public health practice (IOM 2002).

We should note that the typology developed from this analysis was derived from the study of the nation's largest public health delivery systems, those serving populations of at least 100,000 residents. The extent to which these system attributes apply to smaller communities is not known and should be the subject of future study. Although the vast majority of U.S. residents live in the large communities included in this study, most public health systems serve communities of fewer than 100,000 residents. This situation creates a need for public health policymakers and practitioners to understand the structural attributes of both large and small systems. Moreover, our typology does not include all the structural characteristics likely to be important to understanding the organization and operation of local public health activities. In particular, this typology does not account for some of the more commonly described characteristics of governmental public health agencies, such as those related to financing, workforce, and governance models (Beitsch, Brooks, et al. 2006; NACCHO 2006). Accordingly, this typology complements and extends the more conventional ways of describing public health agencies, and it can be used in combination with these agency descriptors to evaluate public health service delivery.

As with other delivery system typologies developed for the health sector, it will be important to refine and enhance this typology by applying it to new data on public health systems and by developing refined measures of core structural dimensions. For example, applying the typology to a single state may permit access to more detailed data on organizational characteristics, creating opportunities for refinement. Another important extension would be to apply the typology framework to state-level public health systems by developing structural measures at that geopolitical level. Likewise, the typology should be extended to examine structural variation across specific domains of public health activity-such as public health preparedness, chronic disease prevention, and environmental health-as suggested by recent research in small and rural public health systems (Wholey, Gregg, and Moscovice 2009). These directions for further development will help fill important conceptual and methodological gaps in comparative research on public health systems, thereby enabling progress toward evidence-based decision making.

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Geographic Variation in Public Health Spending: Correlates and Consequences

Glen P. Mays and Sharla A. Smith

Objectives. To examine the extent of variation in public health agency spending levels across communities and over time, and to identify institutional and community correlates of this variation.

Data Sources and Setting. Three cross-sectional surveys of the nation's 2,900 local public health agencies conducted by the National Association of County and City Health Officials in 1993, 1997, and 2005, linked with contemporaneous information on population demographics, socioeconomic characteristics, and health resources.

Study Design. A longitudinal cohort design was used to analyze community-level variation and change in per-capita public health agency spending between 1993 and 2005. Multivariate regression models for panel data were used to estimate associations between spending, institutional characteristics, health resources, and population characteristics.

Principal Findings. The top 20 percent of communities had public health agency spending levels > 13 times higher than communities in the lowest quintile, and most of this variation persisted after adjusting for differences in demographics and service mix. Local boards of health and decentralized state-local administrative structures were associated with higher spending levels and lower risks of spending reductions. Local public health agency spending was inversely associated with local-area medical spending.

Conclusions. The mechanisms that determine funding flows to local agencies may place some communities at a disadvantage in securing resources for public health activities.

Key Words. Public health spending, population health, practice variation

Geographic variation in health care spending within the United States has long been a source of policy concern because it implies large inefficiencies and inequities in resource use (Wennberg and Gittelsohn 1973). The greater-thantwofold differences in health care spending observed across U.S. communities persist after accounting for differences in medical care prices (Welch et al. 1993; Skinner and Fisher 1997), socioeconomic status (SES), and illness burden (Wennberg and Cooper 1998; Fisher et al. 2000). Moreover, several recent studies suggest that residents of high-spending regions do not enjoy superior health outcomes compared with their counterparts in low-spending regions (Fisher et al. 2003a, b). Medical care represents only one class of resources used to improve health and control disease, and studies suggest that these resources account for only about half of the gains in life expectancy realized during the past half-century (Brown et al. 1991; Trust for America's Health [TFAH] 2006; Sensenig 2007). By comparison, public health resources support activities designed to promote health and prevent disease and disability at the population level, such as efforts to monitor community health status, investigate and control disease outbreaks, educate the public about health risks and prevention strategies, enforce public health laws and regulations like those concerning tobacco use or food preparation, and inspect and assure the safety and quality of water, air, and other resources necessary for good health (Institute of Medicine [IOM] 1988). These activities may account for gains in health and life expectancy that are not attributable to medical care. As such, geographic variation in public health resources may contribute to gaps and inequities in population health. Relatively little is known, however, about the extent and nature of geographic variation in public health spending.

Although no uniform system of accounts exists to track public health spending at national, state, or local levels, available estimates suggest that less than 5 percent of the nation's health-related spending is devoted to public health activities (Brown et al. 1991; TFAH 2006; Sensenig 2007). Public health activities are supported through a patchwork of local, state, federal, and nongovernmental funding mechanisms that vary widely across states and communities (Gerzoff, Gordon, and Richards 1996; Gordon, Gerzoff, and Richards 1997; TFAH 2006). These mechanisms give rise to large geographic disparities in spending for public health services. The National Association of State Budget Officers (NASBO) estimated that state governments' per-capita spending on public health activities varied by a factor of > 30 in 2003, ranging

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from >U.S.\$400 per person in Alaska and Hawaii to <U.S.\$75 per person in Iowa, Arkansas, Idaho, and Utah (NASBO 2005). Estimates of variation in local public health agency spending are even larger, ranging from <U.S.\$1 per capita to >U.S.\$200 per capita in 2005, with the median local public health agency spending about U.S.\$30 per person (National Association of County and City Health Officials [NACCHO] 2006).

On balance, very little empirical evidence exists about the extent and nature of geographic variation in public health spending (Carande-Kulis, Getzen, and Thacker 2007). The lack of uniform data on public health spending has hampered research on this topic. The NASBO and more recently the TFAH have used information from state budget documents to produce estimates of state governmental spending on public health activities, but differences in state accounting and reporting conventions cause significant errors and inconsistencies in estimates (NASBO 2005; TFAH 2006). Other studies have classified the public health expenditures of individual state or local governments using standardized accounting protocols, but these individual assessments do not support systematic comparisons of spending across communities and over time (Barry et al. 1998; Budetti and Lapolla 2008). Estimates of federal, state, and local governmental expenditures on public health activities are included in the National Health Expenditure Accounts maintained by the U.S. Centers for Medicare and Medicaid Services (CMS), using data collected by the U.S. Census of Governments. These estimates, however, are widely considered to be incomplete because they include expenditures for a relatively narrow set of governmental activities and because they exclude expenditures on personal health services commonly provided by public health agencies, such as immunizations, chronic disease screening, and communicable disease control (Sensenig 2007). Completely lacking in the literature are estimates of the resources expended on public health activities by nongovernmental organizations such as community hospitals, communitybased organizations, health insurers, and employers (Mays, Halverson, and Kaluzny 1998; Mays et al. 2000).

This paper uses a recently compiled longitudinal dataset on local governmental public health agencies to examine how public health spending levels vary across communities and change over time. Following similar studies of variation in medical spending, we focus on three primary questions of interest: (1) what are the demographic, socioeconomic, and institutional characteristics of high-spending and low-spending communities? (2) What characteristics are associated with growth and decline in spending levels over time? (3) What types of communities are most likely to experience reductions in public health spending? Answers to these questions will help policy makers at all levels of government anticipate resource needs and make better decisions about how to allocate scarce public health resources.

This study focuses on spending at the local level because local public health agencies—rather than their state and federal counterparts—assume primary responsibility for directly implementing public health activities in most communities (DeFriese et al. 1981; Halverson et al. 1996). Most federal and state grants for public health activities, and significant private funding, are channeled through local public health agencies (Mays et al. 2004b; NACCHO 2006). Moreover, these agencies frequently work to mobilize and coordinate the public health activities of other organizations in the community (Mays, Halverson, and Kaluzny 1998; IOM 2002). As such, these agencies provide valuable settings in which to study the determinants and consequences of public health spending in the United States.

CONCEPTUAL FRAMEWORK

The amount of resources expended for public health services in a given community is determined through a complex interaction of economic conditions and fiscal capacities, delivery system characteristics, community health needs, and policy priorities (Tiebout 1956; Sacks and Harris 1964; Handler, Issel, and Turnock 2001). Local and state economic conditions are particularly important drivers of spending levels because many communities depend heavily on state and local tax bases to fund their public health activities (NACCHO 2006). Economically disadvantaged communities face limited tax bases and many competing demands for these resources, making it difficult to support a full array of public health activities (Hajat, Brown, and Fraser 2001; Bernet 2007).

Characteristics of the delivery system for public health services introduce additional sources of variation in spending (Handler and Turnock 1996; Mays et al. 2004a, b). Governmental public health agencies vary widely in their statutorily defined powers and scope of activities, which are established by both state and local law. A few common activities are performed by the vast majority of local public health agencies in the United States, such as communicable disease surveillance and control, chronic disease screening, and food service inspection. For many other activities like tobacco control, responsibility rests with the local public health agency in some communities, with the state agency in other communities, and with a separate public or private organization in still other communities (NACCHO 2006). Agencies that have statutory responsibility for a broad scope of public activities are likely to require more resources than agencies with a narrower mission.

In some communities nongovernmental organizations play important roles in performing selected public health activities, potentially reducing the need for governmental spending (Halverson, Mays, and Kaluzny 2000; Mays et al. 2000; Mays, Halverson, and Stevens 2001). Conversely, the shortage of nongovernmental providers in some communities may create the need for public health agencies to provide an expanded range of services beyond traditional public health activities. In particular, agencies that operate in medically underserved areas may provide clinical services such as immunizations, prenatal care, and other primary care services for patients who lack access to mainstream medical providers. Agencies that are heavily involved in clinical service delivery may generate higher spending levels due to the higher input costs of providing these services.

Delivery system characteristics may also influence the efficiency of public health practice, resulting in spending variation. For example, public health agencies serving large communities may realize economies of scale in performing public health activities requiring high fixed costs, such as surveillance systems and laboratory capacities (Mays et al. 2006). Conversely, agencies serving rural jurisdictions with low population densities may spend more to perform epidemiological investigations, health education campaigns, or tobacco control enforcement actions compared with agencies serving more geographically concentrated populations. The potential for economies of scale may lead some agencies to pool their resources through mergers, regional alliances, or joint operating agreements.

Population characteristics that determine health risks and needs within the community represent another class of factors likely to influence public health spending patterns. These characteristics include social and economic determinants of health such as income and employment, educational attainment, race and ethnicity, age, and language and culture (Adler and Newman 2002; Mechanic 2002, 2005, 2007). Agencies serving low-SES populations are likely to require more resources to prevent and control health risks than their counterparts that serve less vulnerable populations. Whether this need for more resources translates into an ability to obtain more resources remains an open empirical question.

Finally, political dynamics may influence local public health spending decisions. Predominant political ideologies and cultures within a state or community are likely to shape attitudes about the appropriate role of government in protecting health and preventing disease and injury, and these attitudes may explain some of the geographic variation in public health spending observed across communities (Morone 1997; Oliver 2006). These views are mediated by state and local political institutions and administrative structures, which shape the extent to which public health issues reach the policy agenda. Two related, institutional characteristics are of particular interest when examining the political economy of local public health practice: (1) the existence of a local governing board of health with the authority to establish policy priorities, and (2) the degree to which public health decision making authority is decentralized and delegated from the state to the local governmental level. Local governing boards of health are hypothesized to generate enhanced public and political support for local public health agencies, because their membership frequently includes individuals who have political access, professional credibility, and/or technical expertise that can be used to attract and maintain resources (Mays et al. 2004a, b, 2006). Likewise, decentralized local governmental authority is hypothesized to facilitate resource decisions that are informed of and responsive to community needs (Tiebout 1956; Stigler 1957; DeFriese et al. 1981; Gordon 1983). On the other hand, centralized state authority may allow communities to benefit from economies of scale and the ability to coordinate resources across multiple local jurisdictions (Aikin, Hutchinson, and Strumpf 2006). The empirical evidence on this issue remains limited and mixed.

METHODS

Study Population

A longitudinal, retrospective cohort design was used to analyze public health expenditures among the nation's nearly 3,000 local public health agencies between 1993 and 2005. The study population included all organizations operating during this time period who met the NACCHO definition of a local health department: an administrative or service unit of a local or state gov-ernment that has responsibility for performing public health functions for a geopolitical jurisdiction smaller than a state (NACCHO 2006). All U.S. states except Rhode Island contained agencies that met this definition. In 2005, approximately 73 percent of these agencies served county jurisdictions or combined city–county jurisdictions, with the remaining agencies serving city or township jurisdictions (16 percent) or multicounty or regional jurisdictions (11 percent).

Data Sources

NACCHO collected expenditure data along with organizational and operational characteristics of local public health agencies through census surveys fielded in 1993, 1997, and 2005. A total of 2,888 agencies meeting the NACCHO definition were identified in 1993. The survey response rate was 72 percent in 1993, 88 percent in 1997, and 80 percent in 2005. A core set of variables reflecting annual agency expenditures, revenue sources, staffing levels, jurisdiction population size, and services offered were collected in each year of the survey. Observations were linked across the 3 years of the survey using identifying information on each public health agency, resulting in a panel dataset containing observations on 6,566 agency-years.

Using identifying information about each local public health agency's jurisdiction and the county or counties in which it operates, we linked the NACCHO survey data with contemporaneous, county-level data from several other sources. For public health agencies serving jurisdictions of more than one county, we aggregated county-level data to the multicounty jurisdiction. Because county-level data may provide a poor approximation of the subcounty jurisdictions served by city and township agencies (15 percent of agencies), we tested the sensitivity of results to including these agencies in the analyses and found no evidence of bias. County-level data on population characteristics and health resources were obtained from the Area Resource File. County-level variables reflecting direct federal public health expenditures were constructed from the Consolidated Federal Funds Report. For simplicity we defined federal public health spending to include all federal grant-in-aid programs administered by the U.S. Centers for Disease Control and Prevention. These expenditure data do not include federal funding given to state agencies that are subsequently passed through to local recipients, but such pass-through funding is included in the agency expenditure data collected on the NACCHO survey. State-level data on public health expenditures were obtained from the U.S. Census Bureau's 1993, 1997, and 2005 Census of Governments using expenditure function category 32 that excludes hospital care and most other medical care expenditures. Finally, county-level data on annual medical care spending per Medicare beneficiary were obtained from the CMS and linked with other data using county identifiers. The medical spending estimate reflects total annual Medicare reimbursements for all covered services per Medicare beneficiary. As a robustness check, we also used the county-level Medicare Adjusted Average Per Capita Cost estimate as a risk-adjusted indicator of medical care spending in the county.

Measures and Model Specification

Public Health Spending Measures. The dependent variable of interest in this analysis is the measure of per-capita local public health agency spending. This variable was measured as an agency's total annual expenditures divided by the total population residing within the jurisdiction of the agency. In keeping with prior studies, the total jurisdiction population estimate was used as the denominator for this measure because most of the activities performed by a local public health agency are public goods (e.g., disease surveillance, restaurant inspections, health education) designed to protect and promote health for the community at large rather than for individual service users (Gerzoff, Gordon, and Richards 1996; Gordon, Gerzoff, and Richards 1997). The 1997 and 2005 NACCHO surveys collected jurisdiction population estimates, and so these data were used to construct the estimates of spending per capita in those years. The 1993 survey did not collect detailed population estimates, and so we estimated the jurisdiction population size for that year using Census data. Each spending measure was adjusted to 2005 dollars using a weighted average of the general Consumer Price Index (CPI) and the medical care CPI, recognizing that most public health agencies provide a blend of personal medical services and population-based services (NACCHO 2006). We used a weight that reflected each agency's share of revenues from Medicaid, Medicare, and private health insurance.

Explanatory Variables. The explanatory variables used in this analysis reflect characteristics of the public health agency, the area population, and the community that are hypothesized to influence public health spending, as described in the conceptual framework. A single indicator variable was used to identify agencies that operated under the authority of a local board of health. We classified the administrative control of each agency as either decentralized local government control or centralized state government control. For decentralized agencies, we further specified type of local government agency as county, city/township, or a combined government district. The scope of services offered by the local public health agency was characterized using a series of 75 variables indicating whether a specific service was delivered by the agency. We grouped these services into six categories representing clinical preventive services, population-based activities, medical treatment services, specialty services, regulatory enforcement and licensing activities, and other environmental health services (see Appendix SA2 for variable classifications). For each service category, we constructed a variable

indicating the proportion of services in that category that were performed by the public health agency. As a final public health characteristic, we measured staffing level as the total number of full-time equivalent staff employed by the local public health agency. In keeping with prior studies and to avoid multicollinearity with population size, we scaled this variable by the population size of the jurisdiction to indicate staffing levels per 100,000 population (Tilson and Gebbie 2004; Gebbie and Turnock 2006). We also included variables to capture local medical resources in the community that may offset the need for public health resources, along with variables reflecting population characteristics associated with health risks and needs within the community (Table 1).

Statistical Analysis

All analyses used the local public health agency and the community it serves as the unit of analysis. To identify the correlates of high-spending and lowspending agencies/communities, we grouped communities into quintiles based on the measure of local public health spending per capita in 2005, and tested for differences in delivery system characteristics and community characteristics across the quintiles. Next, multivariate regression models for panel data were used to estimate associations between local public health spending and the array of public health system characteristics, health resources, and community characteristics included in the analysis. We estimated two different versions of these models: (1) a reduced-form model that does not include measures reflecting the scope of services offered by the public health agency; and (2) an expanded model that includes these variables. The expanded model assumes that an agency's service offerings are determined exogenously and therefore their association with public health spending can be estimated directly. For parsimony, some of the covariates listed in Table 1 were dropped from the regression models due to lack of association with the spending variable.

Two alternative model specifications were tested to account for autocorrelation due to repeated observations on the same agencies over time: (1) a random-effects model that assumes that the agency-specific correlation coefficients are randomly distributed and uncorrelated with the other characteristics included in the model; and (2) a fixed-effects model that allows the agency-specific coefficients to be correlated with other covariates. The two specifications yielded qualitatively similar results, and so we present estimates from the random-effects models in this paper. We also tested models that

Table 1: Characteristics of	Local H	ublic He	alth Ag	encies and	d Comn	nunities b	y Quint	ile of Spe	nding p	er Capita	
	Qui	ntile 1	Qui	ntile 2	Qui	ntile 3	Qui	ntile 4	Qui	ntile 5	
Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	$Ratio^{\dagger}$
Public health agency characteristics Expenditures/capita (U.S.\$)	7.68	3.85	19.09	3.21*	29.89	3.45*	45.76	6.29*	101.86	59.48^{*}	13.26
Change 1993–2005 (U.S.\$)	-5.00	15.87	-2.08	20.45	2.03	13.13	2.39	24.54	18.07	39.64^{*}	
Population served (1,000s) Type of agency (0, 1)	101.80	325.28	118.88	351.57	139.01	320.41^{*}	137.47	266.63*	157.02	668.77*	1.54
County	0.26		0.34		0.31		0.35		0.53^{*}		2.06
City or township	0.39		0.20		0.09		0.06		0.08		0.20
Combined or multicounty	0.18		0.23		0.30		0.29		0.20		1.11
Local board of health (0, 1)	0.71		0.77		0.79		0.77		0.77		1.09
Decentralized authority (0, 1)	0.75		0.74		0.73		0.77		0.83		1.12
Revenue sources $(0/0)$											
Local government	57.11	38.06	37.94	29.89	26.81	21.55^{*}	24.95	19.39*	21.73	22.08*	0.38
State government	12.92	20.39	20.27	19.52	24.76	19.05*	21.95	17.92*	23.68	20.57*	1.83
Federal government	15.53	24.71	21.19	23.65	22.48	20.89	20.38	19.81	16.17	19.42	1.04
Clinical revenue	4.50	11.01	11.90	16.68	16.36	16.50^{*}	23.18	20.20^{*}	30.99	25.33^{*}	6.88
Scope of services $(0/0)$											
Clinical preventive	40.79	28.99	62.62	24.32	71.16	22.37*	75.17	22.16^{*}	76.07	21.38^{*}	1.86
Population-based	37.66	22.57	45.05	22.33	47.52	19.91	51.75	20.62^{*}	53.46	19.73*	1.42
Treatment	21.67	20.78	30.59	20.80	37.12	20.31	45.18	19.99*	48.81	22.83*	2.25
Specialty	7.90	17.98	14.15	23.48	17.95	24.84	23.40	29.42^{*}	31.09	31.82^{*}	3.93
Regulatory	50.05	30.91	47.41	28.73	50.60	29.16	51.39	28.93	50.74	30.24	1.01
Environmental	32.38	29.06	28.65	27.44	27.43	26.13	31.29	27.04	31.17	28.11	0.96
FTE staff per 100,000	28.39	40.41	36.04	20.82	52.49	22.31^{*}	77.04	31.74^{*}	136.33	86.84^{*}	4.80
										<i>co</i>	ntinued

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	Qui	ntile 1	Quin	<i>utile 2</i>	Qui	ntile 3	Quin	ttile 4	Qui	ntile 5	
Variable	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	$Ratio^{\dagger}$
Population characteristics											
Metropolitan area (0, 1)	0.72		0.59		0.48*		0.43^{*}		0.38*		0.53
Income per capita (U.S.\$1,000s)	31.58	9.04	28.90	8.81	25.78	6.40	26.38	7.00	26.33	7.65	0.83
Percent with college $(%)$	23.92	10.26	20.70	9.80	17.66	8.77	18.00	8.75	18.14	9.03	0.76
Percent nonwhite $(0,0)$	19.86	17.49	17.98	15.68	19.93	16.88	19.06	16.89	20.49	18.94	1.03
Percent uninsured (%)	12.35	4.61	12.73	4.11	14.09	4.50	13.95	4.34	14.25	4.38	1.15
Physicians per 100,000	219.23	163.94	174.30	156.16	148.13	137.29^{*}	159.57	173.62^{*}	158.37	163.29^{*}	0.72
Hospital beds per 100,000	276.90	343.19	287.37	335.00	342.18	423.74	362.45	369.03	296.67	311.07	1.07
FQHC exists (0, 1)	0.57		0.46^{*}		0.40^{*}		0.43*		0.47^{*}		0.82
*Statistically different from Quintile	e 1 at <i>p<</i> .	05.									
† Ratio of highest quintile to lowest o	quintile.										

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Table 1. Continued

included state-fixed effects and found that results are robust when these effects are excluded. We estimated each model using a logarithmic specification in order to reduce skewness and outliers in the public health spending measure. Standard errors were estimated using the robust method to account for clustering of agencies within states (White 1980).

Logistic regression models were used to identify the types of communities most likely to experience reductions in public health spending between 1993 and 2005. For these models, the independent variables were defined to include (1) the baseline 1993 values of the explanatory variables used in the spending model above; and (2) measures reflecting the absolute difference (change) in values of the explanatory variables between 1993 and 2005. We used coefficients from the logistic regression models to construct estimates of the marginal effect of each independent variable on the probability of experiencing a reduction in public health spending.

RESULTS

Local public health spending reached U.S.\$29.57 per capita for the median community in 2005, virtually unchanged from the 1996 median of U.S.\$29.51 and slightly higher than the 1993 median of U.S.\$26.26 per capita. The aggregate rate of growth in local public health spending during the 1993–2005 period was <1 percent per year in constant dollars. Overall, 65 percent of communities experienced positive growth in per-capita public health spending over the 1993–2005 period, with an average increase of U.S.\$3.73 per capita. The coefficient of variation in public health spending increased significantly from 0.95 in 1993 to 1.04 and 2005, indicating a trend toward greater variation in spending.

Differences between High-Spending and Low-Spending Communities

Public health agency spending levels varied widely across communities and over the 12-year period of study. In the lowest 20 percent of communities, spending averaged <U.S.\$8 per capita in 2005 and declined by U.S.\$5 per capita between 1993 and 2005 (Table 1). By contrast, in the top 20 percent of communities spending averaged nearly U.S.\$102 per capita and grew by more than U.S.\$18 per capita between 1993 and 2005. Communities in the top quintile had spending levels >13 times higher than communities in the lowest quintile.

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Public health agencies in the highest quintile of spending provided a broader scope of clinical preventive services, population-based services, medical treatment services, and specialty services compared with their lowerspending counterparts (p < .05). However, there were no significant differences in the scope of regulatory and environmental health services performed by high-spending and low-spending agencies. Agencies in the highest quintile of spending received larger shares of their revenue from clinical service reimbursements (e.g., Medicaid, Medicare, and private insurance payments) and smaller shares of their revenue from local government sources, compared with agencies in lower spending quintiles (p < .05). Agencies in the highest quintile of spending were more likely to operate as decentralized units of county government, compared with lower-spending agencies (p < .05).

Medical care resources varied inversely with the level of public health agency spending. Low-spending agencies served communities with larger numbers of physicians per capita and were more likely to be served by a federally qualified health center, compared with agencies in higher spending quintiles (p < .05). Medical care spending also varied inversely with public health agency spending (Figure 1). Medical spending per Medicare beneficiary was 11 percent higher in communities within the lowest quintile of public health agency spending, compared with communities within the highest quintile of agency spending (p < .05). This inverse association existed for both inpatient and outpatient Medicare spending and persisted when risk-adjusted Medicare spending estimates were used (data not shown).

Figure 1: Public Health Agency and Medicare Spending Levels in 2005, by Quintile of Public Health Spending



Sources of Variation in Public Health Spending

Multivariate analysis of public health agency spending patterns indicated that structural and institutional characteristics of the public health system were among the strongest predictors of per-capita spending levels. Spending was >14 percent higher among agencies governed by a local board of health compared with agencies without such boards (p<.001), after controlling for other characteristics in the reduced-form model (Table 2). Similarly, spending

	Reduced-H	Form Model	Expand	ed Model
Variable	Coefficient	Standard Error	Coefficient	Standard Error
Public health agency characteristics				
Local board of health (0, 1)	0.1588	0.0361***	0.0256	0.0356
Decentralized local authority (0,1)	0.2720	0.0559***	0.2018	0.0473***
Type of agency (reference $=$ county)				
City or township	-0.5276	0.0740***	-0.2889	0.0670***
Combined or multicounty	-0.1058	0.0466**	-0.1018	0.0448 **
Scope of services offered				
Clinical preventive services (%)			0.6795	0.0688***
Medical care services (%)	_		0.2938	0.0670***
Specialty services (%)	_		0.0872	0.0447**
Population-based services (%)			0.0144	0.0572
Regulatory and licensing (%)	_		0.0077	0.0471
Environmental health (%)			0.0848	0.0453*
Revenue from clinical services (%)	_		0.0117	0.0007***
Population and community characteristics				
Population size (log)	-0.0329	0.0188*	-0.1282	0.0165***
Population per square mile (1,000s)	0.0295	0.0138**	0.0189	0.0113*
Percent population nonwhite (%)	0.0101	0.0017***	0.0033	0.0015**
Percent with college education (%)	-0.0008	0.0037	0.0024	0.0033
Percent non-English speaking (%)	-0.0457	0.0114***	-0.0249	0.0102**
Percent 65+ years old (%)	0.0117	0.0061**	0.0056	0.0052
Income per capita (log)	-0.2898	0.1182**	0.1518	0.1127
Percent uninsured (%)	0.0175	0.0074**	0.0289	0.0064***
Physicians per 100,000 population	0.0004	0.0002**	0.0006	0.0002***
Metropolitan area $(0, 1)$	-0.1637	0.0663**	-0.0553	0.0563
Year (reference $= 1993$)				
1997	0.1434	0.0287***	0.0592	0.0303**
2005	0.2514	0.0586***	0.2093	0.0564***
Constant	5.5873	1.1364***	1.3914	1.0835
R^2	0.1542		0.3140	
Ν	5,588		5,588	
	,		·	

was >25 percent higher among decentralized local public health agencies, compared with agencies operating under centralized state authority. Significant differences in spending were also noted across alternative types of local government agencies.

When variables reflecting the scope of services offered by the local public health agency were included in an expanded model, three of these variables emerged as significant predictors of local public health spending (Table 2). Clinical preventive services had the strongest association with spending, such that a 10 percent increase in the proportion of services offered by an agency was associated with a 6.8 percent increase in spending, after controlling for other variables in the model (p < .01). Consistent with these estimates, we found higher spending levels among agencies that derived larger shares of their revenue from clinical service reimbursements (p < .01). The three nonclinical categories of service-population-based services, regulatory services, and environmental health services—were not statistically associated with spending levels after controlling for other variables in the model, although the environmental health variable approached significance (p < .10). Among the population and community characteristics examined, per-capita income and metropolitan area location were most strongly associated with spending, but these inverse associations were mediated largely by agency service offerings.

Factors Associated with Reductions in Spending

In total, 35 percent of communities experienced reductions in spending during the 1993–2005 study period, with the average loss of > U.S.\$11 per capita in constant dollars. Logistic regression estimates indicated that decentralized public health agencies and agencies governed by a local board of health were significantly less likely to experience reductions in per-capita spending compared with their counterparts (Table 3). Agencies serving more populous communities in the baseline year of 1993 were less likely to experience reductions in per-capita spending over the study period (p < .05), but subsequent population growth during the study period placed agencies at greater risk of reductions (p < .01). Communities with higher proportions of racial minority residents were more likely to experience spending reductions (p < .05).

DISCUSSION

Local public health agency spending varies widely across communities. This variation has increased over time, and it persists after accounting for

Variable	Marginal Effect on Probability of Reduction
Local board of health exists $(0, 1)$	-0.2016****
Agency has decentralized local authority $(0, 1)$	-0.5162^{***}
Baseline population size in 1993 (1,000s)	- 0.0763**
Population change 1993–2005 (1,000s)	0.0378***
Baseline percent population nonwhite in 1993 (%)	0.0866**
Change in percent population nonwhite 1993–2005	0.0445

Table 3: Factors Associated with Reductions in Public Health Spending, 1993–2005

Note. Estimates are computed from a logistic regression model that includes the covariates listed in Table 2.

**p<.05.

****p<.01.

sociodemographic differences in the populations served and for differences in the scope of services offered by agencies. The Dartmouth Atlas of Health Care estimated that per-capita medical care spending varied by a factor of 1.6 between communities in the highest and lowest quintiles of the distribution (Wennberg and Cooper 1998). By comparison, public health agency spending varied by a factor of 13.3, and this interquintile variation remained high at 7.3 after adjusting for differences in population characteristics and service mix. This finding suggests that local public health resources may be distributed more unevenly than that of medical care.

The patterns of variation in local public health agency spending appear quite distinct from that of medical care, such that higher levels of agency spending are associated with lower levels of medical care spending and resources in the community. Several possible mechanisms may contribute to these patterns. First, public health resources may offset the need for medical care in some communities by preventing or limiting disease and injury. Second, high levels of disease burden within a community may simultaneously increase demand for curative medical care and diminish demand for public health activities, which may receive less priority in the face of acute-care needs. Third, low rates of health insurance coverage and limited availability of mainstream medical care providers may suppress access to medical care while simultaneously increasing demand for services from public health agenciesparticularly those agencies that offer clinical services. Finally, high levels of spending on medical care may limit the amount of public resources available to invest in public health activities. Importantly, our measure of medical spending is limited because it reflects only spending for Medicare beneficiaries, which accounted for about 20 percent of personal health care spending nationally in 2005 (CMS 2009). Further research on the mechanisms of interaction between public health and medical care resources is needed to identify opportunities for coordinated resource deployment.

Public health governance and administrative structures emerged as two of the strongest correlates of public health agency spending. Local boards of health and decentralized administrative structures are associated with higher levels of spending, larger increases in spending over time, and reduced vulnerability to spending reductions. These findings are consistent with the hypothesis that local governance and local administrative control engender political and community support for public health activities and encourage entrepreneurship in securing resources. Policies to develop and support local governing and administrative bodies may be effective in expanding public health capacity.

Overall, about 15 percent of the observed variation in local public health agency spending is explained by differences in service mix, while 8 percent is attributable to differences in agency structural characteristics, and another 8 percent is attributable to differences in population characteristics. Two-thirds of the variation in public health agency spending remains unaccounted for in this study. This residual variation is comparable to the unexplained variation found in studies in medical care spending, which range from about 50 to 75 percent of total variation in spending (Congressional Budget Office 2008).

Residual variation in public health spending likely stems from a combination of factors, including imperfections in the spending data used here and unmeasured factors that determine resource needs and availability. Of particular note, the spending measures used in this analysis reflect the resources of local public health agencies and therefore do not capture the resources invested in public health activities by other governmental and private organizations. Prior studies have estimated that these other institutions contribute > 25 percent of the local public health activities performed in the average U.S. community (Halverson et al. 1996; Halverson, Mays, and Kaluzny 2000; Mays et al. 2004a). Some of the residual variation in local public health agency spending may be attributable to these contributions that offset the need for agency effort. Residual variation may also reflect unmeasured differences in population health needs, the costs of producing and delivering public health services, and the effectiveness of agency leadership and management.

The large residual variation in local public health spending also suggests that considerable uncertainty exists among policy makers and administrators about optimal levels of investment in public health activities. Clear evidence and professional consensus has yet to emerge about the mix of programs and services that communities need to protect health and about the levels of human, financial, and other resources needed to assure this availability (IOM 2003). Expanded research to develop this evidence and translate it through guidelines and decision supports for public health practice are needed to reduce uncertainty and improve resource allocation decisions (Scutchfield and Patrick 2007).

Ultimately the ability to detect and correct wasteful, harmful, and inequitable variations in public health spending depends on capturing more detailed data about spending patterns and their effects. The aggregate spending measures used in this analysis reflect total resources used across all categories of spending and therefore do not reveal how resources are distributed across the many programs and services maintained at the community level. By measuring spending levels in specific programmatic areas such as tobacco control, obesity prevention, and communicable disease control, it becomes possible to identify more precise patterns of resource use and to assess the relative value of each type of spending. This fact underscores the need for improved data systems to track not only medical care spending (Cutler, Rosen, and Vijan 2006) but also public health expenditures at national, state, and local levels.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.

Appendix SA2: Services Used to Construct Composite Measures of Service Offerings.

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CHAPTER FOURTEEN

When People outside the Organization Need Information: Strategically Communicating with External Stakeholders

J. David Johnson and Anna Goodman Hoover

The Legacy of Silence: The Paducah Gaseous Diffusion Plant Case Study

Stakeholder relations at the Paducah Gaseous Diffusion Plant (PGDP) in western Kentucky exemplify what can happen when an organization attempts to replace former policies rooted in secrecy with increased informational openness. As of summer 2012, the PGDP is the only operating uranium enrichment facility in the United States. For almost 60 years, the plant has produced fuel—initially for military reactors and nuclear weapons and, later, for commercial reactors. The plant was owned and operated by the United States Department of Energy (DOE) until 1992, when its operations were leased to the United States Enrichment Corporation. However, DOE retains management of the site's cleanup, infrastructure, hazardous wastes, and environmental restoration.

In 1988, samplings of private drinking wells on properties adjacent to the plant revealed traces of both the radioactive isotope technetium-99 and the industrial degreaser trichloroethylene. Subsequent testing also found contaminants in nearby creeks. As a result, the U.S. Environmental Protection Agency added the plant to its National Priority List of Superfund sites in 1993. DOE assumed responsibility for cleaning up the site and for supplying safe, potable water to residents whose properties had been contaminated.

As Slovic, Flynn, and Layman (1991) have discussed, only in recent years has DOE revealed numerous instances of past waste mishandling at many nuclear facilities. The PGDP is one such facility. For decades, internal concerns were raised about worker radiation exposures and environmental impacts at the plant; however, DOE was not forthcoming

to its stakeholders about these concerns. As evidence of mismanagement continued to mount, DOE Secretary Bill Richardson issued a formal apology to employees in 1999 for the agency's concealment of information about exposures and potential impacts (Bruce and Becker 2007).

Successful organizations must maintain good relationships with a variety of external stakeholders. Successful managers, therefore, must evaluate the needs of clients, shareholders, regulatory agencies, the media, and other constituencies frequently, weighing whether, when, and how to meet these needs. Often, stakeholder demands center around the exchange of information and, more specifically, around access to accurate, timely, and relevant reports about the organization itself.

What happens when an organization with a history of providing minimal information to information-hungry stakeholders, such as PGDP, attempts to adapt its policies for increased disclosure? This already challenging process is further complicated in the PGDP case, and in many other quasi-governmental/private partnerships (e.g., Freddie Mac), with blurring organizational boundaries and confusion as to who are stakeholders, actors, regulators, and often, among private investors, guarantors of last resort. Frequently, the organization's transition toward a more responsive model is not a smooth one.

When stakeholders try to make sense of an organization's actions within a broader context, they must rely upon past experiences to assess what is possible within a given circumstance. Having neither direct nor immediate knowledge of internal organizational workings, individuals use what they know of an organization's past actions to assess the motivations for and appropriateness of current organizational actions. This sense-making process helps individuals determine the seriousness of a situation, choose how to react to the situation, and interpret the situation as it changes. Thus, yesterday's organizational actions directly bear upon today's stakeholder decisions, including whether to rely upon information provided by the organization itself or to seek additional information elsewhere, possibly from inaccurate and/or unfriendly sources. If the organization's past actions have indicated an unwillingness to provide credible, timely information, returning the relationship to a positive state can be a long, arduous task.

As this volume details, organizations interact with their external environments in a number of ways. In this chapter, we will focus on how key external stakeholders, especially government officials and investors, obtain information they need from organizations.

Stakeholder Relationships

Reflecting classic approaches to organizations, before modern system theories emphasized the open boundaries of organizations, management tended to focus exclusively on internal operations. The legacy of this tradition has been a lack of transparency and the general lack of accessibility to internal organizational information. In today's technology-driven world, in-depth organizational information can be provided with great ease across multiple channels; however, external stakeholder wishes may conflict directly with an organization's willingness to supply such information. In terms of data sharing, yesterday's inward organizational gaze has been supplanted, to some extent, by today's concerns that sharing certain information could threaten the intellectual property rights of organizations, suggest insider trading issues, create security threats, and/or result in legal liabilities. Such concerns greatly inhibit truly participative relations with key stakeholders.

As organization-stakeholder relations have become more dynamic and complex, managers and scholars alike have had to rethink the classic paradigm. Today, stakeholder satisfaction is widely accepted as a key to organizational success. The last 30 years have seen the formation of new types of organizational coalitions to develop innovative products and services, while modern logistics models focus on ever-closer relationships between organizations and their suppliers. These shifts have been reflected in the dramatic growth of outsourcing and the use of private contractors who often are quasi-employees. Recent controversies at Federal Express and elsewhere illustrate some of the challenges associated with such changes. As in the Paducah case, these quasi-governmental organizations often increase the complexity of stakeholder information seeking.

Organizations are beginning to realize the benefits of closer stakeholder relationships in a number of other areas. New ideas and applications have been both proposed and developed by customers themselves. Work forces have been expanded with volunteers, including citizen scientists who help leverage scant resources by conducting such activities as environmental sampling for state agencies and other nonprofit organizations.

In the face of budget cuts, the Michigan Department of Natural Resources has activated its publics to help maintain hiking trails, track wildlife, and so on. Departments of Transportation across the country have established adopt-a-highway programs that illustrate the willingness of individuals and organizations to work together toward mutual goals.

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The citizen movement provides another strong example of the shift in stakeholder involvement, with individuals attempting to influence policy and practice at a number of levels. Citizen journalists, including online bloggers and community radio practitioners, present their work to increasingly large audiences, while citizen scientists who do not agree with organizational and/or governmental assertions often conduct their own testing and analyses, reaching and publicizing independent conclusions. Such individual efforts have expanded into the public relations arena, as well, with individuals using the Internet, and especially social media, to promote their own efforts and causes, sometimes leading to the creation and expansion of viral marketing campaigns. Reciprocity norms in the sharing of information are essential to modern stakeholder relations (Tangpong, Li, and Johns 2010).

In the face of such fluid boundaries, the maintenance of stakeholder relationships remains a key issue for organizational management. Stakeholder concerns cut across public-private and corporate-nonprofit sectors, with the mediating role of information transfer from organization to stakeholder at the crux of the relationship. Therefore, managers must choose whether, when, and how to meet the information demands of key stakeholders.

Stakeholder Identity Orientations

The first step toward making such important decisions is to answer two very important questions: (1) who is perceived as a legitimate stakeholder, and (2) to what extent should legitimate stakeholder information needs be proactively addressed? These questions are intimately bound to an organization's adoption of one of three identity orientations: individualistic, relational, or collectivistic (Basu and Palazzo 2008).

In individualistic organizations, decision making is guided by selfinterest (Basu and Palazzo 2008). Managers take a pragmatic approach to identifying legitimate primary stakeholders, whose needs are addressed chiefly when there is a direct threat to the organization or when some other organizational interest is served. The relative number of acknowledged stakeholders for individualistic organizations tends to be somewhat smaller than those of other identity orientations, while the organization's willingness to provide information is somewhat reduced. Thus, both the target audience and the amount of information provided likely will be smaller for individualistic organizations.

In contrast, organizations that adopt relational identity orientations emphasize the establishment and maintenance of stakeholder partnerships (Basu and Palazzo 2008). Such an approach to stakeholder management

indicates a somewhat broader view of the relationship between organizations and their stakeholders, implicitly recognizing their symbiotic nature. Relational organizations, therefore, are more likely to perceive a larger number of stakeholders as legitimate and have an increased willingness to provide information to those individuals and groups.

Finally, organizations with collectivistic identity orientations speak in "universal" terms, envisioning themselves as part of a broader network of interested parties (Basu and Palazzo 2008). These organizations incorporate pro-social goals into their agendas and see themselves as one of many stakeholders involved in larger processes. These commitments drive collectivistic organizations to provide information widely to broader publics.

Each of the three identity orientations points to different perceptions of stakeholder legitimacy and varying organizational willingness to provide information. This is not to say, however, that any single orientation is uniformly preferable to any other in the dissemination of information to stakeholders. For example, an individualistic organization that supplies limited information to stakeholders who have little desire for such information as design decisions may have less need to adapt its strategy than a collectivistic organization freely sharing vast amounts of product specifications with stakeholders who have little or no need for the information.

One example of an information technology that did not fulfill its initial promise is the adoption and implementation of electronic health records. Despite considerable national policy interest, physicians and hospitals have proven to be slow adopters of the technology (Johnson 2009b). Seeing an opportunity several years ago, Google unveiled a personal health record that individuals could develop on their own. Although considerable effort, publicity, and partnerships with a variety of vendors converged around the product, Google recently abandoned the effort because of lack of public interest.

As interrelationships among organizations and individuals become increasingly complex, so too must organizations develop more complex ways of building and maintaining goodwill in those relationships. Organizations must be ever more attuned to their environment, especially when concerns arise about the potentially disruptive impact of some innovations on their operations and stakeholder relationships. Managers therefore face a daunting task in today's rapidly expanding, ever-changing information environment: providing the necessary amount of information to meet

stakeholder needs. Since stakeholders must come to intelligent judgments about an organization and its operations based on the welter of facts, forecasts, gossip, and intuition that makes up their information environment, the general thrust of modern organizations is to be more responsive and adaptive to external stakeholders.

Moreover, Emery, and Trist (1965) and Lawrence and Lorsch (1967) note that as an organization's involvement with its environment grows, its internal structures become more complex, leading to front-back, designs, facilitated by information technology (Galbraith 1995). Traditionally, organizations have taken a "field of dreams" approach—that is, "If we build it, they will come." Unfortunately, such endeavors rarely work well anywhere other than a big screen cornfield, as assumed stakeholder interest in information technology applications often does not materialize.

The recognition that stakeholder interest in specific business endeavors cannot be taken for granted represents just one of many forces driving increased organizational efforts to share information with external audiences. Pressure from government entities, sometimes spurred by various legal actions, including e-discovery, as well as legal requirements for open meeting and open records, and other statutory requirements have steered many organizations toward more proactive approaches to information provision.

Coorientation/Matching

It is important for organizations to effectively match their stakeholders' needs in the amount and types of information that they make available. One way to navigate complex organization-stakeholder relationships and the related impacts on information flow is to implement a coorientation approach. Originating in psychology to illustrate the relationship between psychological balance and mutual benefit (Heider 1946), coorientation models have been adopted by public relations professionals as tools for understanding relationships between organizations and their stakeholders (Broom 1977; Grunig and Hunt 1984). Since the model can be adapted to the specific challenges of organization-stakeholder information matching, organizations can identify their own placement within the four conditions of mismatch and match, thus better positioning themselves to adapt information strategies and improve stakeholder satisfaction.

Adversarialism, such as the initial history of the Paducah case, describes a coorientation condition in which stakeholder information needs are high, but organizational willingness to provide information is low. This condition arises when the organization determines that its internal need

to keep information private outweighs its stakeholders' desire for more information. The Paducah facility supported an industry that was born during wartime, with the earliest applications of the technology appearing as weaponry and military reactors; thus, a high level of secrecy was perceived as vital to national security. Other, somewhat less extreme, reasons that managers sometimes give for withholding information from stakeholders include fear of external sanctions, potential legal actions, or loss of proprietary data. When a lack of willingness to disclose information is perceived, stakeholders can become suspicious of organizational motives for "concealing" the information. When the organization is seen as an adversary rather than an ally, stakeholder satisfaction drops, increasing the chances of potential stakeholder abandonment and, ultimately, loss of organizational legitimacy.

Inundation describes the opposite condition, in which an organization provides vast amounts of information to stakeholders who have little desire for it. Inundation resembles adversarialism in exemplifying a motivation-driven approach to corporate social responsibility, with the organization placing its own wishes ahead of its stakeholders' needs. In the case of inundation, the organization has determined that its intrinsic desire for openness outweighs the external influence of low stakeholder needs. The excess of undesired information can lead stakeholders to "tune out," ignoring potentially important messages from the organization as the signal gets lost amidst noise.

The third coorientation state, apathy, describes a condition in which both stakeholder information needs and organizational willingness to provide information are low. From the organization's perspective, this match can result either from an internal organizational focus that ignores potential stakeholder information needs or from the belief that stakeholder information needs actually are low. While apathy can indicate a level of mutual contentment, organizations must be vigilant in performing stakeholder needs assessments. If stakeholder needs increase with no subsequent organizational response, the relationship could transition easily into adversarialism.

The fourth condition, satisfaction, arises when the organization has a strong willingness to meet stakeholders' high levels of information need. Organizations relying upon performance-driven approaches rooted in expectancy matching or stakeholder-driven approaches that examine the needs of external stakeholders have greater probability of achieving satisfaction. However, even the satisfaction condition holds potential challenges, as organizations must conduct frequent stakeholder needs assessments. If stakeholder needs decrease without an ensuing organizational response, the relationship could devolve into the inundation condition.

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Those Who Seek: Needs of External Stakeholders

For this coorientation approach to work, managers must determine exactly who the organization's stakeholders are, thus helping identify what types of information are needed as stakeholder interests and information needs are closely coupled. In general, stakeholders support organizational functioning, whether by providing labor, financial support, a potential market, positive exposure, or some other function. Stakeholder typologies distinguish between primary stakeholders, whose role is essential to organizational survival, and secondary stakeholders, who are not essential to survival but whose actions, nevertheless, can affect the organization (Clarkson 1995).

While relations with internal stakeholders, such as employees, are covered in volume one of this series, this chapter's primary focus is stakeholders who are external to the organization. Among these key stakeholders are policymakers and government agencies who create and enforce laws that affect operations. In addition, organizations depend upon the investors who finance operations, as well as small-business and corporate partners who assist in jointly leveraging resources to meet common goals. Each of these stakeholder categories requires specific kinds of information at specific points in the life cycle of the organization—requirements that managers must determine when and how to meet.

How They Seek

"Efficiency requires members of the audience to be treated amorphously and to bend to the institution. Effectiveness requires that individuals be helped on their own terms (Dervin 1980, 85)."

Stakeholders who require information about an organization have a variety of options for gathering this information, many of which are provided directly by the organization itself. Frequently, the most immediately accessible source is the Internet. Organizational websites often go beyond superficial boilerplate overviews to include investor relations sections, complete with annual reports, investor news, and earnings reports. Many of these items, created by the organization itself, also are provided regularly to investors via surface and/or e-mail, especially for publicly held companies. Further, various regulatory agencies require the organization to create and submit detailed reports of operational matters ranging from financial activities to potential environmental impacts.

One challenge for organizations, however, is insuring that stakeholders use the informational materials that they provide. As noted previously in this chapter, the traditional internally focused management model has lent itself to an approach to information sharing that falls within the adversarialism section of the coorientation model, that is, organizations have provided little information to external stakeholders, leading to concerns about how forthcoming they really are and what "spin" they might be applying. Because individuals base their assumptions about present conditions on past experiences, such historical issues can lead to distrust of materials produced by organizations. Therefore, to create a holistic, unbiased picture of organizational operations, stakeholders often seek information about the organization from other sources, then integrate and analyze all of the collected information before making decisions.

Traditionally, managers have approached stakeholder communication via a one-way, top-down flow of communication. They have relied on mass media campaigns to reach large numbers of people efficiently. These authoritative dicta and the lack of interactivity possible through the preferred communication channels were meant to discourage or preempt, rather than stimulate, information seeking. Many approaches and assumptions of traditional media research often were implicit in this approach. Somewhat akin to mass media's historical bullet theory, stakeholders were thought to be a relatively passive, defenseless audience whose input was sought solely through surveys or focus groups to determine the best way of changing their minds and their subsequent behaviors.

Bullet theory reflected early beliefs that messages from the mass media could be "shot" into a relatively defenseless and passive audience who could be easily influenced.

More contemporary approaches to stakeholder relations are likely to stress a dialogic view of external communication, with both parties initiating and attending to messages in turn. These views incorporate a much more specific role for information seeking, which in traditional views was almost totally ignored. Managers' most important role in these more modern perspectives is as stimulus or cue to action, identifying stakeholder concerns, and helping define the agenda of the most important issues that stakeholders face. Thus, a critical role of managers is that of managing attention.

This approach suggests that a precursor to improved dialogue would be to increase the stakeholder's knowledge base by providing alternative

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information sources. Indeed, one objective of information campaigns should be to sensitize individuals to other sources of communication. For example, stakeholders can increase their information seeking through the use of apps that provide corporate intranet data to mobile devices, thereby increasing the access of outsiders to what has traditionally been internal information. Today's external stakeholders have access to package tracking, reservation data, and other information that were previously the sole domain of those within the organization. Acquainting individuals with sources that are relevant and useful for their immediate purposes is a critical first step to developing better stakeholder information-seeking habits.

Tactics

In some ways, stakeholders are like organizational newcomers, in that they often have to uncover for themselves, using various tactics, what an organization is really like. Thus, discussions of external stakeholder information seeking can be informed by recent research lines related to information seeking by organizational newcomers, especially during organizational entry or job changing (Ashford, Blatt, and Vande Walle 2003). Of particular interest have been the tactics that these individuals use to uncover information about task, cultural, and other expectations that an organization might have (Miller and Jablin 1991). A newcomer to an organization often is confronted with a vast array of information that s/he must make sense of to determine appropriate behaviors. Active information seeking on the part of newcomers and stakeholders often is necessary because organizations frequently withhold information, whether inadvertently or purposively.

The vast array of information that newcomers or stakeholders are exposed to, along with the gaps in provided information, can result in high levels of stakeholder uncertainty. As this uncertainty engenders uncomfortable feelings, stakeholders are driven to seek information that would reduce it. In doing so, they may be doubly vexed because inexperienced information seekers may not know what tactics are appropriate or useful. As a result, their information seeking also may be more thoughtful, with newcomers and stakeholders consciously weighing the efficacies of various strategies they might employ.

The most obvious strategy, and seemingly the most efficient, is to ask *overt questions* on the topic of interest. A new investor, therefore, may ask what the expected return is. This strategy is more likely to be used when individuals feel comfortable with a situation—when they want a direct, immediate, and authoritative reply. Individuals may feel uncomfortable

asking direct questions if they perceive others will view them as constantly pestering for information or if the question reveals more about their own inexperience and/or ignorance of the topic than they want others to know. Questioning also involves selecting a target for the question, which in itself may be a difficult choice. For example, would it be wiser to approach the investor relations officer or to ask a relative or friend who works for the firm? Similarly, there is the risk that a question, such as "Are we tanking?" could result in a negative answer that both parties would like to avoid.

Indirect questions often are employed in cases where someone is uncomfortable. Such questions usually take the form of a simple declarative sentence or observation that is meant to solicit information, often disguised within an apparently casual conversation. For example, a statement like, "You seem to be incredibly busy—your business must really be thriving," could be a somewhat discrete attempt to validate organizational success.

Another, more dangerous, strategy that individuals might pursue is *test-ing limits*. For example, an individual who really wants to find out how an organization operates could engage in drop-in visits.

A less direct strategy is that of *observing*. In such cases, stakeholders can watch the actual behaviors of a target organization, weighing those actions against the organization's words. There are limits, however, to what a stakeholder can directly observe.

Beyond these well-established and documented information-seeking strategies relied upon by newcomers, such strategies as skimming, berrypicking, chaining, and monitoring key sources for developments also might pertain to the external stakeholder's information-seeking challenge (Johnson 2009a). Perhaps the most interesting of these options is browsing, because of its random, nonrational surface appearance.

Blau (1955) classically found workers establishing occasions for information seeking by hanging out with others; merely being present at informal events. Thus, geographic proximity in places such as Silicon Valley can help stakeholders get a feel for the "buzz."

Browsing essentially involves scanning the contents of a resource base and is used as an early strategy in a search process or when someone is scanning his/her environment. A key element of browsing is preparedness to be surprised and to follow-up (Chang and Rice 1993). Browsing in social contexts often takes the form of informal networking. Casual group conversations, including gossip, may take on elements of browsing, with more intensive follow-ups on specific topics that interest the information

seeker. Browsing is facilitated by accessibility, flexibility, and interactivity, which also can provide an occasion for the use of such other strategies as indirect questions.

While walking around, an information seeker might pause to "shoot the breeze" with others. This conversation will be of limited informational value if the stakeholder allows the other conversants to do all the talking. Instead, the information seeker must be prepared to ask neutral questions and to listen with care to responses.

No one can go to the direct source of information regularly; there is not sufficient time. Instead, a stakeholder can use many of Burt's suggestions (1992) related to structural holes, developing a wide range of strategically located, nonredundant sources to provide the widestpossible view of the organization. In doing this, stakeholders also should develop sources of information external to the organization, such as the media, who can offer a more independent view of organizational operations. At the same time stakeholders are developing this breadth of ties, they should insure that there are sufficient redundant ties to provide alternative sources of information on critical issues.

The final newcomer strategy is to use a *third-party* intermediary within the organization to gather information. Thus, rather than approaching the chief financial officer, who would serve as a primary source, a stakeholder might ask questions of his/her administrative assistant, who can serve as a secondary source of information. This strategy is employed most often when a primary source is unavailable or when the seeker feels uncomfortable approaching him/her directly. The downside to this strategy is that the secondary source must be trustworthy and a true surrogate for the primary one. It helps to have key informants for particular domains of information. Traditionally, these individuals have been described as gatekeepers because of their role in filtering information, often in a condensed, understandable fashion.

Recognizing the effort and sophistication needed to satisfy their information needs, individuals often rely on intermediaries to conduct their searches for them. The increasing use of secondary information disseminators, or brokers, is really a variant on classic notions of opinion leadership (Katz and Lazersfeld 1955). Opinion leadership suggests that ideas flow from the media to opinion leaders to less-active segments of the population. Opinion leaders not only serve a relay function, but they also provide social support information to individuals, reinforce messages by their social influence over them, and validate the authoritativeness of the

information. Thus, opinion leaders both disseminate ideas and, because of the interpersonal nature of their ties, provide additional pressure to conform as well. However, these highly intelligent seekers also may create unexpected problems since they may create different paths and approaches to dealing with problems an organization may be having.

The emergence of the Internet as an omnibus source of information appears to have changed the nature of opinion leadership; both more authoritative sources, such as Bloomberg news feeds for financial information, and more interpersonal sources, such as advocacy groups supporting specific policies and practices, are readily accessible online. The risk, however, is that individuals can quickly become overloaded or confused in an undirected environment. In essence, while the goal may be the provision of great amounts of information to reduce uncertainty or to help bridge a knowledge gap, the actual effect can be increased uncertainty and, ultimately, a decreased sense of efficacy, inhibiting the desire to conduct future searches. A stakeholder literacy approach, then, would help people gain the skills to access, judge the credibility of, and effectively utilize a wide range of organizational information from multiple sources.

Increasingly, formal groups are becoming opinion leaders and information seekers for individuals. A big advantage of investor groups is their access to informal contacts. These contacts can provide critical information before it is available from more traditional sources. In addition, such groups can prepare someone psychologically for a more active and directed search for information. More and more, these formal groups, acting as crowd-sourced investors, support the everyday information needs of stakeholders.

The last half-century has seen the emergence of advocacy groups that support the needs of their individual members; such groups also may seek to change policies and practices, as well as societal reactions to their members, attempting to insure that sufficient resources are devoted to the needs of their groups. At times, these groups have agendas that do not necessarily coincide with an individual's need for information that might contrast with or directly oppose the advocacy group's goals. While the entrepreneurial broker is an individual's agent, advocacy groups need members to advance the group agenda. For example, while a mining company might downplay or omit environmental impact information in its corporate communications, an environmental organization advocating against certain types of mining might downplay or omit the company's economic impact information from its communications. Information literate stakeholders would be able to collect, assess, synthesize, and weigh these disparate types of information to support decision making related to the organization.

An example of the delicate balancing act that advocacy groups need to perform to keep their credibility with both the organizations they seek to influence and the stakeholders they represent can be found in American Association of Retired Persons' role in policy debates on cutting the budget deficit. Recently, to keep their credibility with government officials, AARP suggested that the organization might be receptive to some changes in Medicare and Social Security, much to the consternation of many whom they represent.

Given the amount and variety of information available on the Internet, some individuals have expressed concern that lay people may bypass organizational intermediaries in existing power structures. The notion of the citizen scientist, for example, has gained increased attention. Most compelling, however, has been how this informedcitizen movement is driving research. The Army of Women, a patient group that advocates for improvements in breast cancer research, exemplify this trend by generating funds for clinical studies, enhancing participation in trials (particularly challenging in rare diseases), and garnering support for more trials.

Promoting Information Seeking

Johnson (1996, 1997) has summarized the basic approach to information seeking by individuals, with Case (2007) making very similar arguments in a more recent review. First, people seek out information that is the most accessible. Second, mere information access is of little utility without the proper information-seeking skills and training for successful retrieval. Third, people follow habitual patterns in their information seeking. Fourth, face-to-face interpersonal communication is the preferred mode of communication for information seeking. Therefore, the quality of an individual's interpersonal networks has important implications for information seeking; people want to consult others, such as opinion leaders, who have digested and evaluated an array of information (Johnson 2009a). Fifth, different types of persons use different sources of information; this point is reinforced by norms and standards of care that vary across professions (e.g., engineers vs. lawyers). Sixth and finally, individuals have cognitive limits on the amount of information that they can process, especially in short-term memory.

Managers in the current environment must effectively facilitate the flow of information to insure support for an appropriate information

infrastructure that recognizes how stakeholders typically acquire information. Many organizations have realized that promoting information technologies advances strategic advantages, especially in enhancing quality, maintaining market share, and developing innovations. Indeed, it has become commonplace for almost all hospitals and managed care providers to have active information programs for their clients. Obviously, a key role for managers lies in facilitating and encouraging stakeholder attempts to seek and find information. This represents a significant shift in management priorities, as well as a major change in the way stakeholders are viewed.

Organizations increasingly attempt to shape the richness of their stakeholders' information fields. For example, some organizations provide access to corporate intranets, allowing customers to track purchases. This strategy removes barriers to the acquisition of information. Simple scanning of information on the web also can increase the knowledge base of individuals, making it possible for external stakeholders both to communicate more effectively with managers and to make more informed decisions about appropriate solutions to challenges. Creating richer information fields through such practices as "self-serving" in retrieving information from databases, for example, makes for a more informed stakeholder who is likely to consume less managerial time "being brought up to speed" on basic information.

In essence, an information architecture serves three data-related functions: storing, transporting, and transforming (Cash et al. 1994). Increasingly, the blending and integration of these functions is creating exciting opportunities for satisfying information needs. The benefits and possibilities are captured under the heading of informatics.

Databases may be thought of as those information repositories that are the key elements of an organization's memory. Essentially, databases provide a means for storing, organizing, and retrieving information. Electronic storage enhances the possibilities of linking various databases to create increasingly sophisticated searches. Shared databases are at the center of developing information systems, since they provide a common core of information. Traditionally, data storage has meant physical storage of information in filing systems; however, the exponentially growing volume of information has rendered paper-based systems increasingly unwieldy (Johnson 2009a). Modern conceptions of storage have broadened this function considerably to include verification and quality control of information entering a storage system. Once information has been stored, security systems, which bear directly on information-seeking possibilities, become very important. For example, who should have access to personal information, and how is such access granted? Security issues also involve

developing and implementing means to insure that no one can tamper or change information residing in a database.

Data transport is the acquisition and exchange of information. The previously mundane world of data transmission has become the stuff of headline news, with innovative apps by Google, Apple, and other companies providing easier access to information that receives prime placement across major press outlets. Networks, like the Internet, usually combine enhanced telecommunication capabilities with (frequently database driven) software that allows linkage and exchange of information between users. The Internet's ability to provide easy access, both in terms of low cost and reduced barriers, and the user-friendliness of search software and associated applications have been exciting developments for information seekers. Telecommunication systems, such as fiber optic cables and satellite systems, provide the hardware that links individuals and provides enhanced access to systems, largely through the availability of various handheld devices. Telecommunication systems maintain communication channels (e.g., e-mail) through which information can be accessed and reported. Specifically, these systems enhance the information seeking of stakeholders by creating new channels for sending and receiving information, helping them filter this information, reducing their dependence on others, leveraging their time to concentrate on the most important tasks, and enhancing their ability for dealing with complexity.

Communication technologies, such as bulletin boards and discussion lists, permit sending messages to a communication space characterized by potential similarities of messages and communicators, rather than to specific individuals. Such developments enhance participation and access by allowing individuals who share similar interests to identify each other and communicate within the same electronic space.

These technologies represent a transition to more truly interactive, dialogic systems involving social media and Web 2.0. While Web 1.0, or the read-only Web, operated much as a traditional library that promoted more efficient searches and passive reading of available materials (Strecher 2008), Web 2.0 has increased interactivity tremendously. Users can create and share information via text, graphics, and video through a variety of social media applications (Sarasohn-Kahn 2008). These collaboratives promote greater knowledge transfer, concerted action, and greater voice when approaching policymakers for funding, regulation, and other objectives.

While the Internet remains the primary source of Web 2.0 applications for most individuals, some have suggested that a better label would be Interactive Communication, which would encompass personal digital assistants, mobile phones, computer tailored print materials interactive voice response, computer-driven kiosks, DVDs, and so on (Strecher

2008). Four types of interactivity are particularly relevant: user navigation, collaborative filters, human-to-human interaction, and expert systems (Strecher 2008). User navigation is somewhat analogous to searching for information in a library. Collaborative filtering involves sophisticated software written for identifying user behavior and linking individuals who have similar preferences; this type of application is found on Amazon. com, where recommendations are provided based on the purchases of others who have chosen similar products. Human-to-human interaction mediated by the web can take the form of information brokers or investor services that include an instant messaging service, combining the best features of the Internet with traditional financial advisors.

The efforts of advocacy groups now can be more easily pooled as advances in information technology, social networking, and other information tools produce more informed consumers who can share information with each other and whose collective knowledge may even exceed that of some professionals. Such collectives can result in knowledge transfer, greater voice, concerted action, and formal collaborations. These activities are somewhat similar to the citizen scientists' movement in the hard sciences in which large numbers of participants observe, measure, and assess phenomena with the assistance of the Internet and modern computing. Accelerating these trends are a host of technology and decision-support related advances, including enhanced access to authoritative web-based information resources, personal decision aids, and social networking capabilities.

The Internet has spawned many flexible information search and retrieval services that provide substantial benefits. Expert search engines, such as those found in tailoring applications, try to accommodate the different learning and search styles of users, adapting approaches to specific individuals. Messages might be screened, sorted, and prioritized based on several categories: the urgency in which a response is needed, cognitive domains (e.g., key words), social dimensions (e.g., more attention given to friends, those higher in the hierarchy), future communication events (e.g., the agenda for an upcoming meeting), and so forth. Many corporate sites now develop user profiles that keep abreast of self-defined areas of interest as relevant material is added to a database through such tools as RSS feeds and Twitter. Such approaches combine both push, with controlled messages delivered to mass audiences, and pull, with messages sought out by audience members because of their inherent interests wherever they might be. Twitter, for example, provides a perfect platform for announcing new product developments, profit statements, and so on. Various IT tools also are being developed for tracking and identifying different stakeholders and their interests (Chung, Chen, and Reid 2009).

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Social networking services are primarily technology and software facilitators for people to form relationships with each other. Facebook, for example, describes itself as "a *social utility* that *connects you* with the people around you" (http://www.facebook.com/). Typically, social networks define a universe of users through directories. They also can define the types of relationships users would like to have with others. Users often are seen as members of particular communities, and in some applications, social networks facilitate the development of communities of practice around particular interests and activities, such as Yahoo! groups and such real-time interactive games as Scrabble and Farmville. Recent research in instructional communication has shown that such computer-based interactivity can increase the engagement levels of message recipients (Emmons et al. 2004).

The content features of these websites, especially in terms of facilitating the flow of complex information in such diverse forms as textual graphic, visual, and so on, can greatly facilitate the flow of information. The social tagging of websites by various users on del.icio.us, for example, provides one method of sharing communally identified websites. Different technologies and platforms associated with the sites enhance the possibilities for interacting: babble, chat, blasts, blogging, discussion boards, e-mail, loops, pokes, likes, requests, reviews, shouts, tagging, and Track Back Ping are just a few of the ever-increasing number of ways to communicate online. These features have been associated with the development of Web 2.0, which encourages the development of collective intelligence through the democratic participation of users (Boulos and Wheeler 2007).

The integration of data storage and transport with sophisticated software offers unique opportunities for solutions that transcend the limits of individual information processing. Such applications are especially helpful for novices, but they also are a boon for experienced professionals who need to make decisions under pressure. To use a familiar example, a car's dashboard contains a number of instruments that help the driver use a complex system that interacts with its outside environment through an array of sensors. Some of the visual displays indicate that appropriate action needs to be taken quickly (e.g., a significant decline in oil pressure, or a rise in coolant temperature), others give feedback on current performance (e.g., miles per hour), while still others provide longer-term information (e.g., maintenance is required, oil life is diminishing). More modern vehicle dashboards also have inferential capabilities (e.g., projected range, miles per gallon, traffic avoidance) to provide more detail on particular areas of concern to drivers. To be useful, a careful balance must be struck between providing too much information, which may distract the driver from the task at hand, and too little. Careful thought must be

given to what indicators really are critical to system performance. Extending the metaphor, an investor's personal web page could serve as a sort of dashboard, with a visual clue indicating that things had gone into the red zone, thus signaling the need for an immediate response, whether buying, selling, or following-up for additional information.

One method of fully engaging information seekers with computer technologies is to introduce interactivity, which Street and Rimal (1997) describe as computer technologies that allow stakeholders to access, control, and respond to relevant information. Information system designers thus may wish to encourage a state in which individuals feel that they are in the "groove," that is, that they are jamming with the information environment around them (Eisenberg 1990). People want to maximize their cognitive load, as well as their enjoyment (Marchionini 1992), and they do not like tasks or information systems that add to their frustration. Instead, they prefer systems that are intrinsically gratifying and that have an intuitive, game-like feel (Paisley 1993).

For example, people do not like two-step information systems that cite sources of information that they must later seek out. The concept of flow, which captures playfulness and exploratory experience, can encourage people to use new and unfamiliar information technologies. Flow theory, most associated with the work of Csikszentmihalyi, suggests that involvement in a flow state is self-motivating because it is pleasurable and encourages repetition (Trevino and Webster 1992). Thus, search engines that provide direct answers or hyperlinks work better than citing sources that someone needs to look up separately.

Traditional approaches have pushed targeting messages to particular audience segments. Audience segmentation breaks down the mass audience into groups that are as homogeneous within, and as different from, each other group as possible. Considerable evidence points to the importance of effective audience segmentation for the design and implementation of successful campaigns. With improved identification of audience knowledge and beliefs comes an increased ability to create messages that appeal to a specific group of stakeholders. Understanding the beliefs of message recipients is necessary at all levels, from crafting an effective message to its delivery by a salient source through an appropriate channel (Atkin 2001). Lack of specificity in audience targeting not only runs the risk of decreased message effectiveness but also may increase the potential for unintended effects, even promoting the opposite of the intended behavior through boomerang effects.

Organizations need to recognize the fundamentally different nature of various segments of their audience and develop different strategies to reach them. In segmenting stakeholders, organizations need to focus on the importance of different groups (e.g., who most needs to change?) and on their receptivity (e.g., who is most likely to be influenced) (Atkin 1992). This type of approach essentially seeks to understand the stake-holder so well that it sells itself by the mere provision of information. Classical segmentation has been done by demographic characteristics, taking a targeting approach.

In contrast to targeting that focuses on groups of individuals who share similar characteristics, tailoring focuses on individuals who have unique clusters of attributes. The utilization of tailored messages, which have been shown to be more effective than generic messages (Neuhauser and Kreps 2003), within new media interventions provides a fascinating avenue for exploration. There is evidence across a number of domains that tailoring is superior to nontailoring of messages for campaigns. This, in part, is based on the classic formulation that impact equals efficacy times reach, with tailoring argued to have both high efficacy and high reach (Noar, Banac, and Harris 2007). In broad form, tailoring involves the use of computer algorithms to match personalized messages designed to impact behaviors. Tailoring provides a means of generating interactive computer interventions to disseminate very specific messages to individual combinations of socioeconomic, ethnic, gender, interest, and other groups while maintaining the logistical and cost advantages typically provided by mass media outlets.

A tailoring approach focuses on the unique attributes of individuals and mimics some of the classic characteristics of interpersonal channels (Kukafka 2005; Noar, Pierce, and Black 2010). These systems use personalization by gathering specific information during assessment (e.g., name, age, and so forth); *feedback* by involving expert systems recommendations for the individual; and adaptation by involving the development of content packages tailored specifically to the person's information needs (Lustria et al. 2009). Message tailoring goes hand-in-hand with segmentation and has seen considerable advances over the last couple of decades, especially with the advent of new media and technologies that facilitate its application. At the same time that tremendous growth has occurred in terms of consumer tools for acquiring information, a concomitant increase has occurred in marketing and advertising these tools (Tomes 2010). The applications have demonstrated greater influence than classic mass media one-size-fits-all approaches. In part, this has been accomplished by the greater relevance of messages delivered to specific audiences (Strecher 2008).

In the Internet age, erroneous, incomplete, or biased information that is promoted and sustained in the blogosphere can pose a significant threat to an organization's relationships with its stakeholders and, ultimately, to its operations. Investors face growing problems with where to obtain

objective information, since professional analysts often self-censor information. Conversely, factual and news-oriented blogs can serve as a valid means of disseminating comprehensive organizational information to stakeholders. More and more, traditional mailing lists for organizational press releases are being expanded to include bloggers and other citizen journalists.

Outcomes

"Brains have difficulty processing all the relevant information—there is too much, it may not fit with expectations and previous patterns, and some of it may simply be too threatening to accept" (Mintzberg 1975 17).

In the modern age, individuals are faced with three fundamental information-seeking problems: (1) they have more choices than ever before; (2) they have more sources of information regarding these choices; and (3) they increasingly receive information targeted at influencing their behavior rather than simply communicating facts (Marchionini 1992). Thus, stakeholders must constantly struggle with the question of where to invest their time and what to investigate, confronting the question of how much is enough for particular purposes.

Information pollution has become an increasing concern of even the popular press because the wealth of information stored on Internet resources creates some difficulty in determining the reliability of that information. Even when the sources are reliable, such as government agencies, information can be presented as "data dumps," with poor website navigability and a lack of user friendliness. Such situations limit stakeholders' ability to access and retrieve relevant data, potentially frustrating them and discouraging future information-seeking attempts. A related strategy that may be very effective for inhibiting information seeking is to drown people with information and then interpret it for them. There also is reason to be concerned about the commercial or self-serving motivations of many information providers. One unresolved area is who is liable for erroneous information on a database: the host of a website, the author of a message, or the person providing the information they have gleaned from the website to another? These trends suggest a need to revisit simplicity. There also is a need to think carefully about what information should be excluded from an individual's information processing.

All of the forgoing findings relate to the "costs" of information seeking compared to the value or benefit of the information sought, particularly

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as that information relates to decision making (March 1994). While more and more information can be produced and provided more efficiently, there is a concomitant increase in the costs of consuming (e.g., interpreting, analyzing) this information. The costs of information acquisition are many and include the psychological, the temporal, and the material. Many stakeholders appear to assume that having easily obtained information, no matter how incomplete or dubious, is preferable to expending additional effort to gather complete and valid information.

Costs have been articulated in various "laws" of information-seeking behavior. The classic law of "least effort" has been evoked to articulate why channels are chosen first that involve the least exertion. Mooers's law suggests an information source or system will be less desirable if the specific information it contains is deemed more painful or troublesome than the absence of that information (Johnson 2009a). In short, the costs of overcoming ignorance at times outweigh the gains. (And what is amazing is how low the costs are that establish absolute barriers to information seeking.) It is even possible, at least for particular topics, to be sated that is, to have acquired enough information. Thus, there may be as many, if not more, reasons for not seeking as for seeking information.

All of this points to the benefits of organizations adopting easy-to-use push technologies that guide stakeholders, as well as using multiple channels to reach stakeholders. Following the traditional top-down approach to stakeholder communication, organizational websites provide one point of stakeholder exposure to information; however, unlike traditional media channels, such websites have dialogic capabilities. Organizations can use their official online presence to gather information from stakeholders, ranging from basic demographic data to concerns and priorities elicited through online surveys. Organizations also can implement social networking approaches to supplement these efforts, not only to provide information but also to build relationships with stakeholders, creating another arena in which the "temperature" of stakeholder information needs can be taken. Further, organizations can expand the recipients of official communications, such as press releases and annual reports, to include more nontraditional targets, including citizen journalists, respected and relevant blogs, and citizen science groups.

Conclusions

As made explicit earlier in this chapter, it is important that the information provided by organizations meets the perceived needs of stakeholders to the extent possible. Corporate monitoring of Twitter, advocacy groups, and sophisticated tracking of stakeholders and their requirements on the

web is key for achieving appropriate coorientation (Chung et al. 2009). By providing the right amount of information to the right stakeholders, organizations can contribute to a state of shared satisfaction in the information exchange.

Returning to the case study detailed earlier, in compliance with federal laws and community right-to-know provisions, DOE has attempted in recent years to redress legacy trust issues with its stakeholders in a number of ways. Following the site's addition to the Superfund National Priority List, DOE established the PGDP Citizens Advisory Board, or CAB, to assist the community in understanding technical information about the site. Both DOE and the CAB have conducted extensive public meetings about a number of historical and current matters, including property contamination around the facility and options for future waste disposal after the plant is decommissioned. In addition, DOE created an Environmental Information Center in Paducah, featuring access to administrative records, reports, and other information about the facility. Many site-specific reports also are available through the information center's website (http://www.pppo.energy.gov/pad_eic.html).

Despite such efforts, the tensions created by decades of adversarialism remain. As recently as 2006, one representative of a local stakeholder group wrote a letter to the then chair of the House of Representatives Subcommittee on Energy and Water Development, decrying DOE's "shroud of secrecy (KRCEE 2007)." Even more recently, researchers in Paducah who asked local stakeholders to identify credible PGDP information sources were told by numerous individuals that DOE is no longer a trustworthy source of information for many in that community (KRCEE 2011).

It seems clear from the PGDP case study that DOE's previous unwillingness to share relevant information with stakeholders who needed it still has negative ramifications long after the organization has attempted to alter its information sharing policies. Perhaps, to borrow a cliché, the best defense against such a contentious situation is a good offense—that is, an organization should adopt an information-matching approach to avoid adversarialism from the outset, providing the best information it has in the quantities desired by its stakeholders. Otherwise, countless resources and extensive time could be required to repair stakeholder relationships, if, in fact, those relationships can be repaired at all.

When a mismatch occurs between available organizational information and stakeholder needs, the resulting states of adversarialism or inundation can reduce stakeholder satisfaction and potentially harm the organization's operations. Even when information supply and demand are matched, as in the low-low apathy state, there is the potential for relationship devolution if either stakeholder needs or organizational willingness to supply information changes without a complementary shift from the other party. Thus, it is key that managers continually scan their organizations' stakeholders to determine the desired level of information sought, along with making internal determinations about what information can be safely shared. In doing so, organizations can support the establishment of information architectures that meet stakeholder information needs while also satisfying organizational strategic goals. Often this is a very delicate balancing act for organizations.

Key Takeaways

- Managers in our new information environment must effectively facilitate the flow of information by insuring support for an appropriate information infrastructure that recognizes how stakeholders typically acquire information. They must understand where stakeholders are by applying a coorientation framework, bringing them up to speed, and having them self-serve, while tailoring information as much as possible.
- 2. Stakeholder information, and the means of providing it, is a strategic asset that should be systematically incorporated into managerial planning. This resource-based strategy can provide organizations with unique advantages (Tangpong et al. 2010).
- 3. Managers need to lobby federal and state governments to develop and maintain critical information infrastructures, such as publicly available databases. Corporations can substantially exploit existing government databases and have a vested interest in helping to maintain them.
- 4. Organizations must be ever vigilant against threat-rigidity relations with their environment (Staw, Sandelands, and Dutton 1981). The tendency to circle the horses and withdraw behind walls is illustrated by early information-disclosure decisions in Paducah. Such approaches play directly into the creation of adversarial relations with stakeholders, leading to external concerns about an organization's perceived secrecy and trustworthiness. In the absence of timely and relevant information from the organization, stakeholders are likely to attempt to fill that vacuum with information from other sources that may directly oppose the organization's goals.

Glossary

Brokers: Third parties who stand between parties in transactions, providing services that would normally be unavailable to them.

Coorientation: A type of model developed in psychology and public relations that predicts the nature of harmony or conflict relationships based upon matching the motivations and actions of the parties.

Information architecture: An information architecture serves three data-related functions: storing, transporting, and transforming.

Information seeking: Purposive acquisition of information from selected information carriers.

Information-seeking tactics: Approaches that individuals use to uncover information about task, cultural, and other concerns.

Opinion leadership: The social process where ideas flow from the media through opinion leaders to less active segments of the population.

Stakeholders (external): Individuals or groups who are either impacted by or who can impact an organization's operations.

Strategic communication: Purposive attempts to achieve identified outcomes that are important for an organization's performance.

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Public Health Research Implementation and Translation

Evidence from Practice-Based Research Networks

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Background: Research on how best to deliver efficacious public health strategies in heterogeneous community and organizational contexts remains limited. Such studies require the active engagement of public health practice settings in the design, implementation, and translation of research. Practice-based research networks (PBRNs) provide mechanisms for research engagement, but until now they have not been tested in public health settings.

Purpose: This study uses data from participants in 14 public health PBRNs and a national comparison group of public health agencies to study processes influencing the engagement of public health settings in research implementation and translation activities.

Methods: A cross-sectional network analysis survey was fielded with participants in public health PBRNs approximately 1 year after network formation (n=357) and with a nationally representative comparison group of U.S. local health departments not participating in PBRNs (n=625). Hierarchic regression models were used to estimate how organizational attributes and PBRN network structures influence engagement in research implementation and translation activities. Data were collected in 2010–2012 and analyzed in 2012.

Results: Among PBRN participants, both researchers and practice agencies reported high levels of engagement in research activities. Local public health agencies participating in PBRNs were two to three times more likely than nonparticipating agencies to engage in research implementation and translation activities (p < 0.05). Participants in less densely connected PBRN networks and in more peripheral locations within these networks reported higher levels of research engagement, greater perceived benefits from engagement, and greater likelihood of continued participation.

Conclusions: PBRN networks can serve as effective mechanisms for facilitating research implementation and translation among public health practice settings. (Am J Prev Med 2013;45(6):752–762) © 2013 American Journal of Preventive Medicine

Introduction

Public health and prevention programs remain controversial components of the federal Patient Protection and Affordable Care Act, in large part because of uncertainties about their effectiveness in reducing disease burden and constraining growth in

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national health spending.^{1–3} Achieving meaningful health and economic benefits from investments in prevention and public health requires knowledge about which strategies actually support improved health, at what cost, and how best to deliver these strategies to the populations that can benefit from them.⁴ An expanding body of research-tested prevention programs and policies exists, such as those profiled in the CDC's *Guide to Community Preventive Services*,⁵ but large gaps persist in the adoption and implementation of these strategies across states and communities.^{6–12} Moreover, public health professionals are often called to act against health threats for which few if any evidence-based strategies exist, or to act in settings where evidence-based strategies

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are logistically, politically, or economically infeasible. In these situations, innovations in public health practice occur but without the comparative research necessary to determine their impact and value.¹³

These missed opportunities for discovery and learning emphasize the need for "delivery system research" that indicates how best to organize, finance, and deliver public health strategies in real-world practice settings.^{14,15} The need for delivery system research in public health is particularly acute given that public health strategies are delivered through the combined efforts of multiple governmental agencies and their private-sector and community-based counterparts, through complex relationships and using resources that vary widely across states and communities and that evolve over time.^{16–20} Strategies that are easily implemented in one setting often face barriers in other settings.²¹ Expanded delivery system research can elucidate which strategies and adaptations work best in which settings and for which populations.

Practice-Based Research Networks

Delivery system research in public health settings requires the active engagement of public health organizations in the design, implementation, and application of these studies, but historically such engagement has been limited. Data from the CDC's National Public Health Performance Standards Program, for example, consistently indicate that state and local public health organizations are much less likely to achieve national standards in research and evaluation than in other domains of practice.^{10,11,22,23} Periodic national surveys of governmental public health agencies find similarly low levels of research engagement, particularly at the local level.^{24,25} To expand delivery system research in public health settings, the Robert Wood Johnson Foundation (RWJF) launched the Public Health Practice-Based Research Networks Program in 2008.²⁶ Public health practice-based research networks (PBRNs) bring together public health agencies and academic researchers to study the organization, financing, and delivery of public health strategies in real-world practice settings, with the goal of producing actionable evidence that can be used to improve practice and policy.²⁷

Practice-based research networks have been used in medical care research for more than 3 decades to support delivery system research in clinical settings.^{28,29} These clinical PBRNs allow community-based healthcare providers and their staffs to collaborate with researchers in designing, implementing, evaluating, and diffusing solutions to real-world problems in clinical practice.^{30,31} The experience of the PBRN model in clinical settings

suggests that it also may be useful in public health settings to accelerate the production and application of evidence regarding public health delivery.²⁷ Participating practitioners and researchers collaborate to identify pressing research questions of interest, design rigorous and relevant studies, execute research effectively, and translate findings rapidly into practice.

Beginning in 2008, the RWJF's Public Health PBRN Program supported the development of 12 research networks consisting of local and state governmental public health agencies, community partners, and collaborating academic research institutions. These supported PBRNs are located in Colorado, Connecticut, Florida, Kentucky, Massachusetts, Minnesota, Nebraska, New York, North Carolina, Ohio, Washington State, and Wisconsin. Additional public health PBRNs participate in the program as affiliate members and emerging networks under development, with the affiliate networks in Georgia, Missouri, New Jersey, and Tennessee progressing to the point of receiving research support from the PBRN program. Counting both supported and emerging networks, public health PBRNs are currently operational in 28 states, covering more than 1000 state and local public health agencies and 35 universities across the U.S.²⁶

The current analysis examines the experience of PBRNs in engaging public health organizations in the design, implementation, and translation of delivery system research during their initial 2 years of development. Specifically, this analysis (1) examines differences between academic and practitioner PBRN participants in the nature and intensity of engagement in research implementation activities; (2) compares research engagement among local public health practitioners that do and do not participate in PBRNs; and (3) assesses the influence of individual, organizational, and network characteristics on research implementation activities and experiences among PBRN participants. Results offer insight into the current and potential roles of PBRNs in expanding research implementation and translation in public health practice settings.

<u>Methods</u>

Study Population and Sampling

A cross-sectional, self-administered survey was validated and fielded with representatives of public health organizations that participate in one of 14 public health PBRNs. The survey was fielded approximately 1 year after each network formed, with five PBRNs surveyed during 2010–2011, and nine PBRNs surveyed during 2011–2012. A total of 357 people representing these organizations were identified by PBRN leaders as active participants in one of the 14 PBRNs, using a standard case definition of network participation that included meeting attendance and service on research teams and steering committees (Table 1). These individuals were contacted by e-mail and asked to complete the web-based survey instrument. A total of 209 people (59%) provided usable responses to the survey, including 103 representatives from local health departments, 37 representatives from state health agencies, and 76 representatives from academic institutions.

A subset of survey items was included on a 2010 survey conducted by the National Association of County and City Health Officials (NACCHO) and administered to a stratified random sample of U.S. local health departments.²⁴ Departments were classified into one of seven strata based on the size of the population served, and randomly sampled without replacement using sampling rates proportional to population size, resulting in an overall sampling rate of 24% of 2565 total departments (n=625). A total of 505 agency representatives (81%) responded to the NACCHO survey.

The NACCHO survey asked the director of each local health department to complete the survey or designate an alternative respondent who has equivalent knowledge of agency activities. By comparison, the PBRN survey solicited responses from all individuals identified by PBRN leaders as active network participants, resulting in responses from agency directors in 98 of the 103 local health departments responding to the PBRN survey (95%). Both surveys were administered via the Internet, with respondent notification, recruitment, and follow-up conducted with e-mail and telephone contact.

Table 1. Characteristics of public health PBRN participants, % or M (SD)

Variable	All participants, N=209	Practitioners, n=133	Researchers, <i>n</i> =76
Type of organization(s) where employed ^a			
Academic/research unit	36.4	0.0	100.0***
State government agency	17.7	24.8	5.3***
Local government agency	41.1	63.9	1.3***
Federal agency	1.0	1.5	0.0
Professional association	7.7	11.3	1.3***
Community-based organization	3.3	4.5	1.3
Types of PBRN participation ^a			
Serve as key staff in PBRN	18.7	16.5	22.4
Serve on PBRN committee/workgroup	49.8	52.6	44.7
Represent a founding organization	16.3	13.5	21.1
Participate in routine meetings/calls	64.1	63.2	65.8
Participate in PBRN research projects	51.2	41.4	68.4***
Number of staff that participate in PBRN	3.4 (4.8)	3.1 (4.8)	3.9 (4.7)
Orientation to research vs practice ^b	4.7 (1.9)	5.4 (1.5)	3.5 (2.0)***
Prior experience with research implementation	с		
Identifying research topics	3.4 (1.0)	3.2 (1.0)	3.9 (0.9)
Planning/designing studies	3.1 (1.2)	2.7 (1.1)	3.7 (1.0)***
Securing funding/grant-writing	2.9 (1.2)	2.6 (1.1)	3.5 (1.1)***
Implementing studies	3.0 (1.3)	2.5 (1.1)	3.8 (1.1)***
Disseminating study results	3.3 (1.1)	3.1 (1.1)	3.7 (1.1)***
Applying findings in own organization	3.2 (1.1)	3.3 (1.1)	2.9 (1.1)**
Helping others apply findings	2.8 (1.1)	2.7 (1.1)	3.1 (1.1)***
Composite experience measure	9.8 (11.5)	19.6 (6.4)	24.2 (5.8)***

Note: Boldface indicates significance. Differences between Practitioner and Researcher columns are significant at ***p < 0.01; **p < 0.05. ^aRows do not sum to 100% because some participants fall into multiple categories. χ^2 tests are used for significance.

^bSeven-point ordinal scale. Wilcoxon-Mann-Whitney tests are used for significance.

^cFive-point ordinal scale. Wilcoxon-Mann-Whitney tests are used for significance.

PBRN, practice-based research network

Measures

Both the PBRN and NACCHO survey instruments included a common set of questions about the agency's past and current experiences with research implementation. Developed through focus groups with PBRN leaders, the research implementation questions included eight items identified as reflecting core components of the research process: (1) convening key stakeholders; (2) identifying research topics; (3) planning and designing studies; (4) grant-writing and securing funding; (5) implementing studies through collection, analysis, and interpretation of data; (6) disseminating study results; (7) applying findings within one's own organization; and (8) helping other organizations apply findings. For each item, a 7-point ordinal response scale measured the frequency of participation in each activity during the past 12 months, ranging from none to weekly participation.

A composite measure of **research implementation breadth** was constructed by converting each item to a dichotomous none/any scale and calculating the proportion of items reported with any participation in the past 12 months. Similarly, a composite measure of **research implementation intensity** was constructed by calculating the weighted average value of participation frequency across the eight items. In constructing each composite measure, a weight was assigned to each of the eight items using values from a previous expert panel study that rated the perceived importance of engaging practice settings in each of the eight research implementation items.³²

Additionally, the PBRN survey included questions about the types of roles played in PBRN research implementation, the frequency and types of interaction with other PBRN participants for research implementation, and the perceived benefits of PBRN participation. The survey defines PBRN participants at the organizational level based on the primary institution each individual participant represents, including local and state public health agencies, community organizations, professional associations, and academic institutions. The survey instrument provided 7-point ordinal response scales to measure the frequency of interaction between each pair of PBRN participants, ranging from none to weekly interaction. Responses for individual survey items indicated the frequency with which each PBRN participant reported working with each other participant on research implementation activities during the prior 12 months. Pilot testing and validation of the survey instrument in one PBRN confirmed a test-retest correlation coefficient of 0.84 and strong face validity of measures based on cognitive interviews conducted with 15 pilot survey respondents.

Following standard methods of network analysis, survey data were used to construct composite measures of network structure and connectedness for each PBRN and its participating organizations.^{33,34} In cases in which multiple people from the same organization responded to the survey, these responses were averaged into a single organization-level response in order to construct network analysis measures. For each network, **network density** was measured as the number of interactions between all pairs of organizations in the network, as a proportion of the total possible number of interactions. **Average path length** was measured as the average number of organizations in the network, where the shortest path is defined as the connection that passes through the fewest intermediary organizations.

Network cohesion (or breadth) was measured as the sum of the reciprocal of the path lengths connecting each pair of organizations in

the network. Network centralization was measured as the extent to which connections between pairs of organizations were mediated by a single influential organization in the network. Out-degree centralization, which indicates how frequently each organization reports interacting with others in the network (i.e., internal perceptions of network influence), is distinguished from **in-degree** centralization, which reflects how frequently others in the network report interacting with each organization (i.e., external perceptions of network influence).

Additionally, several organization-level measures of network connectedness and influence were constructed for each PBRN participant. **Organizational degree centrality** was defined as the total number of connections that each organization maintained with other organizations in the network, as a percentage of the total possible connections. Out-degree centrality was distinguished from in-degree centrality in this measure, yielding both internal and external perceptions of organizational influence. **Organizational betweenness centrality** indicated the extent to which an organization serves as a bridge between pairs of other organizations in the network and was computed as the number of times an organization lies on the shortest path connecting pairs of other organizations in the network, divided by the total possible number of times that this could occur in the network. All network analysis measures were calculated using UCINET software version 6.08.³⁵

Data Analysis

Four analytic strategies were used to examine the experience of PBRNs in engaging public health organizations in research design, implementation, and translation. First, PBRN participants were stratified into two groups based on whether their primary employment was located in an academic or research organization (researchers) versus in a public health practice organization (practitioners). The types and intensities of research engagement were compared across these groups using chi-square tests for categoric measures and Wilcoxon-Mann-Whitney nonparametric tests for ordinal and interval measures.

Second, PBRN participants from local public health agencies were compared to the NACCHO national sample of local public health agency respondents who did not participate in PBRNs to examine differences in research engagement, using chi-square and Wilcoxon-Mann-Whitney tests. Third, measures of network structure and connectedness were compared across the 14 PBRNs and across five types of participating organizations to examine variation in patterns of interaction for research implementation. Finally, multivariate generalized estimating equations (GEEs) were used to estimate the influence of individual, organizational, and network characteristics on research implementation activities and experiences among PBRN participants, controlling for the clustering of participants within networks. Data were collected in 2010– 2012, and analyzed in 2012.

Results

Research Engagement among Participants

Approximately 40% of the 209 responding PBRN participants worked in local public health agencies, compared to 36% from academic/research organizations and 18% from state health agencies (Table 1). As expected, researchers reported more prior experience with research
implementation activities than did practitioners, and researchers rated themselves as more oriented to these types of activities on the research-to-practice continuum than did their counterparts in practice settings. Overall, both researchers and practitioners reported high levels of engagement in PBRN research design and implementation activities over the prior 12 months, with 94% of practitioners and 97% of researchers reporting engagement in identifying PBRN research topics, and 77% and 96% reporting involvement in implementing data collection and analysis (Table 2). However, the composite measures of breadth and intensity of involvement in research implementation activities were moderately higher among researchers than among practitioners (p < 0.05). Both researchers and practitioners reported high levels of alignment between PBRN research priorities and their own interests.

Network Participants Compared to Nonparticipants

Local public health agencies who participate in PBRNs reported markedly higher levels of engagement in research

Table 2. Research implementation roles and experiences of public health practice-based research network participants,% or M (SD)

Variable	All participants, N=209	Practitioners, n=133	Researchers, n=76
Any involvement in research implementation-past	12 months ^a		
Convening stakeholders	80.7	77.0	86.6
Identifying research topics	94.9	93.6	97.0
Planning/designing studies	86.3	78.9	98.5 ^{***}
Securing funding/grantwriting	81.9	72.8	97.0***
Implementing studies	84.0	77.2	95.5 ^{***}
Disseminating study results	87.9	82.5	97.0***
Applying findings in own organization	82.4	85.1	77.6
Helping others apply findings	81.2	74.3	92.5***
Composite measure of implementation breadth	86.0 (25.2)	81.8 (28.6)	93.0 (16.5)***
Intensity of involvement in research implementation	n—past 12 months ^b		
Convening stakeholders	3.0 (1.4)	2.8 (1.5)	3.3 (1.4)
Identifying research topics	3.3 (1.1)	3.2 (1.0)	3.6 (1.1)***
Planning/designing studies	2.9 (1.3)	2.5 (1.2)	3.6 (1.2)***
Securing funding/grantwriting	2.9 (1.4)	2.5 (1.4)	3.7 (1.2)***
Implementing studies	3.0 (1.4)	2.6 (1.3)	3.7 (1.3)***
Disseminating study results	3.2 (1.3)	2.9 (1.3)	3.8 (1.2)***
Applying findings in own organization	2.9 (1.3)	3.1 (1.3)	2.6 (1.3)**
Helping others apply findings	2.7 (1.2)	2.5 (1.2)	3.0 (1.2)***
Composite measure of implementation intensity	20.7 (11.3)	18.7 (10.8)	24.1 (11.3)***
Alignment of PBRN research with own interests $^{\scriptscriptstyle \mathrm{b}}$	4.9 (1.6)	4.6 (1.8)	5.3 (1.2)**
PBRN consideration given to your ideas $^{\rm b}$	3.8 (1.6)	3.8 (1.6)	3.9 (1.6)
Perceived benefit of PBRN participation ^b	4.1 (0.9)	4.0 (0.9)	4.4 (0.8)***
Likelihood of continuing PBRN participation $^{\circ}$	6.2 (1.2)	6.0 (1.3)	6.5 (0.8)**
Duration of PBRN involvement (years)	1.8 (1.6)	2.0 (1.5)	1.8 (1.4)

Note: Boldface indicates significance. Differences between Practitioner and Researcher columns are statistically significant at ***p < 0.01; **p < 0.05. ^aChi-square tests are used to assess significance.

^bFive-point ordinal scale. Wilcoxon-Mann-Whitney tests are used to assess significance.

^cSeven-point ordinal scale. Wilcoxon-Mann-Whitney tests are used to assess significance.

PBRN, practice-based research network

Table 3. Local public health agency engagement in research implementation activities,^a %unless otherwise indicated

Variable	PBRN agencies, n=103	National sample, n=505
Identifying research topics	94.1	27.5***
Planning/designing studies	81.6	15 .8 ^{***}
Implementing studies	79.6	50.3 ^{**}
Disseminating study results	84.5	36.6**
Applying findings in own organization	87.4	32.1 ^{**}
Helping others apply findings	76.5	18 .0 ^{***}
Research implementation composite measure, M (SD)	84.04 (27.38)	30.20 (31.38)**

Note: Boldface indicates significance.

^aPBRN participants compared with a national sample of agencies

*****p*<0.01; ****p*<0.05

PBRN, practice-based research network

implementation activities compared to a national sample of agencies not participating in PBRNs (Table 3). PBRN participants were more than three times as likely as nonparticipants to engage in identifying research topics and more than five times more likely to engage in planning and designing studies (p < 0.01). The mean composite measure of research implementation was 2.8 times larger among PBRN participants than among nonparticipants. These large differences in research implementation persisted after adjusting for differences in agency expenditures, population size of jurisdiction, per capita income in jurisdiction, and rural/urban location.

Patterns of Interaction within Networks

The 14 PBRNs exhibited considerable variation in network structure and connectedness, indicating broad heterogeneity in the patterns of interaction among participating researchers and practitioners (Table 4). The density of connections among PBRN participants ranged from a low of 14% in Colorado to a high of 93% in Washington. The degrees of cohesion and average distance between participants, however, were much less variable across networks and indicated relatively low levels of fragmentation within PBRNs. Network centralization (in-degree) was more than twice as high in the Florida PBRN as in the Ohio PBRN, and average betweenness centrality was more than 20 times greater in the Colorado network than in the Missouri network.

These measures indicate a higher reliance on centralized "hub" organizations in some PBRNs, whereas other networks rely more heavily on mediating "bridge" organizations to facilitate research interaction. Across all networks, local and state public health agencies had significantly lower levels of betweenness centrality than did academic/research organizations (Table 4). This finding indicates the relatively peripheral positions of practice-based agencies within their networks.

Factors Associated with Research Implementation Experiences

Multivariate estimates indicated that the research implementation experiences of PBRN participants

varied significantly with selected individual, organizational, and network characteristics (Table 5). At the individual level, participants' prior research experience was strongly and positively associated with the breadth and intensity of engagement in PBRN research implementation and with the likelihood of future PBRN participation, after controlling for other factors (p < 0.05). An individual's duration of participation in the PBRN, however, was not associated with any of the four research implementation experience measures examined. At the organizational level, participants from local public health agencies reported significantly lower breadth of engagement in research implementation and significantly lower perceived benefits of engagement compared to participants from other types of organizations (p < 0.05).

Regarding network characteristics, the density of the PBRN network was negatively associated both with the breadth of research activities implemented by PBRN participants and with participants' likelihood of future participation in PBRN research (p < 0.05). Organizations having a larger volume of connections to other PBRN participants, as indicated by their out-degree centrality, reported higher breadth and intensity of research implementation, as well as higher perceived benefits and likelihood of future PBRN participation (p < 0.05). Conversely, the betweenness centrality of participating PBRN organizations was inversely associated with research implementation experiences, indicating that organizations located in the periphery of their networks engaged more intensively in PBRN research implementation and experienced larger benefits from this engagement, compared to organizations occupying intermediary positions within PBRN networks.

				Network-level	measures		Orga	anization-level r	neasures
	n	Density	Breadth	Average distance	Centralization in-degree	Centralization out-degree	Centrality in-degree	Centrality out-degree	Betweenness
Network									
Colorado	46	0.14	0.50	2.24	9.33	28.23	3.95 (3.89)	5.43 (9.53)	20.03 (52.06)
Connecticut	62	0.33	0.35	1.69	4.88	44.97	5.39 (1.48)	5.39 (12.57)	0.60 (3.91)
Florida	23	0.74	0.16	1.31	20.00	22.95	15.17 (6.94)	17.70 (17.81)	1.14 (2.89)
Georgia	14	0.39	0.37	1.80	11.48	60.37	12.62 (6.82)	14.05 (17.94)	1.29 (4.03)
Kentucky	43	0.25	0.42	1.98	10.92	29.23	5.86 (5.17)	5.86 (9.6)	14.23 (34.71)
Massachusetts	18	0.48	0.30	1.65	11.50	45.50	18.89 (10.24)	20.42 (23.62)	1.94 (4.65)
Minnesota	19	0.33	0.50	1.76	12.76	26.48	11.93 (7.63)	13.82 (15.24)	1.84 (6.15)
Missouri	21	0.66	0.20	1.40	7.83	65.92	14.46 (2.36)	19.58 (24.34)	0.00 (0.00)
North Carolina	26	0.71	0.21	1.28	12.99	43.69	20.25 (8.17)	21.53 (22.2)	2.63 (4.88)
Nebraska	32	0.22	0.47	1.93	9.51	62.73	8.46 (5.84)	10.22 (14.92)	0.47 (2.65)
New York	23	0.61	0.22	1.45	9.58	42.17	13.42 (4.99)	21.25 (22.47)	1.74 (2.55)
Ohio	67	0.46	0.29	1.59	7.19	41.96	7.70 (3.4)	8.59 (11.87)	5.08 (10.39)
Washington	20	0.93	0.07	1.14	17.58	45.60	33.43 (10.28)	37.14 (22.8)	0.85 (2.52)
Wisconsin	30	0.59	0.26	1.40	8.03	36.41	8.89 (3.46)	10.73 (13.73)	0.62 (1.44)
								(continued on next page)

Table 4.	Patterns of	interaction	in	public	health	PBRNs:	network	analysis	measures
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Mean values by organization type

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-ocal agencies

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		Network-level m	easures		Org	anization-level me	easures
Density	Breadth	Average distance	Centralization in-degree	Centralization out-degree	Centrality in-degree	Centrality out-degree	Betweenness
0.44	0.32	1.66	9.70	41.08	10.00	10.35	2.91
(0.21)	(0.12)	(0.28)	(4.39)	(11.01)	(8.29)	(16.17)	(13.81)
0.47	0.33	1.63	10.84	42.29	15.62	19.87	3.09
(0.21)	(0.13)	(0.3)	(3.07)	(12.49)	(8.51)	(20.7)	(7.85)
0.45	0.32	1.67	9.72	41.89	11.17	15.87	11.54
(0.21)	(0.12)	(0.31)	(3.21)	(12.56)	(8.54)	(17.75)	(36.02)
0.45	0.33	1.68	10.27	42.42	10.64	8.89	1.87
(0.22)	(0.12)	(0.32)	(2.82)	(11.18)	(9.97)	(16.15)	(8.62)
0.40	0.35	1.75	9.57	38.98	6.65	7.42	0.77
(0.19)	(0.11)	(0.31)	(2.75)	(13.03)	(8.37)	(18.4)	(4.5)
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Discussion

Practice-based research networks have experienced notable successes in convening broad networks of researchers and practitioners from public health settings and engaging these stakeholders in research implementation and translation activities during their initial years of development. This success appears particularly notable among local public health agencies, which historically have had very low rates of research engagement despite the central roles they play in U.S. public health delivery. Local agencies represented the largest single component of public health PBRN participants in this study, and their research engagement extended beyond ancillary roles in study recruitment and data collection to include substantive roles in identifying research priorities, designing and implementing studies, and applying study findings to practice. In particular, PBRN participants from local agencies were more likely than all other types of participants to report applying research findings within their own organizations, reflecting a key research translation goal of the PBRN model.

Local public health agencies who participate in PBRNs reported levels of engagement in research implementation and translation activities that far exceeded levels observed among a nationally representative sample of agencies who do not participate in PBRNs-often by more than 200%. These differences may reflect, at least in part, the success of PBRNs in selecting and attracting those agencies with the motivation, skills, and resources to conduct research. However, the relatively low levels of prior research experience reported by participating local public health agencies suggest that PBRNs achieve their success in research engagement through not only selection but also facilitation and capacity-building. The cross-sectional, observational design of this study precludes a definitive determination of how much of the PBRNs' success with research engagement is attributable to selection versus facilitation and capacity-building, but both of these mechanisms are likely to be beneficial in promoting practice-based research.

The 14 PBRNs examined in this study varied considerably in their composition and patterns of interaction, and multivariate results suggested that these structural features have implications for the research experiences and benefits that accrue to PBRN participants. Overall, participants from local public health agencies reported lower levels of research engagement and lower perceived benefits compared to participants from other types of organizations, indicating a need for targeted approaches to improve the research experiences of local public health agencies. Moreover, this study finds more positive

Note: Standard deviations are shown in pa PBRN, practice-based research network Academic units State agencies Associations Other

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 Table 5. Factors associated with PBRN participants' research implementation experiences: regression estimates, coefficient (SE) unless otherwise indicated

Variable	Implementation breadth, <i>n</i> =174	Implementation intensity, <i>n</i> =174	Perceived benefit, <i>n</i> =174	Future participation, n=174
Prior research experience	0.250 (0.099)**	0.252 (0.093)**	0.005 (0.009)	0.043 (0.018)**
Research-practice orientation	-0.481 (0.308)	0.042 (0.285)	0.007 (0.044)	0.130 (0.076)
Duration of PBRN participation	0.001 (0.001)	-0.001 (0.001)	0.000 (0.000)	0.000 (0.000)
Type of organization (ref=academ	iic)			
Local government	-4.836 (1.380)***	-0.785 (1.231)	-0.465 (0.121)***	$-0.611 \left(0.162 ight)^{***}$
State government	-0.924 (1.998)	-0.739 (1.384)	-0.186 (0.132)	-0.500 (0.271)
Association	-1.173 (1.614)	0.488 (1.420)	-0.193 (0.295)	-0.310 (0.296)
Other	-4.658 (2.536)	-2.201 (1.670)	-0.236 (0.530)	-0.213 (0.700)
Network density	-10.909 (4.242)**	-2.980 (3.234)	-0.582 (0.398)	-1.105 (0.464)**
Network centralization	0.330 (0.247)	0.209 (0.166)	-0.005 (0.021)	-0.002 (0.024)
Organization degree centrality	0.179 (0.048)**	0.060 (0.029)**	0.013 (0.004)***	0.021 (0.007)**
Organization betweenness	-0.031 (0.020)	-0.028 (0.007)**	$-0.004 \ (0.001)^{**}$	$-0.003 \ (0.001)^{**}$
Constant	18.405 (2.772)***	5.311 (2.614)**	3.923 (0.410)***	4.858 (0.630)***
F	30.970	5.370	58.530	16.600
R square	0.323	0.144	0.138	0.194

Note: Boldface indicates significance. Regression models adjust for clustering of participants within networks.

*****p*<0.01; ****p*<0.05

PBRN, practice-based research network

research experiences among lower-density PBRN networks, among highly connected organizations within networks, and among organizations located in the periphery of their networks.

Collectively, these findings suggest that the benefits of PBRN participation do not necessarily accrue through the efficient exchange of information that dense networks provide; rather, benefits accrue through connections to diverse network participants who contribute novel ideas, resources, and perspectives to the research process. Moreover, PBRN participants in the core and the periphery of their networks appear to benefit more than those in the middle. These findings suggest that intermediary organizations—those serving as bridges between otherwise unconnected components of a network-may require targeted approaches to support and improve their research experiences. The strong association between prior research experience and current perceived benefits of PBRN participation suggests that PBRN involvement may become self-reinforcing as more organizations build research capacity through the networks.

In light of these findings, several strategies are likely to be important for the continued development of public health PBRNs and the utility of the evidence they produce. First, PBRNs should seek to expand the number and diversity of practice settings included in their networks, adding more peripheral organizations and reducing their reliance on small numbers of densely connected organizations with long-standing partnerships. This type of growth also will enhance PBRN capacity to implement large-scale research projects that provide more definitive empirical evidence (stronger internal validity) and that generalize or transfer to a wider array of public health practice settings (stronger external validity). Second, PBRNs should seek to enhance participation incentives and supports for local public health agencies and intermediary organizations, which appear most vulnerable to attrition over time. Such supports may include targeted financial and technical assistance, enhanced access to novel information and research findings, and expanded public recognition through publications, professional meetings, awards, and accreditation and credentialing programs.

Limitations

The PBRNs in this study are still early in their developmental stages and focus primarily on conducting small-scale, descriptive, and comparative studies of public health delivery. Whether the active patterns of research engagement observed in this study will persist as networks mature toward more complex and resourceintensive studies remains to be seen. Additionally, the findings from this study of necessity rely on respondent self-selection and, therefore, likely reflect the experiences of the most active and motivated PBRN participants; thus, the conclusions drawn from collected data may not generalize to the experiences of less-engaged participants who did not respond to the survey.

Conclusion

The intriguing but complex findings concerning PBRN network structures and perceived benefits highlight the need for more granular, qualitative studies of network dynamics. Nevertheless, this study suggests that PBRN networks can serve as effective mechanisms for facilitating research design, implementation, and translation in real-world public health practice settings. Thus, they offer important laboratories for helping the public health system learn how best to deliver strategies that improve population health.

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Down from the Mountain: Skill Upgrading and Wages in Appalachia

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The Appalachian region has experienced persistently higher poverty and lower earnings than the rest of the United States. We examine whether skill differentials or differences in the returns to those skills lie at the root of the Appalachian wage gap. Using census data, we decompose the Appalachian wage gap using both mean and full distribution methods. Our findings suggest that significant upgrading of skills within the region has prevented the gap from widening over the last 20 years. Additionally we find that urban areas within Appalachia have not experienced the rise in returns to skills as in non-Appalachian urban areas.

I. Introduction

We examine the movement of wages within the Appalachian region of the United States and the rest of the country in an effort to understand whether changes in the wage gap between Appalachia and the rest of the

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country are due to different changes in skill, in the returns to skill, or both. Our focus on Appalachia is motivated by several factors related to inequality trends. The Appalachian region has historically had lower levels of skilled labor and income relative to the rest of the country, which some researchers claim has resulted in a "poverty trap" (Caudill 1962; Harrington 1962; Duncan 1999; Easterly 2001; Eller 2008). This has led policy makers to focus extensive resources on the region in an effort to raise the levels of education and income in the area. Appalachia was the focal point for much of the legislation underlying the War on Poverty and, since the mid-1960s, has been a well-defined zone of economic activity. Despite all of these efforts, Appalachia still lags behind the rest of the country in educational achievement and income.

While the Appalachian region has long been the focus of policy makers, it has received relatively little attention from economists (Black, Daniel, and Sanders 2002; Black and Sanders 2004). This is unfortunate since knowledge of how regional differences in skill levels and returns to skill translate into regional differentials in wages is essential to a better understanding of widening inequality in general, as well as for more targeted policy prescriptions for regional economic development (Glaeser and Gottlieb 2008). This seems particularly salient for regions with persistently low levels of income. Parente and Prescott (2005) argue that a country starts to experience sustained increases in incomes when the country's capacity to effectively use modern technological resources reaches a critical threshold. To the extent that their framework is applicable to regions within the United States, the implication of recent technological change, which favors college-educated workers, is that persistent income differentials will continue in regions such as Appalachia until these residents close the college-completion gap. At the same time, the relative supply and demand story found in the inequality literature, for example, Katz and Murphy (1992) and Autor, Katz, and Kearney (2008), is that if there was a nationwide increase in the demand for skilled workers, but a shortage in the supply of such workers in Appalachia, then we would predict the returns to skill to increase over time in Appalachia relative to the rest of the country. This would lead to a convergence in regional wages, which contrasts with the predictions of Parente and Prescott (2005). In spite of these competing explanations, and the long-standing policy issues surrounding the Appalachian wage gap, the literature has been surprisingly silent on wage differentials among workers between regions (Moretti 2008).

To identify the reasons for wage differences we estimate human-capital wage equations for men and women that admit region-specific hetero-

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geneity in the returns to observable and unobservable factors that proxy for skill. Beyond the standard demographics found in scores of studies on wage levels and gaps (Altonji and Blank 1999; Card 1999), we control explicitly for self-selection into the labor force and migration into the region of residence (Juhn, Murphy, and Pierce 1993; Dahl 2002; Blundell et al. 2006). With the secular rise of employment among women and concurrent decline among men, it is important to control for unobserved factors related to these trends and the possibility that these processes differ between Appalachia and the rest of the nation. Even conditional on observables, selection into and out of the Appalachian region may not be exogenous to wages, so our model controls for endogenous migration.

In addition to the conditional mean, we also estimate the determinants of wages across the distribution. Black and Sanders (2004) suggests that earnings inequality in Appalachia in the 1980s and 1990s was lower and rose more slowly than the rest of the United States. This may be due to slower wage growth at the higher ends of the earnings distribution, or it may be due to faster wage growth at the lower ends of the earnings distribution. By specifically examining the determinants of wages throughout the distribution we more clearly understand the implications of the observed changes. We estimate quantile wage equations across the region-gender wage distributions, again controlling for nonrandom selection into the labor force and into the region of residence using the methods of Buchinsky (1998, 2001). Given the estimated coefficients at the conditional mean and conditional quantiles, we decompose the regional wage gaps into the shares attributable to differences in demographics and in coefficients (Oaxaca 1973; Machado and Mata 2005). Applications of mean wage decompositions controlling for sample selection bias are scarce (Chandra 2003; Neal 2004; Neuman and Oaxaca 2004), and the quantile approach with selection is even more rare (Blundell et al. 2006; Albrecht, van Vuuren, and Vroman 2009).

The data for our analysis are the 1980–2000 Integrated Public Use Microdata Samples (IPUMS) of the decennial census. Because counties are not identified in the IPUMS we employ a weighting method that identifies the share of a public use micro area (a PUMA for every 100,000 persons) that is in Appalachia, and weight all regressions by the appropriate share. For historical purposes, our base case compares Appalachia to the rest of the nation. Because there is evidence that more skilled workers tend to live in cities, that the difference in skills between cities and rural areas has been growing recently (Glaeser and Mare 2001; Glaeser and Saiz 2004; Moretti 2004), and that the returns to skills have been growing within cities (Chung, Clark, and Kim 2009), we also consider a number of alternative comparisons such as rural Appalachia to rural non-Appalachia, and urban Appalachia to urban non-Appalachia.

Our results indicate that men and women in Appalachia came "down

from the mountain" in the 1980s and 1990s and significantly upgraded their human capital in terms of education attainment compared to men and women in the rest of the nation. This relative skill upgrading prevented the wages of Appalachians from falling further behind those outside the region during the period of widening inequality overall. As a consequence, the wage distribution for men in Appalachia compared to non-Appalachia is less due to demographic shortfalls than to differences in returns to important skills such as education and experience, the latter of which appears to be driven in large part by the relative decline in returns to schooling in Appalachia over the past 2 decades. At the same time, however, for men we find that skill shortages remain more pronounced at the high end of the wage distribution. One potential explanation for our findings is that Appalachia suffers from "missing markets," both a paucity of high-skilled workers and low returns for those with high skills, that is most pronounced in the urban areas of the region.

II. Background and Data

Few regions within the United States have engendered as much attention as Appalachia in discussions of poverty (Caudill 1962; Harrington 1962; Duncan 1999; Eller 2008). In 1964 President Johnson traveled to the small town of Inez, Kentucky, to launch the nation's "War on Poverty," and several presidential candidates have included "poverty tours" of Appalachia as part of their campaigns. Appalachia was first designated as a special economic zone in 1965 with passage of the Appalachian Regional Development Act. The act defined the economic zone of activity and created a federal and state partnership known as the Appalachian Regional Commission (ARC) whose mission is to expand the economic opportunities of the residents by increasing job opportunities, human capital, and transportation. The ARC-designated region traces the Appalachian Mountains from southern New York to northern Mississippi, spanning parts of 12 states and all of West Virginia (see fig. A1 in the appendix, available in the online version of the Journal of Labor Economics).¹ As of 2000, 406 counties were included in Appalachia, and over \$13 billion had been spent by ARC on the region (Glaeser and Gottlieb 2008).

Although much of Appalachia is rural, it does encompass about 10% of the nation's population and includes several urban centers such as Pittsburgh, Pennsylvania; Knoxville, Tennessee; and Birmingham, Alabama. Historically the region was heavily dependent on resource extraction (coal and timber in the central area), manufacturing (especially steel in the north), and agriculture (cotton and tobacco in the south; Eller

¹ Inclusion in ARC was based in part on proximity to the Appalachian Mountains, in part on economic distress, and in part on political economy (Eller 2008). 2008). Appalachian poverty has exceeded national poverty rates by 10% to 20%, but in the central Appalachian region poverty is nearly double the national rate. Median income in Appalachia is at least \$10,000 below the national median, and differences in median income have widened in recent decades.² While still lagging behind the United States as a whole, the Appalachian region has shown some social and economic convergence toward the rest of the country during the last decade (Pollard 2003; Black and Sanders 2004; Haaga 2004). Still, perhaps because of the searing portraits of grinding poverty by Caudill (1962) and Harrington (1962), to this day Appalachia is often viewed as "the other America."

As recently as 1980 only 67% of adult residents (25 years old and older) in Appalachia had completed high school or its equivalent, compared to 76% outside the region.³ By 2000 the fraction of adult Appalachians with at least high school rose to 87%, while it rose more slowly to 89% outside the region. Based on the analysis of Lemieux (2006), we would expect this relative education upgrading to narrow regional wage differentials between 1980 and 2000. At the same time, the gap in the percent of adults with a college degree across regions actually expanded from 6 to 8 percentage points between 1980 and 2000. The results of Autor et al. (2008) suggest that this gap in highly skilled workers would point to widening of regional wage differentials. In fact, the average wage gap between workers in Appalachia and the rest of the nation rose from 9 log points in 1980 to 13 log points in 2000, which seems more consistent with Autor et al. (2008). Both scenarios, however, assume that the standard result of factor-price equalization holds across regions. Recent evidence by Dahl (2002) and Black, Kolesnikova, and Taylor (2009) calls this assumption into question as they find persistent differences in schooling returns across states and cities. How skill returns in Appalachia evolved over time relative to the rest of the nation is not known and yet is critical to the regional evolution of inequality.

Appalachia is of interest not only because of its historical significance in the nation's fight against poverty, but because its large geographic coverage that spans remote rural areas as well as some midsize and large cities offers the opportunity to study the role that urban areas play in regional economic development. It has long been true that urban areas have more skilled workers than rural areas. Moretti (2004) shows that the gap in skill between the most and least skilled urban areas has risen since 1980, and this increase in skill dispersion is correlated not only with the level of workers' skills but also with the size of the area, wealth, and

² See "Economic Overview" at http://www.arc.gov/index.do?nodeId=26.

³ Authors' calculations based on IPUMS data from 1980 and 2000 decennial censuses as described in the Data section. These estimates pool men and women, but we conduct our analyses below separately by gender.

industrial structure. Urban areas with large concentrations of high-tech industries experienced the largest gains in skill over this period. In turn, this growth in the skill gap accounts for some of the overall growth in the income gap between 1980 and 2000. Since the urban areas in Appalachia tend to be smaller, poorer, and contain very little high-tech industry, decomposing wage changes between urban and rural areas within Appalachia, as well as between urban and rural areas inside and outside of Appalachia, will help document the role regional differences in skill and skill accumulation have in accounting for the earnings gap in the United States.

To address the potential importance of urban areas in the analysis, we include comparisons of rural Appalachia to the rest of rural America, of urban Appalachia to urban non-Appalachia, and for the central Appalachian region (the coal-producing states) to the residents in non-Appalachia living in rural areas and metro areas with fewer than 1 million persons. Indeed, the legislation establishing ARC mandated that resources be directed to the locales with the greatest potential for economic growth, which not surprisingly were the urban centers of the region (Eller 2008). Thus, the supplemental analyses on the urban areas of Appalachia are of independent interest.

Data.—Our data derive from the Integrated Public Use Micro Samples (IPUMS) of the 1980, 1990, and 2000 decennial census. The IPUMS contain variables commonly used in estimation of wage equations and also include geographic identifiers. We begin our data in 1980 because earlier IPUMS data contain more aggregated geographic identifiers, making it difficult to estimate individual-level wages separately for the Appalachian region. We select working and nonworking individuals between the ages of 25 and 60 who do not have missing or allocated wages. The age cutoffs are chosen to minimize the presence of full-time students and those nearing retirement. Dropping those with allocated earnings avoids attenuation bias in skill returns (Bollinger and Hirsch 2006). The resulting sample has 7 million men and 8 million women across the three censuses.

The key advantage of the IPUMS data is the long time series of cross sections and the exceptionally large sample sizes that permit identification of region-by-gender skill returns across the wage distribution. The data are limited because the geographic identifiers that are made publicly available are not perfectly coincident with the Appalachian region.⁴ The smallest geographic unit reported in the IPUMS is the Public Use Micro Area, or PUMA, containing groupings of 100,000 residents. In most cases the

⁴ A lesser concern is the fact that the federal government has changed the definition of the Appalachian region slightly over our sample period. In 1980, 397 counties were included in Appalachia, and by 2000 the number of counties was 406. Throughout our analysis we use the 2000 definition of Appalachia.

PUMA is fully contained within either Appalachia or non-Appalachia and thus individuals can be assigned as Appalachian residents (or not) simply from the PUMA information. However, a few PUMAs contain counties in both regions; for these cases we use supplementary information from the Decennial Census Summary Files to determine the proportion of residents in a particular PUMA who live in Appalachia. These proportions are then used to weight individual observations in the summary statistics and regression models to follow. Since the summary files contain detailed population counts by age, sex, and race, the weights are constructed to reflect the probability that the particular individual actually lives in Appalachia. This weighting procedure has its roots in weighting for stratified samples and weighting for item nonresponse (Groves et al. 2004).

Our outcome of interest is the log real hourly wage. We construct the real wage as the ratio of annual earnings to the product of annual weeks worked and hours of work per week and then deflate the average hourly wage by the personal consumption expenditure deflator with 2000 as the base year.⁵ Key demographic variables available in the census and pertinent to our analysis include education attainment, potential experience (defined as age minus years of schooling minus 6), race and ethnicity, marital status, living in an urban area (= 1 if the Beale rural-urban continuum code is 3 or less), and one-digit industry (for workers).

Table 1 contains summary statistics on key economic and demographic variables for our sample of working and nonworking men and women in each of the last three decennial censuses broken down by residency in Appalachia. Among men inside Appalachia versus those outside, we see that the log wage gap widened from 0.094 log points in 1980 to 0.125 log points in 1990 and then held steady at 0.124 in 2000. The widening in the 1980s occurred because male wages in Appalachia fell more than those in the rest of the nation, while in the 1990s the wages of men within Appalachia grew slightly more than the wages outside the region. Among women, the wage gap widened from 0.127 log points to 0.169 between 1980 and 1990, and like men, women in both regions experienced wage

⁵ Since we estimate the models separately by year, deflating by the expenditure deflator is not necessary, but it is needed to discuss the summary statistics over time. On the other hand, Card and Krueger (1992) deflate wages by the average wage in the state to account for state-specific differences in cost of living, and Moretti (2008) proposes a city-specific version of the CPI to account for cost-of-living differences across metro and nonmetro areas. A priori it is not clear whether one should adjust wages for local cost-of-living differences, as the latter may be outcomes affected by the preferences of the community, which in turn are affected by the demographic composition (DuMond, Hirsch, and Macpherson 1999). As a consequence we chose not to use a local price deflator, although we capture some broad effect of location by controlling for urban residence.

AVELAGE VALUES OF SELECTED VALIABLES OF ATELL	allu wullcli		suc appaiat	1114		
	Appalachia 1980	Non-Appalachia 1980	Appalachia 1990	Non-Appalachia 1990	Appalachia 2000	Non-Appalachia 2000
Men:						
Log of real wage	2.689	2.783	2.629	2.754	2.690	2.814
Wage gap (non-Appalachia less Appalachia)		.094		.125		.124
Employment rate	890.	.914	.884	.912	.860	890
Usual hours worked per week	37.750	39.118	38.316	40.068	38.019	39.575
Less than high school	.334	.241	.211	.154	.154	.131
High school	.380	.336	.414	.326	.419	.320
Some college	.132	.190	.212	.274	.244	.286
Bachelor's degree	.107	.153	.107	.158	.120	.169
Master's or more	.048	080.	.057	680.	.063	.094
Potential experience ≤10 years	.193	.232	.153	.188	.129	.150
Potential experience >10 years and ≤ 20 years	.285	.293	.345	.360	.288	.307
Potential experience >20 years and ≤ 30 years	.221	.212	.253	.244	.315	.312
Potential experience >30 years and ≤ 40 years	.208	.196	.186	.163	.218	.195
Potential experience >40 years	.092	.067	.063	.045	.050	.036
White, non-Hispanic	.931	809.	.933	.773	.903	.703
White, Hispanic	.004	090.	.005	680.	600.	090.
Black, non-Hispanic	.059	.100	.054	.095	.061	.101
Black, Hispanic	000.	.001	000.	.002	000.	.002
Other, non-Hispanic	.005	.026	.007	.040	.018	.066
Other, Hispanic	000.	.004	000.	.001	600.	.067
Fishing, Mining, and Construction	.175	.127	.176	.147	.159	.149
Durable Goods Manufacturing	.247	.203	.204	.162	.197	.143
Nondurable Goods Manufacturing	.118	.092	.113	.084	860.	.072
Transport, Communication, and Other Utilities	260.	.097	660.	.091	960.	.091
Wholesale Trade	.045	.055	.048	.057	.046	.048
Retail Trade	.086	.102	.106	.118	.117	.127
Finance, Insurance, and Real Estate	.027	.045	.028	.047	.030	.048
Business and Repair Services	.044	.066	.064	.093	.079	.118
Professional and Related Services	.096	.113	.105	.114	.120	.127
Public Administration	.064	.100	.057	.087	.058	.078

Table 1 Average Values of Selected Variables of Men and Women within and outside Appalachia

.774 .651	2.553	.159	.760	29.013	.114	.314	.317	.171	.084	.149	.300	.306	.207	.039	.696	.056	.119	.002	.068	.059	.027	.064	.055	.040	.025	.158	.083	.117	.370	.061	.769	.646
.473 .688	2.394		.724	27.352	.128	.408	.281	.119	.065	.132	.286	.307	.226	.049	668.	.007	.070	000.	.019	900.	.023	.084	.080	.032	.021	.183	.066	.086	.379	.047	.473	.689
.748 .694	2.399	.169	.743	27.632	.146	.363	.289	.139	.062	.180	.344	.249	.177	.050	.763	.082	.110	.002	.042	.001	.030	.072	.072	.039	.030	.168	.088	.110	.333	.058	.739	.681
.420 .746	2.230		069.	25.375	.193	.446	.223	060.	.048	.152	.331	.255	.197	.065	.927	.005	.061	000.	.008	000.	.026	.085	.128	.030	.023	.185	.062	.084	.336	.042	.416	.731
.782 .765	2.317	.127	.629	22.402	.245	.423	.179	.117	.036	.198	.294	.218	.219	020.	.800	.058	.110	.002	.027	.003	.026	.094	.086	.039	.028	.165	620.	.095	.327	.061	.769	.732
.421 .813	2.190		.563	20.239	.329	.450	.119	.081	.022	.165	.286	.224	.233	.093	.924	.004	.066	.001	.005	000.	.022	.101	.162	.029	.020	.172	.054	.076	.317	.046	.419	.775
Live in urban area Currently married	Women: Log of real wage	Wage gap (non-Appalachia less Appalachia)	Employment rate	Usual hours worked per week	Less than high school	High school	Some college	Bachelor's degree	Master's or more	Potential experience ≤10 years	Potential experience >10 years and ≤ 20 years	Potential experience >20 years and ≤ 30 years	Potential experience >30 years and ≤ 40 years	Potential experience >40 years	White, non-Hispanic	White, Hispanic	Black, non-Hispanic	Black, Hispanic	Other, non-Hispanic	Other, Hispanic	Fishing, Mining, and Construction	Durable Goods Manufacturing	Nondurable Goods Manufacturing	Transport, Communication, and Other Utilities	Wholesale Trade	Retail Trade	Finance, Insurance, and Real Estate	Business and Repair Services	Professional and Related Services	Public Administration	Live in urban area	Currently married

growth in the 1990s, but wages of those inside Appalachia grew faster and narrowed the gap to 0.159.

There are several other trends of note in table 1. First, there is a slight decline in employment among men, and a more discernible rise among women. The regional gap in employment rates for men range from 2 to 3 percentage points, and employment fell more rapidly among men in Appalachia between 1980 and 2000. Women in Appalachia, however, had employment rates 7 percentage points lower in 1980 compared to women outside the region, but cut the gap roughly in half in the ensuing 2 decades. Second, there is evidence of relative education upgrading in Appalachia between 1980 and 2000. Appalachian men are now significantly more likely to graduate from high school and to complete some college, while Appalachian women showed large gains in some college and advanced degrees. Ceteris paribus, this convergence in education attainment should narrow the gap in wages. Third, the Appalachian region has become slightly more ethnically diverse with a decline in the percentage of white, non-Hispanic men and women over this period. Borjas (2004) shows that the South experienced marked increases in immigrants during the 1990s from increases in the number of newly arrived persons as well as from internal migration to the South. These new immigrants were much more likely to settle in the Appalachian South than in earlier decades. These immigrants tend to be low skilled, and this could possibly exacerbate regional wage differences. Fourth, for men there is a large secular decline in the percentage currently married across the board of about 16%. Last, in terms of industrial composition of the male workforce, both regions experienced employment declines in manufacturing and transportation, and both experienced growth in retail trade, FIRE (finance, insurance, and real estate), and business and repair services. In most cases, though, the regional difference in industrial composition either held steady or converged.

III. Wage Determination and Wage Decompositions

We begin by specifying the typical human capital wage equation:

$$\ln W_{ijrt} = X_{ijrt}\beta_{jrt} + \varepsilon_{ijrt}, \qquad (1)$$

where $\ln W$ is the natural log of the real average hourly wage rate for individual *i* of gender *j* residing in region *r* (Appalachia and non-Appalachia) during decennial census year *t*. The demographics *X* that serve as observable proxies of skill include indicators for education attainment (high school dropout [omitted], high school, some college, college, postgraduate), indicators of potential experience (0–10 [omitted], 10–20, 20– 30, 30–40, >40), interactions of education and experience (Heckman, Lochner, and Todd 2003), race and ethnicity, marital status, and urbanicity. We also present results of models that include industry controls so that we can examine the role that changes in industry composition had on the wages of workers.⁶ Least squares estimation of equation (1) will fail to provide consistent estimates of β_{jrt} if $E[\varepsilon_{ijrt}|X_{ijrt}] \neq 0$, which we hypothesize can occur for two reasons—nonrandom selection into the labor force and nonrandom selection into the geographic region of residence.

A. Endogenous Selection into Employment and Region

Wages are observed only for those who are employed. Although concerns about selection on unobservables into work have been more prominent in research on women's wages than men's, the differential decline across regions in labor force participation of men in table 1, and the differential rise in employment among women, implies that endogenous selection into and out of work is a potential concern not just for women but for men as well (Blundell and MaCurdy 1999; Bound and Burkhauser 1999).

To address labor-market selection we specify a latent variable model of the form

$$E_{ijrt}^{*} = Z_{ijrt}\gamma_{jrt} + \eta_{ijrt}, \qquad (2)$$

where E_{ijrt}^{*} is the latent propensity to work, Z_{ijrt} are observed characteristics, and η_{ijrt} are unobserved components. Since we only observe whether the person is employed or not, that is, $E_{ijrt} = 1$ or 0, then being employed implicitly occurs when $E_{int}^* > 0$. A key issue in selection models is how the selection effects are identified separately from the observed factors affecting wages. We rely on exclusion restrictions such that Z includes the variables in X along with additional person- and state-specific covariates. The person-specific exclusion restrictions available in the census to identify selection into work but not wages follows from the canonical model of labor supply (Blundell and MaCurdy 1999), including nonlabor income, the total number of children, and the number of children under age 5. The state-specific variables used to identify the employment decision include those that affect the generosity of welfare and disability, such as the combined maximum monthly benefit guarantee for the Supplemental Security Income plus food stamps and the combined maximum monthly benefit for Aid to Families with Dependent Children (AFDC) and food stamps; institutional constraints, including the state minimum wage; business cycle conditions such as the state unemployment rate; and state political preferences as represented by the party affiliation of the state's governor. We also include the family-size-specific subsidy rate for

⁶ There are a few other possible covariates available in the census that might bear on a worker's productivity, including veteran's status and health status. Both variables have been shown to be important determinants of workers' wages (Berger and Hirsch 1983; Angrist 1990; Haveman, Stone, and Wolfe 1994), but in general they are endogenous to wages and thus we exclude them from our analyses. the federal Earned Income Tax Credit (EITC; Hotz and Scholz 2003). The state-specific variables are obtained from the University of Kentucky Center for Poverty Research (http://www.ukcpr.org/AvailableData.aspx).

In addition to employment selection, the structure of wages can also be influenced by potential endogenous migration decisions (Dahl 2002). The standard model of migration predicts that workers will sort into the location offering the highest wages given the level of skills, and if these migration decisions are influenced by factors unobserved to the researcher, then ignoring nonrandom migration will lead to biased estimates of equation (1).

The decennial census contains information on the place of residence as of 5 years prior to the census.⁷ We define a "stayer" in Appalachia if one resided in the region in both periods, a "mover-in" to Appalachia as someone who currently resides in Appalachia but did not 5 years prior, and a "mover-out" of Appalachia as someone who lived in Appalachia 5 years ago but no longer lives in the region. Stayers and movers in non-Appalachia are defined similarly. Online appendix table A1 demonstrates that the fraction of persons moving into Appalachia exceeds that of movers out, the result of which is that the 5-year stayer rate in Appalachia is declining over time because in-migration is altering the composition of the region. Online appendix table A2 shows that among both men and women, those who move out of Appalachia are two to three times more likely to have completed college or to have received postgraduate training than those who stay in the region. As for those who move into Appalachia, they too are more educated than stayers, but they have less schooling than those who move out. On net, there is some evidence of a brain drain in Appalachia due to migration.

To address possible endogenous migration we again specify a latent variable model

$$S_{ijrt}^{*} = D_{ijrt}\pi_{jrt} + \xi_{ijrt,}$$
(3)

where S_{ijrt}^* is the unobserved propensity to stay in your current location, D_{ijrt} are observable characteristics, and ξ_{ijrt} are unobservable characteristics. Since we only observe whether the person has stayed or moved, that is, $S_{ijrt} = 1$ or 0, then staying implicitly occurs when $S_{ijrt}^* > 0$. In this case D includes the variables in Z, that is, those variables in the labor force selection equation, along with the identifying variable of whether or not the person was born in a state within Appalachia. Dahl (2002) used the birth state as his identifying restriction under the assumption that state of birth affects latent geographic preferences of where to live, but not wages conditional on making the migration decision. Card and Krueger

⁷ In 1980 the census only asked the migration questions for one-half of the sample. Because they were randomly assigned, the data are representative of each region as a whole.

(1992) include state of birth as a direct determinant of weekly earnings, but the argument in Dahl (2002) is that in a two-stage optimization problem state of birth affects the first stage of whether to move or not, but conditional on controlling for the migration choice, state of birth does not affect wages except indirectly through the migration decision. We follow a similar identification scheme as Dahl, but instead of selection into one of 50 states we only estimate selection into one of two regions and rely on the cross-section heterogeneity in state of birth to identify the model. Online appendix table A1 shows that 90% of men and women in 1980 and 1990 currently residing in Appalachia were born in the region, and while it fell to about 86% by 2000, the high concentration of nativeborn in the region suggests that the variable is a strong predictor of staying.

Based on equations (2) and (3) we specify the conditional mean of the error term in equation (1) as

$$E[\varepsilon_{ijrt}|X_{ijrt}] = \sum_{k=1}^{K} \delta_{kjrt} \lambda_{ijrt}^{(k)}(\gamma_{jrt}) + \sum_{k=1}^{K} \phi_{kjrt} \lambda_{ijrt}^{(k)}(\pi_{jrt}), \qquad (4)$$

which is a series estimator that admits possible nonlinearity in labor force selection (the first term) and migration decisions (the second term) via higher-order terms of λ , the inverse Mills ratio (Lee 1984). To operationalize the model, in the first step we estimate the decisions to work and to migrate, which yields the estimated parameters, $\hat{\gamma}_{jrt}$, $\hat{\pi}_{jrt}$. The second step of estimation then involves constructing the terms in equation (4) with the estimated first-stage parameters and appending them to equation (1):

$$\ln W_{ijrt} = X_{ijrt}\beta_{jrt} + \sum_{k=1}^{K} \delta_{kjrt}\lambda_{ijrt}^{(k)}(\hat{\gamma}_{jrt}) + \sum_{k=1}^{K} \phi_{kjrt}\lambda_{ijrt}^{(k)}(\hat{\pi}_{jrt}) + u_{ijrt}.$$
 (5)

We estimate equation (5) via ordinary least squares (OLS) separately for each region, gender, and year only for those individuals who are working stayers in each region. As a practical matter, we set K = 1 in our base case and estimate the work and migration equations (2) and (3) via probit maximum likelihood, which yields the usual two-step Heckman correction (Heckman 1979); however, we also present results when we set K =2 and for the case with a linear probability selection model (Olsen 1980).⁸

B. Mean Wage Decompositions

To compare differences in average wages between two populations (e.g., Appalachia and non-Appalachia in 2000), we employ a modified version

⁸ We explored estimating the selection terms with the semiparametric model of Ichimura (1993), but the very large sample sizes coupled with the large number of covariates made the problem prohibitive, and it failed to converge. In addition, we assume independence between the selection terms, the violation of which is typically thought to be second order (Wooldridge 2001).

of the Oaxaca (1973) and Blinder (1973) method that decomposes wage gaps into differences in the coefficients and differences in the observable characteristics that is robust to nonrandom selection. Typically decomposition of the mean actual wages of workers includes the average differences in the selection correction terms (Neuman and Oaxaca 2004).⁹ However, in our case we are interested in the wage distribution facing the entire population, including nonworkers as well as workers regardless of realized migration decision. Thus we decompose the offer wage distribution rather than the realized wage distribution.

We predict offer wages by using the observed demographics of the whole population of men and women in each region and year along with the selectivity-corrected coefficients, $\hat{\beta}_{jrt}$. Specifically, if we define $\ln \hat{W}_{ijt}^A = X_{ijt}^A \hat{\beta}_{jt}^A$ as the predicted offer wages (of workers and nonworkers, and movers and stayers) of gender *j* in time period *t* for the Appalachian region (*A*), and $\ln \hat{W}_{ijt}^{NA} = X_{ijt}^{NA} \hat{\beta}_{jt}^{NA}$ as the corresponding predicted offer wages outside Appalachia (*NA*), then we can decompose the offer wages at the means by using either the Appalachian coefficients or the non-Appalachian coefficients as the reference price vector. The average predicted non-Appalachian/Appalachian wage gap based on non-Appalachian coefficients is

$$\ln \overline{\widehat{W}}_{j_t}^{NA} - \ln \overline{\widehat{W}}_{j_t}^A = (\overline{X}_{j_t}^{NA} - \overline{X}_{j_t}^A) \hat{\beta}_{j_t}^{NA} + \overline{X}_{j_t}^A (\hat{\beta}_{j_t}^{NA} - \hat{\beta}_{j_t}^A), \tag{6}$$

where the first term on the right-hand side represents the average offer wage gap accruing to demographic differences across regions, and the second term reflects differences in coefficients. Because the decomposition in equation (6) can be sensitive to the reference set of coefficients we also present estimates of (6) using the Appalachian coefficients as the reference group.¹⁰

⁹ In an earlier version of this paper we presented the decomposition of selectivity-adjusted wages of working stayers in each region, but the current approach is more instructive on the whole structure of wages. That said, it is possible to subtract the difference in actual average wages and the difference in average predicted offer wages to assess the size of selection, as we note below in the Results section. We thank Jim Albrecht for making this suggestion.

¹⁰ As an alternative way of correcting for selection into the labor market, we experimented with the technique used in Chandra (2000, 2003) by giving individuals outside the labor market offer wages equal to the 10th or 25th percentile of the wage distribution within cells defined by our experience, race, education, and region variables. For the most part, our decompositions based on this alternative method of estimating offered wages mirror our results based on the standard selection correction model, the one exception being our results for men in 2000 using the non-Appalachian coefficients as the base. In this case we find that the differential in the mean offered wage is largely due to differences in demographics. However, because the coefficients in our wage regressions are so different from the coefficients in any other wage regression we or others estimate, we simply do not believe these results for men in 2000. In the end we conclude that the

C. Quantile Wage Decompositions

The Oaxaca-Blinder decomposition focuses on differences in average offer wages; however, as noted in the voluminous inequality literature, there have been important changes throughout the earnings distribution. We thus extend our previous analysis to decompose changes in the entire wage distribution using quantile regression techniques and building on the methodology of Machado and Mata (2005). The value of examining the wage distribution is that if by estimating equation (5) we observe that the rate of return to education has increased in Appalachia on average, that increase at the mean may reflect that it shifted up among all persons, or it may be that the lowest rates of return have improved, but the highest rates have not (or vice versa). These distinctions have important implications for the role of increasing skill levels versus rising returns to skill across the distribution.

The Machado-Mata procedure uses estimated quantiles of the conditional wage distribution to conduct a series of counterfactual decompositions of the distribution by simulating the marginal wage distributions under alternative scenarios. This approach differs from that of DiNardo, Fortin, and Lemieux (1996), who estimate wage models with nonparametric kernel densities and are not able to separately identify the contributions of variables compared to coefficients.¹¹ Autor, Katz, and Kearney (2005) extend the Machado-Mata approach for wage distributions by separately identifying the contribution of "within-group" inequality from "between-group" inequality and observed versus unobserved skill in the spirit of Juhn et al. (1993). Our approach extends the Machado-Mata method in a different fashion from Autor et al. (2005) by explicitly ad-

results using this alternative technique are similar to our main results reported in the text, with this one exception. These results are available upon request.

¹¹ Recently Firpo, Fortin, and Lemieux (2007) proposed a new method of estimating unconditional quantiles that permits decompositions into differences in coefficients and differences in regressors similar to Machado-Mata. The advantage of their approach over Machado-Mata is that they are also able to identify the contributions of specific regressors to the wage gap, while the Machado-Mata approach only permits a decomposition of the whole vector of regressors. This variable by variable approach has always been possible with the linear Oaxaca-Blinder decomposition method, but as first noted by Jones (1983), the results are sensitive to the choice of reference group if any of the regressors are dummy variables. Although the Firpo et al. method is an elegant extension of the literature, the set of regressors in our model are dummy variables, and our interest is primarily on the full index of skills. More importantly, quantile methods adjusted for sample selection have been developed previously by Buchinsky (1998, 2001) but as of yet similar results have not been established for unconditional quantiles, although Blundell et al. (2006) recently proposed a bounding procedure for quantiles with selection.

mitting nonrandom sample selection bias into the quantile model.¹² As shown in Datta Gupta, Oaxaca, and Smith (1998) there is a close relationship between the Oaxaca approach with selection and the Juhn et al. (1993) method.

To implement the Machado-Mata procedure we first estimate a variant of the selection-corrected conditional quantile proposed by Buchinsky (1998),

$$\ln W_{ijrt} = X_{ijrt}\beta_{jrt}^{\theta} + \sum_{k=1}^{K} \delta_{kjrt}^{\theta} \lambda_{ijrt}^{(k)}(\hat{\gamma}_{jrt}) + \sum_{k=1}^{K} \phi_{kjrt}^{\theta} \lambda_{ijrt}^{(k)}(\hat{\pi}_{jrt}) + u_{ijrt}, \quad (7)$$

for each quantile θ on the sample of workers and stayers that yields the vector of gender, region, and year-specific coefficients $(\hat{\beta}_{jrt}^{\theta}, \hat{\delta}_{kjrt}^{\theta}, \hat{\phi}_{kjrt}^{\theta})$. In order to capture wide heterogeneity in the distribution of wages we estimate equation (7) for 99 quantiles ranging from 0.01 to 0.99. Using the same identification strategy as in the case of the conditional mean, we estimate the first stages in equations (2) and (3) as probit models and set K = 1 under the assumption that the nonlinearity of inverse Mills ratio coupled with the exclusion restrictions should provide sufficient flexibility in the selection process to separately identify $\hat{\beta}_{jrt}^{\theta}$ from $(\hat{\delta}_{kjrt}^{\theta}, \hat{\phi}_{kjrt}^{\theta})$ in the quantile wage equation (7).¹³

With the estimated conditional quantile coefficients we then construct counterfactual distributions by simulating out the marginal "offer" wage distribution using the demographics from the whole population of workers and nonworkers and movers and stayers in each gender, region, and year along with the estimated coefficients on the observed demographics, $\hat{\beta}^{\theta}_{int}$. We decompose the predicted offer distributions into differences in skills and differences in coefficients as before, but now for 99 quantile points rather than just the mean. For example, suppose we take the coefficients and demographics from the non-Appalachian region as the reference group. We can construct a counterfactual distribution using demographic characteristics drawn from the Appalachian region by first drawing observations randomly (with replacement) from the Appalachian data and randomly assigning a quantile, $\theta, \theta \in [0.01, 0.99]$ to each drawn observation. Then we generate a predicted wage using the non-Appalachian quantile coefficients indicated by that observation's θ and the demographic variables (X) of that observation. This generates a simulated

¹² Independently Albrecht et al. (2009) proposed a similar extension to the Machado-Mata method and applied it to gender wage gaps in the Netherlands.

¹³ Buchinsky (1998) used a probit as well as a semi-nonparametric estimator in the first stage, but then a powered-up version of the inverse Mills ratio as we do in the second stage. With two separate selection terms we opted for the parametric first stage in order to enhance transparency and computational feasibility with our very large data sets.

distribution of wages as if individuals in non-Appalachia had the same distribution of X's as the Appalachian region.

The procedure is comparable to the term $X_{ijt}^A \hat{\beta}_{jt}^{NA}$ in a standard Oaxaca-Blinder decomposition. We can then compare differences in the non-Appalachian offer wage distribution to this counterfactual distribution: differences are solely due to differences in demographics and are comparable to the term $(X^{NA} - X^A)\hat{\beta}^{NA}$ in the Oaxaca-Blinder decomposition found in equation (6) with non-Appalachia as the reference price vector. We can also compare differences in the counterfactual distribution and the predicted offer wage distribution in Appalachia: differences are solely due to coefficients on the demographics and are comparable to the term $X^A(\hat{\beta}^{NA} - \hat{\beta}^A)$ in the Oaxaca-Blinder decomposition.

IV. Results

The first-stage estimates for the probability of employment in equation (2) and for the probability of staying in equation (3) are presented in online appendix tables A5 and A6, while the final wage regression estimates are presented in online appendix tables A3 and A4.¹⁴ In general, the exclusion restrictions are highly predictive of work and staying in the region. For example, higher nonlabor income, more children under age 5, and a higher state unemployment rate are each associated with a lower probability of employment, while a more generous EITC increases the odds of employment. Being born in an Appalachian state increases the probability of currently living in Appalachia and not living outside the region. There is strong evidence of nonrandom selection into the region of residence for all years for both men and women, and the same is true for nonrandom selection into work, except for women in 1980, where it appears that controlling for selection on observables was sufficient for wages.

Looking at online appendix tables A3 and A4, we see that both education and potential experience are important determinants of wages for both men and women in each region, but large coefficients on the interactions of education and experience also clearly reject the null hypothesis of separability between education and experience assumed in the canonical Mincer equation (Heckman et al. 2003). Because of the importance of these interactions, this implies that the return to schooling is highly nonlinear. To assist in interpretation, in figures 1 and 2 we plot the percentage wage gain of schooling relative to a high school dropout for a worker with 10–20 years of potential experience for men and women, respectively.

¹⁴ We report the actual coefficients from the probit models in online appendix tables A5 and A6. We report actual coefficients and not the marginal effects because it is the actual coefficients that are used to form the selection correction terms that appear in online appendix tables A3 and A4.



FIG. 1.—Wage gain of men relative to high school dropout with 10-20 years potential experience.

Figure 1 reveals that there was a large increase in the relative return to some college or better in the 1980s for men, both within and outside Appalachia. This result has been well documented in the literature for the nation as a whole, and the estimates here indicate that the trend was also true for the economically depressed region of Appalachia. Indeed, the relative return to college and postgraduate degrees for a man with 10-20 years experience was actually higher in Appalachia in 1980 and 1990 compared to non-Appalachia. This difference is consistent with a higher return offered to workers whose skills are in relatively short supply, which may have characterized the situation in Appalachia since table 1 shows that there are fewer individuals with advanced degrees in Appalachia than in other parts of the country. The 1990s were a different story for men in Appalachia. Although the relative return to college and advanced degrees continued to rise in both regions of the country, they rose more quickly outside Appalachia and actually surpassed the Appalachian returns by 2000. In fact, the proportionate wage gain for high school and some college in Appalachia actually declined after 1990, so that the wage gains at all education levels for this experience cohort of men fell compared to the rest of the nation. This divergence in schooling returns will exacerbate within-Appalachian inequality consistent with the polarization



FIG. 2.—Wage gain of women relative to high school dropout with 10–20 years potential experience.

story of Autor et al. (2008) but will also increase between-region inequality. These trends were not specific to the cohort of men with 10– 20 years potential experience, as they likewise hold for workers with 30– 40 years experience.

Similar to the male experience, in figure 2 there is strong evidence of rising relative returns to skill in the 1980s among women, but this was especially strong outside of Appalachia. Indeed, the wage gain for a college graduate relative to a dropout was a fairly constant 72%–74% from 1980 to 2000, whereas it rose from 61% to 88% in the same period outside of Appalachia. Also like men, there was a reversal between 1980 and 2000 in that the wage gain for women in Appalachia in 1980 exceeded non-Appalachia at nearly every education level but was lower at every level by 2000. Even though there was education upgrading in Appalachia in recent decades, especially at the high school and some college levels, the relative wage gains fell behind the rest of the nation.

The other coefficients in online appendix tables A3 and A4 show that most racial groups earn lower hourly wages than white non-Hispanics, but these gaps appear to be larger outside of Appalachia, at least after 1980. In addition, the premium associated with residing in an urban area is at least double outside of Appalachia for both men and women, suggesting that there are important differences in wage opportunities in urban areas across regions, a point that we return to below. Being married paid off more for men in Appalachia than those outside of the region in both 1980 and 1990; however, the relative difference in the marriage premium fell from 39% in 1980 to a negative 1% in 2000 because of a large secular rise in the returns to marriage in the 1990s among men outside of Appalachia. Both the rates of marriage and the returns to marriage for Appalachian men have fallen over the past decade. Although Wilson's (1987) thesis on the decline of "marriageable men" was initially applied to lowskilled urban African Americans, the results here are suggestive that such a phenomenon may be in evidence in Appalachia as well.

A. Decomposing Changes in Average Wages

In table 2 we report the selection-corrected wage offer decompositions at the means for each year from equation (6).¹⁵ The table shows the mean difference in offered wages (not the actual wage as in the summary statistics in table 1), the portion of the gap due to differences in observed demographics, and the portion due to differences in coefficients. For both men and women, we report the gap first based on non-Appalachian coefficients as the reference group and, second, based on Appalachian coefficients, along with analytic standard errors (Jann 2005).¹⁶

The mean offered wage gap for men rose about 28% between 1980 and 2000, but that was substantially lower than the 54% increase between 1980 and 1990 (the actual gap in table 1 increased 33% between 1980 and 1990, the difference between the offer wage gap and actual wage gap arising from selection effects). Based on the non-Appalachian coefficients, in 1980 63% of the 0.101 wage gap was due to demographic shortfalls among Appalachian men, and the remainder was due to regional differences in coefficients. By 2000, however, the portion due to demographic differences fell by 20 percentage points, and the portion due to coefficients rose a comparable amount. An even more dramatic shift from demographic gaps to coefficient gaps from 1980 to 2000 emerges when using Appalachian coefficients as the reference prices. The differences are all statistically different from zero. Although there is evidence that skill up-

¹⁵ In online appendix table A7, we present decomposition results where we do not control for selection into the labor market or the region. The results are qualitatively similar to the results in table 2.

¹⁶ The formulas for the analytic standard errors are based on a Taylor series approximation under the assumption of independence across samples. Because of overlap of samples due to our weighting procedure, independence is violated, but the overlap is trivial and is ignored in the standard errors. The variance formulas for each term in eq. (6) are given as $V[(\bar{X}_{i\ell}^{NA} - \bar{X}_{i\ell}^{NA})\hat{\beta}_{i\ell}^{NA}] = (\bar{X}_{i\ell}^{NA} - \bar{X}_{i\ell}^{A}) Y(\hat{\beta}_{i\ell}^{NA}) (\bar{X}_{i\ell}^{NA} - \bar{X}_{i\ell}^{A}) + \hat{\beta}_{i\ell}^{NA} (V(\bar{X}_{i\ell}^{NA}) + V(\bar{X}_{i\ell}^{A})]\hat{\beta}_{i\ell}^{NA} + tr(\cdot)$ and $V[X_{i\ell}^{A}(\hat{\beta}_{i\ell}^{NA} - \hat{\beta}_{i\ell}^{A})] = \bar{X}_{i\ell}^{NA} [V(\hat{\beta}_{i\ell}^{NA}) + V(\hat{\beta}_{i\ell}^{A})]X_{i\ell}^{A} + (\hat{\beta}_{i\ell}^{NA} - \hat{\beta}_{i\ell}^{A}) V(\bar{X}_{i\ell}^{NA}) + tr(\cdot).$

Oaxaca	-Blinder Decc	omposition of	Offered Wage	Gaps betwe	een Non-Af	ppalachians ar	nd Appalachia	su	
		Z	Ion-Appalachia	as Reference			Appalachia as	Reference	
	Difference in Offered Wage		Percent Due to		Percent Due to		Percent Due to		Percent Due to
Year	(Log Points) (1)	Demographics (2)	Demographics (3)	Coefficients (4)	Coefficients (5)	Demographics (6)	$\begin{array}{c} \text{Demographics} \\ (7) \end{array}$	Coefficients (8)	Coefficients (9)
Men:									
1980	.101	.064	63	.037	37	.057	56	.045	45
1990	.155	.071	46	.085	55	(.000.) .041	26	.115	74
		(.001)		(900.)		(.003)		(900)	
2000	.129	.056	43	.073	57	.027	21	.102	79
Women.		(.001)		(900')		(.002)		(200.)	
1980	.092	260.	105	005	-5	.071	77	.021	23
		(.001)		(.013)		(.004)		(.013)	
1990	.137	.119	87	.018	13	.069	50	.068	50
		(.001)		(2007)		(.003)		(.007)	
2000	.094	.096	102	002	-2	090.	64	.034	36
		(.001)		(800.)		(.003)		(.008)	

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NOTE.—Analytic standard errors are provided in parentheses.

grading in Appalachia during the 1980s and 1990s played an important role in equalizing interregional wages, the widening of the average wage gaps is a result of the divergence in skill returns.¹⁷

The offered wage gap between non-Appalachian women and Appalachian women is both smaller than that of men and widened by less in the 1980s (just the opposite of the actual wage gap in table 1, again highlighting the importance of controlling for nonrandom selection as evidenced in appendix table A7 in the online version with no selection). However, like the gap for men, the gap for women narrowed somewhat in the 1990s. And while qualitatively similar to that for men, the pattern over the past 2 decades toward less of the gap explained by demographics and more of the gap explained by coefficients is much more muted for women. In each year, differences in demographics account for a majority of the wage gap among women.

B. Decomposing the Distribution of Wages

Because of the myriad of estimated coefficients from the quantile models in equation (7)—99 quantiles each with 18 coefficients by year, region, and gender (over 21,000 coefficients in total)—we instead follow Machado and Mata and present our quantile decompositions graphically.

Figure 3 presents the Machado-Mata decomposition for men and women by year using non-Appalachia as the reference group.¹⁸ Within each panel the line labeled "Predicted Differences" shows the difference in the offered log-wage distribution between the non-Appalachian and Appalachian regions from the quantile models-like the first column of table 2 labeled "Difference in Offered Wage." That is, the estimated coefficients from equation (7) are used in conjunction with the demographics (without the selection terms) for workers and nonworkers, movers and stayers, to construct a predicted wage distribution. The second line, labeled "Differences from X's," compares the counterfactual distribution constructed using Appalachian X variables and non-Appalachian coefficients (β 's) to the predicted non-Appalachian offered wage distribution like the second column of table 2 labeled "Demographics." The third line, labeled "Differences from β 's," compares the counterfactual distribution and the predicted Appalachian wage distribution-like the fourth column of table 2 labeled "Coefficients." The difference between the results in

¹⁷ One possible explanation for these findings is that the quality of schooling is lower in Appalachia and the gap in schooling quality has risen over time. Unfortunately, we are unaware of any large national data set containing measures of school quality both within and outside Appalachia that would allow us to examine this hypothesis.

¹⁸ Online appendix table A3 presents the decomposition results using Appalachia as the reference group.



FIG. 3.—Wage distribution comparison: using non-Appalachia as counterfactual.

figure 3 and table 2 are that we can observe which part of the wage distribution is driving the average difference.

The first panel of figure 3 (first row, first column) displays the differences between non-Appalachia and Appalachia men in 1980. The negative values represent places where there is higher density for Appalachia than for non-Appalachia, while the positive values represent areas where there is higher density for non-Appalachia than for Appalachia. Hence, the predicted differences line shows that the distribution of wages for Appalachia is shifted to the left (or lower) of the distribution for non-Appalachia in 1980. The symmetry of the line indicates that the Appalachian distribution is shifted down relatively uniformly along the wage (x) axis. Thus, the average difference in table 2 is not being driven only by a lack of high earners in Appalachia or only by a lack of low earners in non-Appalachia.

The Differences from X's line displays the portion of the distributional difference in the first panel that is due to different demographics of Appalachian workers. We first note that the magnitude of this line is smaller as compared to the Predicted Differences line. Roughly we can say that at least half of the differences in the distribution are attributable to demographic differences. The symmetry suggests that the X's for Appalachia are shifted lower relatively uniformly through the distribution.

The Differences from β 's line shows that slightly less than half of the distributional difference is explained by the returns to demographics. This indicates that returns are, in general, higher outside of Appalachia. However, because the distribution is given by the X's times the returns, figure 3 shows that the higher X's in non-Appalachia are associated with higher returns, which may reflect investment in high return characteristics outside of Appalachia (this is confirmed in online appendix figure A2, which shows that the wage gain from completing high school and beyond with 10–20 years of potential experience across the 99 quantiles is higher outside Appalachia at higher wages).

As we move down the three rows for men we see that the magnitudes in the Predicted Differences lines increase between 1980 and 1990 and then fall again between 1990 and 2000. This is consistent with the rise in the average wage gap between 1980 and 1990 in table 2 and with the constant wage gap between 1990 and 2000. Most importantly, these lines remain symmetric: the distribution for Appalachian men is shifted down relatively uniformly such that the Appalachian wage gap is constant throughout the wage distribution.

The differences over time in the other two lines are more striking. By 2000, the magnitude of the differences in the demographics gap is attenuated, and like table 2, we see that demographic differences are less important in explaining the overall wage gap by 2000. With the demographics gap declining, we see the coefficients gap rising consistently. In results not tabulated, when we ignore nonrandom selection even more weight is placed on the coefficients gap, suggesting an increasing role played by selection into work and region in figure 3. A similar story emerges in online appendix figure A3 based on Appalachian coefficients and, if anything, the declining role of demographic differences and rising role of coefficient differences is amplified when Appalachian coefficients are used as the base.

Although there is evidence of convergence in skills between men in

Appalachia and non-Appalachia, this convergence is most evident at low wages, and there still remains a shortage in Appalachia at the right tail of the distribution. The coefficients gap is exacerbated between 1980 and 1990, especially at mean log wages and higher, although it is tempered somewhat by 2000. As highlighted in online appendix figure A2, it appears that the rise in overall differences between 1980 and 1990 was driven by a rise in the schooling returns gap, in particular at the high end. The slight closing of the gap between 1990 and 2000 appears to be driven by a decline in the returns gap. Thus, we see that while much of the average difference story in table 2 is confirmed by the distribution decomposition, we learn that the coefficients gap is more important in explaining the preponderance of low-wage male workers in Appalachia, while both the demographics and coefficients gaps are important for explaining the lack of high-wage workers in Appalachia. In short, Appalachia seems to suffer from a problem of "missing markets" for male workers-the double jeopardy of a lack of high-skilled workers coupled with lower returns on those skills.

The second column of figure 3 presents comparable graphs for women (the second column in online appendix fig. A3 is based on Appalachian coefficients). As with men, the first graph for 1980 demonstrates that the offer wage distribution for women in Appalachia was lower than the distribution for women outside of Appalachia. Moreover, the difference is symmetric and thus represents a relatively uniform shifting down of the overall wage distribution in Appalachia compared to the rest of the country. In contrast to men, the density difference is less disbursed and generally falls between 1990 and 2000. Table 1 shows that the actual mean wage gap narrowed between 1990 and 2000, and the mean offered gap in table 2 falls even more, which reflects differential movements in and out of the labor force and region. Figure 3 suggests that the narrowing in the 1990s occurred throughout most of female wage distribution, with the possible exception of very high wages.

For women the line showing the overall differences due to the demographics gap is roughly symmetric, but the magnitude falls only slightly between 1980 and 2000. Thus, some of the decline in differences between 1980 and 2000 for women is driven by decreasing differences in demographics. The demographics gap appears to be at least half or more of the overall gap in each census year. Thus, unlike for men, differences in demographics are more important across the entire wage distribution: the preponderance of low-wage female workers in Appalachia is explained in part by a lack of skills, and the lack of high-wage workers in Appalachia is also be explained by a lack of skills.

The line showing the role of coefficient differences suggests that the coefficient difference is concentrated at the median of the wage distribution. Non-Appalachia appears to have a wider distribution of returns, while for Appalachia the coefficients are concentrated near the median. This indicates a lack of high and low returns in the wage distribution. There may be high characteristic women who are receiving lower returns for those characteristics than their non-Appalachian counterparts receive, while there may be low characteristic women who are receiving higher returns for their characteristics than their non-Appalachian counterparts. We also note that by 2000, the differences between Appalachia and non-Appalachia are muted and there is less of a clear distributional story. It appears that the coefficients are no longer driving the differences, while the X's appear to drive the differences. The muddled coefficient story for women is explained by the fact that labor force selection and migration play a much more important role for women than for men; indeed, in models that ignore selection we find that the role of coefficient gaps explains roughly half the total wage gap in each period. Thus, the wage distribution story for women is similar to that for men in trends, and like men, there is a widening gap in skill returns at high wage, but selection plays a much bigger role for women in the lower part of the wage distribution.

C. Sensitivity Analyses

We considered a number of robustness checks to our results. Because the analysis underlying the trends in average wage gaps largely carries over to the distributional wage gaps, we focus on how the mean decompositions change in response to alternative specifications. In addition, in order to economize on space we report results based only on the non-Appalachian coefficients, and note in passing that as in the base case of table 2, the trends among men toward skill upgrading are more pronounced using the Appalachian coefficients.

1. Industrial Composition

As highlighted in the summary statistics in table 1, the employment trends affecting many one-digit industries were similar across regions, but there were some differences. To account for possible shifting industrial composition we reestimated our wage models including indicators for industry (but excluded industry from both selection equations) and report the results in the top panel of table 3. When industry controls are included, the schooling premium for men increases across the board, while it declines for women. In terms of the Oaxaca-Blinder wage decompositions, the percent attributable to demographics falls in 1980 relative to the base case in table 2, but the trend to more of the gap being explained by differences in coefficients is robust, and indeed strengthened, with the inclusion of industry, especially for women.

Table Robu Wom	: 3 istness of C en (Non-A	Jaxaca-Blind ppalachia as	er Decompo Reference)	sition of Off	ered Wage G	iaps between	ı Non-Appal	achian and .	Appalachian	Men and
			Men					Women		
Year	Difference ir Offered Wage (Log Points) (1)	n Demograph- ics (2)	Percent Due to Demo- graphics (3)	Coefficients (4)	Percent Due to Coeffi- cients (5)	Difference in Offered Wage (Log Points) (1)	Demograph- ics (2)	Percent Due to Demo- graphics (3)	Coefficients (4)	Percent Due to Coeffi- cients (5)
					Industr	y Controls				
1980	.103	.056	54	.047	46	.100	060.	06	.010	10
1990	.159	(100.) .064	40	(.008) .095	09	.153	(100.)	73	(.012) .042	27
2000	.136	(100.) .049 (100.)	36	(,006) .087 (,006)	64	.113	(100.) .092 (100.)	81	(,00/) .021 (.007)	19
•					Linear Proba	ability Selectio	u			
1980	.113	.060	53	.053	47	.102	.097	95	.005	5
1990	.160	(100.)	42	(002) .092 (006)	58	.143	(1001)	83	(210.) .025 (006)	17
2000	.105		52	.050 .050 (.006)	48	.093	(100.) 0960. (100.)	103	003 (.007)	\tilde{c}
					Lee Quadi	ratic Selection				
1980	.017	.062	365	045 (.015)	-265	.112	.095	85	.016 (.027)	14
1990	.180	.066	37	.114	63	.203	.115	57	.088	43
2000	.125		43	(010) .071 (010)	57	.053	(1001) .095 (.001)	179	(.014) 042 (.014)	-79
No1	E.—Analytic s	tandard errors ar	e provided in pa	trentheses.						

2. Modeling Selection

A second robustness check was to relax the normal distribution assumption in the first-stage employment and migration models in two ways, one by assuming a uniform distribution and estimating the first stage with a linear probability model and second by relaxing the linearity assumption in the Heckman correction (Olsen 1980; Lee 1984). In the former case, in lieu of the inverse Mills ratio, Olsen (1980) shows that the conditional mean of the error term under least squares is modeled as (P-1), where P is the fitted value of the linear probability model. The selection corrections in this case make transparent that identification reguires exclusion restrictions that we have in our models. In the latter case, Lee (1984) uses Edgeworth expansions to show that linearity in the control function under normality can be relaxed by taking higher order powers as we show in equation (4). In this case we set K = 2. The bottom two panels of table 3 for each of men and women suggest that the baseline story holds up with the linear probability and quadratic selection terms, namely, that among men there was a shift toward skill return differences in accounting for mean wage gaps, but that the gaps were roughly stable among women and explained by mean differences in demographics.

3. Additional Years of Data

Since the Appalachian region has long been a center for poverty in the United States, we wanted to add additional years of data to our analysis in an effort to produce a longer-run view of the influence of changing skill levels and changing returns to skills on the Appalachian/non-Appalachian wage gap. Unfortunately, lack of data severely hampered our efforts.

The 1970 IPUMS data do have county group identifiers that are similar to the PUMA identifiers found in the 1980–2000 census IPUMS data. However, the county groups in the 1970s data are much larger than in the 1980–2000 data. This means that we have a larger number of individuals who cannot be uniquely assigned to Appalachia, which introduces additional error into our analysis. In addition, many of the variables we use to identify the labor force participation model, such as state EITC generosity, state minimum wage, and state food stamp program data, are either not available or have no cross-state variation. And while AFDC data are available, they are less detailed than data available in later years.

Despite these limitations we did estimate our main models using the 1970s data and decomposed the mean Appalachian/non-Appalachian wage gap into the percentage due to demographic differences in the coefficients. The primary result is that a much larger share of the difference in wages is due to differences in the coefficients. We further reestimated the model using the 1980–2000 data but limited ourselves to the variables that are
available in 1970. Again, we find that a much larger share of the wage gap is due to differences in coefficients.¹⁹ These results do suggest that lack of additional controls for selection into the labor in the 1970s data results in an upward bias in the coefficients in our wage equation, making us reluctant to draw strong conclusions from the 1970s data.

We also looked into using IPUMS data from the 1960 decennial census. However, in addition to the limitations in the 1970 data, the 1960 data have no substate geographic identifiers, nor is there any information on where a respondent lived 5 years earlier (which we use to identify the migration model). Given the problems with the 1970 data, we decided not to estimate our model using the 1960 data.²⁰

4. School Quality

A possible reason for the reversal in returns to schooling between Appalachians and non-Appalachians from 1980 to 2000 in figures 1 and 2 is due to differential school quality across regions. A major challenge we face is obtaining county-level data (to map into PUMAs) across the 1980-2000 period. Indeed, this is a major challenge even for a single year like 2000. There is a long literature in economics that eschews the use of inputs such as per pupil expenditures to measure quality, but unfortunately inputs are much more readily available than outputs. In an effort to address school quality at the substate level for 2000 we constructed high school graduation rates, which is possible using data at the county level from the Department of Education's Common Core of Data. Specifically we construct the 4-year graduation rate for each county in the United States for the 1999–2000 school year by taking the ratio of total twelfth-grade graduates in 1999-2000 to the average enrollment of eighth graders in 1995-1996, ninth graders in 1996-1997, and tenth graders in 1997-1998. The idea behind the 3-year average is to reduce the influence of mea-

¹⁹ These results are not reported in the paper but are available from the authors upon request.

²⁰ At the suggestion of a referee we also tried to control for nonrandom migration by using where someone was born to classify individuals as being part of Appalachia or non-Appalachia. While in principle this is an excellent suggestion, in practice we only know state of birth for individuals, so we run into the same problems with this analysis as we do when we use data on current residence from the 1960 census. Therefore, we concluded that the available data do not support an analysis based on place of birth. As an alternative, since West Virginia is wholly contained in Appalachia we reran the models comparing West Virginia, once with movers and stayers and once with stayers alone, to the rest of the country. In this exercise much more of the wage gap is explained by demographics, but the trend toward a greater share due to coefficients still obtains. As the results do not differ whether we restrict it to stayers in West Virginia, or include movers and stayers, it is suggestive that workers in Appalachia, at least in West Virginia, underinvest in skills. surement error in the denominator owing to students dropping out and/ or moving out of the county.

Our first test with these data was to examine whether 4-year graduation rates were different between Appalachian counties and the rest of the country in 2000. We found that they were significantly lower by about 4 percentage points in Appalachian counties. Given the statistically and potentially economically important difference, we then merged the county graduation rates with our PUMA identifiers, and then into the full 2000 census sample based on PUMA of residence. We then reran our base case models adding graduation rates as a control variable in the selection equations as well as the wage equations. We found graduation rates to be a statistically significant determinant of wages in both non-Appalachia and Appalachia. However, the effect on returns to schooling and the subsequent wage decompositions was minimal. Controlling for 4-year graduation rates does slightly lower the returns to schooling outside Appalachia, but not inside, and the effect on the decomposition is trivial.

Our second test is to include two measures of school inputs to the model with graduation rates. Again the data come from the Common Core for the 1999–2000 academic year and include pupil-teacher ratios and expenditures per pupil. At this point the returns to school for Some College in Appalachia now exceed the return outside Appalachia, but the returns to College and Master's and More in non-Appalachia still exceed those in Appalachia. This continues to point to our missing markets hypothesis at the high end of the skill distribution. Moreover, our finding that the bulk of differences are due to coefficients and not demographics is, if anything, stronger with controls for quality. We thus believe that our results are robust to school quality differences, although we recognize that a complete treatment of this awaits more readily available data on test scores at the local level.

5. Subregions and the Role of Urban Areas

The wage equation estimates showed that there were significant wage advantages to living in an urban area outside Appalachia as compared to inside Appalachia. In addition, there is a widespread perception that references to "the other America" are directed at the rural areas of Appalachia, not urban centers such as Pittsburgh and Birmingham. As a consequence, in this robustness check we examine the role of urban areas in our wage decompositions for five different subregions: (*a*) comparing rural non-Appalachia to rural Appalachia; (*b*) comparing urban non-Appalachia to urban Appalachia; (*c*) dropping residents living in urban areas with more than 1 million people; (*d*) comparing non-Appalachia to the residents of PUMAs contained in the seven central Appalachian states of Kentucky, Maryland, North Carolina, Ohio, Tennessee, Virginia, and

Skill Upgrading and Wages in Appalachia

	1980	1990	2000
Men:			
Base case	.094	.125	.124
Rural to rural	006	005	.027
Urban to urban	.061	.114	.097
Omit urban areas >1,000,000	.049	.040	.059
Non-Appalachia to central Appalachia	.125	.168	.175
Non-Appalachia (omitting urban areas			
>1,000,000) to central Appalachia	.044	.059	.078
Women:			
Base case	.127	.169	.159
Rural to rural	.013	.009	.030
Urban to urban	.113	.169	.144
Omit urban areas >1,000,000	.059	.061	.072
Non-Appalachia to central Appalachia	.155	.212	.205
Non-Appalachia (omitting urban areas			
>1,000,000) to central Appalachia	.067	.082	.086

Table 4 Actual Non-Appalachian/Appalachian Log Wage Gaps for Alternative Subregions

West Virginia; and (e) comparing non-Appalachian residents residing in urban areas under 1 million to the residents of PUMAs contained in the central Appalachian states. The rural-to-rural and urban-to-urban comparisons presumably remove some of the unobserved heterogeneity across areas and thus may make a more plausible "treatment group–comparison group" evaluation. Likewise, because Appalachia does not contain any of the very large urban areas such as New York, Los Angeles, or Houston, our base results in table 2 may be unduly influenced by those areas and thus c should remove some of that influence. Finally, the central Appalachian states are more similar in terms of geography and demographics compared to the Deep South and northern sections in New York and Pennsylvania, and are often most frequently perceived as being "the" Appalachian region.

In table 4 we report the actual average wage gaps for each of the five subregions as well as the overall gap from table 2 (labeled base case). Most striking is that for men the average wage gap between rural Appalachia and the rest of rural America is zero in both 1980 and 1990, and widens to just under 3 log points in 2000. This suggests that the level of and trend toward a widening wage gap observed over the past 2 decades was driven by differential changes in wages between Appalachian and non-Appalachian urban areas or by differential movements between urban and rural areas in the two regions. The same holds for women in Appalachia as well. When we omit urban areas with population greater than 1 million the wage gaps fall by 5–10 log points depending on year and whether we examine men or women, suggesting that the actual wage gaps are heavily influenced by large urban areas. As expected, the wage gaps widen when we restrict Appalachia to the central states, but when we also drop large urban areas outside Appalachia the wage gaps fall as much as 60%.

Recall, however, that our decompositions focus on offered wages across the population of workers and nonworkers, and thus in table 5 we report the Oaxaca-Blinder mean offer wage decompositions for the five subregions. We estimated the selection equations (2) and (3) and wage equations (5) and (6) separately for each subgroup, but one limitation in the migration selection equation is that we lack identifying information on whether or not the person was born in an urban or rural location, and thus we continue to rely on whether the person was born in an Appalachian state as the exclusion restriction.

In the top panel of table 5 we see that for both men and women the offered wage gaps between rural Appalachia and the rest of rural America are actually negative, meaning that on average offer wages are higher in rural Appalachia. For men, much like the actual gap, the offer wage gap is near zero. Contrary to the base case, the differences in rural areas across all years for both men and women are wholly accounted for by differences in interregional coefficients and not demographics. Comparing urban Appalachia to the rest of urban America in the second panel, we also see that in any given year for both men and women demographic differences explain less of the gap compared to differences in coefficients, but this differential widened over time. This suggests that the base case results in table 2 were driven largely by the increasing importance of urban areas over time offering higher wage returns to skills. Indeed, the remaining three panels in table 5 suggest that it is not that the residents of central Appalachia are somehow different from other Appalachians, nor that urban areas per se were important to widening interregional wage gaps, rather that it is large urban areas with more than a million people driving much of the Appalachia/non-Appalachia wage gaps in recent decades. Appalachia lacks these large urban areas and the corresponding growth in wages that such cities enjoyed in recent decades.²¹

²¹ One concern expressed by an anonymous referee was that these results indicate that we are finding a "rust belt" effect as opposed to an Appalachian effect. We tested this hypothesis in two ways. First, we simply dropped the non-Appalachian rust belt states (Michigan, Pennsylvania, Ohio, and Indiana) from the analysis. When we did this our results were similar to what we report in the paper, indicating that the rust belt states were similar to the rest of the country. Second, we included the rust belt states as part of Appalachia. When we did this the actual and predicted wage differential was quite similar between the two regions, particularly when comparing urban areas. Taken together, these results suggest that the Appalachian region is quantitatively worse off than the upperrust belt region.

V. Conclusion

Our results indicate that men and women in Appalachia came "down from the mountain" in the 1980s and 1990s and significantly upgraded their human capital in terms of education attainment compared to men and women in the rest of the nation. This relative skill upgrading prevented the wages of Appalachians from falling further behind those outside the region during the period of widening inequality overall. As a consequence, the wage distribution for men in Appalachia compared to non-Appalachia is less due to demographic shortfalls than to differences in returns to important skills such as education and experience, the latter of which appears to be driven in large part by the relative decline in returns to schooling in Appalachia over the past 2 decades. At the same time, however, for men we find that skill shortages remain more pronounced at the high end of the wage distribution, which is borne out in the summary statistics in table 1 that show that college completion and advanced degrees in Appalachia are about one-half the rate of attainment in the rest of the country.

Appalachia seems to suffer from "missing markets"-the double jeopardy of a lack of high-skilled workers coupled with lower returns on those skills. Perhaps surprisingly, this is most pronounced in the urban areas of Appalachia and not the rural areas, as commonly perceived. Indeed, the wage gap between rural Appalachia and the rest of rural America is virtually nonexistent—the wage gap is driven by weakness in the urban areas. As lucidly described by Glaeser and Gottlieb (2008) the policy response to such missing markets in urban Appalachia is not clear ex ante. If there are human capital externalities and/or agglomeration economies that have yet to be exploited in Appalachia, or if redistributive concerns take primacy, then the policy response would involve the combination of more heavily subsidizing college-level degree programs-a supply-side issue—along with the demand-side issue of developing high-skill jobs that encourage higher-educated Appalachians to remain in the region rather than migrate to higher returns in other areas of the United States. On the other hand, if agglomeration economies and externalities are most pronounced in other metro areas of the country, and tastes for redistribution weak, then policies that foster migration to those high return areas are likely to be most cost effective. To more effectively inform policy on efficiency grounds, further evidence is needed on the presence or absence of region-specific externalities.

009 (.001) 018
(.001) 024 (.001) (.001) (.001) (.001) (.001)

Table 5

Comparison of Non-Appalachia to Central Appalachian States	77 .032 23 .161 .145 90 .016 10	55 (.014) 45 (.002) (.002) (.002) 55 (.004) 45 .180 (.174) 97 (.006) 3 (.014) (.014)	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	ison of Non-Appalachia Excluding Urban Areas >1,000,000 to Central Appalachian States	79 .012 21 .055 .071 129016 -29	(.014) (.021) (.021) (.021) (.021) 30 (.073) 70 .061 (.065 1070047 7.030 (.033) 70 (.033)	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
Comparison of Non-Appalach	.032 23	(1011) .094 45 / 010)	(.010) .073 42 (.011)	on-Appalachia Excluding Urb	.012 21	(.014) .073 70 (.010)	
	0 .108 77	0 (.001) 0 .116 55	3 (.001) 58 (.001) 58	Comparison of N	6 .044 79	5 (.001) 5 .032 30 7 001)	2 (1001) 37 (001) 37
	1980 .14	1990 .21	2000 .17		1980 .05	1990.	2000 .08

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Food Stamp Program Participation of Refugees and Immigrants

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The Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) dramatically changed the availability of food stamps to immigrants, but not to refugees. However, refugee usage of food stamps in the post-reform era has declined more than usage of either other immigrants or native citizens. We investigate food stamp program participation of immigrants and refugees to ascertain if the resulting decline was an unintended effect of the reform or is due to some other phenomena. We use data from the Immigration and Naturalization Service to construct an instrument for refugees. We find that refugees are more likely than other immigrants to use food stamps. While PRWORA clearly reduced non-refugee immigrant food stamp participation, the post-reform era decline in refugee usage is fully attributable to a strong refugee response to changing labor market conditions. We also find that refugees' use of food stamps declines rapidly with time in the United States, unlike that of other immigrants.

JEL Classification: H53, J61, C13

1. Introduction

From its inception in 1977 until the 1996 welfare reforms, the food stamp program provided food assistance to low-income households, including legal immigrants, who met nationally uniform income and asset eligibility tests. After two decades of increasing food stamp use by immigrant households (Borjas and Hilton 1996), the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA) drastically altered the availability of food stamps to non-citizen legal immigrants but not to refugees (Fix and Tumlin 1997). Immigrants who arrived in the United States prior to 1996, who could not demonstrate 40 quarters of work history, and who were not yet naturalized became ineligible for federal food stamp benefits.¹ Immigrants arriving after August 1996 were also made ineligible. In contrast, refugees were largely spared by the PRWORA. Under the new law, refugees were given "qualified" status, allowing them to qualify for food stamps regardless of their arrival date.

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¹ The work requirement applies to the sum of all quarters worked by all members of the immigrant family, including spouses, parents, and children. Immigrant families with 40 or more cumulative work quarters are eligible for benefits, as are families in which an immediate member serves or has served in the U.S. military (Fix and Zimmerman 1999).

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Refugees were also given a five-year exemption from the new law's eligibility restrictions to non-refugee legal immigrants.²

Few expected the 1996 changes in immigrant access to food stamps to affect the participation patterns of refugee households that were exempted from PRWORA immigrant restrictions. However, from 1994 to 1997, refugee participation in the food stamp program fell by 37% (Fix and Passel 1999). During the same period, participation in the food stamp program dropped by 30% for immigrants and by 21% for natives. Such an unexpected decline in program participation among a constituency that the reforms were designed *not* to affect indicates that there may have been some unintended consequences of the reform. Understanding the impact of policy change on behavior and identifying potential unanticipated consequences is crucial for future efforts of policy makers in targeting reforms effectively.

The purpose of this paper is to disentangle the impact PRWORA might have had on refugee behavior from other, potentially confounding, influences on that behavior. Additionally, while other investigations of immigrant behavior typically combine refugees and non-refugees into a single group (e.g., Borjas 1994; Borjas and Hilton 1996; Lofstrom and Bean 2002), the analysis in this paper will indicate whether this grouping is appropriate or whether refugee behavior is distinct from that of non-refugee (NR) immigrants. Further, the methodology we employ to identify refugees can be applied to analyses of other issues of relevance to the growing immigrant population. The analysis will also correct for measurement error in the reporting of food stamp participation, a correction that is found to be important.

The results demonstrate that refugees behave quite differently, at least regarding food stamp participation, and that not distinguishing them from NR immigrants will bias results as they relate to "immigrants" overall. Specifically, we find that refugees are dramatically more likely to participate in the food stamp program than are either NR immigrants or native-born individuals with like characteristics, and NR immigrants may be less likely to participate than are native-born individuals. Within the context of the 1996 reforms, we find no evidence that the clearly documented reduction in refugee food stamp participation can be attributed to PRWORA. We also find that refugee participation in the food stamp program is far more sensitive to the local unemployment rate than it is for either native-born individuals or NR immigrants. Finally, we find that while NR immigrants' usage of food stamps increases or remains steady with years in the United States, refugees' participation declines with time since immigration.

2. Background

Immigration to the United States, the numbers and policies for which are controlled by the U.S. Congress, increased significantly in the late 1980s and continued through the 1990s. In the decade ranging from 1991 to 2000, the nine million immigrants entering the United States exceeded that of any previous decade, including the 10-year boom from 1901 to 1910, during

² The 1998 Agriculture Research Extension and Education Reform Act subsequently restored food stamp benefits for selected immigrants, including pre-enactment children, elders, and the disabled. More recently, the 2002 Farm Bill extended eligibility to low-income immigrant children and disabled legal immigrants who arrived after August 1996 and to legal immigrants with five years of residency, provided they and their sponsors met stricter and more enforceable deeming guidelines (Capps et al. 2004).

Variable	All	Natives	Immigrants	NR Immigrants	Refugees ^a
FS participation	0.0768	0.0730	0.1056	0.0990	0.1778
Under 65 years	0.0845	0.0813	0.1062	0.1022	0.1534
Over 65 years	0.0503	0.0457	0.1026	0.0810	0.2680
Not poor	0.0297	0.0280	0.0442	0.0404	0.0858
Poor	0.3975	0.4086	0.3484	0.3319	0.5187
Pre-reform	0.0929	0.0876	0.1366 0.0762	0.1281	0.2258
Post-reform	0.0592	0.0568		0.0716	0.1288
By year of arrival 1970s cohort 1980s cohort 1990s cohort			0.1141 0.1321 0.1101	0.1137 0.1258 0.0949	0.1193 0.1970 0.2590
Observations	295,382	260,985	34,397	31,492.6	2900.398

Table 1. Food Stamp	Participation by	Immigrant,	Age, Poverty,	and	Pre-Post-Reform
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Based on authors' calculations using Current Population Survey 1994–2001, excluding CPS years 1996 and 1997. NR = non-refugee; FS = food stamp program participation.

^a Refugees variable constructed by authors.

which the country accepted nearly 8.8 million immigrants (Immigration and Naturalization Service 2000a; table 1, p. 18). In 2000, the Immigration and Naturalization Service (INS) granted nearly 850,000 immigrants legal permanent residence. Of those immigrating to the United States in 2000, 8% were refugees or asylees, down somewhat from 1997, when refugees comprised 14% of all immigrant arrivals. As of April 2003, over five million applications for immigration and change of legal status were pending at the Bureau of Citizenship and Immigration Services (Immigration and Naturalization Service 2002).

To be clear, the legal definition of immigrant comprises "persons lawfully admitted for permanent residence in the United States" (Immigration and Naturalization Service 2000b). As we explain below, data limitations will complicate clear identification of immigrants, as not all foreign-born people living in the United States are admitted for permanent residence. Immigrants may apply for legal permanent resident (LPR) status while still living abroad or as an adjustment to their visa while living in the United States. In 2004, 62% of all immigrants were already living in the United States on temporary visas, such as temporary worker, student, or travel visas, when they obtained LPR status (Rytina 2005). To open the doors to certain highly skilled workers in fields such as information technology, the Immigration Act of 1990 increased the number of temporary work visas granted each year and made it easier to transition from temporary worker status to permanent resident status (Lowell 2001).

Refugees are a distinct subset of all legal immigrants, those granted refugee status prior to coming to the United States because of clear and credible fear of persecution as a result of race or ethnicity, nationality, or political or religious beliefs. Each year the President, after consulting with Congress, approves new refugee limits by region of the world based on an assessment of worldwide need. The President set an upper limit of 70,000 refugees per year in 2002, 2003, and 2004 (Rytina 2005). Along with temporary workers and students, refugees also apply for an adjustment of their legal status to "permanent resident" after arriving in the United States.³ Asylees are another subset of legal immigrants. Asylees come to the United

³ Refugees are eligible for adjustment to permanent resident status after living continuously in the United States for at least one year.

States without any guarantee of residency and apply for asylee status based on a substantiated fear of persecution should they return to their home country. Asylees can apply for adjustment to legal permanent resident status one year after gaining asylee status. Asylees are treated the same as refugees with regard to food stamp eligibility and throughout this paper.

In response to the tightening of immigrant eligibility rules under PRWORA, some states chose to extend state-funded food stamp benefits to legal immigrants until they attained federal eligibility. Zimmerman and Tumlin (1999) report that 17 states extended food stamp benefits to legal immigrants arriving prior to August 1996. Ten states (California, Colorado, Connecticut, Maine, Maryland, Massachusetts, Minnesota, Nebraska, Washington, and Wisconsin) chose to extend food assistance benefits to immigrants arriving after August of 1996. Analyzing the trends in food stamp participation pre- and post-PRWORA, Borjas (2004) finds much larger participation drops in states that did not extend benefits to non-citizen legal immigrants.

Broadly, investigation of the impact of the 1996 welfare reforms on immigrants falls into two categories, descriptive and multivariate policy analysis. The work by Fix and Passel (1999), Capps et al. (2004), and Zimmerman and Tumlin (1999) clearly describes the overall decline in participation in the period following the implementation of PRWORA. These authors carefully isolate immigrants from natives and citizens from non-citizens. The multivariate policy analyses, including those of Borjas (2002, 2004), Lofstrom and Bean (2002), and Van Hook (2003), estimated participation models controlling for individual characteristics to isolate the impact of PRWORA's "chilling effect" from other explanations, such as changing economic conditions, state fixed effects, and changes in citizenship.

Measures of refugee status are typically not available in large cross-sectional data sets of the type necessary for participation model estimation. Most post-welfare reform studies have tried to identify immigrants and refugees using the Current Population Survey (CPS), the Survey of Program Participation, or the decennial census. Researchers typically take one of two approaches: either they do not attempt to identify refugees separately from all immigrants (for example, see Lofstrom and Bean 2002) or they remove any household with immigrants from countries with relatively high percentages of refugees (for example, see Borjas 2002; Cortes 2004). Passel and Clark (1998) may represent the most comprehensive effort to disentangle the legal status of immigrants, although not for the purposes of multivariate analysis. However, their methodology is not applicable to a multivariate analysis such as the one undertaken here.

Table 1 demonstrates the difference in food stamp participation rates by immigration status using CPS data for the years 1993 to 2000 (CPS years 1994 to 2001), omitting the years 1996 and 1997 to allow for implementation of PRWORA across states. Over the entire time period, food stamp participation averaged 7.7%. Non-refugee immigrants participated at a rate of 9.9%, while refugees participated at a rate of 17.8%. For natives and NR immigrants, younger households participated at a lower rate than did households headed by a person over 65 years of age. The opposite holds for refugee households. Among poor households, immigrants participate at a lower rate than natives. Over the entire time period, 41% of native households, 35% of NR immigrant households, and 52% of refugee households participated in the food stamp program. Table 1 also demonstrates the larger drop in participation among immigrants. We also see that refugees who have spent fewer years in the United States participate at a much higher rate. The rates reported in Table 1 are comparable to those found by Borjas (1994), who examined food stamp participation rates among immigrants.

3. Data

The primary data for our food stamp participation analysis are the March Demographic files of the CPS for the years 1994 through 2001, which offer large sample sizes, program participation data, and reasonable immigrant data. These data have been widely used to study immigration (Fix and Passel 1999). The CPS asks questions on citizenship and country of birth, which will allow us to assign an immigrant status for each individual. We focus on improving the identification of refugees, a subset of immigrants.

Our approach to identifying differences in participation between refugees and other groups makes use of data provided by the INS titled "Immigrants Admitted to the United States," data which are available for the period ranging from 1972 through 1998. These data contain the universe of all persons applying for LPR status during a particular fiscal year. There are two types of immigrants captured in these files. The first type is new entrants: individuals who are entering the United States and simultaneously applying for LPR status. The second type comprises conversions: individuals who have been living in the United States for some period of time under another type of visa and who are now applying for adjustment to LPR status.

In addition to some demographic data, the INS data provide information on entry into the United States. Of particular interest here is the year of initial entry and the status of entry. The year of entry establishes when the individual first came to the United States (comparable to the question in the CPS), while the status at entry determines the initial classification at entry. It is from this classification that we identify refugees and asylees. The INS data use a number of codes to indicate refugee and asylee status, which can change from year to year depending on circumstances within various countries.

Three Estimation Samples

The data deriving from the CPS are household-level observations with demographic information on the head of the household. For married heads we also include spouse data in our regression models. Armed forces households, non-family households, and households with heads of household under the age of 18 years are excluded from the sample. This results in 389,883 households. We also exclude observations from the 1997 and 1998 CPS years (corresponding to 1996 and 1997 program participation years), the year including and following the passage of Temporary Aid to Needy Families. Excluding 1996 data removes the "anticipation" effect, while excluding 1997 data allows for full implementation of the new policies. This sample, hereafter called the full sample, includes 295,382 households.

An important issue in this context, and one we address more fully in our sensitivity tests, is that of illegal immigrants. The Census Bureau and other researchers indicate that the CPS respondents include some illegal immigrants (see Jasso et al. 2000). Illegal immigrants are not a part of the population we intend to study, and, if they were identified, we would exclude them from our study. To see the impact of illegal immigrants on our findings, we follow the method of Passel and Clark (1998), constructing two samples that attempt to exclude illegal aliens. In one sample, hereafter referred to as the "No Central Americans" sample, we exclude all immigrants from Central America and Mexico. This represents one extreme case and is certainly removing individuals from the sample who are not illegal immigrants. The "full" sample represents the other extreme, the failure to remove any illegal immigrants. Households

with some illegal immigrant adults may legally receive food stamp benefits as a result of mixed citizenship within the household. Illegal immigrants who have a child in the United States may have a child who qualifies for food stamps (see Van Hook and Balistreri 2006); hence, it may not be accurate to simply remove households containing some illegal immigrants.

A third sample, hereafter referred to as the "intermediate" sample, is also constructed and removes only Central Americans and Mexicans who are under the age of 40 years and who have less than a high school education. This sample reflects work by authors such as Passell (1986), Bean, Telles, and Lowell (1987), Fix and Passell (1994), Lowell and Suro (2002), Lubotsky and Ibarraran (2007), who have attempted to identify the characteristics of undocumented or illegal immigrants. Foreign-born individuals legally visiting the United States on temporary visas for work or schooling are also ineligible to receive food stamps. There is no way to identify these individuals in the CPS. In order to address this, our third sample also excludes households in which the head of household is an immigrant working for the government and in which the spouse, if any, is not in the labor force. We also exclude immigrant households in which the head of the household or the spouse is a student and in which any non-student head is not in the labor force. Additional samples were constructed to further test robustness. These samples remove only recent immigrants from Central America and Mexico (in part because of past amnesties, most illegal immigrants are recent), remove only young immigrants from Central America and Mexico, remove only low-education immigrants from Central America and Mexico, and remove only agricultural workers from Central America and Mexico. These restrictions were also repeated only for immigrants from Mexico. Our results are qualitatively similar across all of these samples (results are available from the authors by request). We discuss results from the intermediate sample only and provide the full sample and the No Central American sample results in the Appendix 2.

Means of Samples

Table 2 presents means for the variables used in the analysis for each of the three samples as well as for the subsample of immigrants. The fifth column also presents means for refugees. The fifth column was calculated using the probability of being a refugee (described below) as a weight. Since we do not know who is actually a refugee, the averages for the refugee measures here are less than 1. Panel A presents the means for variables representing the household or the head of household. Panel B presents the means for the spouse when the head of the household is married with spouse present. The demographic statistics are not markedly different from those typically seen in household samples. The typical (average or modal) household is headed by a 49-year-old married white male with a high school degree. Female-headed households comprise approximately 40% of the sample. Households headed by an African-American comprise 10.1% of the sample. Households headed by a married couple comprise about 56.8% of the sample. While high school graduates are the modal head of household (approximately 32% of the sample), the second and third largest educational categories comprise those with some college (18%) or with a fouryear degree (15%). In fact, nearly 50% of the sample has a head of household who has obtained some post-secondary education. Almost 8% of the sample reported receiving food stamps at some time in the previous calendar year. As can be seen in panel A, approximately 3.8% (or 11,357) of the households comprise immigrants from Mexico or Central America. Dropping households comprising individuals who immigrated from Central America yields the second

Variable	Full Sample	No Central Americans	Intermediate Sample	All Immigrants	Refugees ^a
Food stamp participation	0.077	0.074	0.075	0.106	0.178
Age	49.496	49.874	49.791	45.836	49.357
Female	0.404	0.405	0.404	0.388	0.343
African-American	0.101	0.104	0.102	0.071	0.045
Hispanic	0.121	0.086	0.107	0.515	0.529
Asian	0.027	0.028	0.027	0.166	0.225
Native American	0.011	0.011	0.011	0.004	0.000
Elementary school	0.089	0.073	0.081	0.255	0.185
Some high school	0.093	0.090	0.090	0.100	0.079
High school-no diploma	0.012	0.012	0.012	0.023	0.019
High school graduate	0.318	0.323	0.323	0.233	0.271
Some college	0.179	0.183	0.181	0.113	0.124
Associates/technical degree	0.071	0.073	0.072	0.046	0.059
College graduate	0.153	0.158	0.155	0.136	0.158
Master's degree	0.056	0.058	0.057	0.053	0.057
Terminal degree	0.029	0.030	0.029	0.040	0.048
Married spouse present	0.568	0.566	0.568	0.613	0.613
Veteran	0.194	0.201	0.197	0.033	0.017
Disabled	0.134	0.136	0.135	0.086	0.119
Multi-family household	0.059	0.054	0.057	0.108	0.074
Number of children under age 5 years	0.206	0.193	0.197	0.323	0.217
Number of children age 5 to 18 years	0.574	0.549	0.562	0.811	0.664
Local unemployment rate	5.095	5.038	5.077	5.996	6.044
Immigrant	0.116	0.082	0.102	1.000	1.000
Refugee_main	0.015	0.016	0.015	0.128	0.889
Refugee_30	0.014	0.014	0.014	0.119	0.895
Refugee_IV	0.010	0.010	0.010	0.084	0.760
Years in U.S.	2.201	1.672	2.051	18.902	17.581
Central Americans	0.038	0.000	0.024	0.320	0.003
Young, low-education Central American students or government workers	0.001	0.000	0.000	0.012	0.015
Sample size	295,382	284,025	290,644	34,397	2900.4

Table 2A. Means for Samples, Household, and Householder Variables

^a Refugees variable constructed by authors.

sample of 284,025 households. Approximately 0.1% (or 418) of the households comprise immigrants from Mexico or Central America with less than a high school education, who are under the age of 40 years, working in agriculture, or are non-citizen government workers or non-citizen students. Dropping only these households from the full sample yields the intermediate sample of 290,644 households.⁴ Overall there is little difference between the three samples.

According to the Bureau of Census, some immigrants in the CPS are illegal aliens, most of who come from Central America (including Mexico). Obviously, not all immigrants from Central America are illegal, nor are all Central American immigrants with less than a high school education. Illegal immigrants are categorically ineligible for food stamps. Hence, the full sample should understate the level of overall immigrant use of food stamps (thus biasing downward the coefficient on immigrant). In contrast, the samples that remove all Central American immigrants will bias the results only if legal Central American immigrants are more or less likely to participate in food stamp programs than are other legal immigrants, controlling for education and other characteristics. Since all legal immigrants must meet the same requirements, including demonstrating some economic viability, we argue that the samples excluding Central American immigrants likely do not significantly bias coefficients. Interestingly, the main conclusions of this paper hold qualitatively across all three samples.

Spouses	Full Sample	No Central Americans	Intermediate Sample	All Immigrants	Refugees ^a
Age	46.645	47.045	46.911	42.666	45.7882
Female	0.791	0.791	0.792	0.769	0.815783
African-American	0.058	0.060	0.059	0.049	0.033684
Hispanic	0.125	0.087	0.110	0.507	0.450572
Asian	0.034	0.035	0.035	0.174	0.256936
Native American	0.009	0.009	0.009	0.005	0.00185
Elementary school	0.066	0.047	0.057	0.247	0.186404
Some high school	0.077	0.073	0.074	0.102	0.073063
High school-no diploma	0.010	0.009	0.010	0.022	0.017997
High school graduate	0.362	0.370	0.366	0.258	0.312278
Some college	0.170	0.175	0.172	0.104	0.108403
Associates/technical degree	0.081	0.084	0.083	0.052	0.061262
College degree	0.160	0.166	0.163	0.140	0.151521
Master's degree	0.053	0.056	0.054	0.047	0.056384
Terminal degree	0.020	0.020	0.020	0.028	0.032689
Disabled	0.078	0.079	0.079	0.058	0.086495
Married spouse present households	167,811	160,826	164,970	21,088	1777.3

Table 2	2B. N	leans t	for N	Married	Spouse	Present.	Spouse	Variable
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The full sample includes all non-military adult-headed households. The second column excludes all immigrants from Central America and Mexico, an extreme attempt to reduce the impact of illegal immigrants. The intermediate sample removes young, low-educated Central American and Mexican immigrants. This sample is our preferred approach to reducing the impact of illegal immigrants.

^a Refugees variable constructed by authors.

The fourth and fifth column comprise immigrants (from the full sample) and refugees. These results are typical of those associated with similar samples (see, for example, Borjas 2004; Cortes 2004). We note that immigrants in general tend to be less well-educated than native-born individuals, while refugees are slightly more well-educated than typical immigrants. Refugees are more likely to be Asian and less likely to be African than typical immigrants.

The Years in U.S. variable is the number of years since the head of household first entered the United States to stay. For native born, this variable is zero and should be thought of as the interaction with the immigrant indicator.

The *local unemployment rate* variable was constructed from Bureau of Economic Analysis annual unemployment rates. For households residing in an identified metropolitan statistical area (MSA), the unemployment rate for the MSA was assigned. For those households not assigned to a metropolitan area, the overall state unemployment rate was assigned.

The variable *immigrant* derives from the citizenship status reported in the CPS. Households headed by an individual whom the CPS classifies as "Foreign Born" (as opposed to native) were considered immigrants with the following exceptions. Individuals born abroad of U.S. parents are classified as "Native." Individuals born in U.S. territories (for example, Guam) are also classified as natives. Overall, nearly 12% of the households comprise immigrants. When all immigrants from Central America are dropped, this percentage falls to 8.2%; in the intermediate sample this percentage is 10.2%.

Some researchers (see, for example, Fix and Passell 1999) separate immigrants into two categories: naturalized citizens and permanent residents. Others (Borjas 2004) argue that this distinction is endogenous. Van Hook (2003) finds support for the endogeneity argument. Because of the potential of endogeneity, we combine naturalized citizens and permanent residents into a single category.

We present results for two measures of refugee status. The first one, Refugee_main, is similar to measures used by other researchers (such as Borjas 2002): individuals from the 13 "refugee sending countries." Based on the INS World Tables, 1,527,071 refugees entered the United States between 1982 and 1998. Of the over 1.5 million refugees, over 300,000 (20%) derived from countries other than the 13 refugee sending countries. Furthermore, of all immigrants from the 13 main refugee sending countries, only 32% were refugees. We find that 1.5% of our sample households are considered refugees under this definition.

Our preferred measure of refugee status, which we will call Refugee_IV, is the probability of being a refugee, as derived from our INS models. Here, we see that the average probability is about 1% in our CPS sample.

4. Modeling and Estimation Approach

Food Stamp Program Participation

Moffitt (1983) proposed a standard model of program participation based on utility maximization. We follow similar applications (for example, Fraker and Moffitt 1988; Blank and Ruggles 1996; Borjas 2002; Ziliak, Gundersen, and Figlio 2003) in positing a reduced form model of the households' participation decision. Based on the model of Moffitt (1983), the agent maximizes a utility function, $U(Y + \theta PB) - \phi P$, which is a function of private income sources Y, an indicator P for participation in the food stamp program, and B, the level of the benefit from the food stamp program. The coefficient θ allows the food stamp benefit to have differential marginal utility from a similar cash transfer, while the coefficient ϕ represents utility costs of participation such as stigma. The household will participate if

$$U(Y + \theta B) - U(Y) > \phi, \tag{1}$$

that is, if the gain in utility from the benefit is higher than the utility cost of participation. Moffitt (1983) notes that labor force participation, which affects Y, is endogenous to the decision and models the two decisions jointly, while Hagstrom (1996) estimates a joint model of labor force participation for both husbands and wives along with food stamp program participation.

Our interest lies in estimating a reduced form participation model. Potential income is determined by factors such as age and education, whether the household has one or two potential earners (married or single), and also local labor market conditions. Moffitt (1983) notes that the stigma parameter, ϕ , may be a function of age, race, and family composition. Following standard indirect utility results, we posit that the household will participate in food stamp programs if

$$U(Y(X) + \theta B(S, T, X)) - U(Y(X)) - \phi(X) > 0,$$
(2)

where X are demographic characteristics and local labor market conditions, S are state-level dummies, and T measures changes in the level and availability of benefits over time. The benefit may be, in part, determined by labor force participation, which in turn is determined by demographic characteristics. The benefit also may be determined by eligibility requirements, in this case by immigrant and refugee status. It may also be that potential earnings and tastes for

leisure and program participation differ by immigrant and refugee status. To arrive at an estimable model, we specify a single index threshold crossing model:

$$FS = 1 \text{ if } D_i\beta + \gamma I_i + \delta R_i + \varepsilon_i > 0,$$

$$FS = 0 \text{ otherwise.}$$
(3)

The variable FS is an indicator for food stamp program participation by the household. The term $D_i\beta + \gamma I_i + \delta R_i + \varepsilon_i$ represents the reduced form indirect utility differential for participating in food stamp programs (see Eqn. 2). A similar model is estimated by Borjas and Hilton (1996) and Borjas (2002). The variable D represents demographic characteristics of the head of household (age, education, race, gender, marital status) and of the spouse, if present. The variable I is an indicator that the head of household is an immigrant. The variable R is an indicator for refugee status. We assume that ε_i is normally distributed, thus giving rise to a probit model for participation. The structural parameters (θ , ϕ) cannot be recovered: the parameters β , γ , and δ represent the net effect of these variables on the agents' indirect utility. They can be interpreted as factors that increase or decrease likelihood of participation. For example, we find that refugees are more likely to participate than other groups. This may be due to lower potential earnings, Y, or to higher benefit levels, B, which would make participation more valuable. It may also be due to lower stigma, ϕ , thus making participation less costly.

After PRWORA, some states extended state-funded food stamp benefits to non-eligible immigrants (for example, see Zimmerman and Tumlin 1999; Borjas 2004). Additionally, there are many state-level variations in the application process, in substitute programs, and other economic conditions that might result in state variation in participation. To account for this, we include state dummy variables in all of our specifications. We do not report these coefficients, but they are available on request. We have also experimented with interactions between the state dummy variables and the immigrant and referee variables. Because of small populations of immigrants in some states, it was difficult to identify state-specific interaction effects. However, the general results below were robust to these specifications.

The probit model described by Equation 3 implies that

$$\Pr\{FS = 1\} = F(D_i\beta + \gamma I_i + \delta R_i),\tag{4}$$

where F is the cumulative distribution of the standard normal density. Using the law of total probabilities, we can then write the probability expression for food participation as

$$\Pr\{FS = 1\} = F(D_i\beta + \gamma I_i + \delta) \Pr\{R_i = 1\} + F(D_i\beta + \gamma I_i) \Pr\{R_i = 0\}.$$
 (5)

This expression then gives rise to a specification that can be estimated using maximum likelihood, since the probability $Pr\{R_i = 1\}$ is obtained from the immigration data, as described below. It should be noted that if *F* were simply the identity function (that is, if we posited a linear probability model), then this estimation approach would be identical to traditional instrumental variables estimation. One might be tempted to include *Rhat* (the probability of being a refugee) simply as a regressor in the probit model. However, this induces heteroskedasticity into the error term that can bias probit estimation. Further, it induces a non-normal distribution that can also bias probit estimates. We examined this option as well and found that it overstated the coefficient γ .⁵ The probability decomposition technique we

⁵ Those results are available from the authors.

employ suffers from none of these problems. The model and likelihood function are easily expanded to include terms that are interacted with the refugee status variable. The key assumption is that we have the probability of refugee status for each person. Essentially this is an instrumental variables approach. The next subsection describes how country, year, gender, and age are used to construct the probability of being a refugee.

The Probability of Refugee Status

From the 27 years' worth of INS data, we construct files of persons entering the United States in each of the periods identified in the CPS data.⁶ For all years after 1971, we have the universe of all legal entrants. Our treatment of potentially illegal immigrants is discussed below. For years prior to 1972, we only have individuals who entered and postponed their application for LPR status to sometime after 1971.⁷

The INS data allow us to calculate the marginal proportion of refugees for each country by entry year and gender. Additionally, for country/entry year/gender groups with sufficient observations and variation in both refugee status and age at entry, we calculate probit models with age as the explanatory variable. Hence, all country/entry year/gender groups have a marginal proportion. Of the 6652 country/time/gender groups, 1788 also have an intercept and slope coefficient from a probit model. Of the remaining 4864 groups for which no probit was calculated, 3566 are country/time/gender groups with no refugees (for example, Canada), and 77 are cases in which all immigrants were refugees. Of the remaining 1221 groups for which no probit was fit, 835 of them were cases in which less than 1% of all immigrants were refugees, and the remaining were cases in which there were so few immigrants that the model would not converge.

In the 1788 probit models calculated, the relationship to age was typically negative. The average coefficient on age (across country/time/gender groups) was -0.023, and 66.8% of the age coefficients calculated were negative. The minimum was -0.88, while the maximum was 0.047. In general, men were more likely to be refugees than women.

The results of the analysis of the INS data were then matched, by country/year of entry/ gender, to the individuals in the CPS data. For individuals who were not immigrants, the probability of being a refugee is set to zero. For those who were either born in a foreign country of native parents or born in a U.S. protectorate, the probability of being a refugee is also set to zero. For other immigrants whose country/entry year/gender groups yielded a valid probit model, we assign the probability of being a refugee from the probit model based on the age at entry of the CPS individual. For immigrants whose country/entry year/gender group did not yield a valid probit, we use the marginal proportion of refugees. See Redstone and Massey (2004) for an analysis of the CPS data on year of entry. Finally, because of the paucity of data in the pre-1950 period, we assigned zero probability of refugee status to immigrants from this period. These constructed probabilities for refugee status for each individual serve as the instrument for refugee status.

⁶ CPS groups by years: prior to 1950, 1950–1959, 1960–1964, 1965–1969, 1970–1974, 1975–1979, 1980–1981, 1982–1983, ..., 1996–1997, and 1998–2001.

⁷ We examined the proportion of refugees in the periods prior to 1971 as well as the countries of origin. While not a perfect match, the periods in the 1960s are not inconsistent with the periods in the 1970s fully observed. The 1950s were less consistent, and the period prior to the 1950s was clearly a selected sample.

The validity of an instrument has two components. The first component is that the instrument has predictive power for the variable in question. In this case, it is quite clear that refugee status varies by country, year, and gender. We also find that the age variable is typically significant in our model, and so it too is predictive. The second issue is whether these variables are independent of the participation decision, conditional upon the variables included in the specification already. It should be noted that age and years in the United States are included in the regression. We explore this issue in the robustness section and find that our results appear to be robust to this assumption.

A number of differences between our approach and that of other researchers are worth noting. As noted above, some researchers address the refugee issue by dropping immigrants from certain countries from the analysis. Dropping observations from refugee countries is similar to including a measure of refugee status like Refugee_main in that there are still many refugees unidentified in the data, and some non-refugees are excluded. Other researchers include country-specific dummy variables. This again combines both refugees from those countries with non-refugees. It fails to identify any refugee-specific effect. Our approach identifies the refugee-specific effect, but because we use country of origin as an instrument, our approach prevents us from identifying country-specific effects. As noted in the next section, we do explore region-specific effects and year of immigration-specific effects. Our basic results appear robust in this regard.

Measurement Error in Participation Reporting

In addition to addressing the measurement problem in refugee status we address measurement error in reports of food stamp program participation. Bollinger and David (1997) demonstrate that there exists substantial misreporting of food stamp program participation in survey data. As discussed in both Bollinger and David (1997) and Hausman, Abrevaya, and Scott-Morton (1998), the probability of reporting participation in food stamp programs can be written as:

$$\Pr(Reported Food Stamp Participation) = (1 - p - q)\Pr\{FS = 1\} + p.$$
(6)

The terms p and q are the rates of false positives and false negatives, respectively. We use the results of Bollinger and David (1997), specifically the estimated error rates p and q, to construct the likelihood function. Bollinger and David (1997) find the proportion of false-positive rate to be about 0.32%, while the false-negative rate is about 12.15%. The probability of true food stamp participation, $Pr{FS = 1}$, is constructed from the probability expression above. The resulting likelihood function combines both our new correction to address and measure the participation differential for refugees and the correction proposed by Bollinger and David (1997) to address response error in the self-report of food stamps. Maximum likelihood estimation maximizes the following log likelihood function with respect to β , γ , and δ :

$$L = FS_i * \ln[(1 - 0.1215 - 0.0032) * (F(D_i\beta + \gamma I_i + \delta) \Pr\{R_i = 1\} + F(D_i\beta + \gamma I_i) \Pr\{R_i = 0\}) + 0.0032] + (1 - FS_i) * \ln[(1 - 0.1215 - 0.0032) * (1 - F(D_i\beta + \gamma I_i + \delta) \Pr\{R_i = 1\} - F(D_i\beta + \gamma I_i) \Pr\{R_i = 0\}) + 0.1215)].$$
(7)

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Here, FS is the food stamp program participation reported by the household. While other approaches to correct for response error in reports of food stamps are available (see, for example, Giannarelli 1992), the results of Bollinger and David (1997) are particularly well suited to this problem. Overall, we find that the measurement error correction is far less important than separating refugees from other immigrants.

5. Estimation Results

To facilitate an understanding of the results we organize them into three subsections. In the first subsection we present two sets of baseline results: one with no measure of refugees included and one using the Refugee_main variable described above. This section establishes baseline results similar to those of studies that use these kinds of measures of refugee status.⁸ In the second subsection we present results using the instrumental variables approach to consistently estimate the refugee coefficients. The results demonstrate the importance of a consistent estimation procedure and the impact of the mismeasurement of refugee status inherent in previous procedures. In the third subsection we present two final specifications. These specifications both include the correction for measurement error in the reporting of food stamps and include interactions with local unemployment rates and the years since immigration. This section presents our preferred results that support our main conclusion that refugees are substantively different than other immigrants in their usage of food stamps and in their response to PRWORA. Failure to account for this difference biases conclusions about immigrants in general and disguises the experiences of an important subpopulation.

Baseline Estimates

Table 3 provides for five model specifications. In addition to the covariates presented, state fixed effects were included to account for state differences in policy, administration, and enforcement of the food stamp program. Other specifications, including year dummy variables, were found to reveal similar results. The coefficients on the demographic variables are as one would expect. Age and education are negatively associated with food stamp program participation, while the presence of children or disabled persons increases the probability of participation.

Column 1 of Table 3 presents estimates for a specification similar to those of other analyses in which refugees are grouped with NR immigrants. The coefficient on post-reform is negative and significant, as has been well established in the literature. The coefficient on the local unemployment rate is positive, indicating that local labor market conditions are significant in determining participation. The coefficient on immigrant is positive and significant. This type of result has led researchers and policy makers to the conclusion that immigrants are more likely to use welfare programs than are native-born individuals.

⁸ Borjas (2002) also accounts for immigrant heterogeneity by including controls for cohorts, age at the time of arrival, and years in the United States, variables we use as exclusion restrictions in our instrumental variable approach.

	Immigrant Only Specification	Refugee_main	Refugee_IV	Refugee_IV with Unemployment	Refugee_IV Long
Householder variables	operintention	openieution	specification	Rate	opeemeation
a and a second contraction of the second sec	0.017	0.018			1.1.1
Age	-0.016	-0.017	-0.017	-0.019	-0.019
P 1	(49.09)**	(49.77)**	(49.61)**	(48.52)**	(47.77)**
Female	0.494	0.499	0.503	0.561	0.565
	(36.38)**	(36.62)**	(36.83)**	(35.59)**	(35.69)**
African-American	0.447	0.456	0.452	0.504	0.505
	(33.09)**	(33.71)**	(33.37)**	(32.66)**	(32.72)**
Hispanic	0.268	0.268	0.258	0.294	0.322
	(16.97)**	(16.96)**	(16.21)**	(15.95)**	(17.33)**
Asian	0.062	-0.039	-0.033	-0.050	-0.098
	(1.55)	(0.94)	(0.80)	(0.97)	(1.83)
Native American	0.360	0.360	0.357	0.390	0.392
	(10.85)**	(10.81)**	(10.73)**	(10.20)**	(10.26)**
Elementary school	0.472	0.480	0.485	0.573	0.575
	(31.41)**	(31.86)**	(32.07)**	(32.60)**	(32.65)**
Some high school	0.403	0.405	0.406	0.461	0.461
	(31.02)**	(31.03)**	(31.09)**	(30,74)**	(30.63)**
High school-no diploma	0.238	0.236	0.242	0.268	0.266
	(7.45)**	(7.40) **	(7.54)**	(7.28)**	(7.21)**
Some college	-0.171	-0.172	-0.172	-0.197	-0.194
	(13.29)**	(13.29)**	(13.28)**	(13.21)**	(12.99)**
Associates/technical	-0.287	-0.289	-0.290	-0.324	-0.321
degree	(14.58)**	(14.65)**	(14.63)**	(14.10)**	(13.95)**
College	-0.569	-0.573	-0.579	-0.706	-0.711
, i i i i i i i i i i i i i i i i i i i	(28.96)**	(29.00)**	(29.11)**	(27.36)**	(27.45)**
Master's degree	-0.706	-0.706	-0.710	-0.914	-0.916
5	(18.87)**	(18.77)**	(18.75)**	(16 67)**	(16.85)**
Terminal degree	-0.626	-0.643	-0.651	-0.871	-0.869
	(11.49)**	(11.56)**	(11.58)**	(9.90)**	(10.21)**
Married spouse present	-0.933	-0.926	-0.927	-0.870	-0.885
statute of the present	(27 20)**	(26.93)**	(26.85)**	(20 44)**	(20.74)**
Veteran	0.000	0.008	0.012	0.016	0.019
	(0.02)	(0.51)	(0.77)	(0.86)	(0.97)
Disabled	0.815	0.817	0.818	0.959	0.959
	(74.48)**	(74.46)**	(74.39)**	(72.83)**	(72 78)**
Serana variables	()	(1110)	(1122)	(12:00)	(12.10)
spouse variables					
Age	-0.001	-0.001	-0.001	-0.007	-0.007
	(1.09)	(1.56)	(1.62)	(7.62)**	(7.39)**
Female	0.363	0.367	0.367	0.387	0.393
	$(16.86)^{**}$	(16.96)**	(16.92)**	$(14.98)^{**}$	(15.16)**
African-American	-0.072	-0.064	-0.063	-0.032	-0.029
	$(2.65)^{**}$	(2.36)*	(2.30)*	(0.97)	(0.90)
Hispanic	-0.021	-0.004	-0.004	-0.013	-0.016
2	(0.94)	(0.18)	(0.18)	(0.49)	(0.59)
Asian	0.367	0.322	0.277	0.276	0.229
1	(7.82)**	(6.66)**	(5.58)**	(4.32)**	(3.47)**
Native American	0.226	0.227	0.229	0.283	0.288
Sand Street Street	(4.23)**	(4.24)**	(4.27)**	(4.50)**	(4.56)**
Elementary school	0.271	0.280	0.282	0.394	0.391
	(10.74)**	$(11.03)^{**}$	$(11.05)^{**}$	(12.68)**	$(12.52)^{**}$
Some high school	0.328	0.334	0.336	0.410	0.409
	(15.40)**	(15.61)**	(15.68)**	(16.15)**	(16.09)**

Table 3. Food Stamp Program Participation Estimates

Table 3. Continued

		Immigrant Only Specification	Refugee_main Specification	Refugee_IV Specification	Refugee_IV with Unemployment Rate	Refugee_IV Long Specification
High school—no diploma0.2090.2150.2120.2440.239Some college -0.103 -0.102 -0.103 -0.115 -0.112 Associates/technical -0.235 -0.236 -0.239 -0.341 -0.346 degree(6.99)**(7.04)**(7.45)**(7.48)*College graduate -0.329 -0.331 -0.339 -0.498 -0.505 (10.06)**(10.03)**(10.15)**(9.79)**(9.66)*Master's degree -0.359 -0.364 -0.376 -0.697 -0.617 (5.36)**(5.36)**(5.44)**(4.45)**(4.86)*Terminal degree -0.321 -0.366 -0.391 -0.594 (3.14)**(3.41)**(3.52)**(2.94)**(3.52)*Disabled0.6190.6180.6170.7970.795(20.25)**(20.99)**(60.70)**(29.65)**(29.63)*Household-level variables(60.59)**(60.59)**(60.59)**(5.73)*Multi-family household -0.016 -0.011 -0.017 -0.018 Multi-family household -0.016 -0.072 (0.95)(1.04)Children ages 5 to 0.267 0.269 0.319 0.319 18 years(63.36)**(63.51)**(61.69)**(61.54)**Local unemployment rate 0.049 0.048 0.056 0.056 $(16.2)**$ $(16.81)**$ $(16.80)**$ $(15.84)**$ $(15.38)**$ Immigrant 0.062 -0.07	e variables (cont.)					
Some college $(3.81)^{**}$ $(3.91)^{**}$ $(3.84)^{**}$ $(3.71)^{**}$ $(3.60)^{*}$ Some college -0.103 -0.102 -0.103 -0.115 -0.112 Associates/technical -0.235 -0.236 -0.239 -0.341 -0.346 degree $(6.99)^{**}$ $(7.04)^{**}$ $(7.45)^{**}$ $(7.48)^{**}$ College graduate -0.329 -0.331 -0.339 -0.498 -0.505 $(10.06)^{**}$ $(10.03)^{**}$ $(10.15)^{**}$ $(9.79)^{**}$ $(9.96)^{**}$ Master's degree -0.359 -0.364 -0.376 -0.697 -0.617 $(5.36)^{**}$ $(5.36)^{**}$ $(5.44)^{**}$ $(4.45)^{**}$ $(4.86)^{**}$ Terminal degree -0.321 -0.366 -0.391 -0.534 -0.594 $(3.14)^{**}$ $(3.41)^{**}$ $(3.22)^{**}$ $(2.94)^{**}$ $(3.35)^{**}$ Disabled 0.619 0.618 0.617 0.777 0.795 $(29.25)^{**}$ $(29.09)^{**}$ $(28.91)^{**}$ $(29.65)^{**}$ $(29.63)^{**}$ Household-level variables $(1.07)^{**}$ $(0.76)^{**}$ $(5.7.26)^{**}$ $(5.33)^{**}$ Children under 5 years 0.267 0.269 0.319 0.319 18 years $(63.36)^{**}$ $(63.51)^{**}$ $(63.51)^{**}$ $(61.54)^{**}$ Local unemployment rate 0.049 0.048 0.072 0.97^{*} 0.16^{*} $(16.62)^{**}$ $(16.81)^{**}$ $(16.81)^{**}$ $(16.48)^{**}$ $(16.43)^{**}$	n school—no diploma	0.209	0.215	0.212	0.244	0.239
Some college -0.103 -0.102 -0.103 -0.115 -0.115 Associates/technical -0.235 -0.236 -0.239 -0.341 -0.346 degree $(6.98)^{**}$ $(6.99)^{**}$ $(7.04)^{**}$ $(7.45)^{**}$ $(7.43)^{**}$ College graduate -0.329 -0.331 -0.339 -0.498 -0.505 $(10.06)^{**}$ $(10.03)^{**}$ $(10.15)^{**}$ $(9.79)^{**}$ $(9.96)^{**}$ Master's degree -0.329 -0.366 -0.376 -0.697 -0.617 $(5.36)^{**}$ $(5.36)^{**}$ $(5.44)^{**}$ $(4.459)^{**}$ $(4.35)^{**}$ Terminal degree -0.321 -0.366 -0.391 -0.534 -0.594 $(3.14)^{**}$ $(3.41)^{**}$ $(3.52)^{**}$ $(2.94)^{**}$ $(3.35)^{*}$ Disabled 0.619 0.618 0.617 0.797 0.795 $(29.25)^{**}$ $(29.09)^{**}$ $(28.91)^{**}$ $(29.65)^{**}$ $(29.63)^{**}$ Household-level variables(1.07) (0.76) (0.72) (0.95) (1.04) Children under 5 years 0.473 0.474 0.477 0.559 0.562 $(60.59)^{**}$ $(63.58)^{**}$ $(63.51)^{**}$ $(61.69)^{**}$ $(61.54)^{*}$ Local unemployment rate 0.499 0.448 0.048 0.056 0.562 $(19.89)^{**}$ $(16.81)^{**}$ $(15.84)^{**}$ $(16.43)^{**}$ $(15.48)^{**}$ $(16.43)^{**}$ Immigrant 0.062 -0.050 -0.072 -0.076	a beneor no arpronia	(3.81)**	(3.91)**	(3.84)**	(3.71)**	(3.60)**
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	e college	-0.103	-0.102	-0.103	-0.115	-0.112
Associates/technical degree (-0.235) (-0.329) (-0.32) (-0.341) (-0.346) (-0.329) (-0.341) (-0.339) (-0.346) (-0.339) (-0.346) (-0.339) (-0.346) (-0.339) (-0.348) (-0.339) (-0.348) (-0.339) (-0.348) (-0.359) (-0.339) (-0.366) (-0.376) (-0.697) (-0.617) (-0.617) (-0.617) $(-0.536)^{**}$ (-0.376) (-0.697) (-0.617) (-0.617) (-0.617) (-0.617) (-0.617) (-0.617) (-0.617) (-0.617) 	it concert	(4.64)**	(4.56)**	(4.59)**	(4.21)**	(4.07)**
Indegree(6.98)**(6.99)**(7.44)**(7.45)**(7.48)*College graduate -0.329 -0.331 -0.339 -0.498 -0.505 (10.06)**(10.03)**(10.15)**(9.79)**(9.96)*Master's degree -0.359 -0.364 -0.376 -0.697 (5.36)**(5.44)**(4.45)**(4.86)*Terminal degree -0.321 -0.366 -0.391 -0.534 (3.14)**(3.41)**(3.52)**(2.94)**(3.35)*Disabled0.6190.6180.6170.7970.795(29.25)**(29.09)**(29.09)**(29.65)**(29.63)*Household-level variables(1.07)(0.76)(0.72)(0.95)(1.04)Children under 5 years0.4730.4740.4770.5590.562(60.59)**(60.59)**(60.50)**(61.69)**(51.54)*Local unemployment rate0.0490.0480.0480.0560.056(19.89)**(19.39)**(19.32)**(16.48)**(16.43)*Post-reform (1998–2000) -0.175 -0.175 -0.197 -0.197 -0.194 (3.18)**(2.38)*(3.39)**(1.45)(1.77)Immigrant0.062 -0.050 -0.072 -0.076 -0.154 (3.98)**(16.81)**(3.51)**(4.19)**(4.11)*Refugee_IV (0.02) $(3.63)**$ (5.16)*Refugee_IV (0.02) $(3.63)**$ $(5.16)*$ Refugee_IV*post-reform </td <td>ociates/technical</td> <td>-0.235</td> <td>-0.236</td> <td>-0.239</td> <td>-0.341</td> <td>-0.346</td>	ociates/technical	-0.235	-0.236	-0.239	-0.341	-0.346
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	egree	(6.98)**	(6.99)**	(7.04)**	(7.45)**	(7.48)**
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	ege graduate	-0.329	-0.331	-0.339	-0.498	-0.505
Master's degree -0.359 -0.364 -0.376 -0.697 -0.617 Terminal degree -0.321 -0.366 -0.391 -0.534 -0.594 Terminal degree -0.321 -0.366 -0.391 -0.534 -0.594 Disabled 0.619 0.618 0.617 0.797 0.795 (29.29)**(29.09)**(28.91)**(29.63)**(29.63)**Household-level variables(1.07) (0.76) (0.72) (0.95) (1.04) Children under 5 years 0.473 0.474 0.477 0.559 0.562 (60.59)**(60.59)**(60.70)**(57.26)**(57.33)*Children ages 5 to 0.267 0.269 0.269 0.319 0.319 18 years(63.36)**(63.51)**(16.48)**(16.43)*Local unemployment rate 0.048 0.048 0.048 0.056 0.056 (19.89)**(19.39)**(19.32)**(16.48)**(16.43)*Immigrant 0.062 -0.050 -0.072 -0.076 -0.105 (16.62)**(16.81)**(16.80)**(14.5)(17.7)Immigrant*post-reform 0.099 -0.121 -0.104 -0.157 -0.157 Refugee_IV 1.043 -0.106 0.683 (20.71)**(0.44)(2.97)*Refugee_IV*post-reform 0.099 (0.09) $(3.61)^*$ $(5.16)^*$ Immigrant* 0.001 0.427 0.614 (0.02)(3.61)** (0.001) 0.4		(10.06)**	(10.03)**	(10.15)**	(9.79)**	(9.96)**
Initial energy $(5.36)^{**}$ $(5.36)^{**}$ $(5.44)^{**}$ $(4.45)^{**}$ $(4.86)^{*}$ Terminal degree -0.321 -0.366 -0.391 -0.534 -0.594 Disabled 0.619 0.618 0.617 0.797 0.795 $(29.25)^{**}$ $(29.09)^{**}$ $(28.91)^{**}$ $(29.65)^{**}$ $(29.63)^{**}$ Household-level variables (1.07) (0.76) (0.72) (0.95) (1.04) Children under 5 years 0.473 0.474 0.477 0.559 0.562 $(60.59)^{**}$ $(60.59)^{**}$ $(60.70)^{**}$ $(57.26)^{**}$ $(57.33)^{*}$ Children ages 5 to 0.267 0.269 0.319 0.319 18 years $(63.36)^{**}$ $(63.58)^{**}$ $(63.51)^{**}$ $(61.64)^{**}$ $(16.43)^{*}$ Local unemployment rate 0.049 0.048 0.048 0.056 0.056 $(19.89)^{**}$ $(19.39)^{**}$ $(19.32)^{**}$ $(16.48)^{**}$ $(15.84)^{**}$ $(15.84)^{**}$ Immigrant 0.062 -0.050 -0.072 -0.076 -0.105 Immigrant* 0.059^{**} $(3.39)^{**}$ (1.45) (1.77) Immigrant*post-reform 0.099 (1.67) 1.043 -0.106 0.683 $(20.71)^{**}$ (0.44) $(2.97)^{*}$ (0.02) $(3.63)^{**}$ $(5.16)^{*}$ Immigrant* 0.001 0.427 0.614 (0.02) $(3.63)^{*}$ $(5.16)^{*}$	ter's degree	-0.359	-0.364	-0.376	-0.697	-0.617
Terminal degree -0.321 -0.366 -0.391 -0.534 -0.594 Disabled 0.619 0.618 0.617 0.797 0.795 $(29.25)^{**}$ $(29.09)^{**}$ $(28.91)^{**}$ $(29.65)^{**}$ $(29.63)^{**}$ Household-level variables (1.07) (0.76) (0.72) (0.95) (1.04) Children under 5 years 0.473 0.474 0.477 0.559 0.562 $(60.59)^{**}$ $(60.59)^{**}$ $(60.70)^{**}$ $(57.26)^{**}$ $(57.33)^{*}$ Children ages 5 to 0.267 0.269 0.269 0.319 0.319 18 years $(63.36)^{**}$ $(63.58)^{**}$ $(63.51)^{**}$ $(61.69)^{**}$ $(61.54)^{*}$ Local unemployment rate 0.049 0.048 0.048 0.056 0.056 $(19.89)^{**}$ $(19.39)^{**}$ $(19.32)^{**}$ $(16.48)^{**}$ $(16.43)^{*}$ Immigrant 0.062 -0.050 -0.072 -0.107 -0.157 $(3.18)^{**}$ $(2.38)^{*}$ $(3.39)^{**}$ (1.45) (1.77) Immigrant*post-reform 0.099 (1.67) (1.67) (1.67) Refugee_IV 1.043 -0.106 0.683 $(20.71)^{**}$ 0.441 $(2.97)^{**}$ (0.44) $(2.97)^{**}$ 0.001 0.427 0.004 -0.004 -0.004		(5.36)**	(5.36)**	(5.44)**	(4.45)**	(4.86)**
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	ninal degree	-0.321	-0.366	-0.391	-0.534	-0.594
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		(3.14)**	(3.41)**	(3.52)**	(2.94)**	(3.35)**
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	bled	0.619	0.618	0.617	0.797	0.795
(EVE)((29.25)**	(29.09)**	(28.91)**	(29.65)**	(29.63)**
Household-level variablesMulti-family household -0.016 -0.011 -0.011 -0.017 -0.018 (1.07) (0.76) (0.72) (0.95) (1.04) Children under 5 years 0.473 0.474 0.477 0.559 0.562 $(60.59)^{**}$ $(60.59)^{**}$ $(60.70)^{**}$ $(57.26)^{**}$ $(57.33)^{*}$ Children ages 5 to 0.267 0.269 0.219 0.319 0.319 18 years $(63.36)^{**}$ $(63.58)^{**}$ $(63.51)^{**}$ $(61.69)^{**}$ $(61.54)^{*}$ Local unemployment rate 0.049 0.048 0.048 0.056 0.056 $(19.89)^{**}$ $(19.32)^{**}$ $(16.48)^{**}$ $(16.43)^{*}$ Post-reform (1998–2000) -0.175 -0.175 -0.197 -0.198 $(16.62)^{**}$ $(16.81)^{**}$ $(16.80)^{**}$ $(15.84)^{**}$ $(15.84)^{**}$ Immigrant 0.062 -0.050 -0.072 -0.076 -0.105 $(3.18)^{**}$ $(2.38)^{*}$ $(3.39)^{**}$ (1.45) (1.77) Immigrant*post-reform -0.103 -0.121 -0.104 -0.157 -0.154 $(20.71)^{**}$ (0.44) $(2.97)^{*}$ $(2.97)^{*}$ Refugee_IV 1.043 -0.106 0.683 $(20.71)^{**}$ (0.44) $(2.97)^{*}$ Refugee_IV*post-reform 0.001 0.427 0.614 (0.02) $(3.63)^{**}$ $(5.16)^{*}$ Immigrant* -0.004 -0.004 -0.004 <td>hald lavel mariables</td> <td>(27.20)</td> <td>(25.05)</td> <td>(10171)</td> <td>(23100)</td> <td>(20102)</td>	hald lavel mariables	(27.20)	(25.05)	(10171)	(23100)	(20102)
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$\begin{array}{cccccccccccccccccccccccccccccccccccc$	ti-family household	-0.016	-0.011	-0.011	-0.017	-0.018
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Children ages 5 to 0.267 0.269 0.269 0.319 0.319 18 years $(63.36)^{**}$ $(63.58)^{**}$ $(63.51)^{**}$ $(61.69)^{**}$ $(61.54)^{*}$ Local unemployment rate 0.049 0.048 0.048 0.056 0.056 $(19.89)^{**}$ $(19.39)^{**}$ $(19.32)^{**}$ $(16.48)^{**}$ $(16.43)^{*}$ Post-reform $(1998-2000)$ -0.173 -0.175 -0.175 -0.197 -0.198 $(16.62)^{**}$ $(16.81)^{**}$ $(16.80)^{**}$ $(15.84)^{**}$ $(15.88)^{*}$ Immigrant 0.062 -0.050 -0.072 -0.076 -0.105 $(3.18)^{**}$ $(2.38)^{*}$ $(3.39)^{**}$ (1.45) (1.77) Immigrant*post-reform -0.103 -0.121 -0.104 -0.157 -0.154 $(3.98)^{**}$ $(4.18)^{**}$ $(3.51)^{**}$ $(4.19)^{**}$ $(4.11)^{*}$ Refugee_main 0.686 $(17.34)^{**}$ (0.44) $(2.97)^{*}$ Refugee_IV*post-reform 0.009 (0.02) $(3.63)^{**}$ $(5.16)^{*}$ Immigrant* 0.001 0.427 0.614 (0.02) $(3.63)^{**}$ $(5.16)^{*}$	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	(60.59)**	(60.59)**	(60.70)**	(57.26)**	(57.33)**
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Local unemployment rate 0.049 0.048 0.048 0.048 0.056 0.056 $(19.89)^{**}$ $(19.39)^{**}$ $(19.32)^{**}$ $(16.48)^{**}$ $(16.43)^{*}$ Post-reform $(1998-2000)$ -0.173 -0.175 -0.175 -0.197 -0.198 $(16.62)^{**}$ $(16.62)^{**}$ $(16.81)^{**}$ $(15.84)^{**}$ $(15.84)^{**}$ $(15.84)^{**}$ Immigrant 0.062 -0.050 -0.072 -0.076 -0.105 $(3.18)^{**}$ $(2.38)^{*}$ $(3.39)^{**}$ (1.45) (1.77) Immigrant*post-reform -0.103 -0.121 -0.104 -0.157 -0.154 $(3.98)^{**}$ $(4.18)^{**}$ $(3.51)^{**}$ $(4.19)^{**}$ $(4.11)^{*}$ Refugee_main 0.686 $(17.34)^{**}$ (0.44) $(2.97)^{*}$ Refugee_IV 1.043 -0.106 0.683 $(20.71)^{**}$ (0.44) $(2.97)^{*}$ Refugee_IV*post-reform 0.001 0.427 0.614 (0.02) $(3.63)^{**}$ $(5.16)^{*}$ Immigrant* -0.004 -0.004	8 years	(63.36)**	(63.58)**	(63.51)**	(61.69)**	(61.54)**
Post-reform $(19.89)^{**}$ $(19.39)^{**}$ $(19.32)^{**}$ $(16.48)^{**}$ $(16.43)^{**}$ Post-reform $(1998-2000)$ -0.173 -0.175 -0.175 -0.197 -0.198 Immigrant 0.062 -0.050 -0.072 -0.076 -0.105 Immigrant*post-reform -0.103 -0.121 -0.104 -0.157 -0.154 Immigrant*post-reform -0.103 -0.121 -0.104 -0.157 -0.154 Refugee_main 0.686 $(17.34)^{**}$ $(4.19)^{**}$ $(4.11)^{*}$ Refugee_IV 1.043 -0.106 0.683 (20.71)** (0.44) $(2.97)^{*}$ Refugee_IV*post-reform 0.001 0.427 0.614 (0.02) $(3.63)^{**}$ $(5.16)^{*}$ Immigrant* -0.004 -0.004 -0.004	al unemployment rate	0.049	0.048	0.048	0.056	0.056
Post-reform $(1998-2000)$ -0.175 -0.175 -0.175 -0.197 -0.197 Immigrant 0.062 -0.050 -0.072 -0.076 -0.105 $(3.18)^{**}$ $(2.38)^{*}$ $(3.39)^{**}$ (1.45) (1.77) Immigrant*post-reform -0.103 -0.121 -0.104 -0.157 -0.154 $(3.98)^{**}$ $(4.18)^{**}$ $(3.51)^{**}$ $(4.19)^{**}$ $(4.11)^{*}$ Refugee_main 0.686 $(17.34)^{**}$ $(2.071)^{**}$ (0.44) $(2.97)^{*}$ Refugee_IV 1.043 -0.106 0.683 $(20.71)^{**}$ (0.44) $(2.97)^{*}$ Refugee_IV*post-reform 0.001 0.427 0.614 (0.02) $(3.63)^{**}$ $(5.16)^{*}$ Immigrant* -0.004 -0.004 -0.004 -0.004 -0.004	(1000, 0000)	(19.89)**	(19.39)**	(19.32)**	(16.48)**	(16.43)**
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	-reform (1998–2000)	-0.173	-0.175	-0.175	-0.197	-0.198
Immigrant 0.062 -0.050 -0.072 -0.076 -0.105 $(3.18)^{**}$ $(2.38)^{*}$ $(3.39)^{**}$ (1.45) (1.77) Immigrant*post-reform -0.103 -0.121 -0.104 -0.157 -0.154 $(3.98)^{**}$ $(4.18)^{**}$ $(3.51)^{**}$ $(4.19)^{**}$ $(4.11)^{*}$ Refugee_main 0.686 $(17.34)^{**}$ $(20.71)^{**}$ (0.44) $(2.97)^{*}$ Refugee_IV 1.043 -0.106 0.683 $(20.71)^{**}$ (0.44) $(2.97)^{*}$ Refugee_IV*post-reform 0.001 0.427 0.614 (0.02) $(3.63)^{**}$ $(5.16)^{*}$ Immigrant* -0.004 -0.004 -0.004 -0.004 -0.004	196 (199 s.)	(16.62)**	(16.81)**	(16.80)**	(15.84)**	(15.88)**
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	ngrant	0.062	-0.050	-0.072	-0.076	-0.105
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Refugee_main 0.080 (17.34)** 0.099 (167) $1.043 - 0.106$ 0.683 (20.71)** (0.44) (2.97) * Refugee_IV*post-reform 0.001 0.427 0.614 (mmigrant* $-0.004 - 0.004$ -0.004	in a second s	(3.98)**	(4.18)	(3.51)**	(4.19)	(4.11)**
Refugee_main*post-reform 0.099 Refugee_IV $1.043 - 0.106$ 0.683 Refugee_IV*post-reform 0.001 0.427 0.614 Immigrant* $-0.004 - 0.004$ -0.004	igee_main		(17.24)**			
Refugee_IV 0.099 Refugee_IV*post-reform 0.099 Immigrant* 0.099 Immigrant* 0.099 Immigrant* 0.099 Immigrant* 0.099 Immigrant* 0.099			(17.34)**			
Refugee_IV $1.043 - 0.106 \\ (20.71)^{**} \\ (0.44) \\ (0.02) \\ (3.63)^{**} \\ -0.004 \\ -0$	igee_main post-reform		0.099			
Refugee_IV 1.043 -0.106 0.033 Refugee_IV*post-reform $(20.71)^{**}$ (0.44) $(2.97)^{*}$ Immigrant* 0.001 0.427 0.614 (0.02) $(3.63)^{**}$ $(5.16)^{*}$	Wasa IV		(1.07)	1.043	-0.106	0.683
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Keiugee_iv post-reform 0.001 0.427 0.014 (0.02) $(3.63)^{**}$ $(5.16)^{*}$ Immigrant* -0.004 -0.004	ugaa IV*nost reform			(20.71)	0.44)	0.614
$[mmigrant^*] -0.004 -0.004$	ugee_iv post-reform			(0.02)	(3.63)**	(5 16)**
11111112/1/111	aigrant*			(0.02)	-0.004	-0.004
unemployment (0.71) (0.58)	nemployment				(0.71)	(0.58)
Refugee*upemployment 0.181 0.220	agee*upemployment				0.181	0.220
(5.89)** (7.44)*	agee unemployment				(5.89)**	(7 44)**
Vears in U.S. 0.0004	rs in U.S.				(5.05)	0.0004
(0.28)	15 m 0.5.					(0.28)
Refugee*years in U.S0.063	ugee*years in U.S.					-0.063
$(12.87)^*$	staat	1 165	1 140	1 154	1 077	(12.87)**
Constant $-1.105 -1.149 -1.154 -1.0// -1.08/$	stant	-1.105	-1.149	-1.134	-1.0//	-1.08/
Observations 290.644 290.644 290.640 290.640 290.640 290.640	ervations	290 644	290 644	290 640	290 640	290 640

Absolute value of z-statistics in parentheses. All specifications include state fixed effects. * Significant at 5%. ** Significant at 1%.

The coefficient on the interaction with immigrant and post-reform is negative and significant. This demonstrates that the reform has some effect on participation among immigrants beyond the overall effect registered in the post-reform coefficient.

Column 2 of Table 3 includes the Refugee_main dummy variable as the measure of refugee status and an interaction with the post-reform indicator.⁹ In interpreting these results it is important to note that refugee is a sub-classification of immigrant: All refugees are also classified as immigrants. Therefore, the large and positive coefficient on Refugee main indicates that refugees have a much higher propensity to participate in the food stamp program than do other immigrants and the native born (adding the coefficient on immigrants to the coefficient on refugees). The coefficient on immigrant is now negative and statistically significant because refugees are accounted for separately. In an effort to account for the presence of illegal immigrants, we have experimented with other samples, and in no case was the coefficient on immigrant positive and significant, and in all cases the coefficient on the refugee indicator was positive and significant. Hence, regardless of how illegal immigrants are handled, we conclude that failing to separate out refugees results in biased conclusions about NR immigrants and fails to identify the experiences of the refugee population. Finally, note that the coefficient on the interaction between immigrants and post-reform remains negative. This implies that immigrants, regardless of citizenship, are less likely to participate in food stamp programs than are non-immigrants. This is consistent with prior work, in particular the work of Van Hook (2003), since we are combining citizenship groups. The coefficient on the interaction between Refugee_main and post-reform is a small positive and insignificant number. It appears that both NR immigrants and refugees have had a decline in post-reform participation that is even larger than that experienced by the native-born population (recall, again, all refugees are also immigrants, and so the immigrant coefficients apply to them as well). The fact that there appears to be no difference between immigrants and refugees is somewhat puzzling since refugees were exempt from the more stringent rules applied to other immigrants.

Instrumental Variables Estimation

Column 3 of Table 3 presents the same specification as column 2, but it uses our preferred instrumental variables estimation approach, described above. As can be seen, the coefficient on the refugee variable, Refugee_IV, increases dramatically compared to that of Refugee_main. The mismeasured estimates in column 2 are attenuated toward zero, as is often the case with mismeasured coefficients. Note also that the coefficients on immigrant are all negative and significant and have increased in magnitude relative to the coefficients reported in column 2. Again, this is a typical result from measurement error; other coefficients are biased as well, particularly those closely correlated with the mismeasured variable. In contrast, the coefficients on other variables have changed very little. For example, the coefficient on *some college* for the householder is very stable across all columns at about -0.173. Similarly the other coefficients on educational categories are stable across the samples and specifications.

⁹ Another variant of this approach would classify any immigrant from a country in a specific time period as a refugee if 30% or more of the immigrants from that country/time were refugees. The results are comparable and available upon request.

Here we see that NR immigrants are less likely to participate in food stamp programs than are the native born. In contrast, refugees are heavy users of the food stamp program. Refugees tend to be disadvantaged in local labor markets as a result of poor language training and less preparation in general for economic life in the United States. Nearly all refugees are placed on food stamps upon arriving in the country. As we will see below, refugees do tend to work their way off food stamps over time, as policy makers expect. Separating refugees from other immigrants shows that previous studies that conclude that immigrants in general are high users of food stamps miss an important story. Still puzzling, however, is the fact that the coefficient on refugees interacted with the post-reform variable is negative but not significant. Since the coefficient on the interaction between immigrants and post-reform is negative and significant, it appears that forces acting on refugees and NR immigrants in the post-reform period had the same effect on both groups.

Extended Specification

The results in this section now include the correction for response error in reporting of food stamp participation discussed in the methodology section. Column 4 in Table 3 presents the first results to correct for measurement error in reporting food stamp program participation. Additionally, the specification presented in column 4 includes an interaction between the local unemployment rate and the indicators for both immigrants and refugees.

As noted in Bollinger and David (1997), the main effect of response error in food stamp program participation is attenuation of slope coefficients. For example, the coefficient on having some college changes from -0.172 in column 3 to -0.197 in column 4. The increased magnitudes of the coefficients in column 4, compared to prior specifications, are due to the correction for measurement error in food stamps.

The coefficients on post-reform increased slightly in magnitude when correcting for measurement error in food stamp participation. Its continued significance implies that the reforms did reduce native-born use of the food stamp program. The coefficient on immigrant increases but is no longer statistically significant. We suspect this is largely due to the inclusion of interactions with the unemployment rate. Similarly, the coefficient on the interaction between immigrants and the post-reform era is larger in magnitude and still negative and significant. Again, the results indicate that food stamp program participation of immigrants fell even more sharply in the post-reform era than did participation of the native born.

The coefficient on Refugee_IV declines markedly in column 4. Additionally, the coefficient on the interaction between Refugee_IV and the post-reform era has now become positive and is significant. The puzzling negative coefficient on Refugee_IV and its post-reform interaction disappear when we control for refugees' interaction with local labor markets. Indeed, the coefficient on the interaction between refugee and post-reform is large enough to completely offset both of the negative post-reform coefficients (the general one and the interaction with immigration), indicating that refugees did not see a post-reform decline in food stamp program participation. There does not appear to be any "chilling" effect on refugees. Indeed, in the intermediate sample, the results indicate that refugee food stamp program participation rose by 7.3% in the post-reform period holding constant labor market conditions.

Noting that the coefficient on the local unemployment rate is positive and significant, we turn to the two interaction terms between the unemployment rate and the immigrant and

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Figure 1. Unemployment Rate and Food Stamp Program Participation

refugee indicators. The coefficient on the interaction between the unemployment rate and immigrants is a very small and insignificant number. In general, immigrants' program participation appears to be no more sensitive to local labor market characteristics than is that of the native born. In sharp contrast, the coefficient on the interaction between the unemployment rate and the refugee indicator is three times the size of the coefficient on the local unemployment rate. It is statistically and economically significant: Refugees are four times as sensitive to fluctuations in the local unemployment rate compared to either native-born individuals or other immigrants. The two interaction terms for refugees imply that refugees' apparent decline in food stamp program participation in the post-reform era is largely accounted for by the coincidental improvement in the labor market. Thus, the decline in refugee use of food stamps observed in the raw data (see Table 1) can be entirely explained by this important difference.

Using the results from column 4, we present the time-series plot of the participation rate for native born, immigrants, and refugees in Figure 1. The probabilities are evaluated at the overall values for the native born, the immigrant values for immigrant, and the Refugee_main values for the refugees.¹⁰ The unemployment rate is the average rate for the sample in each year. Each population has two plotted lines; the first line is for what would have occurred in the

¹⁰ Overall values: A 47-year-old, white, male head of household with a high school degree. He is married to a 47-year-old white female with a high school degree. Neither the head of the household nor the spouse is disabled or a veteran. There are no children in the household, and a 5.07% local unemployment rate is observed. Immigrant values: A 45-year-old, Hispanic, male head of household with a high school degree. He is married to a 44-year-old Hispanic female with a high school degree. Neither the head of the household nor the spouse is disabled or a veteran. There are no children in the household. A 6.05% unemployment rate is observed. Refugee_Main values: A 50-year-old, Hispanic, male head of household degree. He is married to a 49-year-old, Hispanic, male head of household with a high school degree. He is married to a 49-year-old, Hispanic, male head of household with a high school degree. He is married to a 49-year-old Hispanic female with a high school degree. Neither the head of the spouse is disabled or a veteran. There are no children in the household with a high school degree. He is married to a 49-year-old Hispanic female with a high school degree. Neither the head of the household nor the spouse is disabled or a veteran. There are no children in the household. A 5.99% unemployment rate is observed.

presence of no reform, and the second line includes the reform starting in 1997. The two lines coincide for the pre-reform period (1993–1996). As can be seen, regardless of the reform, food stamp program participation among refugees would have dropped dramatically in response to the improving economy. This result is good news for both legislators and refugees. Far from indicating an unanticipated detrimental effect of PRWORA on refugees, the declining participation in the post-reform period is largely due to improved economic conditions that affect refugees more dramatically than native-born individuals or other immigrants.¹¹

Column 5 extends the specification in column 4 to examine how food stamp program participation for immigrants and refugees changes with the length of time in the United States. The variable Years in U.S. measures the number of years since an immigrant entered the United States to stay. For the native born, this variable is zero. The variable can be viewed as an interaction between Years in U.S. and immigrant. The coefficient on immigrant now represents the difference between a native born and a new immigrant (an immigrant with zero years in the United States). Again, both the Refugee_IV approach for addressing the refugee indicator and the correction for response error in food stamp participation are used. As in column 4, we find that the coefficient on immigrant is statistically insignificant. Again, the coefficient on postreform is negative, as is the interaction between post-reform and immigrant; both are statistically significant. The coefficient on refugee is larger, but its interpretation is now refugees who are in their first year in the United States. Examining the coefficient on Years in U.S. reveals that immigrants' participation in food stamp programs either increases slightly with time in the United States or does not change at all with time in the United States. In sharp contrast is the large negative coefficient on the interaction between Refugee_IV and Years in U.S. This coefficient is at least 10 times the magnitude of the coefficient on Years in U.S. for all immigrants. Clearly, over time, refugee use of food stamps declines dramatically. The more rapid decline in participation supports Cortes' (2004) findings of faster wage and human capital growth among refuges relative to economic immigrants. It is also consistent with the results of Hansen and Lofstrom (2001, 2003), who also find that refugees assimilate faster than other immigrants, but start further behind.

Figure 2 presents plots of the food stamp program participation rate against *Years in the* U.S. Again, immigrants are evaluated at the immigrant values and refugees are evaluated at the Refugee_main values (see footnote 10). The figure demonstrates the higher initial rate of participation and the higher rate of decline among refugees. Contrary to the descriptive work that motivated this research, holding unemployment constant, post-reform refugee participation in the food stamp program is higher than pre-reform participation.

The positive coefficient on the interaction between post-reform and refugee is significant and has increased in magnitude. Indeed, it indicates that in the post-reform era, had unemployment rates not changed, new refugees would have increased food stamp program participation, as this coefficient more than offsets the sum of the coefficients on post-reform and its interaction with immigrants. The coefficient on the interaction between unemployment and Refugee_IV has also increased in magnitude, further supporting the conclusion that the economic conditions were responsible for the apparent decline in refugee food stamp participation during the post-reform era.

¹¹ This result is consistent with prior research indicating that changing economic conditions have a larger welfare participation effect on lower skilled workers than on relatively higher skilled workers. See Hoynes (2000).







Robustness of Results

We have explored the robustness of these results and conclusions to a variety of sample and specification issues. Space and interest preclude a full presentation of these results here. Instead we provide a brief description of our efforts to ensure that the results above are robust. All results are available from the authors upon request.

As noted above, perhaps the most important issue is how illegal immigrants may bias our results. Bean, Telles, and Lowell (1987) report that the vast majority of illegal immigrants are from Mexico and Central America. As noted in the data section, our efforts at removing illegal immigrants have focused on these populations. More broadly, however, one can intuit how including illegal immigrants might bias these results. Since illegal immigrants are, in general, not eligible for food stamps, our coefficient on immigrants would likely be negatively biased if the sample contains illegal immigrants. As we remove illegal immigrants, we expect to see the coefficient on immigrants rise. The tension arises from the unknown participation patterns for legal immigrants from these countries. While we do control for characteristics such as age and education, it may be that legal immigrants from these countries are low users of food stamps (relative to other young, low-education immigrants) and so bias the coefficient up. Hence, a larger coefficient is not necessarily right. For example, the No Central Americans sample (results reported in the Appendix 2) removes all immigrants from Central America and Mexico-many of whom are legal, highly educated, and older. These people may very well be low users of food stamps, and so that coefficient may be too high. We estimated all of our models on 11 additional samples: removing low-education Central Americans and Mexicans; removing young, low-education Central Americans and Mexicans; removing young, loweducation Central American and Mexican agriculture workers; removing Mexican immigrants; removing low-education Mexican Immigrants; removing young, low-education Mexican immigrants; removing young, low-education Mexican Immigrants; removing Central American Immigrants working in agriculture; removing Mexican immigrants working in agriculture; removing young, low-education Central American immigrants working in agriculture; and removing young, low-education Mexican immigrants working in agriculture. In general, the coefficient on immigrant in the first model varied from -0.026 (as reported in column 2 of Appendix 1) to -0.26 (as reported in column 1 of Appendix 2). Estimates from other models were typically bounded by the full sample and the No Central Americans sample. Perhaps most importantly, the coefficients on refugee, the interaction between refugee and the post-reform period, the interaction between refugee and unemployment, and the interaction between refugee and Years in the U.S. were largely unchanged across the different samples.

A second concern is how our results are affected by the citizenship choice of immigrants. We argue above that since citizenship may be endogenous to the choice to participate in the food stamp program, we prefer not to use it as an explanatory variable. However, we did estimate our three main models separating immigrants and refugees by citizenship (and all interactions as well). We find that prior to welfare reform, naturalized immigrants were slightly less likely to participate in food stamp programs than are resident aliens or the native born (who were roughly equal), although the difference was not statistically significant. This also carried over to refugees, where the difference was significant: Naturalized refugees were less likely to participate in food stamp programs than were refugees who had not become naturalized. Refugees of either citizenship status were significantly more likely to participate in food stamp programs than were the native born or immigrants of either citizenship status. We find that naturalized refugees are more sensitive to local labor market conditions than are the native born or other immigrants, but they are less sensitive than refugees who had not chosen or qualified for citizenship. When we included the variable Years in U.S., we found that the difference in participation for refugees between citizens and non-citizens is largely explained by the time in the United States variable.

A third concern in the interpretation of these results is that the refugee measure may be a proxy for other characteristics of immigrants from particular regions of the world. Refugees are highly concentrated in origin from Asia and Central America, and so the refugee coefficient may simply reflect differences in all immigrants from these regions. In order to test this, we estimated a specification in which we replaced the simple indicator for immigrant with nine indicators for region of origin: Europe, Asia, Middle East, North America, Central America, Caribbean, South America, Africa, and Oceana (the reference category, like the immigrant indicator, is native born). These indicators were also interacted with the post-reform indicator and the unemployment rate. The estimated coefficients on the refugee indicator, the interaction between refugee and post-reform, the interaction between refugee and unemployment rate, and the interaction between refugee and Years in the U.S. differed only slightly from those reported in column 5 of Table 3. For example, the coefficient on refugee in the intermediate sample rose from 0.683 to 0.704, while the coefficient on refugee interacted with the post-reform dummy fell from 0.614 to 0.416. Qualitatively, the conclusions are quite similar.

A final concern is that the characteristics of immigrants in general appear to have changed over time (see Borjas 1999). It is possible that the characteristics of refugees have also changed over time, and hence the results we report—particularly the participation rate profile with years in the United States—is simply an artifact of changing immigrants. To test this we estimated the models on subsamples in which only recent immigrants and refugees were included. In the first specification, we included only immigrants and refugees who had been in the United States for 10 years or less. In the second specification, we included only those who had been in the United

States for six years or less. In this case, the coefficients on the refugee variables rose to 1.04. The coefficients on the interaction with Years in the U.S. and refugee were still negative and statistically significant and slightly larger in magnitude, signifying that refugees do appear to have faster convergence to native born than do immigrants. Specifications combining both the restricted immigrant sample and the country of origin were comparable to the restricted immigrant sample results.

6. Conclusions

We draw conclusions from this paper along two dimensions. The first is methodological. Ignoring refugees biases the coefficient on immigrants. The typical approach to measuring refugee status (as found in Table 3, column 2) underestimates the effects of refugee status on participation in food stamp programs. Additionally, failure to account for response error in program participation additionally understates the effects of all variables on participation.

The far more important dimension is that the story of food stamp program participation among immigrants and refugees is complex. A simple dummy variable for immigrant and refugee status fails to capture important aspects of food stamp participation decisions. Clearly, immigrants and refugees have different patterns of food stamp usage. Refugees are far more likely to participate in food stamp programs near the time of arrival in the United States, but their participation rates decline relatively quickly with the time in the United States. Secondly, refugees are far more sensitive to the economic climate than are both U.S. citizens and other immigrants.

Our results indicate a number of important policy implications. First, the decision of Congress in the mid-1990s to exempt refugees from the new eligibility rules imposed on immigrants seems to have had the desired effect on refugees. Beyond the humanitarian issue, we see that this group has what might be described as a "good" program experience: they participate heavily in food stamp programs when they first arrive, but they apparently become self-sufficient over time and rely less on food stamps. Secondly, the decision to disqualify new immigrants from food stamp programs may have been somewhat misinformed. As a whole, NR immigrants are less likely to participate in the food stamp program than are natives, holding other characteristics constant. Concern over immigrant misuse of food stamps appears to have been misplaced.

	Immigrant Only Specification	Refugee_main Specification	Refugee_IV Specification	Refugee_IV with Unemployment Rate	Refugee_IV Long Specification
Householder variables				ĵ.	1. A. I.
Age	-0.016	-0.016	-0.016	-0.019	-0.019
-0-	(47.14)**	(48.32)**	(48.16)**	(47.21)**	(46.75)**
Female	0.504	0.51	0.513	0.573	0.576
	(37.47)**	(37.82)**	(37.94)**	(36,70)**	(36.76)**
African-American	0.454	0.458	0.458	0.51	0.513
	(33.78)**	(34.04)**	(33.96)**	(33.22)**	(33.36)**
Hispanic	0.256	0.247	0.25	0.288	0.321
a molecular	(16.36)**	(15.75)**	(15.85)**	(15.78)**	(17.44)**
Asian	0.111	0.045	-0.002	-0.006	-0.045
	(2.86)**	(1.13)	(0.05)	(0.12)	(0.86)
Native American	0.361	0.358	0.356	0.388	0.391
i tuti to i interiouni	(10.91)**	(10.79)**	(10.75)**	(10.23)**	(10.27)**
Elementary school	0.432	0.45	0.456	0.535	0.54
Dictition any series of	(29.74)**	(30.84)**	(31.08)**	(31.49)**	(31.67)**
Some high school	0.383	0.39	0.392	0.445	0.446
bonno migni bono or	(30.01)**	(30.53)**	(30.60)**	(30.32)**	(30.31)**
High school-no	0.214	0.221	0.224	0.245	0.247
diploma	(6.91)**	(7.14)**	(7.21)**	(6.91)**	(6.92)**
Some college	-0.172	-0.173	-0.173	-0.199	-0.196
Source country.	(13.41)**	(13.45)**	(13.41)**	(13.37)**	(13.18)**
Associates/technical	-0.291	-0.293	-0.294	-0.329	-0.327
degree	(14.77)**	(14.83)**	(14.84)**	(14.37)**	(14.24)**
College	-0.568	-0.574	-0.579	-0.709	-0.715
	(29.00)**	(29.09)**	(29.18)**	(27.51)**	(27.56)**
Master's degree	-0.714	-0.714	-0.719	-0.923	-0.924
	(19.08)**	(18.96)**	(18.93)**	(16.85)**	(16.99)**
Terminal degree	-0.629	-0.649	-0.657	-0.881	-0.88
	(11.60)**	(11.70)**	$(11.71)^{**}$	(9.92)**	(10.17)**
Married spouse	-0.976	-0.966	-0.966	-0.939	-0.947
present	(28.97)**	(28.61)**	(28.51)**	(22.60)**	(22.71)**
Veteran	-0.009	0.001	0.006	0.01	0.013
	(0.59)	(0.05)	(0.39)	(0.51)	(0.69)
Disabled	0.818	0.819	0.821	0.958	0.958
	(75.18)**	(75.07)**	(74.99)**	(73.38)**	(73.28)**
Spouse variables					
Δαο	0.0004	-0.0001	-0.00003	-0.005	-0.005
Age	(0.71)	(0.18)	(0.04)	(5.64)**	(5.62)**
Female	0.377	0.378	0.38	0.404	0.408
1 ciliale	(17.88)**	(17.87)**	(17.88)**	(16.03)**	(16 14)**
African-American	-0.07	-0.063	-0.06	-0.031	-0.027
Amean-American	(2 58)**	(2 31)*	(2 20)*	(0.95)	(0.85)
Hispanic	-0.048	-0.029	-0.026	-0.044	-0.041
Thispanic	(2.18)*	(1.33)	-1.19	(1.69)	(1.56)
Asian	0.383	0.309	0.283	0.279	0.238
Asian	(8 27)**	(6.45)**	(5.75)**	(4 43)**	(3.63)**
Native American	0.23	0.231	0.232	0.287	0.291
. thur to a sinor tour	(4 32)**	(4.33)**	(4.34)**	(4.59)**	(4.65)**
Elementary school	0.23	0.24	0.245	0.33	0.332
Laomondary bonoor	(9.65)**	(10.03)**	(10.20)**	(11.39)**	(11.43)**
Some high school	0.307	0.314	0.318	0.385	0.388
Source ment option	(14.76)**	(15.02)**	(15.16)**	(15.64)**	(15.67)**

Appendix 1. Full Sample Estimates of Models

Appendix 1. Continued

	Immigrant Only Specification	Refugee_main Specification	Refugee_IV Specification	Refugee_IV with Unemployment Rate	Refugee_IV Long Specification
Spouse variables (cont.)	1.100				ć .
High school-no	0.208	0.213	0.214	0.254	0.254
diploma	(3.98)**	(4.06)**	(4.05)**	(4 10)**	(4 06)**
Some college	-0.104	-0.103	-0.104	-0.117	-0.115
6	(4.68)**	(4.66)**	(4.65)**	(4 32)**	(4 22)**
Associates/technical	-0.238	-0.241	-0.243	-0.345	-0.35
degree	(7.12)**	(7.17)**	(7 19)**	(7.60)**	(7 64)**
College graduate	-0.334	-0.337	-0.344	-0.506	-0.513
	(10.27)**	(10.28)**	(10.35)**	(10.06)**	(10.23)**
Master's degree	-0.36	-0.368	-0.377	-0.713	-0.643
	(5.44)**	(5.46)**	(5.50)**	(4 58)**	(5 03)**
Terminal degree	-0.305	-0.355	-0.376	-0.474	-0.54
	(3.05)**	(3.36)**	(3.46)**	(2.88)**	(3.25)**
Disabled	0.618	0.615	0.616	0.784	0.784
	(29.52)**	(29.24)**	(29.12)**	(29.77)**	(29.74)**
Household-level variables	S				
Multi-family household	0.006	0.011	0.012	0.01	0.01
	(0.42)	(0.76)	-0.85	(0.61)	(0.6)
Number of children	0.487	0.489	0.491	0.576	0.579
under 5 years	(62.24)**	(62.31)**	(62.45)**	(58.89)**	(59.00)**
Number of children	0.281	0.283	0.284	0.335	0.334
ages 5 to 18 years	(67.99)**	(68.19)**	(68.19)**	(65.88)**	(65.57)**
Local unemployment	0.053	0.051	0.051	0.056	0.055
rate	(22.19)**	(21.51)**	(21.42)**	(16.66)**	(16.51)**
Post-reform period	-0.168	-0.171	-0.171	-0.198	-0.2
(1998-2000)	(16.29)**	(16.53)**	(16.54)**	(15.98)**	(16.09)**
Immigrant	-0.006	-0.106	-0.134	-0.259	-0.38
	(0.35)	(5.44)**	(6.71)**	(5.39)**	(7.10)**
Immigrant*post-	-0.124	-0.122	-0.128	-0.154	-0.15
reform period	(5.22)**	(4.79)**	(4.87)**	(4.63)**	(4.52)**
Refugee_main		0.804			
		(19.18)**			
Refugee_main*post-		0.058			
reform period		(0.93)			
Refugee_IV			1.094	0.165	0.984
			(22.32)**	(0.73)	(4.45)**
Refugee_IV*post-			0.033	0.402	0.601
reform period			(0.46)	(3.59)**	(5.25)**
Immigrant*local				0.01	0.01
unemployment				(1.78)	(1.76)
Refugee*local				0.154	0.199
unemployment				(5.31)**	(6.96)**
Years in U.S.					0.006
					(4.36)**
Refugee*years in U.S.					-0.068
Constant	-1.237	-1.216	-1.217	-1 127	$(14.20)^{++}$
	(26.67)**	(26.14)**	(26.12)**	(20.74)**	(20.66)**
Observations	295,378	295,378	295,378	295,378	295,378

Absolute value of z-statistics in parentheses. All specifications include state fixed effects. * Significant at 5%. ** Significant at 1%.

		Immigrant Only Specification	Refugee_main Specification	Refugee_IV Specification	Refugee_IV with Unemployment Rate	Refugee_IV Long Specification	
H	ouseholder variables	1.2	1.1		109 11	eta - 193	-
	Age	-0.016	-0.017	-0.016	-0.019	-0.019	
		(47.64)**	(48.38)**	(48.15)**	(47.04)**	(46.36)**	
	Female	0.49	0.496	0.499	0.558	0.561	
	1988	(35 52)**	(35 85)**	(35.97)**	(34 71)**	(34 82)**	
	African-American	0 447	0.454	0.454	0.507	0.51	
	/ monoun	(32.98)**	(33 37)**	(33 34)**	(32 68)**	(32 76)**	
	Hispanic	0.299	0.277	0.275	0.312	0 342	
	mopume	(18 47)**	(17 02)**	(16.82)**	(16.42)**	(17.86)**	
	Asian	-0.001	-0.021	-0.053	-0.056	_0.099	
	/ LORALLY	(0.02)	(0.52)	(1.27)	(1.08)	(1.86)	
	Native American	0.362	0.362	0.362	0.396	0.399	
		(10.85)**	(10.83)**	(10.81)**	(10 31)**	(10.37)**	
	Elementary school	0.487	0.495	0.498	0.587	0.59	
	Enomentary senteer	(31 34)**	(31 73)**	(31 79)**	(32.16)**	(32 23)**	
	Some high school	0.402	0.407	0.408	0.464	0.463	
	Some men senoor	(30.55)**	(30.83)**	(30.85)**	(30.48)**	(30 30)**	
	High school_no	0.237	0.244	0.247	0 271	0.27	
	diploma	(7 34)**	(7.53)**	(7.60)**	(7.25)**	(7.20)**	
	Some college	(7.34)	-0.173	0.173	0.198	0.195	
	Some conege	(13 35)**	(13 27)**	(13 20)**	(13 17)**	(12.88)**	
	Associates technical	-0.295	_0.205	(13.20)	0.333	0.33	
	degree	(14 76)**	(14 76)**	(14 75)**	(14 25)**	(14.10)**	
	College	-0.572	0.574	0.570	0.708	0.712	
	Conege	(28.83)**	(28.81)**	(28.86)**	(27.08)**	(27.13)**	
	Master's degree	-0.715	_0.713	-0.717	_0.917	_0.919	
	Master 5 degree	(18 87)**	(18 74)**	(18 70)**	(16.56)**	(16.73)**	
	Terminal degree	-0.645	_0.659	-0.666	(10.50)	0.909	
	reminar degree	(11 63)**	(11.66)**	(11.66)**	(0.68)**	(10.05)**	
	Married spouse	_0.939	_0.929	_0.929	0.867	0.882	
	nresent	(26.82)**	(26.51)**	(26.43)**	(10.84)**	(20.14)**	
	Veteran	0.002	0.008	0.013	0.018	0.02	
	veteran	(0.10)	(0.53)	(0.79)	(0.018	(1.04)	
	Disabled	0.816	0.819	0.821	0.964	0.964	
	Disabled	(73 52)**	(73 55)**	(73 51)**	(71 01)**	(71.85)**	
		(15.52)	(15.55)	(15.51)	(71.21)	(71.05)	
S	pouse variables						
	Age	-0.001	-0.001	-0.001	-0.007	-0.007	
		(1.57)	(1.87)	(2.00)*	$(8.10)^{**}$	(7.87)**	
	Female	0.368	0.369	0.37	0.393	0.399	
		(16.67)**	(16.66)**	(16.67)**	(14.76)**	(14.94)**	
	African American	-0.068	-0.061	-0.058	-0.022	-0.02	
		(2.50)*	(2.23)*	(2.11)*	(0.67)	(0.6)	
	Hispanic	-0.023	-0.013	-0.014	-0.027	-0.034	
		(0.95)	(0.56)	(0.57)	(0.94)	(1.14)	
	Asian	0.353	0.298	0.277	0.265	0.218	
		(7.54)**	$(6.18)^{**}$	$(5.60)^{**}$	(4.13)**	(3.28)**	
	Native American	0.235	0.236	0.237	0.303	0.308	
		(4.35)**	(4.37)**	(4.39)**	(4.78)**	(4.84)**	
	Elementary school	0.322	0.317	0.318	0.444	0.44	
		(11.85)**	(11.60)**	(11.56)**	(13.14)**	(12.96)**	
	Some high school	0.343	0.346	0.349	0.431	0.431	
		(15.72)**	(15.85)**	(15.95)**	(16.53)**	(16.49)**	

Appendix 2. No Central Americans Sample Estimation of Models
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Appendix 2. Continued

	Immigrant Only Specification	Refugee_main Specification	Refugee_IV Specification	Refugee_IV with Unemployment Rate	Refugee_IV Long Specification	
Spouse variables (cont.)		2			10.01	
High school—no	0.206	0.21	0.211	0.245	0.24	
diploma	(3.63)**	(3.69)**	(3.68)**	(3.56)**	(3.45)**	
Some college	-0.104	-0.102	-0.102	-0.113	-0.11	
e.	(4.61)**	(4.53)**	(4.49)**	(4.07)**	(3.94)**	
Associates/technical	-0.247	-0.249	-0.25	-0.36	-0.366	
degree	(7.21)**	(7.23)**	(7.24)**	(7.64)**	(7.68)**	
College graduate	-0.336	-0.339	-0.344	-0.512	-0.516	
00	(10.13)**	(10.13)**	(10.20)**	(9.79)**	(9.96)**	
Master's degree	-0.36	-0.367	-0.375	-0.703	-0.613	
- I J	(5.31)**	(5.35)**	(5.39)**	(4.33)**	(4.74)**	
Terminal degree	-0.317	-0.357	-0.375	-0.503	-0.566	
	(3.07)**	(3.30)**	(3.39)**	(2.77)**	(3.18)**	
Disabled	0.621	0.62	0.621	0.805	0.804	
	(28.70)**	(28.54)**	(28.46)**	(29.11)**	(29.09)**	
Household-level variable	S					
Multi-family household	0.034	0.036	0.036	0.035	0.034	
intura raining nousenera	(2 21)*	(2 34)*	(2 36)*	(1.95)	(1.87)	
Number of children	0.495	0.495	0.498	0.585	0.587	
under 5 years	(59 37)**	(59 30)**	(59 40)**	(55.82)**	(55.89)**	
Number of children	0.284	0.284	0.285	0.337	0.338	
ages 5 to 18 years	(64 53)**	(64 50)**	(64 44)**	(62 29)**	(62 11)**	
Local unemployment	0.051	0.05	0.05	0.056	0.056	
rate	(18 37)**	(17.76)**	(17 70)**	(15 92)**	(15.91)**	
Post-reform period	-0.171	-0.174	-0.174	-0.199	-0.199	
(1998–2000)	(16.04)**	(16.24)**	(16.23)**	(15.79)**	(15.82)**	
Immigrant	0.114	-0.023	-0.063	-0.161	-0.235	
	(5.33)**	(0.96)	(2.52)*	(1.95)	(2.56)*	
Immigrant*post-	-0.049	-0.041	-0.047	-0.082	-0.073	
reform period	(1.63)	(1.18)	(1.28)	(1.63)	(1.45)	
Refugee_main	()	0.73	()	1	(
		(16.54)**				
Refugee main*post-		-0.023				
reform period		(0.35)				
Refugee_IV			1.015	-0.005	0.816	
			(19.29)**	(0.02)	(3.35)**	
Refugee_IV*post-			-0.059	0.339	0.529	
reform period			(0.76)	(2.74)**	(4.23)**	
Immigrant*local				0.007	0.01	
unemployment				(0.69)	(0.92)	
Refugee*local				0.164	0.205	
unemployment				(5.08)**	(6.57)**	
Years in U.S.					0.002	
					(1.13)	
Refugee*years in U.S.					-0.065	
C	1 201	1 100	1 107	1.101	(12.83)**	
Constant	-1.201	-1.185	-1.187	-1.101	-1.112	
Observations	(23.22)**	(24.82)**	(24.84)**	(19.95)**	(20.11)**	
Observations	284,025	284,025	284,025	284,025	284,025	_

Absolute value of z-statistics in parentheses. All specifications include state fixed effects. * Significant at 5%. ** Significant at 1%.

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Expanding the Concept of Significant Choice Through Consideration of Health Literacy During Crises

Morgan Wickline, MA¹ Timothy L. Sellnow, PhD¹

Nilsen defined the concept of the ethic of significant as "choice making that is voluntary, free from physical or mental coercion . . . based on all the information available when the decision must be made." This study highlights the importance of speakers in crisis situations not only meeting the ethical stipulations of significant choice but also taking into consideration the health literacy of their audience. Health literacy is defined as the ability of individuals to gather, interpret, and understand information regarding health matters. To advance this claim, a case study involving a food recall is examined. Television news coverage was analyzed to observe the importance of both significant choice and health literacy in such public communication. The findings, from the standpoint of significant choice and health literacy, indicate that the messages disseminated during this crisis failed to account for a notable portion of the audience. From a practical standpoint this study asserts that clear and open communication cannot be considered only from the perspective of the party sending the message. Rather, careful consideration of the audience's ability to comprehend and act on the information is equally important.

Keywords: ethics; health literacy; disaster and emergency preparedness

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n emergency or crisis health situations, rapidly disseminating information that empowers the public to L protect themselves is essential. In response to the challenges of communicating health information in such circumstances, the Centers for Disease Control and Prevention (CDC) developed the crisis emergency risk communication (CERC) model (Reynolds & Seeger, 2005; Veil, Reynolds, Sellnow, & Seeger, 2008). The model advocates that public health practitioners work with all stakeholders to access information and share that information with the public. This process includes serving as a spokesperson in media broadcasts. In this manner, public health practitioners work with organizations facing crises such as food recalls in order to fulfill their ethical obligation to communicate openly and truthfully with all of their constituents and stakeholders. Thomas Nilsen (1966) describes this ethical imperative in terms of significant choice. He argues, "When we communicate to influence the attitudes,

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TABLE 1 Time Line of August 2010 Egg Recall

- August 13, 2010: Wright County Egg begins recalling eggs amid suspicions of salmonella contamination.
- August 18, 2010: Wright County Egg issues a press release about the recall.
- August 19, 2010: The Food and Drug Administration issues a press release containing important messages for self-protection.
- August 20, 2010: A second press release points to Hillandale Farms as a second source of contaminated eggs.
- August 20, 2010: Recall expands to include three more brands.
- August 24, 2010: Number of people affected reaches 1,300.
- September 22, 2010: Wright County Egg owner Jack DeCoster apologizes publicly.
- October 15, 2010: Hillandale Farms is cleared to resume normal shipping and distribution operations.
- December 1, 2010: Wright County Egg is cleared to resume operations.

beliefs, and actions of others, the ethical touchstone is the degree of free, informed, and critical choice on matters of significance in their lives that is fostered by our speaking" (p. 46). Although meeting the requirements of significant choice in all situations is important, this obligation is heightened when listeners facing urgent circumstances threatening their health seek information that will influence their decision-making process. The ethic of significant choice argues fundamentally that "when a group has vital information the public needs in order to make urgent health decisions, that information must be disseminated as completely and accurately as possible" (Streifel, Beebe, Veil, & Sellnow, 2006, p. 391).

This article presents a case study of a food recall that highlights the importance of speakers not only meeting the ethical stipulations of significant choice but also taking into consideration the health literacy of their audience. Health literacy is defined as the ability of individuals to gather, interpret, and understand information regarding health matters. This includes, but is not limited to, reading prescription labels, reading medical literature, following doctor's instructions, and navigating the health care system. Though this case study focuses on a large-scale recall involving several entities, the same principles of ensuring a significant choice and meeting the health literacy needs of the audience can certainly be applied in a one-on-one interaction between a patient and practitioner.

The case providing the context for this study is an August 2010 United States egg recall (see Table 1). Hillandale Farms and Wright County Egg found themselves in the midst of an organizational crisis when both were identified as the sources of *Salmonella*contaminated eggs causing a food-borne illness outbreak across 16 states. As the recall grew, these organizations were conspicuously absent from the dialogue surrounding the event. Instead, the organizations allowed others, including the U.S. Department of Agriculture, the Food and Drug Administration (FDA), and various news reporters and television news anchors, to speak in their place. Unfortunately, these proxy communicators left much to be desired in the way of satisfying significant choice requirements and meeting the audience's health literacy needs.

The remainder of this article provides a more thorough review of the literature supporting our proposed expansion of significant choice as a standard for ethical communication of health messages during crises; offers a brief overview of the case, the data set, and method; and concludes with a discussion of the findings and ethical implications of this study.

REVIEW OF LITERATURE

Significant Choice

Nilsen (1966) defined the concept of significant choice as "choice making that is voluntary, free from physical or mental coercion" and "based on all the information available when the decision must be made" (p. 37). He contended that when faced with a choice, the only decision-making situation that did "justice to our moral nature" (p. 35) was one in which the speaker told the truth and presented all the right information in such a way as to allow the audience to make the best decision possible for themselves. Any other situation—perhaps one in which bits of information were purposefully withheld or false information was presented-was not morally right speech and therefore created a situation in which the audience could not make a significant choice. Although the ethic of significant choice can be applied to matters of manipulation and coercion, our focus in

this study is exclusively on identifying the information needed for the public to make a significant choice and to observe the degree to which that information was shared with the public.

The need for speakers to create an opportunity for significant choice for their audience members is heightened in a crisis situation, especially when the crisis has the potential to negatively affect audience members' health. Parker and Gazmararian (2003) claim that "ideally, health communicators must have credible, clear messages that can be understood by those with inadequate, marginal, and adequate health literacy levels" (p. 117). Although presenting complete and accurate information is vital to creating a condition of significant choice, the information must be delivered in a way the audience can comprehend when the decision at hand is health related. Simply making the right information available and meeting the requirements of significant choice is not sufficient. We argue that the speaker(s) must go a step further by ensuring that the audience's health literacy is taken into consideration and that the information is presented clearly and in a way that is palatable for them. Thus, by considering the ethic of significant choice in the context of a health-related crisis, we propose adding another caveat: Simply providing true information and all the information available at the time is not sufficient. The speaker should also strive for clarity in message content and delivery by taking into account the audience's health literacy levels. A failure to tailor messages to match the literacy levels of the audience may lead to a gap in understanding. The consequence of diminished comprehension could deter the audience members from taking the steps needed to protect themselves, thereby amplifying harm.

Health Literacy

Seeger (1997) contends that "free and unrestrained speech and dissemination of information in the open marketplace of ideas contributes to the discovery of truth" (p. 79). This availability of information is the stepping-stone for many health decisions. Health literacy is the ability of individuals to understand basic health information and make appropriate decisions. More specifically, "Health literacy is not simply the ability to read. It requires a complex group of reading, listening, analytical, and decision making skills, and the ability to apply these skills to health situations" (National Network of Libraries of Medicine, 2013). This definition differentiates between health literacy and general literacy. Although people may be literate in the social sense of having the ability to read and write, they are not necessarily health literate and proficient in

navigating the tasks associated with their health listed above.

When searching for health information, people often look for messages of self-protection, that is, messages that let them know what they need to do to protect themselves and their health (Veil et al., 2008). This is also true in a crisis situation with potential health implications. We define a crisis as a suddenly emerging situation in which the health of individuals is threatened and there is limited time to respond before the situation worsens. In these instances, providing messages that are clear and accurate is particularly important because "we are concerned about the effect that the speaking of one person has on the well-being of those influenced by it" (Nilsen, 1966, p. 20). In this manner, the concepts of health literacy and significant choice are inextricably linked. Decisions about managing one's health are some of the most "significant" life choices people make. These problems are compounded in health crisis situations such as a food-borne illness outbreak, when transmitting messages of self-protection to the populations at risk is tantamount.

METHOD

Our analysis focuses on the 2010 Salmonella egg recall. Specifically, this case study focuses on the televised coverage of the crisis from August 13 to August 27, 2010. This time period was selected because it represents the onset of the egg recall, which was deemed the acute phase of this crisis. The CDC CERC stipulates that in the initial onset of the crisis, sharing messages for self-protection with the public is essential (Revnolds & Seeger, 2005). They explain that at this point, the risk is high and public knowledge is limited. During these 2 weeks, messages about the recall and about cooking eggs safely were most likely to appear in television news coverage. We chose to focus specifically on television for two reasons. First, television remains the most common medium used in times of crisis, threat, or natural disaster. Second, television is particularly relevant for crisis communication with those who have marginal or low health literacy. To complete the media content analysis, the researchers used the television tracking system housed in a southeastern U.S. university. Stations included in the study were CNN, CNNH, CSPAN, CW, CBS, Fox, FNC, NBC, ABC, PBS, and MSNBC. The keywords selected for this event were egg and Salmonella. If either of these words or combinations of words was found in a television segment, the segment was isolated and captured for further analysis. A total of 566 videos containing news about the recall were recorded and coded.

A content analysis of the captured video was based on three key messages related to consumer protection during the egg recall. Although content analysis began in studies of journalism, it is applied increasingly in health communication research (Manganello & Blake, 2010). Content analysis of health-related messages now spans both traditional and new media such as blogs and Twitter posts (Miller, Pole, & Bateman, 2011; Park, Rodgers, & Stemmle, 2013).

For our analysis, a subject matter expert at the National Center for Food Protection and Defense identified the three key messages essential for self-protection during the early stages of the egg recall. A second subject matter expert at the Institute for Food Technologists validated the key messages selection. The three key messages included the following:

- 1. Wash hands and cooking surfaces that come in to contact with raw eggs thoroughly.
- 2. Cook eggs thoroughly until the yolks are no longer runny.
- 3. Check egg cartons for recall information and Julian dates to ensure they are not part of the recall.

All of the videos were observed and coded by two coders. An initial 10% sample of 56 videos was coded by both coders to determine intercoder reliability. Intercoder reliability was calculated using Scott's pi (Scott, 1955). Reliability was found to be acceptable for each question with the minimum agreement at or above 90.1% ($\pi = 0.84$).

RESULTS

Key Messages

When the videos were coded for the presence or absence of key messages essential for self-protection during the early stages of the egg recall, we found that, overall, these messages were included in the broadcasts with an alarming infrequency.

We initially looked for messages instructing viewers to wash hands and clean cooking surfaces. Only 3% of the videos (n = 17) included instructions to wash hands and cooking surfaces thoroughly after handling and cooking eggs. While hand washing is a normal part of food preparation, when handling a potentially contaminated product it becomes a vital step for selfprotection. Despite this fact, news coverage was mostly lacking in disseminating this information.

The second key message of self-protection involved cooking eggs thoroughly until the yolk was no longer runny. This message appeared in 19 percent of the broadcasts (n = 108), which is the highest frequency of all three messages. Because cooking eggs to a high temperature has the potential to kill any strains of *Salmonella*, it is perhaps the most important message. Ideally, this message would appear with far more regularity. In addition, cooking instructions are particularly essential for self-protection when the recall is steadily expanding to additional vendors, as was the case in this egg recall.

The third message involved instructions on how to check for recall information in egg cartons that consumers might have in their homes. This included checking for brand names, plant numbers, and Julian dates. The results indicate that only 9% (n = 51) of broadcasts included plant numbers, Julian dates, or both, which would help consumers determine if their eggs were part of the recall.

We also coded for the presence or absence of instructions on where to go for more information. The results showed that 38% (n = 215) of broadcasts gave viewers a place to go to get additional, up-to-date information on the recall. The most frequently referenced source for updates were websites. The websites mentioned were provided by the television station or by such agencies as the FDA or CDC.

Additionally, the broadcasts were coded for the presence or absence of messages about the symptoms of salmonellosis and instruction on what to do if illness is suspected. The broadcasts during this outbreak gave the symptoms of salmonellosis in 82 videos (14%). Only 2% of broadcasts gave viewers information on what to do if they suspected they had contracted salmonellosis.

Next, we reflect on this case to offer several conclusions for developing crisis messages that meet the ethical standards of significant choice and health literacy.

ANALYSIS

The vital messages for self-protection were not included in the broadcasts with the frequency or form needed to meet the standards of significant choice and health literacy. In terms of health literacy, ambiguous references, such as Julian date, and confusing instruction, such as indicating an ideal temperature for cooking eggs, served only to complicate the messages of self-protection and failed to meet the basic health literacy needs of the diverse audience.

In terms of health literacy, broadcasts sometimes mentioned cooking eggs to a temperature of 160 degrees to ensure all bacteria were killed. Although cooking temperatures can be helpful in preparing other foods such as meats, in this instance the recommendation can be confusing because determining the precise temperature of an egg during the cooking process can be difficult. Reminding consumers to beware of all undercooked eggs, not just those in pure forms, is advisable while a recall such as the one included in this study is still in effect. Such a warning would be especially beneficial to those viewers with a lower health literacy level, who could be potentially unaware of the presence of undercooked eggs in food products such as batter.

The absence of specific comprehendible information about which brands and shipments of eggs were unsafe is also problematic. Previous examples of food-borne illness outbreaks indicate that many consumers cease consumption of the contaminated product when they feel they do not have enough information to make a safe purchasing decision. However, in this case, the contaminated product is considered inelastic, that is, there are no reasonable substitutes for eggs as there would be for lettuce or peppers. Because of this inelasticity, consumers are much more likely to continue purchasing eggs. Having the proper information (e.g., brand names, plant numbers) enables consumers to have confidence they are avoiding the eggs suspected of contamination. Thus, providing clear messages and continuous updates for the duration of the crisis is essential. Consumers need this information to avoid either underreacting (not taking the proper precautions) or overreacting (avoiding the product even when it is safe for consumption).

The dependence on websites as recommendations for viewers to seek additional information poses several problems as well. First, simply listing a website for more information during a broadcast story is not a substitute for providing the key messages discussed above. Viewers are still vulnerable to the contamination's ill effects during the time gap between when they hear the news of a recall and when they are able to find the necessary self-protection information. Any delay in getting the key messages to consumers has the potential to increase both morbidity and mortality. Second, previous experience with crises indicates that access to a website is hampered when thousands of consumers attempt to simultaneously log on to a given site in search of information. Thus, access is limited. Third, a notable portion of Americans have barriers to accessing other sources of information. Low income, for example, often precludes individuals from accessing information via sources such as the Internet. For this segment of the population, general illiteracy and health illiteracy can be an insurmountable barrier in the search for important, health-related information. It would be more beneficial to viewers for the most pertinent information (the three key messages) to be given in the broadcast, rather than the perfunctory description followed by a website address where consumers should go to get more information. Announcing an alarming event and then relying solely on a referral to a website for further details is no substitute for thorough and accurate reporting that accounts for audience diversity.

The failure to discuss the symptoms of salmonellosis is also problematic. Lacking this information, some consumers may have passed their symptoms off as flu or some other virus instead of seeking the proper medical care. Not only does this prove troublesome for the ill, but also undocumented cases of salmonellosis or other food-borne illnesses hamper the CDC's and FDA's efforts to track contaminated products and make accurate claims about the scope and breadth of contamination. *Restaurant Business* reports,

Identifying an outbreak and tracking it back to its source can be a major, multi-agency task that involves a balancing act . . . It's routine for hospitals to report certain illnesses to state or local health departments. Among those are many food borne illnesses. ("E. Coli Outbreak," 2006, p. 74).

Because the symptoms of salmonellosis can resemble those of other illnesses, it is important during an outbreak to remind people what the symptoms are in order to ensure they seek medical attention and are properly diagnosed and treated. In turn, the medical professionals treating the ill will report the instances to the proper organizations so they can do their job of tracking the outbreaks. Failure to provide this information to viewers might have been an obstacle to them seeking the necessary medical care, in turn allowing an infection to go undocumented.

IMPLICATIONS

The importance of meeting the requirements of significant choice in a crisis situation has been well documented in previous studies (Streifel et al., 2006). However, there is little research that combines the ethic of significant choice with the concept of health literacy. This study contributes to that research by examining the possibility of meeting significant choice requirements, as outlined by Nilsen (1966), but still failing to provide a message truly comprehendible to an expansive and diverse audience. This study sought to demonstrate the importance of providing clear instructional messages to audiences.

In a crisis situation, it is important to provide stakeholders with all the information they need to make informed choices regarding their self-protection. This information is often delivered in the form of instructional messages allowing viewers to engage in the dialogue and become active clarifiers of the information. That is to say, the message should meet their general and health literacy needs. To do any less denies them the benefit of significant choice and an informed decision. These statements ring true in all crisis situations, from large-scale events to personal health crises that affect just one person or family. The modern Hippocratic oath, taken by all physicians before beginning practice, states, "I will remember that there is art to medicine as well as science, and that warmth, sympathies, and understanding may outweigh the surgeon's knife or the chemist's drug" (Tyson, 2001). This tenet alludes to the importance of being sensitive to patients' health literacy levels and needs rather than just focusing on treatment of the illness or injury. Additionally, it is the primary goal of physicians (and all health care providers, for that matter) to not only cure but also prevent disease when possible. Williams, Davis, Parker, and Weiss (2002) state, "Studies indicate that patients' health literacy is associated with less-optimal health outcomes, health status, and hospitalization rates" (p. 385). Thus, if practitioners are to satisfy the criteria of significant choice, they must work diligently with the media to provide messages that combine the open, honest, and straightforward communication with sensitivity for the general and health literacy needs of their patients.

This study reveals that the majority of television coverage of the egg recall did not provide viewers with essential information in a readily comprehendible manner. Future research should focus on the link between health officials and television reporters. The key question for future studies involves informing and convincing reporters that sharing messages of selfprotection, as advocated in the CERC model, is essential, particularly in the early stages of the crisis. This study indicates that without such involvement of the health community, reporters and spokespersons for organizations facing crises may not fully comprehend the importance of sharing such information. Fortunately, recent research reveals a growing willingness of reporters to collaborate with subject matter experts in their reporting. Clearly, this is an opportunity worth pursuing and evaluating by health communication practitioners.

DIMITATIONS

We acknowledge several limitations in our study. First, we focused exclusively on television. Other forms

of communication such as radio coverage and radio ads may have provided additional information to the public. Similarly, print coverage, nontraditional media, and information from other sources such as institutions of faith may have contributed to individual's understanding during the onset of the crisis.

CONCLUSION

This study was limited to a single case and to a single form of information acquisition. Hence, the analysis does not investigate the function of other media forms during health-related crises. Future research should focus on the application of these theories and concepts to other forms of health crises and at different phases of a crisis to determine the full extent to which significant choice and health literacy play a part in forming efficacious messages during a crisis. It would also be interesting to test different strategies for reaching diverse literacy levels and create different recommendations for organizations to take into consideration when planning their crisis response and creating instructional messages for self-protection to be disseminated to stakeholders.

By their nature, crises create a need for information enabling potential victims to protect themselves. Naturally, any intentional effort to withhold such information in an effort to protect oneself or one's organization from criticism and litigation is unethical. This study suggests further that failing to account for the varying degrees of health literacy among the population is an ethical violation as well. This can also be applied to practitioners who fail to account for the health literacy needs of their patients, thereby failing to ensure understanding. If too much importance is given to the "surgeon's knife and the chemist's drug" and not enough given to compassion and comprehension, then practitioners risk violating the ethical standards set forth in the Hippocratic oath and potentially amplifying harm. As such, clear and open communication cannot be considered only from the perspective of the party sending the message, be it a large organization or a single practitioner. Rather, careful consideration of the audience's (or the patient's) ability to comprehend and act on the information is equally important.

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In the November 2013 issue of *Health Promotion Practice*, Mary Shaw-Ridley should have been listed as the associate editor of the Ethics in Health Education article, "Expanding the Concept of Significant Choice Through Consideration of Health Literacy During Crises." The following paragraph should have appeared with the article:

Associate Editor, Ethics in Health Education Department

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Message Convergence as a Messagecentered Approach to Analyzing and Improving Risk Communication

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This study introduces the message convergence framework, initially established by Perelman and Olbrechts-Tyteca, as means for comprehending and analyzing the process through which audiences simultaneously decipher pluralistic meaning from multiple sources typical of crisis events. Emphasizing Perelman and Olbrechts-Tyteca's concept of plurality, the framework establishes three propositions: focusing on source credibility, significance of source convergence, and the evolution of source convergence throughout the crisis. The propositions are applied to the transcripts generated by focus groups that observed a series of simulated television reports about a mock crisis. Participants performed well in distinguishing among sources and their credibility, in recognizing and evaluating points of convergence, and in seeing how these points of convergence gain and lose strength or persuasiveness as the crisis unfolds. The framework is seen as a practical tool for assessing an organization's credibility and relationships prior to a crisis and for monitoring coverage of crises in both traditional and social media.

Keywords: Risk; Message Convergence; Arguments; Crisis; Food Contamination

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During crises, "the public seeks information to determine whether the crisis will affect them, how they should think, and what they should do" (Seeger, Sellnow, & Ulmer, 2003, p. 71). Mileti (1999) establishes that contemplation of the available information is essential for "determining what protective action to take and taking it" (p. 141). The interpretation of this information is complicated by the fact that crises typically result in the public being bombarded with various, and often conflicting, messages from several entities (Anthony & Sellnow, 2011a). Heath (2009) characterizes this situation as "a contest among multiple voices" (p. 21). In the presence of these competing messages, individuals are presented with the task of processing multiple messages from distinct sources to find meaning and react accordingly to protect themselves and their families. Effective crisis communication occurs when observers are able to make "enlightened choices" that reflect "the best facts, reasoning, and evaluations" (Heath, 2009, p. 36).

To date, much of the crisis communication research emphasizes the credibility of messages from a single source whose reputation is threatened (Benoit, 1995; Coombs, 2012). Little work has been done to assess the interaction of the multiple messages communicated simultaneously during crises. This study introduces the framework of message convergence as a means for comprehending and analyzing the process through which audiences simultaneously decipher a pluralistic meaning from multiple sources typical of crisis events. Message convergence occurs when "several distinct arguments" established by separate sources "lead to a single conclusion" (Perelman & Olbrechts-Tyteca, 1969, p. 471). These consistent conclusions have considerable strength or influence upon audiences during crisis situations (Anthony & Sellnow, 2011a). Our analysis explains the process through which audiences perceive and articulate points of convergence in crisis communication. First, the key propositions of the message convergence framework are summarized. Second, we apply the framework to transcripts derived from focus groups based on a crisis simulation. Third, we provide conclusions and implications for how message convergence manifests in a crisis. Finally, practical applications of the message convergence framework for crisis communicators are offered.

Message Convergence

The message convergence framework is drawn from Perelman and Olbrechts-Tyteca's (1969) *The New Rhetoric: A Treatise on Argumentation*, which explores pluralistic meanings from varied message sources. Frank (2004) argues that as part of the New Rhetoric project, their work is considered "the most important system of argument produced in the twentieth century and can serve as an ecumenical site for the development of argumentation theory" (p. 267). The influence of the *New Rhetoric* is based on its capacity to provide an applied understanding of how people actually reason their way to "actions or behaviors" (McKerrow, 1990, p. 19). From this standpoint, Perleman and Olbrechts-Tyteca "undertook a comprehensive analysis of the specimens of reasoning actually used by lawyers, philosophers, politicians, journalists, moralists, and others "who try to 'make a rule prevail' in situations where empirical evidence and formal logic cannot settle the issue" (Gross & Dearin, 2003, p. 7).

Dearin (1969) explains, "in opposition to classical rationalism, which sought unique truth and certitude about its conclusions," Perelman expanded "the domain of reason to encompass a rhetorical rationalism that allows for a pluralism of values and a multiplicity of ways of being reasonable" (p. 214). Pluralism permits expression and consideration of opposing views in response to disagreement. Perelman (1979) explains, "philosophical pluralism refrains from granting to any individual or group, no matter who they are, the exorbitant privilege of setting up a single criterion for what is valid and what is appropriate" (p. 71). From this perspective, "humans could also have different and conflicting interpretations of knowledge, and it could very well be that two people who disagree might both be right" (Frank, 2011, p. 247). Thus, pluralism accounts for the complexity of human interaction, allowing for "human solutions rather than final solutions" to problems (Tindale, 2010, p. 347).

"Human solutions" are needed because a "final solution" or a singular and endless truth on a contested matter is unattainable. Venette (2008) views risk as a precrisis state. He defines risk communication as a continuous "information exchange and testing among individuals who are developing an understanding of a risk" (p. 198– 199). A plurality of information is provided simultaneously by "experts, opinion leaders, experiences, and significant stories" (p. 198). The combined narrative created by these risk messages provide "explanations that structure reality" for the audience (p. 199). Listeners construe risk by noting the ways in which the arguments within the greater narrative reinforce or conflict and by comparing this unity or disparity to their previously held beliefs on the issue (Venette, 2003). Perelman and Olbrechts-Tyteca (1969) articulate that plurality in risk communication is particularly valuable in that no individual source is privileged or silenced. If arguments on a risk issue align or converge in ways that conflict with previous assumptions, audiences adapt their structure of reality to account for the compelling evidence (Venette, 2003).

Moreover, the information provided by conflicting sources is not often completely incompatible. Rather, points of agreement typically exist on some level among the disputing sources. The message convergence framework offered by Perelman and Olbrechts-Tyteca (1969) provides a succinct and comprehensive explanation of how elements of agreement are recognized by listeners and can serve to persuade them.

Perelman and Olbrechts-Tyteca (1969) observed that arguments on a given topic are "in constant interaction at more than one level" (p. 460). This interaction results from differing views related to both the context of the discussion and content of the arguments. Perelman and Olbrechts-Tyteca identified four levels of interaction:

- between various arguments put forward by separate sources;
- between the arguments and the overall argumentative situation;
- between the arguments and their conclusion; and
- between arguments occurring in the discourse and those that are about the discourse. (p. 460)

Human argument-interaction is extended in two ways. First, closer scrutiny of the arguments put forward may intensify the interaction. Second, interaction expands by "giving consideration to an increasing number of spontaneous arguments having the discourse as their subject" (p. 460). To resolve the interacting messages, Perelman and Olbrechts-Tyteca (1969) explain that observers seek to identify areas of convergence among the various arguments. They explain that opposing arguments are best understood systematically because the argumentative situation "shifts each moment as argumentation proceeds" (p. 460). As competing or distinct arguments interact, the strength and weakness of the claims are assessed by those engaged in discourse about the issue.

Thus, stakeholders characteristically cannot conclude that one party is absolutely right. Instead, as arguments interact in the system of discourse, there are typically some degrees of convergence among the claims. Perelman and Olbrechts-Tyteca (1969) explain that convergence occurs when "several distinct arguments lead to a single conclusion" (p. 471). The "strength" of converging arguments is "almost always recognized" because the "likelihood that several entirely erroneous arguments would reach the same result is very small" (p. 471). Three central propositions can be distilled from Perelman and Olbrechts-Tyteca's discussion of message convergence. We summarize each of these propositions in the following section.

Central Propositions

Proposition one. When two opposing sides of an issue offer conflicting arguments, as is often the case during crises, there is rarely a complete distinction between them. Perelman and Olbrechts-Tyteca (1969) note that "if several distinct arguments lead to a single conclusion [convergence], be it general or partial, final or provisional, the value attributed to the conclusion and to each separate argument will be augmented" (p. 471). The fact that individuals or institutions seemingly in opposition agree on some premise makes that agreement especially noteworthy for stakeholders. For example, a government agency such as the United States Department of Agriculture (USDA) may disagree with a food processing company's claims of who is or is not responsible for a foodborne illness outbreak. The fact that they agree a product should be recalled, however, makes the recommendation that consumers stop eating that product compelling. This notion that message convergence from distinct sources contributes to persuasiveness is summarized in Perelman and Olbrechts-Tyteca's first proposition: *Convergence in the claims made by distinct sources, be it partial or complete, increases the strength of those claims.*

Proposition two. Audiences are able to recognize the plurality of views within issues that concern them. Audience commitment to accessing multiple sources and scrutinizing messages for points of convergence, however, is dependent on audience motivation. If audiences do not deem an issue important, they are unlikely to seek out points of convergence or assign significance to the convergence they passively recognize. Perelman and Olbrechts-Tyteca (1969) explain, "sometimes the

convergence will be considered irrelevant because the hearer does not attach the same importance to the system as does the speaker, or because the convergence is regarded as [being] without significance" (p. 472). Thus, their second proposition states: *The more significant the points of convergence are to the audience, the stronger the claims.*

As the swirl of interacting arguments spontaneously expands during a crisis situation, perceived convergence may evolve. Observers will continue to recognize and consider new claims that may or may not support the convergence seen earlier in the crisis. Perelman and Olbrechts-Tyteca (1969) explain this ongoing interpretation as a manifestation of the informal context in which public debate or discussion occurs. They explain, "in a nonformal system, an affirmation of convergence is one that can always be challenged, as it depends on the interpretation given to the arguments" (p. 471).

Proposition three. Thus, as the discussion of a contested issue evolves, the strength of converging arguments may change. Perelman and Olbrechts-Tyteca (1969) offer three tensions by which convergence may or may not foster trust in an audience: compatibility versus incompatibility, contrived versus genuine, and coherence versus incoherence.

First, convergence initially emerges from perceived compatibility of some claims shared by distinct parties. As arguments evolve, perceived compatibility can diminish. As a result, Perelman and Olbrechts-Tyteca note, "the convergence between arguments may cease to carry weight if the result arrived at by the reasoning shows up elsewhere some incompatibility which makes it unacceptable" (p. 472).

Second, the persuasiveness of convergence rests with its spontaneous and genuine alignment of claims over the lifecycle of a debate. If at any time the convergence is seen as contrived, its persuasiveness is lost. Perelman and Olbrechts-Tyteca (1969) summarize this reaction by explaining, "convergence also can cause mistrust: It may be feared that the new elements were arranged specifically in order to bring about the convergence" (p. 473).

Third, the "nonformal" system out of which message convergence emerges is imperfect (p. 471). Thus, observers expect some degree of ongoing disagreement. The volatility and uncertainty of crisis situations makes disagreement even more likely. Thus, complete convergence is likely to foster distrust. Perelman and Olbrechts-Tyteca explain this phenomenon: "because of the distrust felt for excessive coherence, a certain measure of incoherence is taken as a sign of sincerity and seriousness" (p. 473). Any of these conditions identified by Perelman and Olbrechts-Tyteca can make message convergence fleeting. This continuous interpretation process leads to the third proposition: *The strength of convergence may be modified as a result of a reflection about this very convergence*.

In summary, the message convergence framework illustrates the function of interacting arguments for audiences who observe competing messages. Convergence is seen as a potentially persuasive condition arising from the interaction of arguments.

The convergence process begins by the distinction of various sources participating in the public debate, advances to an assessment of those sources, and then evolves to the recognition of message convergence if such a convergence occurs in discourse. We turn next to the methods employed in this study.

Methods

The current study was funded by the National Center for Food Protection and Defense and the National Center for Risk and Economic Analysis of Terrorism Events to assess the ways in which individuals make decisions about food choices in the face of a food contamination crisis. Focus groups were employed as the primary means of data collection. Focus groups are meaningful because they allow for various perceptions and opinions to surface, and the persons in focus groups are "stimulated by the experiences of other members in the group to articulate their own perspectives" (Lindlof & Taylor, 2011, p. 174). The study consisted of eight focus groups conducted in several cities throughout the country including Little Rock, Arkansas; Memphis, Tennessee; Washington D.C.; Baltimore, Maryland; Silver Springs, Maryland; Detroit, Michigan; Dearborn, Michigan; and Lexington, Kentucky. A multiple-city approach was employed to attain geographic, racial, and socioeconomic diversity among participants. Focus groups lasted between 42 and 63 minutes.

Participants

Because the study focused on a simulation involving a contaminated food product served to children in a school setting, we sought to interview individuals responsible for food and nutrition choices within the home. To that end, we screened interviewees to verify that they made these food-related decisions. A majority of our interviewees were women, which is consistent with previous research, indicating that women are the primary decision makers for familial nutritional needs (Silk et al., 2008). In the current study, parents or caregivers of children and elderly adults were recruited to describe their experience in making decisions concerning food and nutrition in the wake of a food contamination. Both men and women were recruited to participate in the study through referral, or snowball sampling. Across the eight focus groups (N = 65), 52 of the participants (80.0%) were female while 13 (20.0%) of them were male. Additionally, 32 (49.23%) participants reported their race to be African-American, 20 participants (30.77%) reported that they were Caucasian, and eight participants (12.31%) reported that they were Arab Americans.

Data Collection

As per the approval of the Institutional Review Board, participants were asked to watch a series of three mock television broadcasts of a salmonella contamination of chicken in school lunch programs. Subject matter experts in food science at the National Center for Food Protection and Defense and in crisis communication at the Centers for Disease Control and Prevention (CDC) served as advisors in the development of the simulation. The mock broadcasts simulated actual news broadcasts occurring over a three-day period with information being obtained and disseminated to the public. In the clips, participants received messages from a television reporter, the CDC, the FDA (Food and Drug Administration), and the Poultry Association of America, concerning a realistic salmonella contamination. Some of the messages from various sources were complementary, while others were conflicting. Before showing participants the video clips, the researchers informed the participants that they were not viewing a real food contamination crisis, but rather a simulation of a broadcast following a food contamination.

Focus Group Protocol

After participants viewed the mock broadcasts, the focus group interviewees were asked a series of 15 questions. The interview protocol was designed based on the propositions proposed by Perelman and Olbrechts-Tyteca (1969) and extant crisis communication literature. All focus groups were asked the same questions from the established protocol. First, individuals were asked to discuss their primary sources for information (i.e. radio, television, newspaper, and interpersonal sources including family, friends, and neighbors) immediately following a food crisis. Next, questions focused on the sources that participants saw as most credible, both in the simulation and in their daily lives, were posed. Participants were also asked if they could identify points of convergence in the simulation and discuss the degree to which these points of convergence were or were not influential. Participants were again encouraged to discuss the perception of convergence and its persuasiveness in their daily lives as well. Finally, participants were asked to identify points where divergence or disagreement occurred in the three stories. They were also prompted to discuss the degree to which their perceptions of actual crises evolve over time. Focus group participants were assured of their confidentiality as outlined by the Institutional Review Board. Each interviewer was granted permission to digitally record the focus group conversations. At the conclusion of each focus group, participants were given a 10.00 gift card for participating in the study.

Data Analysis

The focus group recordings were transcribed verbatim and edited to remove all identifying information of the participants. The scholars analyzed the transcripts through the framework analysis technique (Ritchie & Spenser, 1994), an approach that allows for inclusion of both *a priori* as well as emergent concepts during the data analysis phase. The framework analysis technique aligns closely with Lindlof and Taylor's (2011) "etic analytic view" approach to qualitative data, which allows the researcher to evaluate qualitative data "through the conceptual categories provided by

our disciplinary knowledge and theory" (p. 95), while "remaining open to new constructs, contradictions, and negative cases" (Iverson & McPhee, 2008, p. 181).

The analysis entailed reading the transcripts multiple times to become familiar with them. The authors met initially to discuss recurring themes and key concepts present in the transcripts. Based on the propositions proposed by Perelman and Olbrechts-Tyteca (1969) and literature surrounding argumentation and crisis communication, the authors established coding categories for the data. We also developed operational definitions for the constructs of convergence, divergence, mutual exclusion, congruence, dominance, and contrived convergence.

Based on the determined coding categories, the three authors coded the transcripts separately. The authors employed the coding categories to structure the emerging themes into factors surrounding convergence of information in the midst of a food contamination crisis. The authors met again to discuss the ways in which they coded the transcripts based on the established categories. Disagreements in coding were resolved through discussion.

Finally, the first author organized themes and *in vivo* quotations into the paper, and the second author assessed the structure of the paper. Any disagreements in the presentation of themes or quotations within the paper were resolved through discussion.

Although no overarching contradictions to the convergence framework were noted, some nuances in their interpretation were evident in the participants' comments. To illustrate the richness and range of responses provided by the participants, a small number of examples to represent the recurring themes are provided. These examples are shared in the discussion of each of the three propositions presented in the following section.

Results

Overall, coding the transcripts revealed support for all three proposed theoretical propositions. This section is organized so that the findings are reported under message convergence proposition headings. In this results section, we provide representative examples of statements from focus group participants.

Convergence in the Claims made by Distinct Sources

Perelman and Olbrechts-Tyteca's (1969) first proposition establishes that audiences consider the credibility of the sources whose arguments converge or diverge. Simply put, less credible sources are less influential. To explore source credibility, participants were asked to describe the sources they considered credible during a crisis situation. Consistent with the diversity present among the focus group participants, individuals reported seeking information, either actively or passively, from a variety of sources to obtain information concerning food-related crises. Participants recounted seeking information from sources including national

television networks, local television networks, National Public Radio, local radio stations, family members, friends, family physicians, supermarkets, and local churches. When participants discussed seeking information from online sources, individuals reported that they had accessed information from the websites of major news networks (including CNN, MSNBC, FOX, and YAHOO), the CDC website, and the FDA website. Additionally, participants articulated that they perceived social media networks, including Facebook and Twitter, as viable sources for obtaining information. Participants explained that they were exposed to information from one source, such as a national television network, and as a result sought additional information from other sources.

Focus groups participants revealed their distinct source preferences for obtaining information during an unfolding crisis, and in particular, a food contamination crisis. Additionally, participants acknowledged that more often than not, information from multiple sources led to a better understanding of the situation.

The focus group participants generally preferred federal regulatory agencies over other types of information sources. For example, a participant from Dearborn articulated her conception of credibility by stating, "I would believe the FDA, whatever they say before I would believe the poultry people. Just because they're the FDA. That's the way my mind thinks." Participants categorized government sources as some of the most trusted for reliable information, though some participants maintained their skeptical attitudes toward government entities. In seven of the eight focus groups, most participants voiced a distinct preference for the CDC to any other federal regulatory agency. Specifically, when discussing a food contamination crisis, 31 individuals reported that they were more likely to trust the CDC for obtaining information while only seven participants tended to trust the FDA more than the CDC. Participants believed the researchers at the CDC were more credible than other sources, that their information is more precise, and, as a whole, participants felt more comfortable adhering to recommendations from the CDC. A participant from Lexington described her reasons for preferring the CDC:

I've had salmonella [poisoning] before and the CDC has very, very accurate information about that. They tell you how to treat it...where it's more likely to affect people in different regions of the country. I just see the CDC as a more viable kind of website. They give you more information and more resources.

One participant from Washington D.C. explicitly stated that he considered the CDC researchers the most credible experts: "I go to the experts. The experts, for example, [at] the CDC or ... experts that they talk about. I am more tempted to believe the experts." Thus, governmental regulatory agencies were considered credible sources.

The perceived expertise of government agencies was consistently revealed among participants in all of the focus groups. Eight study participants articulated that they were apt to trust both the CDC and the FDA equally. Seven participants expressed their indecision concerning whom they would tend to trust more. Alternatively, 12 participants articulated that they were unlikely to trust information from federal government sources, regardless of the entity.

Overall, respondents perceived organizations with a vested monetary interest in the crisis as less credible. In viewing the video clips, a participant from Lexington clearly explained this distinction between the public and private sectors:

And I think that when I hear the Poultry Association making a statement, I might listen to that with a little more, well, they have a vested interest in this. That would be something that, 'okay, I hear what they're saying, and we'll just see.' But that would be my first thought: that they really have a vested interest in this. This is their livelihood.

Because of the financial connections of organizations operating in industries involved in the crisis, the organizations were viewed as less credible by respondents than the government agencies.

Significant Points of Convergence for the Audience

Perelman and Olbrechts-Tyteca's (1969) second proposition observes that audiences recognize and actively seek out points of convergence when exposed to multiple arguments. This commitment to recognizing convergence is dependent upon the degree to which the audience sees the convergence as significant to them. Participants in the study shared similar approaches to seeking out, considering, and recognizing points of agreement or overlap in arguments. They also consistently indicated that in simulation and in actual crises, these points of convergence are significant.

One participant from Silver Springs claimed that when deciding upon a course of action in the presence of risk, she looks for points of consistency. She stated:

I am going to listen to what I'm hearing the most. You know, like what is common between what everyone is saying. So if I'm watching ten different things and eight people are saying "Wash your hands every five minutes," then I would probably be more prone to wash my hands every five minutes.

The participant articulated that when hearing specific arguments resound multiple times across multiple sources, she is more likely to participate in the advocated action by the diverse sources. Similarly, when asked about how he would handle informational contradictions following a food contamination crisis, one participant from Little Rock stated, "I think I'd probably look for overlap. If everyone's saying the same thing, then I could probably trust that one thing. And then I would seek out information about the rest of it." Thus, participants reported that hearing a message multiple times from different sources is convincing.

In his discussion of overlapping messages, one participant from Baltimore described his use of multiple forms of media in the presence of risk. He stated:

On YouTube, everyone's a reporter now. So if I go on YouTube and I'm seeing these videos popping up, I might watch one and pay attention to where they're getting their information from. And then... get on Facebook or Twitter, and usually you'll see something that correlates to what you saw on YouTube. And then go to the headlines and you'll see a headline that correlates with all three.

The participant revealed that he intentionally seeks diverse sources and looks for similarities among the sources or information that is "correlated" among them all. Thus, he looks for overlaps in the messages to obtain a more comprehensive picture of the crisis story and to determine which of the arguments surrounding the crisis he will believe.

Similarly, a participant from Little Rock stated, "I always check multiple news sources and see what was consistent in each of those stories from each individual news source." This statement is a testament to the premise that individuals do not simply rely on one source of information for their decision making, but instead, consider the influence of a number of sources that aid in creating a comprehensive understanding of the crisis.

A focus group member from Memphis articulated that a "consensus" should emerge from diverse sources. Specifically, when individuals are trying to make decisions concerning food in the midst of a contamination crisis, the participant stated, "I think starting to hear a consensus from the sources helps. Like in the news reports, it seems that the consensus was that this [contamination in the video simulation] was really not a terrorist attack. It's really not likely." Another participant from Washington D.C. reflected that during the simulation, she drew upon the convergence of messages claiming that the terrorist threat in the food contamination simulation videos was a hoax. She said that she initially thought, "Oh wait it might really be true, but I thought, no, I've already heard from several other sources that this is not likely. So starting to hear a consensus would help me make a decision." The presence of consensus among diverse sources may be a powerful force in an individual's decision-making processes.

Participants also focused much of their discussion on the inherent presence of contradictory messages in the wake of a food contamination crisis. Consumers are familiar with the often tempestuous nature of media reporting in the wake of a crisis. For example, during crises, information is generated quickly, updated constantly, and incorrect information is typically debunked in a timely manner. A Baltimore focus group member articulated his familiarity with the perpetual flux of messages as a means of discerning meaning during a crisis:

Another precaution that may sound simple is don't believe everything you hear. If you switch the stations over, you'll find contradictions. You turn to different stations, you'll get 20 different forecasts... so somewhere between the exaggeration and the sensationalism, you'll find the truth. You have to discern it ultimately for yourself.

Consumers do not merely rely on one source to gauge their understanding of the crisis at hand, they report suspending any actions concerning the food contamination until additional sources contribute to the crisis discussion. Once additional sources have weighed into the discussion and the organizational entities have released more information concerning the event, stakeholders are able to glean converging arguments from multiple sources. Observing this convergence engenders a comprehensive understanding of the crisis.

Reflections on the Perceived Strength of Convergence

Perelman and Olbrechts-Tyteca's (1969) second proposition asserts that as an argumentative situation (in this case a crisis event) evolves, so too does the audience's perception of convergence and its strength. As arguments evolve, opposing sides are able to provide rebuttals that challenge the claims made earlier in the crisis. Perelman and Olbrechts-Tyteca cogently state, "what for one side is the end of the debate is for the other merely a step toward a later conclusion" (p. 461). When asked how they interpret emerging contradictions, participants in every focus group articulated a strategy of waiting and allowing more information and additional sources to enter the crisis arena before making final decisions. One participant stated, "I wait, I give time, I listen, and then I wait a day or two and, of course I am being cautious in the situation, to hear what the general consensus is after a few days." Participants revealed that they engage in a pattern of waiting in the midst of various types of crises, including food contamination crises.

The act of waiting for additional information to emerge before solidifying one's beliefs is consistent with Perelman and Olbrechts-Tyteca's (1969) discussion of the compatibility of arguments. Although some arguments appear to be compatible when they first emerge, participants voiced that after several hours, days, or months, additional information and sources can enter the crisis narrative and disempower the previously overlapping messages, rendering them incompatible. For example, one participant from Memphis claimed, "I seek out the information and look for a common thread, but with the knowledge that maybe the whole story isn't in yet. I would tend to be a little more careful until we know a little bit more." This participant acknowledges that over time, messages that appear to overlap in the early stages following a crisis may not continue to converge as the crisis narrative unfolds and evolves. The uncertainty present at the outset of a crisis gave this participant a reason to exercise patience in arriving at a final conclusion about the crisis.

Another focus group participant from Little Rock clearly articulated the importance of waiting, especially given the amount of information presented to stakeholders during a crisis:

But again, it is a matter of waiting. You have to get all of the information, and it comes so quickly now, it is hard to get it all. You know, and then to try to sit there and figure what is best. Sometimes the best thing is to stop and don't send your kids [to school with a packed] lunch, give yourself some time, and then you're more empowered that way as well because you are making the decision... but [news sources and industry leaders] are telling you as much as they can, whether they are accurate or not, and you just have to make up your own mind.

The act of waiting before making decisions or taking action allows individuals to assess whether or not their initial perceived convergence will remain compatible or if additional sources and experts that enter the crisis argument may thwart the initial perception of interacting messages.

Individuals acknowledged that their decisions concerning food contaminations were not simply derived from one source, but rather from a coalescence of meaning.

Thus, the waiting period provided additional time for other potentially legitimate sources to weigh into the discussion. As one participant from Silver Springs commented, "Well sure. Some made more sense than others, but all of the sources can be wrong from time to time. So you compile your decision of a kind of preponderance of evidence from difference sources." This statement reinforces the premise that consumers do not simply rely on one source for information, but condense a number of sources into one comprehensible and manageable assessment of the crisis. In terms of message convergence, observing the evolution of arguments provides a greater understanding of the consistencies and overlaps among the interacting arguments.

Disbelief as a result of overlap. Participants also acknowledged that when messages overlap, especially from particular sources, individuals are less inclined to believe the overlapping information. This finding was true concerning the information from major industries and governmental instructions; messages from particular sources made individuals feel less inclined to believe the presence of convergence. For example, one participant in Baltimore shared that when reflecting on crisis messages from government entities, she felt manipulated when information from multiple government entities espoused similar messages. She stated:

They want us to feel *this* way. They want us to feel like little sheep running back and forth, and I began to resent it. So don't tell me about terrorists unless it's something you know because otherwise I feel like I am being manipulated.

Another participant from Detroit, when discussing the seemingly contrived convergence of information during crises, discussed her perception of the overlapping messages during the H1N1 crisis:

It was money. It was all about money. I am sure that they [corporate America] probably made millions of dollars off of that H1N1 and they are still making money off of that. Wal-Mart, Kmart, and all of the grocery stores participated in it.

Clearly, when speculation that an organization's emphasis on convergence is contrived, the effectiveness of its argument dwindles.

Participants displayed consistent willingness to wait for the best information available in a crisis situation. They also recognized that over time, the strongest arguments, including those with clear convergence among sources, can diminish as further information is revealed.

Discussion and Implications

The current study presents exploratory research findings that focus on the ways in which individuals make sense of competing information in the midst of a food contamination crisis. The framework of message convergence provides a perspective for understanding how individuals seek and manage information in the midst of crisis situations. The discussions in the eight focus groups generated substantial support for Perelman and Olbrechts-Tyteca's (1969) initial propositions of message

convergence. Perhaps, more importantly, the findings invite consideration of how convergence can be applied ethically and strategically by crisis communicators.

True to their foundational objective, Perelman and Olbrechts-Tyteca's (1969) message convergence framework is realistic in that it accounts for the fact that audiences receive multiple messages from diverse sources simultaneously. This condition is intensified as multiple sources seek to resolve the uncertainty inherent in crisis situations. Participants in this study displayed a capacity for contemplating the credibility of multiple sources concurrently. Specifically, respondents valued neutral or independent sources, questioned organizations with a financial stake in the crisis, and considered past experience with sources as dimensions of credibility.

In considering the first proposition, participants expressed source credibility as a primary means of resolving the "contest among multiple voices" typical in crisis communication (Heath, 2009, p. 21). Interestingly, a preference for the CDC remained commonplace even at the point in the simulation where the FDA and CDC showed convergence in their messages. The visibility, impartiality, and well-known dependence on the appropriate application of the scientific method made CDC the favored information source. This finding suggests that in cases where source creditability is extremely high, the CDC is an audience preferred source throughout the convergence process.

This merited trustworthiness was not the case, however, for the poultry organization featured in the simulation because that company was frequently categorized within a broad list of organizations with vested financial interests. Findings offer further support for scholars who contend that the potential an organization has to favorably influence the outcome of a crisis depends largely on the extent of its ability to establish a visible and credible reputation prior to the crisis (Anthony & Sellnow, 2011b; Coombs, 2012).

The second proposition focused on the degree to which audiences recognized and established significance to converging arguments. The participants consistently indicated that they actively seek out multiple sources during crisis events. Most participants were able to distinguish points of convergence in the simulation data provided. Furthermore, many of the participants looked for points of consistency among various sources, and some also mentioned comparing various traditional sources to discern points of overlap. Others used social media as a primary resource for actively seeking out points of convergence and divergence among the myriad sources available through the Internet. This finding indicates that audiences actually create their own pluralism by assertively seeking information from multiple sources available to them through various mediums. Many of the participants in this study revealed that their adherence to recommendations during a crisis depends upon the degree to which they are able to recognize convergence among multiple sources.

Our findings further suggest that audiences are active in seeking information to test or verify the personal relevance of new findings. As Perelman (1979) explains, audiences realize that in times of uncertainty such as crises, perfect solutions are not attainable. Rather, reasonable "human solutions—acceptable but capable of being changed and improved" are all that can be derived (p. 79). Thus, observing the

evolution of created human solutions, based on the convergence of multiple sources, is a means by which audiences can determine their best plan for self-protection. Actively observing this progression is vital because new revelations and shifts in actions recommended for self-protection are a natural part of a crisis lifecycle.

The third proposition explored in this study focused on the ability of the audience to continuously assess points of convergence and their veracity as crises evolve. Participants consistently indicated that they avoided rushing to judgment when considering the multiple arguments surrounding crises. A frequent comment was that participants remain "in waiting" the most accurate account of the crisis and of the best actions to take to protect themselves. The frequency of the "in waiting" theme reveals that individuals understand that multiple sources must weigh in before they make their nutritional decisions during a food contamination crisis.

The findings offer reassurance that pluralism is not lost throughout the course of a crisis debate. Regardless of source or medium, participants consistently mentioned a willingness to wait, listen, and consider alternate interpretations as the crisis progressed. In their third proposition, Perelman and Olbrechts-Tyteca (1969) explain that convergence exists in a fluid state. They explain, "the convergence between arguments may cease to carry weight if the result arrived at by the reasoning shows up elsewhere some incompatibility which makes it unacceptable" (p. 472). The respondents in this study displayed a willingness to consider new evidence, take into account the underlying motives of sources, and to thereby adapt their interpretation of the crisis. From the standpoint of pluralism, a lone dissenting voice may be the impetus for stimulating an audience to reconsider the emerging convergence they observe. Preservation of pluralism is essential to combating attempts by any source to create a contrived sense of convergence. Perelman and Olbrechts-Tyteca indicate that such contrivance is detectable and distasteful to audiences. Without this ongoing scrutiny, audiences could fall victim, not only to manipulation but also to failures in reasoning such as groupthink (Janis, 1971; Tompkins, 2005). The hope is that audiences will scrutinize convergence with the same intensity as any single argument. In doing so, the vulnerability of a dramatic failure in reasoning can be avoided.

Practical Applications

Combined, the findings associated with the three propositions indicate that as crises unfold, audiences engage in a thoughtful process of considering the credibility of multiple sources offering information and recommendations, actively seek points of convergence in determining the veracity and personal relevance of the claims, and recognize that the conclusions or solutions offered may give way to more accurate deductions and advice in the future. Thus, audiences accept the pluralistic nature of communication in extended crisis situations and display the ability and willingness to engage in what Kahneman (2011) calls System 2 thinking, where audiences devote "attention to the effortful mental activities" needed to slowly consider complex situations (p. 21). Comparatively, System 1 thinking results in perceptions formed "automatically and quickly, and with little or no sense of voluntary control" (p. 20). With this capacity in mind, several practical applications can be derived from the message convergence framework.

- Organizations and government agencies can ideally serve as "honest broker[s]" of risk information for stakeholders (Horlick-Jones, Sime, & Pidgeon, 2003, p. 283). The greater extent to which organizations and agencies can establish neutrality and appropriate use of research methods, as is the case with CDC, the more likely the information they share will be perceived as credible.
- Audiences actively seek both convergence and personal relevance of risk information during crises. The messages shared by agencies and organizations can contribute to that process by emphasizing the level of risk for specific audiences. Venette (2008) explains, "an audience may fully recognize and even endorse the arguments provided by an expert or authority," but the audience members are unlikely to adhere to the recommendations if they do not "internalize the probability of negative consequences" (p. 200).
- Audiences accept the complexity of crisis situations and acknowledge that the conclusions and even recommendations may change over the lifecycle of the crisis. Accordingly, agencies and organizations should not feel overly rushed to reach a final conclusion. Accepting uncertainty is a far better strategy in risk and crisis communication (Seeger, 2006).
- Finally, organizations and agencies should avoid intentionally misleading audiences via contrived convergence. The findings in this study suggest that audiences are sensitive to bias and are likely to detect such deceptions sooner rather than later.

These applications are pertinent to individuals, organizations, and government agencies responding to crises. Crisis events are, by nature, equivocal and lead to multi-sourced messages, but findings from this study illustrate that audiences have the skills and patience to navigate converging and diverging information.

Limitation and Future Research

The primary limitation of the study concerns the level of access participants had to diverse information sources. The participants in the study indicated that they are able to gather information from multiple sources through various mediums. Much of what we found in this study depends on access to a plurality of sources. This sample fails to account for those who, for many reasons, may not have regular access to traditional and nontraditional sources of information. For example, Lachlan and Spence (2011) explain that "underserved communities such as the poor, recent immigrants, and ethnic minorities" are particularly vulnerable to crises (p. 448). In part, this vulnerability is based on a lack of access to effective information. Future research should focus on underserved populations in order to better understand their access to and consideration of multiple sources of information during crises.

In addition, this study reveals that future research should consider the influence of psychological factors such as emotion on message convergence. For example, Slovic (2000) observes that highly emotional examples can result in audiences overestimating risk. Similarly, Westerman, Spence, and Lachlan (2012) note that highly graphic images and terminology can cause audiences to oversimplify a crisis situation to a point similar to what Kahneman (2011) characterizes as System 1 thinking.

Another area worthy of future study is the emerging sources of risk and crisis information. For example, some participants stated that they were often notified through their grocery store of a recall based on the customer rewards cards that track the products purchased by consumers. Perceptions of such a notification system should be considered. Further inquiry into social organizations from which individuals receive information may also be helpful in determining what types of information is disseminated by organizations and digested by consumers during times of crises. For example, some participants indicated that they received information about current events from their churches. If information concerning food safety could be disseminated to local churches and then announced from the pulpit by a trusted minister, at least those consumers who attended church could have a heightened understanding of food safety issues.

Conclusion

Message convergence provides scholars a lens for understanding the tempestuous nature of message dissemination and information seeking after a crisis. As stakeholders are bombarded with information from many sources (Sellnow, Ulmer, Seeger, & Littlefield, 2009), message convergence reveals that multiple arguments interact to form a meaningful understanding of the crisis for stakeholders. Organizations and managing agencies involved in food contamination crises must respond to stakeholders in a timely manner so that stakeholders may understand the crisis and protect themselves. Whether the crisis is a case of *Enteritis Salmonella* in a school lunch program or some other disaster, stakeholders need timely information, especially from trusted and reputable organizations, to help them understand their susceptibility to the crisis and to make "enlightened choices" (Heath, 2009, p. 36).

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Case Studies in Crisis Communication

RIGHT LESSONS LEARNED ABOUT PROTECTING AMERICA'S FOOD SUPPLY

Edited by Timothy L. Sellnow and Robert S. Littlefield



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Foreword

This monograph is funded by North Dakota State University's Food Safety Risk Assessment Grant with the United States Department of Agriculture's Cooperative State Research, Education, and Extension Service. The work was further guided by North Dakota State University's Great Plains Institute for Food Safety http://www.ndsu.nodak.edu/foodsafety/ and the North Dakota State University Risk and Crisis Communication Project http://risk-crisis.ndsu.nodak.edu/index.html.

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> T.L.S. R.S.L.

Chapter 1 Introduction

VER THE PAST DECADE, crisis and risk increasingly have become a common part of most conversations and daily life. While much of the public's attention has focused on security issues and the eradication of terrorism following the attacks on September 11, 2001, the food supply also has drawn considerable attention due to its impact on consumers, producers, and policymakers at all levels. One area of this interest focuses on accidental food contamination; that is, the tainting of food occurring naturally within the food system. The other focus centers on deliberate actions that are taken by individuals, groups, or companies to modify or contaminate the food supply.

Regardless of whether contamination is intentional or accidental, food safety is a primary concern. The Centers for Disease Control and Prevention

Adaptation is central to organization learning; in that, as an organization or group experiences a crisis, new understanding is gained requiring accommodation and the replacement of concepts previously held by those affected by the crisis. estimate that 76 million cases of foodborne illness occur annually in the United States alone. Of the 76 million cases, approximately 325,000 are so severe that the victim must be hospitalized; and sadly, 5,000 people die due to foodborne illnesses every year (Centers for Disease Control and Prevention, 2005). Combining these statistics with the threat of intentional terrorist contamination reveals the compelling need for understanding effective crisis communication strategies in the food safety context. Since food safety is a major concern for everyone, when facing a crisis outbreak caused by accident or intentional actions,

the response strategies undertaken by managers who are dealing with these crises have the potential to inform and instruct others who find themselves in similar crisis situations. This collection of essays identifies best practices in crisis and risk communication with a focus on public relations, communication ethics, the urgency of dissemination, and the need for efficiency. In addition to identifying the best practices, this collection enables various publics who may be in crises to review and consider the responses and lessons learned by those with first-hand experience in dealing with similar situations.

Organizational Learning

To better understand the case studies identified in this collection, a review of theories related to crisis and risk communication is useful. Because we approach these cases looking for the strategies and practices used by individuals to deal with and communicate about crises, the concept of organizational learning is central to our understanding. Organizational learning is drawn from general systems theory. That is, just as all variables influence each other in a system, when a crisis occurs in an organization, every aspect of the entity is affected.

Seeger, Sellnow, and Ulmer (2003) describe organizational learning as "both the process whereby members acquire new knowledge, responses, or skills and the systemwide modification of culture, procedures, and practices" (p. 36). As individuals within organizations observe the pre-crisis, crisis, and post-crisis events as they unfold; they evaluate the viability of particular strategies, determining those to be repeated and those to avoid in future similar situations. Adaptation is central to organization learning; in that, as an organization or group experiences a crisis, new understanding is gained requiring accommodation and the replacement of concepts previously held by those affected by the crisis.

Organizational learning is particularly important in post-crisis contexts because managers want to know what happened, why the crisis occurred, and what strategies will preempt similar crises in the future. Organizations that have a common perspective about the importance of adapting to changes brought on by a crisis, the willingness to plan for future crises, and the vision to view moving through a crisis as a chance for the creation of a renewed sense of purpose can be characterized as learning organizations (Senge, 1990).

Huber (1996) provides an explanation of the stages organizations experience as they establish their identity through the learning process. These stages include:

- Acquisition of knowledge.
- Distribution of information among various sources.
- Interpretation of information when commonly understood interpretations are available; and
- Storing of knowledge for future use, in organizational memory. (pp.124-127).

Seeger et al. (2003) extended Huber's analysis, suggesting that learning involves higher level interpretative and institutionalizing processes (p. 40).

This is where mindfulness enters the organization. As members of the organization become more aware of effective crisis management strategies, they become conscious of how their statements and actions influence their perceived success or weakness in managing a crisis. Organizations that do not learn from Since food safety is a major concern for everyone, when facing a crisis outbreak caused by accident or intentional actions, the response strategies undertaken by managers who are dealing with these crises have the potential to inform and instruct others who find themselves in similar crisis situations.

their mistakes will fail, while those who become mindful of their mistakes and seek a renewed perspective will likely endure.

The Case Study Approach

One of the best ways to learn about various communication strategies for responding to a crisis is to study of how a number of different entities dealt with the unique aspects of their crisis situations. This commonly is called the case study approach to research. Case studies have been widely used when examining crisis situations due to their descriptive and interpretive functions. The benefit of this collection of cases is the opportunity for readers to compare and cross-apply the best practices to different crisis situations.

For our purposes, we propose that the case study method is both an approach to research and a choice of what to study (Patton, 2002). As researchers, we used a common framework for analyzing the data available from public communication and the media in the construction of the case studies, thus acknowledging the methodological emphasis. Concurrently, the essays we chose to include represent individual cases whereby lessons were learned and best practices isolated and studied. We approached the case studies holistically and individually. Within the broader context of food safety, the crises were studied as organizational responses to accidental or intentional contamination. As an individual crisis, each study included context-sensitive information reflective of how the organization responded.

To provide clarity, each case study was written to include common elements that would provide comparable information for the reader to follow. These included:

- General introduction, with a research question specific to each case,
- · A chronological timeline and brief scenario for how the crisis

developed using pre-crisis, crisis, and post-crisis parameters,

- The database comprised of printed material drawn from media available to the public,
- Common method for presenting data and analysis that involved describing, interpreting, and evaluating the practices used in each case,
 - Conclusions to be drawn from the failures, successes, and lessons learned, and

In this case, our goal is to provide consumers, producers, and managers of the food supply with a collection of case studies where best practices and lessons learned can be identified, providing readers with insight into ways to successfully manage crisis and risk in the future. Implications for best practices.

From a research perspective, this format provided for consistency across the different studies. For example, there were categories for analysis, a timeline of the crisis, and lessons learned. The information for the case studies in this collection was drawn from public media, providing the reader with comparable data to analyze.

Six Cases of Crisis Communication in

Food Safety

Denzin and Lincoln (2000) suggest that, "perhaps the most unique aspect of case study is the selection of cases to study" (p. 446). In this case, our goal is to provide consumers, producers, and managers of the food supply with a collection of case studies where best practices and lessons learned can be identified, providing readers with insight into ways to successfully manage crisis and risk in the future. Each case study is unique in its area of contamination, the agent, the product, and how the organization or community responded. The first four cases describe accidental contamination (three involving company responses, one examining an interagency response), while the last two cases illustrate intentional modification with different intended results (one company-driven modification to increase food production, the other prompted by a cult seeking to influence local politics).

"Social Responsibility: Lessons Learned from Schwan's Salmonella Crisis," by J.J. McIntyre, examines the role of social responsibility during Schwan's salmonella outbreak. The study used newswire and major newspaper articles to construct a case study identification to establish both the crisis and post crisis description of events surrounding the nation's largest single vehicle outbreak of salmonella enteritidis. An analysis of Schwan's crisis displays a lack of industry vigilance, probably responsible for the outbreak. Schwan's maintained legitimacy through the crisis and demonstrated a high degree of social responsibility in its use of corrective action that mimicked Johnson & Johnson's handling of the Tylenol crisis.

Lisa Sjoberg's chapter, "Chi-Chi's Crisis: Lessons Learned Through the Use of Organizational Apologia," examines how external agents affect organizational apologia. Approximately one hundred newspaper articles were gathered to generate a case study of the Chi-Chi's organization and its Hepatitis A outbreak. After rhetorically analyzing the case study, it is evident that Chi-Chi's spokespeople were effective in their use of apologia because they used a justificatory approach to manage the external agents that affected the crisis. While their apologia was effective overall, a more upfront approach with various constituents would have improved Chi-Chi's response to this social legitimacy crisis.

"Jack in the Box: Lessons Learned by Accepting Responsibility," by Robert

S. Littlefield, explores the pre-crisis, crisis, and post-crisis phases of the 1993 E. coli outbreak at the Jack in the Box restaurants in the Seattle, Washington, and surrounding areas. Theoretical insight drawn from organizational learning theory and the development of a Crisis Management Plan suggest that corporate managers could have improved communication with various stakeholders and acted more systematically to frame, oversee, and track their responses to the crisis.

The chapter, "Crisis Plans and Interagency Coordination: Lessons Learned

from Tainted Strawberries in the School Lunch Program," by Julie M. Novak, highlights the importance of pre-crisis planning with appropriate stakeholders through an exploration of a 1977 Hepatitis A outbreak in the National School Lunch Program. When multiple agencies at many levels are responsible for protecting

When multiple agencies at many levels are responsible for protecting the health and wellbeing of school-aged children, prior planning facilitates efficient and effective coordination.

the health and well-being of school-aged children, prior planning facilitates efficient and effective coordination. Review of this crisis provides for lessons learned and optimal development and updating of preparedness and crisis planning.

Response to the diffusion of genetically modified wheat is the subject of Agnes N. Lyonga's paper, "Monsanto's Genetically Engineered Wheat Crisis: Lessons Learned from Faulty Diffusion Strategies." On 30 July 2002, Monsanto pulled back its stated timeline for bringing the first genetically engineered wheat to market by 2005 and announced on 10 May 2004, that it was dropping plans to commercialize the crop after spending seven years and hundreds of millions of dollars researching and developing it. The data used for this study were online newspaper articles, Monsanto annual reports, and other on-line reports on food biotechnology research. After a long struggle to impose GE wheat onto its stockholders, Monsanto finally realized that there was no need/ problem that necessitated its innovation, especially with the increased public awareness, global fear, and outrage concerning genetically modified organisms (GMOs).

"Biological Terrorism and the Local Community: Communication Needs and Response," by Patric R. Spence and Kenneth A. Lachlan is an exploration of intentional food contamination, and focuses primarily on the Bahgwan Shree Rajneesh cult in Wasco County, Oregon. In 1981, cult members attempted to influence the outcome of a local election by contaminating salad bars in local restaurants. They conclude by suggesting that contamination of the food chain may occur at a variety of points in the system, with the result compromising the faith of the public in the security of the food supply.

The afterword, "From Food to Fork: Communication and Best Practices in Food Safety," by Matthew W. Seeger, offers an explanation of the factors causing an increased awareness of food contamination outbreaks, and a call for organizational learning and mindfulness as more occurrences of accidental and intentional food contamination appear in the future.

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Chapter 2

Social Responsibility: Lessons Learned from Schwan's Salmonella Crisis

J. J. McIntyre North Dakota State University mall businesses are a vital part of our nation's economy; however, a few entrepreneurs are not content to remain small. These ambitious spirits possess a drive enabling them to grow their local businesses into empires. These local giants' unique foundations set them apart from the corporations explored in this book.

Privately-owned companies operate in a cohesive manner, often relying on close family ties and local stakeholder vestment. The large base of support, coupled with the benefits of a company status,¹ creates a unique social and communication perspective. When a crisis occurs, multiple groups are affected, and this study will examine how a company copes with the adversity of a crisis situation.

Schwan's, a family-owned and operated company based in Marshall, Minnesota, is a major player in the local, national, and global food industry. In 1994, Schwan's was faced with the largest common vehicle salmonella outbreak in history (Hennessy et at., 1996). This study will examine how Schwan's dealt with the crisis and discuss the lessons that can be used to construct best practices for company practitioners.

Research Questions

How did Schwan's maintain legitimacy through the salmonella outbreak and act in a socially responsible manner? What specific actions did Schwan's take during the outbreak that were not only seen as legitimate but considered socially responsible and why?

Crisis Timeline

Schwan's has hit a few bumps on the road to success. The company has met and overcome at least five potentially devastating incidents: a flood in the 1950s, a fire in 1970s, razor blades in pizza packaging in the 80s, and the death of company owner Marvin Schwan in 1993, a year before the salmonella outbreak.² This study will concentrate on the most recent and most severe of the exigent situations, the salmonella enteritidis outbreak of 1994, when the company's cumulative crisis experience was put to the test.

7 October 1994	Schwan's is notified of a possible connection
	between their ice cream products and a salmonella
	outbreak.
	Marshall plant is closed and a recall is issued.
12 October 1994	Schwan's ice cream is positively linked to
	salmonella.
29 October 1994	Schwan's announced safety improvements that will
	be implemented to prevent future contamination.
14 October 1994	Initiated free hot line and medical testing.
7 November 1994	Marshall plant reopened.
3 February 1995	Schwan's reached a tentative agreement with the
	class-action lawsuit.
30 August 1995	Settlement approved by the court.
18 October 1994	Schwan's cleared of all wrongdoing.

Theoretical Underpinnings

To gain deeper insight into what happened to Schwan's during its national crisis it is beneficial to examine some of the existing literature on corporate

 $^{^{\}rm 1}$ Companies do not have to publicly disclose financial reports, nor do they need to worry about stockholders or stock prices during a crisis situation.

 $^{^{2}}$ Relatively little is know publicly about the crises mentioned, but a future exploration into the common threads of crisis management is certainly warranted.

responsibility. Schwan's is a privately-owned company and not a corporation. Nevertheless, its large size, multinational status, and diversity of products, services, and stakeholders justifies the use of existing corporate literature on social responsibility to describe, interpret, and evaluate its social actions.

The term corporate citizen is an apt description of a corporation's role in society. Social expectations, combined with legal rights and duties, illustrate the complex role of a country's citizens. Corporations and companies

are organizations that can be viewed as citizens of the countries where they conduct business (Tombs & Smith, 1995). The citizen paradigm provides a set of guidelines to use when choosing and evaluating appropriate behavior. For example, a company existing as a discrete entity is bound to act by the laws of the land or face a penalty fitting the crime. At the same time, laws give companies the legal rights and protection they need to operate—the same as an individual citizen.

A corporation has legitimacy if it is still operating, but socially responsible behavior must at least maintain legitimacy in order to be classified as socially responsible. The two terms are intimately intertwined and dependent on each other.

In addition to legal rights and obligations, a company is faced with establishing and maintaining social legitimacy with its stakeholders. Organizational legitimacy is the public-given right of an organization to exist. Legitimacy is similar to a popularity contest where the loser is told not to compete anymore. Metzler (2001) argues, "Legitimacy is based on the actions of an organization and responsible communication about them [the actions]" (p. 321). The dual responsibilities of maintaining legitimacy is a never-ending job for the public relations department and the management of an organization.

Tombs and Smith (1995) contend that corporations acting socially responsible must exceed the platform of legitimacy. Corporate responsibility and legitimacy are both judged on the merits of action and communication as described above; however, social responsibility "requires classification within a framework of acceptable corporate behavior" (p.136). A corporation has legitimacy if it is still operating, but socially responsible behavior must at least maintain legitimacy in order to be classified as socially responsible. The two terms are intimately intertwined and dependent on each other.

There are three types of corporate social responsibility which are viewed as increasingly responsible (Tombs and Smith, 1995): liberal, paternalist, and democratic.

- Liberal forms are concerned with following the basic rules of society, but assert the sole responsibility of the corporation is to follow the owners' wishes—which is usually to make as much money as possible within societal rules.
- Paternalist forms recognize the inclusion of stakeholders and the existence of a social contract between the corporation and society.
- Paternalist organizations will shift their practices to respond to current social callings; however, the interaction between the organization and its stakeholders remains circumscribed because the corporation determines the stakeholder's legitimacy to the process.
- Democratic forms of corporate social responsibility require transcendence from compartmentalized knowledge. This form also recognizes "the legitimacy of a plurality of views, voices and rationalities exists within the process" (p. 140). In this view, stakeholder participation is exponentially increased and the

responsibilities and direction of the organization are shared.

Each form of corporate social responsibility briefly described here does make necessary changes to maintain legitimacy. The differences between the forms emerge from their efforts to include multiple stakeholders in varied processes.

Method

Database

Major paper and newswire articles retrieved from the *Lexis-Nexis* Academic Database yielded 52 articles that were used to examine the events of the outbreak. The articles range in date from 7 October 1994 to 16 May 1996. Official responses from both the Schwan's company and participating government agencies were also taken from the articles. News articles were used in this study to demonstrate what the general public knew about the crisis.

Approach

Articles in the database were used to conduct a case study identification to construct the crisis- and post-crisis descriptions of the events surrounding the salmonella enteritidis outbreak. Quotations and other information used in this study were taken from news sources that were either the first to report the information or presented a more comprehensive account of the event. Accuracy of the statements made in early reports was checked by using later articles that supported the claim. General information about the Schwan's company was obtained from an academic search in Infotrac, *Lexis-Nexis*, the Internet (Google), and the Schwan's Company website.

Analysis

Pre-crisis

The Schwan's ice cream business was born out of necessity. In the early 1950's, the government put a price freeze on retail milk prices, but farmer's prices were left open to market demand. Caught between shrinking profit margins, the family business almost went bankrupt. Marvin Schwan, using his knowledge of ice cream production, had an idea to make ends meet. He bought an old 1946 Dodge van, loaded it up with 14 gallons of ice cream packed in dry ice, and went door to the area's farm families. When Marvin returned home that evening the van was empty and Schwan's home delivery was born (Schafer, 1995).

Marvin continued to demonstrate ingenuity and creativity in his business practices. For example, the cheese surplus in the 1980's resulted in the Department of Agriculture giving away huge stockpiles of cheese to public schools. Marvin saw an opportunity and took advantage of the situation by offering schools discounts on frozen pizza in exchange for the school's cheese allotments. The beneficial relationships developed into hundreds of school contracts. Eventually, the Schwan's company earned over 70% of the market share in the school market (Fritz, 1989). Frozen pizza and ice cream remain a cornerstone of the company; still, Schwan's continues to persist in a tireless pursuit of expansion.

Schwan's has continued to diversify and expand its business both in the United States and abroad. There are now three divisions in the Schwan Food Company and three additional subsidiary businesses that focus on alternate fuel injection systems, automobile insurance, and inbound/outbound customer phone service. The Schwan's company has also exploded into the global market, operating in over 50 countries, and selling many easily recognized food brands including: Tony's, Red Baron, Chicago Town, Freschetta, Pagoda, and Larry's (The Schwan Food Company, 2003b).

Indications of a problem began to surface when 67 confirmed cases of salmonella enteritidis infection were reported to the Minnesota Department of Health and an additional 14 cases were reported in the neighboring state of South Dakota (Slovut, 1994b).

Crisis

Schwan's resolve was put to the test on a Friday morning in October 1994. The Minnesota Department of Health notified Schwan's of a correlation found between a recent increase of salmonella enteritidis infections and the company's ice cream. The number of infections was much higher Produced in Marshall, Minnesota, Schwan's ice cream is typically distributed directly to consumers by delivery drivers in the 48 contiguous states.

than normal levels and health officials indicated the possibility of an outbreak emerging.

Salmonella is a bacterium that flourishes in moist foods such as poultry and dairy products. The cause of the salmonella infections was still not positively identified, but a strong link to the ice cream did exist: "Most of those infected have one thing in common: They ate ice cream manufactured at the Schwan's plant in late August or early September" (Slovut, 1994b). Some of those already infected by the bacteria were hospitalized with flu-like symptoms, but no deaths were reported.

Produced in Marshall, Minnesota, Schwan's ice cream is typically distributed directly to consumers by delivery drivers in the 48 contiguous states. The ice cream is not generally sold in grocery stores, but is carried by at least two Minnesota supermarket chains (Slovut, 1994b). After speaking with officials from the Minnesota Department of Health, Schwan's "agreed to stop manufacturing, distributing and selling ice cream from the plant until the source of the contamination has been found" (Slovut, 1994b).

The Minnesota Health Department acted immediately by issuing a statement to the public not to eat any Schwan's ice cream products. The health departments of other states and the U.S. Center for Disease control and Prevention (CDC) were notified of the situation. A hotline was established to answer consumer's health questions and arrange for testing people who had eaten Schwan's ice cream and displayed symptoms of salmonella. Later the same afternoon, officials from the state Health Department, U.S. Department of Agriculture (USDA), and U.S. Food and Drug Administration (FDA) began investigating the Marshall plant for a contamination source (Slovut, 1994b).

The next day, Schwan's held a press conference and issued a recall of all its ice cream products. Dave Jennings, spokesperson for Schwan's, was paraphrased as saying "his company had not been ordered by any health agency to recall its product but that production had stopped and all the company's ice cream would be held back" (Blackwood, 1994).

During the following week, Schwan's started to feel the gravity of the situation. Reports of salmonella poisoning increased dramatically across the continental United States and by Tuesday infections were linked to hundreds of reports in 14 states (Kuebelbeck, 1994a). Minnesota state epidemiologist, Michael Osterholm, stated the outbreak was "probably the single biggest food-

borne outbreak that I've been involved with in 20 years" (Kennedy, 1994d). Class action lawsuits were immediately filed against Schwan's, "alleging that their clients became ill because Schwan's failed to prevent or discover the salmonella" (Slovut, 1994b). By the end of the week, reports of possible salmonella cases again skyrocketed. The Associated Press reported, "Ice cream made in Minnesota is now blamed for thousands of suspected cases of salmonella in at least 35 states" (Kuebelbeck, 1994b). Jennings responded to the blossoming crisis by saying, "Will it hurt our reputation? Of course it will" (Kennedy, 1994d).

One week after Schwan's was informed of the crisis situation, the Minnesota Department of Health, believing enough information about the outbreak has been collected, closed its hotline (Slovut, 1994c). The same day, Schwan's established a new hotline for customers to receive information on a free salmonella test by their own physicians (Schwan's to pay for customer tests," 1994). Schwan's paid the medical bills for all concerned consumers.

Meanwhile, Schwan's made an attempt to keep customers in ice cream. The company temporarily moved its ice cream production to the Wells Dairy facility in LeMars, Iowa. Jennings explained the company's decision to continue production, "We're trying to produce some flavors to meet some of the demand" (Kennedy, 1994d). Although not all flavors were produced and volume did not meet normal levels, production continued at the LeMars plant until the Marshall plant reopened. While health officials continued the plant investigation, an estimated 130 employees of the Marshall plant were laid off ("Schwan's ice cream tested for salmonella," 1994, Kennedy, 1994b).

The contamination investigation of the Marshall plant continued to develop slowly. David Kessler, FDA Commissioner, told reporters, "It is enormously difficult to do this kind of scientific detective work" (Schwartz, 1994). Jackie Refiner, a spokesperson for the Minnesota Agriculture Department, said, "We're looking at everything from the ingredients to the mixes to the transportation system to the plant. We're trying to determine in which of those areas the salmonella might be growing and how it got there" (Kuebelbeck, 1994b).

Almost two weeks after the investigation began, a positive link between Schwan's ice cream and the salmonella outbreak was found in an unopened container of ice cream from the plant in Marshall (Slovut, 1994a). The next day, the Schwan's plant outbreak was "traced to a shipment of raw eggs carried in a tanker later used to transport pasteurized ice cream products" ("Schwan's takes salmonella safeguards," 1994; "Truck transporting eggs could be source of salmonella outbreak," 1994). While salmonella was not found in any of the trucks, it was established as the most likely cause of the outbreak (Sandok, 1994).

The following day Schwan's publicly responded to the health officials' investigative findings. Schwan's announced the "immediate implementation of a number of voluntary measures that should provide every possible safeguard to ensure the safety of those ingredients that are delivered into our plant" (Slovut, 1994d). The two-pronged approach included using a dedicated fleet of tankers to carry ingredients and re-pasteurizing the ingredients at the plant.

One month after the crisis began, Schwan's was allowed to reopen the Marshall plant (Sandok, 1994). The company's attention became focused on the legal ramifications of the crisis. Schwan's used its close customer contacts to settle much of the matter out of court. Customers were asked to sign a statement releasing the company from further liability in exchange for cash or gift certificates. The payments averaged about \$160 to each of the 6,000 customers who signed the agreement. The company's insurance carrier was also involved in the process. Liberty Mutual's adjusters called customers, offering to settle for as little as \$25.00 a person (Kennedy, 1994b). When class-action lawsuit lawyers publicly brought these actions into question, Jennings stated, "The settlement strategy is designed to build and protect customer loyalty. If it also serves to weaken the class-action effort, so be it" (Kennedy, 1994b).

Post-crisis

Almost four months later, the tentative settlement agreement between Schwan's and its customers involved in the class-action lawsuit was legally

approved.³ Individual compensation ranged from \$25.00 to \$75,000.00 per person, depending on the severity of his or her sickness ("Judge approves settlement over Schwan's salmonella outbreak," 1995). On 18 October 1995, just over a year after the crisis surfaced, Schwan's was cleared of wrongdoing by state inspectors. Schwan's did not

On 18 October 1995, just over a year after the crisis surfaced, Schwan's was cleared of wrongdoing by state inspectors.

pasteurize its products at the plant in Marshall before the crisis, but they were not required by law to do so. Despite the company's name being cleared with no fine imposed, Schwan's agreed to pay the state \$60,272 to cover the expenses incurred from the outbreak (Kennedy, 1995b).

Schwan's is stronger than ever and has expanded its enterprises even further. Currently, "the Schwan Food Company is America's leading branded frozen-food maker" (The Schwan Food Company, 2003b). The Schwan's website attributes the success of the company to expansion: "Acquisitions and start-ups play key roles in a company dedicated to achieving its vision for growth" (The Schwan Food Company, 2003a). Since the outbreak in 1994, the number of employees has quadrupled and sales have doubled. In 2003, the still privatelyowned Schwan's company reported combined sales reaching \$4 billion while employing 24,000 people worldwide (The Schwan Food Company, 2004).

Conclusions

Where Schwan's Failed

Schwan's pasteurization practices, while legal, were shown to be inadequate and the company's lack of industry vigilance might have been responsible for the onset of the crisis. The shortcomings of the pasteurization process were responsible for the salmonella bacterium surviving in Schwan's ice cream. While production at Schwan's met industry regulations on the pasteurization of ingredients, most of the industry used a different technique that provided better safety for consumers. Reporters noted that most ice cream in the United States is pasteurized immediately before processing. However, in the Schwan's case, it was pasteurized then shipped as a mix to another plant without being re-pasteurized. The differences between the two processes proved costly to Schwan's reputation as a provider of quality foods.

Schwan's worked hard to keep its customers out of the courtroom, but at least two class action lawsuits surfaced⁴ in the aftermath of the crisis. Before the class action lawsuits began to surface, both Schwan's and its insurance carrier tried to settle out of court with many consumers. The actions can be viewed as both a success and a failure. Schwan's did succeed in keeping many potential litigants out of class action lawsuits, but its actions may have hurt its public image.

³ Kennedy mentioned a class action in Illinois, but no more information was found on the case.
⁴ The Minnesota lawsuit was settled without a trial and another lawsuit, originating in Illinois, was mentioned in Kennedy (1995a), but the case dropped out of the media.)

Stakeholders, due to their diversity, may differ in their perceptions of Schwan's actions. Customers and other stakeholder groups who were watching the process unfold could have perceived news about the settlements as underhanded. Alternatively, stakeholders may have perceived the strategy positively. The actions taken could have also displayed the company's good intentions toward earning and retaining customer loyalty. While figures released about the lawsuit do not include lawyer fees or the plaintiff's time, compared to consumers who signed a settlement directly, Schwan's paid a bit more to class action lawsuit plaintiffs.

Schwan's messages were marked by specific actions that went beyond what was asked for or demanded by authorities. The actions not only served to protect the company's legitimacy, but went a step further to display social responsibility.

Where Schwan's Succeeded

Stakeholders base their judgment of an organization's legitimacy both the actions it takes and its communication of these actions to stakeholders (Metzler, 2001). Schwan's excelled in both areas simultaneously. First, Schwan's displayed a continuous

concern for its customers through socially responsible actions. Second, the company produced focused messages from a solitary spokesperson that created a unified and consistent flow of pertinent information to stakeholders. The areas could be separated into individual functions of crisis response; however, Schwan's successfully tied the two areas together in a nearly seamless fashion by the timely announcement of implemented corrective actions.

Action and communication

Schwan's messages were marked by specific actions that went beyond what was asked for or demanded by authorities. The actions not only served to protect the company's legitimacy, but went a step further to display social responsibility. Recognizing different viewpoints within society, Schwan's response to the crisis draws largely from the democratic form of corporate social responsibility, which is the most responsible behavior on the continuum (Tombs & Smith, 1995). The following list exhibits Schwan's socially responsible actions during and after the crisis and what stakeholders were told about Schwan's actions via the media.

- Shutdown production facility, ordered an investigation of the plant, and immediately ordered recall.
- · Offered customers compensation for possible tainted products.
- Initiated a hot line for consumer questions, concerns, and testing information.
- Paid for medical services and diagnostic testing conducted by the customer's doctor.
- Offered compensation to consumers who became ill from salmonella. Settled a class action lawsuit.
- Reimbursed expenses the state incurred during the crisis.

Schwan's was in continuous contact with the media, announcing the actions it was taking to help correct problems as or before they arose. When the crisis situation changed, Schwan's was prepared to respond with well-thoughtout comments and a specific action that appeared to be in the best interest of consumers. Schwan's immediate implementation of voluntary measures throughout the crisis displayed a steadfast responsibility to its numerous stakeholders. Schwan's recognized the multiple viewpoints held by stakeholder groups, and the company's unique qualities were put to use in satisfying the various concerns. Initially, worried consumers could call a 24-hour hotline to find out how to get a free medical test by their own doctors. The calls were handled by Schwan's personnel who could answer and respond to individual concerns that were ultimately given a voice through the hotline (Sellnow, Ulmer, & Snider, 1998).

Customers were later contacted either by door-to-door delivery drivers or by phone calls to discuss possible compensation for their sickness or

inconvenience. Consumers could choose to be compensated by gift certificates, cash payment, or a combination of both in return for signing a statement agreeing not to sue.

Individuals who did not find this practice fair could join the class action lawsuit. Schwan's would have preferred all of its customers sign the release statement; however, official statements tended to direct hostility toward the victim's lawyers and not the victims themselves. Schwan's statements also countered the plaintiff's lawyer's public complaint that Schwan's was

undermining the class action lawsuit by saying, "If that means the plaintiffs' attorney doesn't make as much money off the lawsuit, that's an outcome I can live with . . . We don't feel like we need a class action to explain our obligation is to our consumers" (Kennedy, 1994c). Schwan's lawyer, Jim O'Neal, later reiterated the sentiment. O'Neal was paraphrased as saying, "Schwan's wants to mend differences with its customers instead of fighting them in court" (Kennedy, 1995b).

The compassion for affected consumers remained constant throughout the different campaigns, as did the recognition of multiple stakeholder groups. Clearly, Schwan's still felt obligated to those who did not want to settle beforehand. Failing to see the class action suit as legitimate, while at the same time recognizing the individual claims as legitimate, reinforces the claim that Schwan's was acting in a democratic form of social responsibility. It could be argued (perhaps a bit unfairly) that the actions were self-serving and legally motivated; however, the general public and previous scholarly work (Sellnow, et al., 1998) perceived the actions as sincere—even if they were mutually beneficial.

What Schwan's Learned

Schwan's handled the crisis effectively, using corrective action as the primary response strategy during the crisis (Sellnow, et al., 1998). The corrective actions were proactive and consistently above and beyond what health authorities ordered or even suggested.⁵ The socially responsible corrective actions placed retaining the company's reputation and customer base above immediate financial issues. Schwan's did not over-react nor underreact to situations as they arose. The actions taken by the company were well received, both nationally and locally. Questions concerning the company's legitimacy were almost nonexistent, reinforcing the idea that Schwan's took care of affected consumers.

Implications

Schwan's extremely private nature, coupled with its residency in a

Schwan's extremely private nature, coupled with its residency in a small town, helped create a favorable image in the media.

⁵ Health authorities suggested that Schwan's should either start using a dedicated fleet of sealed tanker trucks to deliver ingredients or repasteurize every shipment of ingredients. Schwan's publicly announced it would implement both measures (Slovut, 1994f).

small town, helped create a favorable image in the media. Unbiased outside information about the Schwan's company is hard to find. Reporters trying to uncover the inner workings of Schwan's were met by local resident's reluctance to speak out about the company. "People don't speak out of line about the company, or are afraid to talk, because everyone wants to respect [Schwan's] wishes" (Kennedy, 1994a). Instead of exposing dirt on the company, reporters printed endearing background information about Schwan's, such as this anecdote:

In the beginning, there were just chocolate and vanilla. Those two ice cream flavors were all Marvin Schwan sold to area farm families when he founded his home delivery service in 1952 with a truck he bought for \$100. He refrigerated the vehicle with dry ice and pounded out a route. It wasn't an easy ride; the truck got 22 flat tires or blowouts in that first year alone. (Kennedy, 1994a)

Similar stories are commonly found in both local and national news reports. News organizations frequently portrayed the Schwan's company as a symbol of the American Dream. The reports may have resonated with the common man, but the company shows no desire to be placed with other companies. A New York Times article commented on a wooden sign hanging in the company's lobby that says simply, "The Uncommon Company" (Feder, 1994). The charming accounts may have served to soften the news of the outbreak and even persuade people to root for the company during the crisis.

Schwan's company status seemed to be a large benefit during the crisis. The company did not have to consult a large organizational bureaucracy to make decisions and was able to react quickly to the changing situation. The effective actions did not lack in morality or responsibility and often disregarded immediate financial repercussions.

The combination of the above benefits allowed consumers to feel comfortable with the company's leadership. After the crisis, Schwan's was able to sink back into the comfortable realm of obscurity. There were no complaints from stockholders or market analysts, and the company could choose not to disclose other information. Once the public's health was not in danger, the general public could easily forget about the incident because they had nothing to gain or lose from following the company's actions.

Schwan's appears to have adopted Tylenol's corporate strategy of crisis management. A former Marvin Schwan lieutenant was paraphrased as saying, "Schwan's response to the salmonella outbreak will resemble Johnson & Johnson's textbook handling of the deadly tampering with Tylenol" (Kennedy, 1994a). Tylenol's strategy, at a basic level, included an immediate product recall, followed by the adoption of improved safety measures to smooth reintroduction. Schwan's actions followed this general format, and displayed the benefits of organizational learning. The Tylenol strategy appears to be generalizable to other business, on both the corporate and company level, and may serve as a template for other organizations facing a large-scale public crisis for the first time.

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Chapter 3 Chi-Chi's Crisis: Lessons Learned Through the Use of Organizational Apologia

Lisa Sjoberg North Dakota State University I 1976 the conversion of a Minneapolis sports bar to a Mexican eatery created the well-known chain of Mexican restaurants known today as Chi-Chi's. One year later, Chi-Chi's had expanded to four restaurants and by 1980 ninety-two locations speckled the United States from coast to coast (Robinson-Jacobs, 2003). Chi-Chi's has continued to expand, with an annual revenue reaching \$200 million in 2000.

Despite its trademark menus and financial success, Chi-Chi's has not been without its problems. In 1994, Chi-Chi's was sold to Family Restaurant's, Inc., which later changed its name to Prandium, under whose ownership Chi-Chi's remains. Although it had experienced financial success for many years, Chi-Chi's and other Prandium, Inc., chains, including Koo Koo Roo, declared bankruptcy on 8 October 2003. According to the *Orlando Sentinel*, the reason for this bankruptcy filing was cash flow problems the restaurant had been experiencing for quite some time ("Litigation hinges," 2003).

While Chi-Chi's comprised as much as 70% of Prandium's sales, by October 2003 Chi- Chi's claimed assets of \$50-\$100 million and reported debts of over \$100 million (Robinson-Jacobs, 2003). In February 2003, Prandium hired a financial expert to combat the financial problem, which proved to be unsuccessful.

While facing bankruptcy was a problem in and of itself, Chi-Chi's faced a greater crisis in November of 2003—a major Hepatitis A outbreak linked to one of its Pennsylvania franchises. Although it was not known initially, the source of the hepatitis was imported Mexican green onions, which had also been tied to hepatitis outbreaks earlier in the fall of 2003. The circumstances surrounding the Hepatitis A outbreak—Chi-Chi's bankruptcy—affected how the restaurant handled the crisis. This essay examines the hepatitis crisis, the tactics used in Chi-Chi's public defense or apologia, and how Chi-Chi's unique situation affected this defense.

Research Questions

Apologia is a "justificatory form of corporate communication in which an organization seeks to respond to criticism through the presentation of a compelling defense and explanation of its actions" (Hearit, 1999, p. 292). While all organizations utilize apologia during crisis situations, two major external agents affected Chi Chi' s response: its vendors and its creditors. Therefore, this essay examines how external agents affect an organization' s apologia.

Crisis Timeline

Pre-crisis August and September 2003 Hepatitis outbreaks in West Virginia, Georgia, North Carolina, and Tennessee. September 2003 Chi-Chi's receives infected shipment of green onions from Mexican farms. October 2003 Chi-Chi's files for Chapter 11 bankruptcy. Crisis 3 November 2003 Hepatitis A outbreak at the Beaver Valley Mal location and Pennsylvania is confirmed health. Officials announce hepatitis threat. 13 November 2003 Nationwide, Chi-Chi's removes green onions from menus.

21 November 2003	Green onions are declared to be the cause of the outbreak. U.S. halts all Mexican green onions imports.			
22 November 2003	U.S. shuts down four companies operating eight firms that export onions to the U.S.			
12 December 2003	Ten secondary Hepatitis A cases reported.			
Post-crisis				
15 January 2004	Beaver Valley Mall Chi-Chi's reopens.			
23 February 2004	Mediation system is approved to pay hepatitis victims.			
26 February 2004	Twenty-six Chi-Chi's restaurants are closed due to under performance.			
June 2004	Bankruptcy court approves settlements of \$2 million for 60 victims.			

Literature Review

Apologia

Apologia has long been associated with rhetoric and public speaking; however, not until the past decade has apologia been associated with organizations. In their leading study, Ware and Linkugel (1973) define apologia generally as "a speech of self-defense" and declare that it is human nature to defend oneself when one's virtue, morality, and reputation have been questioned (p. 274). Recently, many studies have utilized this notion in examining how corporations respond to the public when their images are questioned (Hearit, 1996; Hearit, 1999; Sellnow & Seeger, 2001; Seeger & Ulmer, 2002; Hobbs, 1995; Benoit & Lindsey, 1987; Ice, 1991). According to Hearit (1995), apologia in the corporate arena is often a "response to a social legitimacy crisis" (p. 1). In so responding, the organization is able to accomplish two goals: (1) create a gap between the organization and its mistakes and (2) bridge the gap between the organization and the public's values.

Publics

Every organization has different constituents that play key roles in the organization's survival and success. In the mid-to-late Twentieth Century, organizations moved toward making products *for* the public instead of trying to sell their products *to* the public. As keeping constituents or publics pleased became increasingly important, this change had an impact on public relations, "the relationships with those who constitute an organization's publics or constituents, the ways and means used to achieve favorable relationships, and the quality or status of the relationships" (Cutlip & Center, 1982, p.4).

Grunig and Hunt (1984, pp. 139-143) identify four types of publics, or "corporate relationships," and their impact an organization: (1) enabling publics, who regulate the corporation in terms of resources and authority; (2) functional publics, who act as the inputs (labor and money) and outputs (goods and services) of the organization's system; (3) non-native publics, who develop the values of the organization through organizational societies and memberships; and (4) diffused publics such as community members, who live near the organization and are indirectly affected by the organization.

In order for organizations to use apologia effectively to handle crises, it is imperative that these publics are considered in the development of the organization's apologetic strategies. Although many crises call for apologia on behalf of the organization, frequently an apologetic response will not be given unless "organizational publics believe the criticism to be true and there is a concomitant effect on an organization's bottom-line" (Hearit, 1999). Depending on which of the publics are influenced most by the crisis, different strategies of apologia will be more effective.

Apologetic strategies

In their leading apologia research, Ware and Linkugel (1973) outline four basic responses, available to apologists (Hobbs, 1995): denial, bolstering, differentiation, and transcendence. These strategies have now been incorporated into the study of organizational rhetoric. Denial and bolstering are considered reformative strategies in that they seek only to change the "cognitions" of the publics and not the meaning the mistake has created for the publics involved (Hobbs, 1995). In using denial, organizations are attempting to

Apologia has long been associated with rhetoric and public speaking; however, not until the past decade has apologia been associated with organizations.

completely renounce their relationship to mistakes the publics involved find unfavorable. Bolstering allows the organization to distance itself from the unfavorable mistake by allying itself with something the public finds favorable. Transformative strategies (differentiation and transcendence) extend the reformation in that they alter the mistakes meaning and how the organization is attempting to fix it. Differentiation allows the organization to remove itself from "the negative context of the situation," while transcendence places the organization in an often value-oriented and abstract positive context (Ware & Linkugel, 1973, p. 280).

In order for apologia to be most effective, some researchers argue, it should combine one reformative and one transformative strategy. This combination creates what is known as the four postures (Ware & Linkugel, 1973). Absolution (a combination of denial and differentiation) seeks to "acquit" the organization from the negative charges (Hobbs, 1995). Denial and transcendence account for the vindication posture or the upholding of the organization's values, especially compared to the organization's accusers. Explanation (bolstering and differentiation), based on the belief that an understanding will prevent the publics' denunciation, offers the publics a correct understanding of the organization's stance. Finally, justification utilizes bolstering and transcendence to seek not only the understanding gained from explanation, but acceptance as well.

Method

In order to effectively analyze Chi-Chi's crisis, the application of theory and context were useful in order to complete a rhetorical analysis of the newspaper articles, press releases, and interviews connected with the crisis. In this particular case, rhetorical analysis allowed for the examination of the messages of the various publics involved with Chi-Chi's and the apologia the corporation utilized with their publics. To provide a theoretical background for this case study, a bank of various articles from communication and public relation journals were compiled and developed into the previous literature review. These articles provided the apologetic categories (denial, bolstering, differentiation, and transcendence) for analysis, to determine whether or not Chi-Chi's rhetorically succeeded in their apologetic strategy.

Approximately 100 newspaper articles were gathered, primarily from *The Patriot News* and the *Pittsburgh Post-Gazette*, local Pennsylvania papers reporting on the outbreak, and various national and international papers

using *Associated Press* releases to cover the story. These sources were dated from September 2003 to July 2004. Enhancement pieces, press releases, and national advisories from government agencies added depth to the newspaper sources.

Analysis

Pre-Crisis

By November 2003, Chi-Chi's had been linked with the largest single source Hepatitis A outbreak the nation had ever experienced (Srikameswaran, 2003). Throughout August and September numerous states, including Georgia, West Virginia, North Carolina, and Tennessee, reported over 500 Hepatitis A cases, including 82 traced to a single restaurant in Tennessee (Mandak, 2003b). By late September and early October, green onions had been identified as the cause ("Investigators probe," 2003). The latest outbreaks, however, were not the only ones linked to green onions. In 1998, green onions from two firms in Mexico and one in California were linked to a Hepatitis A outbreak in Ohio, although the actual source is still unclear.

Because Hepatitis A has a relatively lengthy incubation period of fifty days, it is frequently difficult to identify the disease's source (Boodman, 2003). In fact, the Federal Department of Agriculture (FDA) and Centers for Disease Control and Prevention (CDC), along with various state health departments, state that usually only half of all reported Hepatitis A outbreaks are ever linked with a source ("Investigators probe," 2003).

Green onions tend to harbor the disease because their multi-layered nature makes cleaning difficult. Because of this, no effective cleaning procedures standards exist in the restaurant industry ("We're safe," 2003). However, the FDA has established "voluntary [cleaning] guidelines for fresh fruit and vegetables" (Mandak, 2003c).

Food safety investigators and experts note that only two percent of all imported food is inspected as it crosses the border (Boodrnan, 2003). While Chi-Chi's uses green onions in many of its salsas, dips, and entrees, it ships fresh green onions to its restaurants to make mild salsa and cheese dip inhouse. Hot salsa is manufactured offsite. The green onions arrive in 8.5-pound boxes packed in ice and are stored for at least five days after they arrive. While the green onions are stored, the ice melts and creates a soup comprised of the melted water and onions. The onions are then rinsed, machine-chopped, and refrigerated for an additional two days, after which they are mixed into forty- to eighty-quart buckets of mild salsa. While the onions have been already stored for a minimum of seven days in this procedure, the mild salsa itself has a been stored for up to ten days, which creates a storage time for the onions of up to seventeen days (Boodman, 2003). Even though the Hepatitis A virus could not have been cleaned from contaminated onions, even with chlorine, through "prolonged soaking in contaminated ice, the virus probably seeped deep inside the onions" making the virus more toxic (Drexler, 2003).

Between mid-September and mid-October 2003, eleven thousand customers dined at the Beaver Valley Mall Chi-Chi's in Pennsylvania (Roddy et al., 2003). The first Hepatitis A victim reportedly ate at this Chi-Chi's restaurant around 20 September (Snowbeck, 2003a). However, most of the victims ate at the restaurant between 3 October and 6 October, with the latest victim visiting Chi-Chi's on 18 October (Snowbeck, 2003d). Even though most of the victims of the illness ate at the restaurant in October, the outbreak was not confirmed until 3 November 2003 ("Officials say outbreak," 2003). Because of hepatitis' lengthy incubation period, many victims did not demonstrate symptoms of the illness until mid-October. The first patient, in fact, did not enter the hospital until late October.

Crisis

During November 2003, Chi-Chi's and the Hepatitis A outbreak dominated local and national headlines. Besides news of the potential causes of the outbreak, there were reports of three deaths related to the disease. On 3 November 2003, Pennsylvania health officials announced the threat of a Hepatitis A outbreak linked to the Chi-Chi's Beaver Valley Mall restaurant ("Third death reported," 2003). Due to growing suspicions as to the disease's

cause, Chi-Chi's voluntarily closed the restaurant doors to limit the virus outbreak (Chi-Chi's, Inc., 2003c). Because the impact of Hepatitis A can be drastically reduced, if not eliminated, if potential victims receive the inoculation within fourteen days of contact, Pennsylvania and Beaver County health departments opened an immune goblin clinic on 5 November 2003, in an effort to contain the disease. While the Hepatitis A victims count was at 84, with 2,400 people receiving immunizations on the opening day of the clinic, the number of infected rose to 130 the following day,

with a total of 2,800 people receiving immunizations (Lin, 2003; Snowbeck, 2003d). The count of infected victims was up to 510 in mid-November, including thirteen of the Beaver Valley Mall Chi-Chi's employees (Wahlberg, 2003; "Investigators probe," 2003). By the end of November, the hepatitis case count had reached 635, those screened for the virus had reached 10,000, and those immunized had reached 9,100 ("Restaurant hepatitis toll," 2003). Also, by the end of November, the outbreak had claimed the lives of John Spratt, age 46, Jeff Cook, age 38, and Dineen Wieczorek, age 51, all of who had eaten at Chi-Chi's in the previous weeks.

The infected Chi-Chi's employees played an integral role in the determination of the cause of the outbreak. At the onset of the crisis, many thought Chi-Chi's unsanitary practices were the cause. However, when Chi-Chi's employees fell ill to the disease simultaneously with other victims, health officials noted that it was unlikely that Chi-Chi's had an immediate role in the spreading of hepatitis (Wahlberg, 2003).

After interviewing 207 victims who ate at the restaurant, research showed 98% had eaten mild salsa or cheese dip (Mandak, 2003b). By 10 November 2003, green onions were suspected as the correlating factor in what was reportedly the largest single-source hepatitis outbreak in United States history ("Health officials link," 2003). Similar outbreaks in Georgia, North Carolina, West Virginia, and Tennessee also assisted researchers in locating the source. While it took eighteen days to determine green onions' role in similar outbreaks, health officials took approximately twenty days to fix the blame on green onions at Chi-Chi's ("Investigators probe," 2003; Snowbeck, 2003d).

On 15 November 2003, the FDA issued a national warning; cautioning people to eat only cooked green onions (Mandak, 2003b). Once green onions were officially determined to be the source of the hepatitis, Chi-Chi's, Taco Bell, TGI Friday's, Baja Fresh, and Acapulco, and El Torito Restaurants, removed green onions from their menus nationwide ("Third death reported," 2003; "Hepatitis scare crimps," 2003; Pennino, 2003; Prendergast, 2003). Even after green onions had been identified as the cause, investigators had difficulty determining the initial source of the outbreak (Mandak, 2003d). However, by 19

The infected Chi-Chi's employees played an integral role in the determination of the cause of the outbreak. November 2003, health officials strongly suspected that infected green onions caused the outbreak from Mexico; however, the names of the Mexican firms were not released (Snowbeck, 2003c). Around this same time, the Mexican government closed down four companies operating eight firms that exported green onions to the United States. Again the names of the companies were not released (Snowbeck, 2003e).

On 21 November 2003, due to these growing suspicions, the United States halted imports of Mexican green onions. In a conference call between the FDA and Mexico's Ministry of Agriculture, four companies were linked with "deficiencies in agricultural processing" and as potential sources of the recent Hepatitis A outbreak. The firms named were Dos M Sales, Agro Industrias Vigor, Tecno Agro International, and Agricola La Guna (Lindquist, 2003b). Investigators also linked four United States green onion distributors with the hepatitis outbreak, including Castellini Company of Wilder, Kentucky; Newston Fresh Foods, LLC of Salinas, California; Apio Fresh, LLC of Guadalupe, California; and Boskovich Farms, Inc., of Oxnard, California ("Couple sues four distributors," 2003).

In early December, three FDA officials, one CDC official, and four Mexican government officials began investigating the Mexican firms to determine if negligence was to blame for the outbreak (Snowbeck, 2003f). During the investigation, the Mexican government accused the United States of being irresponsible in naming the growers without proof, claiming food grown in Mexico was every bit as safe as that grown in the United States (Lindquist, 2003a). These contradictions continued as the Mexican government's inspections of the Mexican firms found problems only at three of the four firms, while the United States discovered problems at all four. The largest concern arose at the Dos M Sales plant owned by United States citizen Michael Brazel and located west of Mexicali outside of La Rumorosa. Investigators suspected that untreated water from a small dam was used for sanitation purposes at Dos M Sales. The investigators found the following to be areas of concern throughout the Mexican plants: poor sanitation, inadequate hand washing facilities, worker health and hygiene, quality of irrigation water, and the ice and materials used for packing the green onions (Lindquist, 2003b).

Due to its recent bankruptcy, Chi-Chi's was working with bankruptcy courts seeking access to money to pay the medical bills of virus victims who were suing Chi-Chi's. However, with the discovery of the onion firms' connection to the outbreak, some of the lawsuits were dropped against Chi-Chi's and filed against the green onions growers and distributors. One distributor, the Castellini Company, responded to these accusations by claiming that other than moving them from one truck to another they were not involved with transporting infected green onions ("Wilder, K. Y. firm sued," 2003).

On 10 December 2003, the courts established the guidelines for Chi-Chi's to follow in payments to victims. These guidelines allowed Chi-Chi's to pay outof-pocket claims up to \$3,000; however, claims of between \$3,000 and \$20,000 were to be reviewed by insurance companies and those greater than \$20,000 were to be approved by the bankruptcy court (Mandak, 2003e).

By the end of November, the CDC believed the outbreak was winding down. At its peak in early December, the count of those infected had reached 635 ("Restaurant hepatitis toll," 2003). However, on 12 December 2004, letters were sent home to parents from the Beaver County school district, notifying them that two students were diagnosed with Hepatitis A (Srikameswaran, 2003). The two student cases were among ten secondary hepatitis cases resulting from close contact with those that had the initial strain of Hepatitis A (Snowbeck, 2003g).

Post-crisis

On 15 January 2004, the Beaver Valley Mall Chi-Chi's reopened to lines of excited patrons (Fuoco, 2004), but the outbreak continued to affect Chi-Chi's many constituents, despite the rejuvenation of the Beaver Valley Mall location.

"Hepatitis claims?" advertising for Hepatitis A litigation appeared on billboards throughout Beaver County, and state and federal agencies were just beginning to understand the outbreak's economic toll (Sentementes, 2004).

The Chi-Chi's outbreak had an enormous impact on the restaurant and food industries

throughout the nation. When Chi-Chi's pulled green onions from their menu in mid-November, they were closely followed by Taco Bell, TGI Friday's, and various other restaurants, who also removed green onions from their locations throughout the nation ("Hepatitis scare crimps," 2003; Pennino, 2003; Prendergast, 2003). Independently-owned Mexican restaurants in the Pittsburgh area saw a reduction in their sales and patronage due to fear of hepatitis, although none was as severe as Chi-Chi's experience (Fitzpatrick, 2003; Mandak, 2003d). Grocery stores also saw a drop in sales of green onions, so much so that some grocers threw away \$2,000.00 worth of green onions from their stores ("Green onion sales," 2003; McNulty, 2003).

While the economic impact of the Chi-Chi's outbreak itself was detrimental, the outbreak also stimulated conversations about food handling procedures, most of which were in Pennsylvania. The Allegheny County Health Department suggested that restaurants place disclaimers on their menus about raw and/or undercooked produce similar to warnings about raw/undercooked meat (Nephin, 2003). These warnings, health officials said, would assist in protecting of restaurants and their consumers from food-borne illnesses. Because of theirs and the National Restaurant Association's belief that these warnings would prove beneficial, the Allegheny County Health Department planned to implement these warnings at the start of 2004. The restaurant industry also returned to the discussion of requiring food handlers to wear gloves. While all restaurant employees are required to wash their hands prior to handling food, many managers did not believe gloves would aid in eliminating the spread of food-borne illnesses (Gleiter, 2003). However, after the outbreak, more restaurants and grocers were beginning to use gloves in order to enhance safety procedures.

The hepatitis outbreak had a strong impact not only on the food industry, but also on local, state, and national health departments. While most states average 159 health workers for every 100,000 people, Pennsylvania only has 37 for every 100,000, or a total of 4,465 for the entire state ("State ranks last," 2003). However, even with a limited staff was stretched to its limits, the Pennsylvania Department of Heath still managed to provide over 10,000 hepatitis screenings and 9,100 inoculations. The Pennsylvania Department of Health declared that 130 of 660 who were infected with hepatitis required hospitalization, generating a grand total of hospital bills at \$1.2 million (Fitzpatrick, 2003; Sentementes, 2004). Each immune globulin shot cost \$15, bringing the total cost to the state health department to \$136,000 in shots alone. According to data collected from previous outbreaks, it is estimated that average expenses for each hepatitis victim range from \$1,817.00 to \$3,837.00. Because the Pennsylvania outbreak was so severe, the total health care costs

The Chi-Chi's outbreak had an enormous impact on the restaurant and food industries throughout the nation. far exceeded the \$2.25 million spent in the 1997-1998 Spokane, Washington, Hepatitis A outbreak (Fitzpatrick, 2003). These figures also do not account for the costs incurred to investigate the outbreak on the national level.

Bill Marler, attorney for many Pennsylvania hepatitis victims, estimated in November 2003 that a total cost of \$100 million would be likely after all medical charges, lost wages, and emotional stresses were taken into account (Fitzpatrick, 2003). By mid-February of 2004, 200 claims totaling close to \$1 million had been filed against Chi-Chi's, seventy- five percent of which had been paid (Mandak, 2003a). On 23 February 2004, a judge approved the mediation system so that lawsuits could be filed against Chi-Chi's, which was in the middle of bankruptcy (Johnson, 2004). While payment to victims was perhaps the largest expense incurred, Chi-Chi's also had the expense of paying the Beaver Valley Mall location employees until the restaurant reopened in January (Chi-Chi's, Inc., 2003a).

Analysis

While many of the attorneys and victims in the Chi-Chi's case did not feel that Chi-Chi's responded quickly enough or appropriately, some experts, including Randy Hiatt, a restaurant analyst, believed Chi-Chi's responded in the best manner possible. In order to handle the crisis, Chi-Chi's appointed a single high-level company officer, Chi-Chi's CEO Bill Zavertnik, to manage public relations during the crisis. In so doing, Chi-Chi's hoped to be open with its publics and to confront the crisis directly.

Chi-Chi's did not comment formally on the hepatitis outbreak until 7 November 2003, four days after the outbreak was confirmed at the Beaver Valley Mall location. Initially, many believed unsanitary practices in the Beaver Valley Mall Chi-Chi's was responsible for the outbreak. At this time Chi-Chi's noted that six of its employees had contacted Hepatitis And took responsibility in its statement:

We sincerely apologize to all of our loyal customers and want to inform the community that Chi-Chi's will do everything within our power to make sure that our patrons continue to enjoy a healthful and rewarding dining experience and that our employees have a safe and sanitized working atmosphere. (Chi-Chi's, Inc., 2003a)

Two other responses from Chi-Chi's (on 11 & 12 November 2003) further illustrate Chi-Chi's proactive response to the crisis. Chi-Chi's hired medical consultants to work with the CDC and FDA to identify the cause of the outbreak, voluntarily removed green onions from its menus, and closed the Beaver Valley Mall location. Chi-Chi's greatest concern was how to assist infected customers with medical expenses and lost wages, and how to compensate employees while the Beaver Valley Mall location was closed. In order to begin dealing with these concerns, Chi-Chi's established a toll-free number for concerned victims and employees. Chi-Chi's remained firm in defending its outstanding record with health inspections and their long record of upholding health and safety in their restaurants to ensure the finest dining experience possible (Chi-Chi's, Inc., 2003b).

To this point, Chi-Chi's mainly used the apologetic tactic of bolstering in an attempt to distance the organization from the crisis by citing positive actions it had taken while emphasizing its outstanding safety and health records. By utilizing this tactic, Chi-Chi's acknowledged that it had failed but was trying to respond as diligently and effectively as possible. This was an appropriate tactic since denial of the outbreak and Chi-Chi's involvement in it would only have discredited the restaurant's reputation and distanced the organization from its customers and creditors. As a reformative strategy, bolstering allowed Chi-Chi's to interact with all of its publics in assuming a responsible, moral position in the crisis and actively demonstrated Chi-Chi's good faith and its efforts to help those affected by the outbreak.

On 21 November 2003, green onions were officially declared to be the cause of the outbreak. As a result of investigations by the CDC and the FDA, Chi-Chi's was freed from the accusations of blame many had harbored at the commencement of the outbreak. While Chi-Chi's did mention the organization's relief in its exoneration, it never accused or confronted the distributors who were to blame for the infected green onions. As the crisis waned and distributors and growers were named, Chi-Chi's continued its use of bolstering and transcendence, stressing the organization's values, to retain its publics' respect. In doing so, Chi-Chi's was able to justify its position, emphasizing that it was, in fact, through the organization's own efforts that the cause of the outbreak was identified.

As claims for financial assistance with medical expenses and lost wages continued to mount, Chi-Chi's lawyers decided the growers and distributors of the tainted green onions should also be involved in victims' reimbursements (Mandak, 2004). While Chi-Chi's could easily have transferred fault and responsibility to the growers and distributors involved in the crisis, it instead sought a partnership so that all those bearing some responsibility for the crisis (whether large or small) would be involved in assisting crisis victims. Chi-Chi's took the higher road in its approach, recognizing that the organization could not have prevented the outbreak but still accepting responsibility for the restaurant's indirect role. It is interesting to note that many of the distributors and growers involved in the outbreak either did not respond publicly or directly denied their involvement in the crisis. The Mexican government also responded to the accusations with denial, believing that the food produced in Mexico was just as safe as that produced in the United States.

Most of the outbreak-related litigation took place between February and July 2004, and was expected to consume most of Chi-Chi's \$51 million liability insurance (Mandak, 2004). Faced with an onslaught of victim' s claims, Chi-Chi's desperately needed the financial assistance of other responsible parties (distributors and growers). In mid-April, Chi-Chi's lawyers began to put more pressure on suppliers in order for Chi-Chi's to maintain its responsibility to its creditors as well as the victims. One year after the outbreak, litigation continues.

Conclusions

Where Chi-Chi's failed

- While it was important for Chi-Chi's to accept responsibility for the outbreak, Chi-Chi's justificatory response did not place enough responsibility on the onion suppliers.
- Had Chi-Chi's been more forceful with the green onions distributors and growers of the at the beginning of the litigation process, it would have had been better equipped to maintain its financial responsibility to its enabling publics.

Where Chi-Chi's succeeded

- Chi-Chi's maintained an aggressive approach, voluntarily closing its restaurant and removing green onions from the menu.
- · Chi-Chi's justificatory apologia provided a moral approach resulting

in many faithful customers returning to the reopened Beaver Valley Mall Chi-Chi's.

What Chi-Chi's learned

- Accepting responsibility and responding to the crisis is imperative; however, organizations should not assume all responsibility if other parties are involved.
- Being honest with one's publics is the best approach to handling a social legitimacy crisis.
- While integrity is important when confronting crises, responding directly to the public at the onset of the crisis instead of waiting three weeks to hold the first press conference would have been a more successful strategy.

Implications For Best Practices

The Chi-Chi's crisis supports apologetic research suggesting that when food safety is involved blending one reformative strategy and one transformative strategy produces the most effective public response. Chi-Chi's use of bolstering and transcendence proved successful with the majority of its publics. Justification allowed Chi-Chi's to maintain it integrity as a food service while explaining the crisis to all of its publics. In order to most effectively handle a crisis, it is important that all responsible parties work together to assume responsibility and share in its resolution. Furthermore, direct response to the press and public will demonstrate honesty and the desire to amend the situation as quickly as possible.

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34 Protecting America's Food Supply

Chapter 4 Jack in the Box: Lessons Learned by Accepting Responsibility

Robert S. Littlefield, Ph.D. North Dakota State University **P** plants involves bacterial contamination with resulting public health problems. One such crisis began on 5 January 1993, when an outbreak of E. coli 0157:H7 in Seattle, Washington, was eventually linked to hamburgers served at Jack in the Box restaurants. Only a minute amount of E. coli carried by a variety of foods, including raw meat and poultry, is enough to make a person sick, and according to estimates, millions of people are infected annually. For most people, the result is a few days of diarrhea, nausea, and vomiting. However, these infections can cause "kidney failure, bloodstream infections and even death" (Morris, 1993). On January 13, Children's Hospital alerted

Once the outbreak was linked to Jack in the Box, Foodmaker, Inc., officials responded ambiguously to the crisis by defending their cooking practices and expressing concern for customers, but deflected blame to other entities as the cause of the problem. the Washington Health Department that its doctors were treating a large number of children with E. coli infections ("Jack in the Box's worst nightmare," 1993). Within a month, three were dead and the health of nearly 400 people in Washington was compromised (Gilmore & Lewis, 1993).

Once the outbreak was linked to Jack in the Box, Foodmaker,

Inc., officials responded ambiguously to the crisis by defending their cooking practices and expressing concern for customers, but deflected blame to other entities as the cause of the problem. Even when the Health Department found evidence that the hamburger meat was not cooked to the state approved temperature, Foodmaker, Inc., officials shifted the blame to the inspectors for the results they found. Eventually, Foodmaker, Inc., was forced to address specific improper cooking practices and apologized for its part in causing the outbreak of E. coli.

Research Questions

In an effort to understand what happened during this food crisis, this chapter explores the pre-crisis, crisis, and post-crisis actions taken by Jack in the Box and its parent company Foodmaker, Inc., and addresses the questions:

- Why did Foodmaker, Inc., change its communication strategy when dealing with the E. coli crisis resulting from the sale of undercooked hamburgers at Jack in the Box restaurants in Seattle, Washington?
- What organizational lessons did Jack in the Box and Foodmaker, Inc., learn as a result of this crisis?

Crisis Timeline

Three phases of the crisis are identifiable. The pre-crisis phase began 10 years before the 1993 crisis, when E. coli was found to be the source of food poisoning as several children became ill in Washington State. The pre-crisis continued until 1993, when a group of children were hospitalized in the Seattle area, prompting health officials to investigate. The crisis phase continued from this point until Foodmaker, Inc.'s, annual meeting, when Jack in the Box and Foodmaker apologized and changed their public communication about the crisis. The post-crisis began in mid-February and continued to the end of the year as company spokespeople implemented what they hoped would be specific

strategies to effectively regain their customers and to build the goodwill of the franchisees.

Pre-Crisis Phase

Fre-Crisis Fluse	
1982	First E. Coli outbreak identified
1986	Last major outbreak (before the current crisis) of E.
	coli strain at fast food restaurant in Walla Walla,
	Washington.
24 Sept 1990	Article in Supermarket News, a trade
	publication mailed to distributors like Vons,
	specifically calls attention to E. coli.
1992	Jack in the Box opens 63 restaurants, plans
	to open another 70 in 1993, including 12
	in Washington.
March 1992	Jack in the Box touts quality control measures
	and high cooking standards when it offers stock and
	solicit investors
1 May 1992	Washington raises standards to 155 degrees
19 November 1992	Production of 193 cases of contaminated
15 November 1552	homburger by Vena
	namburger by vons.
Crisis Phase	
5 January 1993	Outbreak begins in Seattle Washington area
13 January	Start of crisis: Children's Hospital alerts
10 Galldary	Washington Health Department of large number
	of children with E coli
15 January	Jack in the Box aware of the outbreak
18 January	Jack in the Box nublicly linked to outbreak. Jack
10 Sanuary	in the Box stone colling hamburgers in
	Weahington state
10 January	Leak in the Box replaced 28,000 nounds of
19 January	most requires cales switches to 155
	linear, resumes sales, switches to 155
99 I	Einst doothy true moon old in Teasure
22 January	First death; two-year-old in Tacoma
25 January	
27 January	Jack in the Box still not cooking hamburger at
	regulation temperature
28 January	Second death ("Bacteria claim another child,
	1993)
4 February	Foodmaker lawsuit filed against suppliers
12 February	Foodmaker, Inc., apologizes; fires Fleishman-
	Hillard
De et entrée Dhares	
Post-crisis Phase	
20 February	Third death (Third person dies, 1993).
23 February	Epidemiological evidence uncovered that meat
	passed through deboning plant in Los Angeles on
	18 November 1992
11 March	Heavy discounting and renewed advertising
	begins
26 March	Lawsuit settled; identification of larger problem
28 March	30 of 90 slaughterhouses shut down nationwide

Theoretical Underpinnings

Organizational learning theory provides insight as we seek to understand how Jack in the Box and Foodmaker, Inc., dealt with the crisis. When faced with a crisis, "organizations . . . must be open to new insights, understanding, and skills while maintaining the knowledge, skill, and wisdom that have proved successful" (Seeger, Sellnow, & Ulmer, 2003, p. 36). Sitkin, Sutcliffe, & Weick (1999) defined this as "a change in the organization's enacted response repertoire" (p. 7). In this instance, once facts about the cause of the outbreak became public, Jack in the Box came to realize that its strategy—deflecting blame and providing

Crisis communication specialists suggest that Jack in the Box and Foodmaker, Inc., might have been better prepared to deal with the outbreak and its aftermath had a crisis plan been in place. major discounts to entice people to eat at the restaurants—could not be maintained. To reestablish its credibility with stockholders and promote acceptance by the public, Jack in the Box had to change its response in order. This awareness is consistent with what Seeger et al.

(2003) described as the processes of learning: "It emphasizes system openness and flexibility as essential for accommodating changing conditions and for new understanding of existing conditions. By learning, the organization adds new know-how, competence, skills, and capacity" (p. 37). In the case of Jack in the Box, when cooking procedures were found to be the cause of the undercooked meat, management instituted a training program to assure the public that steps were being taken to make certain that the crisis would not be repeated. When the public relations strategy failed, the company fired its public relations agency, apologized, and accepted responsibility for the crisis.

Crisis communication specialists suggest that Jack in the Box and Foodmaker, Inc., might have been better prepared to deal with the outbreak and its aftermath had a crisis plan been in place. According to Seeger et al. (2003), "The fundamental function of a crisis plan is to reduce risk and help an organization respond to crisis in a timely and effective manner" (p. 166). When a crisis occurs, the need to identify the source of the problem, to identify a plan to correct the problem and contain the crisis, and to communicate quickly with a variety of groups, can overwhelm an organization. As Seeger et al. (2003) continue: "a crisis often results in inconsistent and delayed responses, maladaptive reactions, failure to contain and reduce the harm, an extension of the crisis stage, adversarial relations with stakeholders, and a protracted and damaging postcrisis stage" (p. 166). The absence of a crisis plan affects how an organization responds ethically to a crisis situation. As Seeger (1997) contends, when organizations confront a crisis situation without a crisis plan, dissention occurs over which values should dominate in a particular situation and the potential for making an unethical decision increases.

As the crisis unfolded, organizational learning and a crisis plan proved to be the characteristics needed by Jack in the Box and it's parent company, Foodmaker, Inc. As management attempted to orchestrate ambiguous responses to health officials, patrons, and stockholders, the absence of a crisis plan limited Jack in the Box's and Foodmaker, Inc.'s, ability to keep the restaurant chain blameless. In the end, the corporate leaders and the entire organization learned their lessons publicly as they were forced to shift from deflection to acceptance of blame.

Method

The data base for this chapter is drawn from 48 news articles published

during 1993 in national and major regional newspapers covering Seattle, Washington, and the surrounding area. The *Lexis-Nexis* database located these articles, which were subsequently downloaded and analyzed. The articles range in date from 19 January to 31 December 1993.

For this case study, a close textual analysis of the news articles revealed stages of the crisis, enabling the application of theory associated with precrisis, crisis, and post-crisis stages of crisis management. The accuracy of the information presented in the early stages of the crisis was verified in later accounts. The application of organizational learning due to the apparent absence of a crisis management plan provides insight into how Jack in the

Box spokespeople communicated with the public and with various groups of stakeholders.

Analysis

Pre-Crisis Phase

The outbreak in 1993 was not the

first one in the state of Washington. After two E. coli outbreaks in the 1980s, the Washington Health Department decided the quality of the meat products being distributed within the state could not be controlled. However, by increasing the cooking temperature of meat at restaurants, 99.99% of the most harmful bacteria in the meat could be destroyed (Blake, 1993). After much debate, in 1992 the department raised its cooking standards and required restaurants to cook hamburgers to an internal temperature of 155 degrees, replacing the old 140 degree rule which was the standard used in most states. Although Jack in the Box and its parent company, Foodmaker, Inc., claimed not to have been informed about this change, company spokespeople later acknowledged they had been notified. In fact, while the area's Jack in the Box restaurants had been routinely checked by the Seattle-King County Health Department "for inadequate refrigeration, rodents and other health hazards," hamburger temperatures were only checked on five of 134 inspections in 1991 and 1992 ("Inspectors rarely tested hamburgers for undercooking," 1993).

Jack in the Box had been in business for 42 years at the time of the outbreak. In 1992, the restaurant had opened 63 new establishments and planned to open another 70 in 1993, 12 of which were to be in Washington ("Jack in the Box's worst nightmare," 1993). The company presented itself as a growing, successful organization to its stockholders and took pride in describing itself as a safe investment.

Crisis Phase

As soon as Jack in the Box became aware of the crisis, the corporation took action to deal with the situation. First, by 19 January Jack in the Box had replaced 280,000 hamburger patties ("Meat seized in poisoning," 1993), halted hamburger sales in the state of Washington by January 20 ("Foodmaker shares dive Seattle," 1993), checked all grills to be sure they were operating at a proper temperature ("Jack in the Box says it will pay," 1993), and changed meat suppliers for its restaurants in Washington and Idaho by the end of the month (McCullough, 1993). In addition, Jack in the Box retrained its grill operators to cook meat more thoroughly, opened a toll-free number for consumers, and expressed deep regret to the public (McCullough, 1993). Jack in the Box agreed to pay all hospital bills for victims (Sanchez & Greenhill, 1993; Moriwaki & Kusumoto, 1993). The chain also contributed a sizable donation to help find

Jack in the Box quickly responded publicly upon learning of the crisis, with company spokespeople asserting that the blame for the outbreak should fall on other entities.
a cure of the E. coli infection ("Jack in the Box's worst nightmare," 1993). To further guarantee the safety of the hamburgers, after it reopened the Mercer Island Jack in the Box took the temperature of every hamburger coming off the grill and reported the results of the health department (Nelson, 1993).

Jack in the Box quickly responded publicly upon learning of the crisis, with company spokespeople asserting that the blame for the outbreak should fall on other entities. Robert Nugent, president of Jack in the Box, announced:

Over the next few weeks, company spokespeople reiterated that they followed appropriate food preparation guidelines, often suggesting that undercooked hamburger was the fault of others. "In the last 10 years, we've sold 400 million pounds of hamburger safely and without incident. Then, bang, it hits you. It's your worst, worst nightmare" ("Jack in the Box worst nightmare," 1993). When the fast-food chain stopped selling all hamburger products by noon on 19 January 1993 and replaced its hamburger supply

("50 poisoned by burgers," 1993), Sheree Zizzi, spokeswoman for Foodmaker, Inc., expressed the company's concern about the outbreak and its willingness to find the cause of the problem. To deflect potential blame, she stressed that employees were being contacted "to be sure the food is properly prepared and cooked" (Kusumoto, 1993). Zizzi commented on January 28, "We haven't seen the Health Department report, but rest assured we'll be investigating it fully. Our procedures clearly outline proper hygiene, food storage, and cooking in accordance with state standards" (Williams & King, 1993, p. A1).

Over the next few weeks, company spokespeople reiterated that they followed appropriate food preparation guidelines, often suggesting that undercooked hamburger was the fault of others. Company president Robert Nugent repeatedly stated that Jack in the Box increased its cooking times to exceed federal and state requirements ("Jack in the Box says it will pay. . . ," 1993). At one press conference, Nugent blamed the health inspectors for the undercooked hamburger: "It's my belief that the health inspectors from King County were not, in fact, allowing our employees to exercise the cooking procedures.... They didn't let him finish [before they inspected for undercooked meat]" (Nelson, 1993).

To further the perspective that Jack in the Box was not the cause of the problem, and to build good will with the public, Jack in the Box Chairman Jack Goodall said, "The company extended its prayers and sympathy to the families affected" (Angelos, 1993, p. C1). Within a week, the company announced it would pay hospital bills for all customers stricken with E. coli bacterial intestinal disease. Robert Nugent said, "Costs will be paid 'no strings attached" (Gilmore & Lewis, 1993). A special hotline number was established for people to call if they thought they were infected ("Jack in the Box says it will pay . . . ," 1993). Later, the company explained that by accepting assistance, people were not "signing away their right to file suit later" ("Jack in the Box says it will pay. . . ," 1993, p. A6). Throughout the crisis, Nugent said the company would do the morally right thing.

Foodmaker, Inc., through its statements and actions, shifted the blame from Jack in the Box to its suppliers. Robert Nugent, President of Jack in the Box, stated: "The outbreak of food-related illnesses in Washington over the past two weeks has required us to re-evaluate all our suppliers, processors and quality control procedures throughout the system" (McCullough, 1993, p. 4B). Foodmaker also filed a law suit against Vons Companies, Inc., and its other suppliers, seeking to recover all of the costs resulting from the outbreak of E. coli 0157:H7 (Gilmore & Lewis, 1993). Later, Jack in the Box acknowledged that "its contract did not call for Vons to test the meat" ("Jack in the Box worst nightmare," 1993).

The economic impact of the crisis for Jack in the Box and Foodmaker, Inc., began on 20 January, when Foodmaker shares fell \$1.50, or 11% on the New York Stock Exchange ("Foodmaker shares dive Seattle," 1993). Jack in the Box restaurants referred all questions from reporters to the corporate officials in San Diego, "which did not return calls" (Nogaki, 1993). While Washington

accounted for only 6% of Jack in the Box's cash flow, sales continued to fall "though the company will not say by how much" ("Jack in the Box's worst nightmare," 1993). Later reports documented that "by the first week in February, [sales] were down 40% from the comparable 1992 period" (Sims, 1993).

Foodmaker, Inc., chairman Jack Goodall offered "our deepest sympathy and most heartfelt apologies" and "we're very sorry" which was the first time an apology for causing the crisis had been acknowledged.

Throughout the crisis, company spokespeople downplayed the economic impact ("Jack in the Box sales expected to rebound," 1993). According to Zizzi, "Sales have been secondary to us" ("Jack in the Box says it will pay...," 1993). As Foodmaker, Inc., and Vons, the nation's ninth-largest supermarket chain, became implicated, shares in their company dropped. Foodmaker lost about one third of its value in January (Flores, 1993) and Vons stock went down \$2 on the NYSE Big Board immediately after the outbreak (Chambers, 1993). While the outbreak represented an economic loss for the companies, there were other associated costs. Mimi Fields, Washington's health officer, estimated the cost medical and governmental costs of the crisis at \$1 million and said, "the cost of grief to the families ... is incalculable" (Chambers, 1993).

Post-Crisis Phase

At the beginning of the post-crisis stage, several statements made and actions taken at the Jack in the Box annual meeting in San Diego marked a change. Nugent conceded "he had been wrong when he insisted that the Washington State Department of Health had not notified the company last year of new, more stringent hamburger cooking regulations." Foodmaker, Inc., chairman Jack Goodall offered "our deepest sympathy and most heartfelt apologies" and "we're very sorry" which was the first time an apology for causing the crisis had been acknowledged. Foodmaker announced that "to ease the concern of investors, the company would draw from a \$50 million line of credit and use the \$100 million liability insurance policy to protect itself from claims," and the corporation discontinued its relationship with the public relations firm Fleishman-Hillard, Inc., of St. Louis (Nogaki, 1993).

Families of the victims and franchisees sued Foodmaker, hoping to recover their losses. The comments of Sheree Zizzi, spokeswoman for Foodmaker when the suit of Riley Detwiler, one of the victims, was settled reflected a businesslike tone, "We're pleased to have resolved this matter. We believe the settlement was fair and equitable" ("E. coli parents settle suit," 1993). Foodmaker official Robert Nugent was less pleased when commenting on the unsuccessful settlements with franchisees, "We are very disappointed that after extensive negotiations we were unable to resolve the matter in an amicable fashion." Gina Devlin, a Foodmaker spokesperson, "declined to specify the terms or the number of restaurants affected" (Adelson, 1993). The main arguments of the franchisees were that Foodmaker, Inc., was negligent for failing to ensure that the meat they supplied was safe (Harrison, 1993) and that the company was not forthcoming about information that later affected stock prices (Flores, 1993).

The economic impact on the nation's #5 fast food hamburger chain was severe. Foodmaker ran television and newspaper ads featuring Jack W. Goodall, assuring the public that the food was wholesome, that the company would pay all medical costs for customers who became ill from eating at its restaurant, and that a discounting plan was in place to "capitalize on the good will" of the people who wanted to eat at Jack in the Box but were afraid to go back (Sims, 1993). According to reports, "The company lost \$29.3 million in the quarter after the disaster, including \$8 million in financial assistance for franchisees and lower income rents and royalties. Sales were down 11% to \$217.3 million" (Harrison, 1993). The crisis also prompted Foodmaker, Inc., to scale back its plans for expanding Jack in the Box (Bryant, 15 February 1993). The crisis also affected the meat packaging industry. By May, 30 of 90 beef slaughterhouses were closed as part of a USDA review (Sugarman, 1993).

An analysis of sales at Jack in the Box is also revealing. When franchisees began suing Foodmaker, Inc., for their losses, the parent company suggested that the economic damage was not as severe as claimed. While sales did improve after the company acknowledged its responsibility and took corrective measures regarding the cooking temperatures, Mitchell Shapiro, an attorney for the franchisees who were suing, argued: "Some of the recovery is artificial. A lot of those sales are of heavily discounted items." Once the discounts and specials were phased out by Jack in the Box, sales fell by as much as 30% in some of the franchises (Harrison, 1993).

Conclusions

Although Dean Owen, a Washington Health Department spokesman, claimed on 19 January that the cause of the crisis had not yet been determined, it was not long until three sources were blamed: The United States Agriculture Department (USDA) and state health officials blamed Jack in the Box for not cooking hamburger at 155 degrees as required by state; Jack in the Box blamed its supplier, the Vons Companies of Arcadia, California, for supplying tainted meat; and Washington state health officials believed the meat was contaminated at the slaughterhouse ("Jack in the Box's worst nightmare," 1993).

USDA and State Health Officials blamed Jack in the Box for not cooking the hamburgers at the 155 degrees required by the state ("Jack in the Box's worst nightmare," 1993). Several factors contributed to placing blame on Jack in the Box. On 28 January, "Inspectors . . . found the grill was not working properly," cooking hambergers at 13 to 17 degrees below the state-required 155 degrees; "health officials said the restaurant yesterday also had no soap and towels for work handwashing"; and "there was raw meat touching items such as lettuce that was not to be cooked" (Williams & King, 1993). Jack in the Box was clearly a factor in that 93% of those who became ill remember eating at a Jack in the Box, according to Dr. John Kobayashi, chief epidemiologist for the State Department of Health (King et al., 1993). The problem was especially serious for children: "smaller, children's burgers . . . are now considered a key culprit in the E. coli outbreak" [Thin patties sometimes curl up on a grill unless they are flattened with a press; they don't cook properly.] ("Inspectors rarely tested . . . ," 1993).

Jack in the Box blamed Vons Companies for the crisis. As early as 29 January investigators isolated the Vons Companies of Arcadia as the source of the contaminated meat. Vons processed the meat on 19 November and

shipped it only to Jack in the Box restaurants (Glamser & Hoversten, 1993). Investigators found that 90% of the victims ate contaminated hamburger that could be traced to a shipment received from the Southern California Vons Companies. Federal agriculture officials said it occurred before the meat arrived at Vons and up to 14 slaughterhouses that might have provided meat to the distributor were being investigated (Gilmore & Lewis, 1993). Mary McAboy, a Vons spokeswoman attempted to deflect the criticism: "We continue to be

confident that Vons' processing did not contaminate the meat. Health authorities have made it clear that proper cooking would have prevented this tragedy" (Gilmore & Lewis, 1993).

Washington state health officials, with evidence provided by the Centers for Disease Control "Jack in the Box got off to a bad start because they first said they had no comment. . . . Then, they attempted to pass the blame to Vons. I would have advised them to step right up and accept responsibility."

in Atlanta, suggested that meat contaminated at the slaughterhouse was responsible for the crisis. According to state officials, "The most likely source was meat contaminated with feces at the time of slaughter" ("Jack in the Box's worst nightmare," 1993). "Investigators . . . said yesterday that they have found 'epidemiological evidence to suggest' that the meat, infected with the E. Coli 0157:H7 bacterium, passed through the Service Packing deboning plant in Los Angeles on November 18. The deboning meat was then shipped to the Vons Company of Arcadia in Los Angeles County, which processed it into 40,000 hamburger patties and sold it to Jack in the Box restaurants in the three states where the food poisoning occurred" (Ingram, 1993). Of the nine sources of the meat for Service Packing, five are in California. The only Bay Area plant listed is Rancho Veal, Co., of Petaluma. To further focus on the slaughterhouses as the source of the crisis, "health officials said tests indicated there was no mishandling or refrigeration problems in the processing or transportation of the beef to Jack in the Box distribution centers" ("Jack in the Box's worst nightmare," 1993).

Some observers suggested that governmental agencies should have taken a more aggressive strategy when dealing with E. coli. An editorial in the *New York Times* gave the following perspective: "There are many ways the industry could lessen the risks of food poisoning, but the government does not require any of those steps, like microbiological testing to set bacterial standards for raw products... the seal of approval on the meat it inspects is misleading" (Burrows, 1993).

Where Jack in the Box Failed

Jack in the Box, and Foodmaker initially did not handle the crisis effectively. According to Michael Brennen, vice president of Seattle-based public relations firm DeLauney Phillips, Inc., "Jack in the Box got off to a bad start because they first said they had no comment.... Then, they attempted to pass the blame to Vons. I would have advised them to step right up and accept responsibility" (Jack in the Box's worst nightmare," 1993). They also criticized "the Washington State health authorities for not informing the company of new cooking regulations" (Sims, 1993). These ambiguous, inconsistent and delayed responses suggested a failure on the part of Jack in the Box and Foodmaster, Inc., to contain and reduce the harm of the crisis.

James Lukaszewski, a crisis management consultant in White Plains claimed, "They were the model of doing things incorrectly" (Sims, 1993). Their

recovery strategy was two-pronged: "Convince patrons that the food poisonings were isolated incidents stemming from a single batch of tainted meat; and . . . offer customers an incentive" (Sims, 1993). Foodmaker's dissatisfaction with the handling of the crisis may have precipitated the dismissal of its public relations firm, Fleishman-Hilliard Inc. of St. Louis. According to Sims (1993): "Foodmaker officials, who insisted on anonymity, said the restaurant company and the public relations firm had parted because of personality conflicts and disagreement over how the crisis should be handled. They declined to be more

Foodmaker's strategy to convince patrons that the food poisonings were isolated incidents stemming from a single batch of tainted meat and to offer customers an incentive to return to Jack in the Box proved somewhat successful. specific." The difficulty they experienced with their public relations agents extended the crisis stage beyond what it might have been with a more consistent response at the start of the crisis.

One of the biggest failures involved how Jack in the Box and Foodmaker, Inc., handled the franchisees. Several franchisees sued Foodmaker, Inc., for

the losses they suffered after the outbreak. Even by July, the 85 franchisees who operate 325 of the chain's 450 outlets, claimed losses stemming from sales 30 percent below normal and the failure of Foodmaker, Inc., to adequately compensate "for the financial fallout" following the outbreak (Harrison, 1993). Sellnow and Ulmer (1997) argued that Jack in the Box used strategic ambiguity to "diffuse and confuse responsibility" after the crisis. The result of this strategy was the inability of franchisees to make informed decisions about how to handle their own business practices and their unwillingness to settle financially with Foodmaker, Inc., when the corporation attempted to resolve the matter.

Where Jack in the Box Succeeded

Despite the initial denial of guilt, Foodmaker and Jack in the Box spokespeople presented themselves to the public in a sincere manner that appealed to the general public. Wiley Brooks, a Seattle-based public relations consultant, believed that while Foodmaker "got off to a bad start," the media were quite critical of the company: "The public never quite bought the media's edge on the story, mainly because people responded to the sincerity of the television and print ads" (Sims, 1993). The public presence in the media of Robert Nugent, Jack Goodall, and Sheree Zizzi portrayed a company that was taking the matter seriously.

Foodmaker's strategy to convince patrons that the food poisonings were isolated incidents stemming from a single batch of tainted meat and to offer customers an incentive to return to Jack in the Box proved somewhat successful. The replacement of 28,000 pounds of hamburger with new meat, retraining all employees regarding the handling of meat products, and raising the cooking temperature in Jack in the Box restaurants to the state standard of 155 degrees constituted Foodmaker's modified public relations strategy. Even though customers tended to order fish or chicken instead of hamburgers immediately following the outbreak (Nogaki, 1993), most customers seemed willing to give Jack in the Box another chance. As Richard Edelman, president of Edelman Public Relations Worldwide in New York, "It's not the first time that kills your business credibility. It's the second time" (Nogaki, 1993). By mid-March, business was returning to normal ("Sales rebounding at Jack in the Box," 1993).

What Jack in the Box Learned

The corporate management team for Jack in the Box and Foodmaker, Inc., found that denial and deflection were ineffective strategies for managing the E. coli crisis. This was especially the case as the Washington Health Department identified faulty cooking practices that failed to kill the E. coli bacteria present in the tainted meat. The result of inconsistent and conflicting statements was the portrayal of Jack in the Box and Foodmaker, Inc., as self-serving.

The absence of a crisis plan resulted in disagreement over which

values should dominate the campaign to regain customers and calm constituent groups within the corporate structure. As corporate leaders gained new insight into how the public perceived the crisis, and new information became available about the contamination of the meat at the slaughterhouse, the decision to expand

The corporate management team for Jack in the Box and Foodmaker, Inc., found that denial and deflection were ineffective strategies for managing the E. coli crisis.

their response repertoire to include an apology and promises to pay for any damages caused by the crisis was welcomed by the public.

Implications for Best Practices

Despite being named among the 10 worst United States corporations by Ralph Nader (Reuters, 1993), Jack in the Box restaurants remain throughout the country. While Jack in the Box and its franchisees suffered economically and three people died as a result of the outbreak in 1993, two implications provide insight as other organizations seek to avoid similar crises in the future: (1) Organizations should be open to learning new insights as they confront crises related to their operations, and (2) organizations can avoid conflicting internal strategies when facing similar situations by developing crisis plans.

As Jack in the Box spokespeople confronted the challenge of conflicting information about the cause of the outbreak, the need for organizational learning was apparent. Seeger et al. (2003) suggest that organizations learn by using feedback to "regain stability in light of new information" (p. 38). Drawing from Huber (1996), Seeger et al. distill learning into four processes: "(1) acquisition of knowledge, (2) distribution of information among various sources, (3) interpretation of information, and (4) storing of knowledge for future use, in organizational memory" (2003, p. 38). As early reports of the outbreak were linked to Jack in the Box, the spokespeople had not acquired all of the information they needed to respond. Once more complete information became available, the company leaders were able to interpret what had happened and respond more effectively. When Foodmaker officials finally acknowledged that Jack in the Box could have killed the E. coli bacteria and averted the crisis if food handlers had cooked the meat at the state-recommended temperature of 155 degrees, they had a greater understanding of what would be needed in the future. Clearly, companies can learn from this crisis by developing an organizational culture that is willing "to adapt or evolve in response to their environment" (Seeger et al., 2003, p. 38).

The second implication resulting from this case study is the realization that much of the public backtracking that occurred by Jack in the Box and Foodmaker, Inc., spokespeople could have been avoided had the organization prepared a Crisis Management Plan (CMP) and used it as it dealt with the E. coli outbreak. Drawing from Barton (2001), Seeger et al. describe a CMP as "a strategic document carefully prepared and maintained as a master guide for framing, overseeing, and tracking a systematic crisis management and response process" (2003, p. 169). Coombs (1999) created a 15-point CMP to assist organizations seeking a more effective way to handle crises. Included in the plan are the following: Names of the crisis management team; contact information for all persons and agencies involved in the plan, including outside groups such as fire, police, hospitals, and regulatory agencies; overview of the types of crises possible; incident report sheets to document what happened, who made decisions, and who was contacted; parameters of proprietary information not to be disclosed without top management approval; a strategy worksheet for constructing messages to the public; secondary and stakeholder contact sheets; a business resumption plan; crisis control center; and details how the CMP will be evaluated (Seeger et al., 2003, p. 170). Had Jack in the Box enacted such a plan and followed its steps, it could have avoided multiple spokespeople presenting conflicting information and might have prevented the continued cooking of meat at unsafe temperatures after the initial outbreak occurred. Rather than shifting blame, all of the information could have been gathered and processed by the crisis management team. Messages to the media and public would have been more accurate and may have appeared less self-serving. The care taken to keep secondary and stakeholders apprised of the situation may have averted the lawsuits that resulted when Jack in the Box spokespeople guaranteed that all claims would be paid to those who had suffered from the crisis. After the crisis past, the plan would have provided the team a means by which the process could be evaluated and improved.

The E. coli outbreak stemming from Jack in the Box restaurants in the Seattle, Washington, area produced a crisis resulting in three deaths, with over 400 people adversely affected. Since the outbreak in 1993, there have been no further E. coli crises associated with Jack in the Box. Through organizational learning and recognizing the need for a crisis management plan to guide how a company responses to such incidents, leaders in business and industry will be better prepared to deal with similar situations in the future.

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5 Crisis Plans and Interagency Coordination: Lessons Learned from Tainted Strawberries in the School Lunch Program

Julie M. Novak North Dakota State University Ithough the American food supply may be the safest in the world, millions of Americans experience food borne illness every year, and some 9,000 mostly the very young and elderly—die as a result (Hingely, 1997). Since 9/11, risks related to bioterrorism have joined the ongoing safety threats to the food system and to the health and well-being of individuals. While foolproof safety systems may be impossible, past experiences demonstrate that planning, preparedness, and interagency coordination not only help prevent crises, but also facilitate prompt response, mitigation, and resolution of crises.

When multiple agencies at many levels are responsible for protecting the health and wellbeing of school-aged children, prior planning facilitates efficient and effective coordination, and thereby prevents or minimizes significant harm from contaminated foods. A 1997 Hepatitis A outbreak in the National School Lunch Program provides an opportunity to highlight the vital importance of pre-crisis planning with appropriate stakeholders. When multiple agencies at many levels are responsible for protecting the health and well-being of school-aged children, prior planning facilitates efficient and effective coordination, and thereby prevents or minimizes significant harm

from contaminated foods. Review of this past crisis reveals lessons learned for the optimal development and updating of preparedness and crisis plans.

Case Study Overview

The Governmental Role Industry has primary responsibility for the safety of the food it produces and distributes, but federal, state, and local agencies also work to prevent food borne illness by verifying that industry is carrying out its responsibility and by initiating regulatory control when necessary. Three federal agencies work with industry to prevent food contamination: the U .S. Department of Agriculture (USDA), the Food and Drug Administration (FDA), and the Environmental Protection Agency (EPA) (Fomanek, 2001). The food product determines which regulatory agency has primary jurisdiction.

- USDA: meat, poultry, and egg products.
- FDA: all other foods, including game meats, bottled drinking water, and shell eggs.
- EPA: water, including drinking water from public systems, and the use and disposal of organic and inorganic wastes on agricultural land.

These agencies and the Centers for Diseases Control and Prevention (CDC), the premier U .S. public health agency, respond to outbreaks of food borne illnesses by investigating and managing any failures in the food system (Food and Drug Administration [FDA], 1997).

School Lunch Program

The USDA also regulates foods purchased for and used in federally sponsored food programs. This includes food services in prisons, senior programs, and schools and other institutions. In 1997, over 93,000 schools participated in the National School Lunch Program. Every school day throughout that year, the USDA served over 26 million meals to school-aged children—four billion meals in one year (Food and Nutrition Service, 1997). The USDA purchases only U.S. grown commodities for the school lunch programs, and all suppliers must certify in writing that the product is in fact domestic. In addition to this requirement for vendors, USDA occasionally conducts compliance audits regarding the origin of the product (Knight, 1997).

Interagency Coordination

While each federal agency performs a specific role with defined food products, most outbreaks require coordination between multiple agencies. For example, the FDA is responsible for the safety of processed packaged food, which includes any frozen strawberries or products made from the strawberries. The USDA, however, shares responsibility for the same product when it is purchased and used in federally-sponsored food programs. The CDC provides the epidemiologic and public health expertise to determine the cause of outbreaks and to recommend treatment options for the health of affected and vulnerable persons. In the event of an outbreak from food served in the National School Lunch Program, the FDA, the USDA, and the CDC all assume investigative and management responsibilities (FDA, 1997). State and local agencies maintain interagency coordination with their federal counterparts and with agencies serving the same geographical area.

Contaminated Strawberries—Hepatitis A Outbreak

In March 1997, over 200 children and teachers in Michigan became sick with Hepatitis A as a result of eating contaminated strawberries as part of their school lunch. Although the Hepatitis A outbreak occurred in Michigan, government agencies quarantined millions of pounds of frozen strawberries in 15 states and the District of Columbia. Additionally, school officials in several states ordered thousands of children who had consumed strawberries linked to the contaminated shipments to be protectively vaccinated (Hong, 1997).

Crisis Timeline

Pre-Crisis Phase

- Strawberries grown and harvested near San Quentin and Baja California Norte areas in Mexico, then sold and transported to Andrew and Williamson Sales, Inc., (A&W) in San Diego, California. One week after the confirmed Hepatitis A outbreak in Michigan, FDA investigators found the fields where the strawberries originated contaminated (McClain, 1997), with open-pit latrines and no handwashing facilities or health procedures in place (Knight, 1997).
- A&W intentionally mislabeled Mexican-grown strawberries as 100% U.S. grown. The strawberries sold to vendors for the USDA School Lunch Program.

Crisis Phase

- Over 200 children and adults contracted Hepatitis A in Michigan.
- Michigan state authorities informed the CDC of possible Hepatitis A outbreak in multiple schools in two different counties.
- CDC, USDA, and FDA linked Hepatitis A outbreak to contaminated strawberries.
- USDA and FDA notified states of possible contamination in other shipments of strawberries and suspended further serving in schools.
- FDA began investigation of A&W.
- Schools coordinated the administration of gamma globulin for any persons consuming potentially contaminated strawberries and within the time period of vaccine effectiveness.

Post-Crisis Phase

- A& W indicted for fraud.
- A&W convicted and required to pay \$1.5 million.

Theoretical Underpinnings

Crisis plans are the most critical tool for crisis prevention and resolution, especially when multiple agencies must coordinate their efforts. Crisis planning begins with the projection of possible crises and the identification

Crisis plans are the most critical tool for crisis prevention and resolution, especially when multiple agencies must coordinate their efforts. of the stakeholders, structures, resources, and strategies "necessary to resolve the crisis with as little disruption, cost, and harm as possible" (Seeger, Sellnow, and Ulmer, 2003, p. 163). In the event of a crisis, prior planning positions agencies to

respond and recover without delay or exclusion of important partner agencies. As systems theory illustrates, when failure in one part of the system occurs, the consequences and repercussions due to failure will impact may other parts (Seeger et al.). Advance planning better situates agencies to effectively manage crises through the creation of "a set of anticipatory measures that enables an organization to coordinate and control its response to an emergency" (Nudell and Antokol, 1988, p.21).

When crises in food safety occur, communication plays a pivotal role. Crisis response and mitigation requires uncertainty reduction, coordination, information dissemination, and messages relevant to the specific needs of each stakeholder (Seeger et al., 2003). Agencies at multiple levels work to determine the nature and magnitude of the outbreak, to assess the multidimensional impact and potential consequences, to provide accurate and reliable information, and to make informed and acceptable decisions with the participation of all stakeholders. Stakeholders include interested parties likely to be affected by any system failure or crisis. Contact and working relationships prior to crises best ensures timely contacts, dialogue, and responses during crises. During the stress and uncertainty of a crisis, it is easy to overlook important stakeholders. However, failure to communicate effectively with all stakeholders can actually increase outrage and harm by denying stakeholders the information they need to make informed decisions or by excluding stakeholders that disproportionately bear the consequences of a crisis from participation in crisis management.

Method

This analysis employed a case study method to develop descriptions of how the events, coordination processes, and external communication pertaining to a 1997 Hepatitis A outbreak in the Michigan school lunch program were portrayed in media coverage. Specifically, newsprint reports about interagency and stakeholder coordination indicated the importance of planning and preparedness when responding to a food borne illness outbreak that involves national, state, and local entities.

The data for this study included national and local coverage by major print media sources for the six months following the outbreak in March 1997. Articles were obtained through *ProQuest Newspapers* and *LexisNexis* databases. Key events in the case and themes of communication are described from the perspectives of crisis communication and crisis planning.

Analysis

In December 1996, the USDA approved a contract with Andrew and Williamson Company Sales, Inc., (A&W) in San Diego, California, for the purchase of strawberries. The contract specified that the processed frozen fruit had to originate from crops 100% grown, processed, and packed in the United States and required A&W to supply a written statement certifying that the products delivered to USDA met such specifications. A false statement to federal officials concerning the origin of a product is a criminal offense, punishable by up to five years in prison and significant fines (Krikorian, Ramos, and Groves, 1997). Civil penalties may be assessed, including debarment from federal contracting and the loss of a license to sell perishable agricultural commodities. A&W provided the required certifications directly to the USDA and through three brokers. Although USDA officials conduct random inspections at packing plants with which they have a contract, no federal official had inspected A&W since 1988 (Knight, 1997).

As subsequent investigations revealed, during the winter of 1996 A&W had purchased strawberries grown on remote ranch properties near San Quentin and Baja California Norte in Mexico. A&W processed, packed, and froze the purchased strawberries in 30-pound containers for commercial use and distributed about 900,000 pounds of the strawberries to commercial outlets, which used the fruit for making dessert toppings, pies, and cocktail mixes. A&W later distributed 1.7 million pounds of frozen strawberries to the USDA through four vendors: Kendall Frozen Fruits, Inc., of Encino, California; Pacwest Foods, Inc., of Newbury Park, California; JSO Associates, Inc., of Great Neck, New York; and New West Foods of Watsonville, California. They provided the required certification, "100% U.S. grown," directly to the USDA and the four vendors. Wawona Farms in Clovis, California, packed the strawberries in cups in early 1997 and shipped the frozen dessert cups to schools ("Holes cannot," 1997). These shipments contained strawberries later associated with the Hepatitis A outbreak.

The USDA had received reports early in 1997 that a San Diego firm was illegally purchasing foreign-grown strawberries for use in school lunches but failed to act before the Michigan Hepatitis A outbreak occurred (Knight 1997). According to Kenneth Clayton, deputy administrator of Agricultural Marketing Services, one reason the reports were not acted upon was that competing packing plants sometimes spread unfounded rumors about one another (Knight).

The Michigan Department of Health notified the CDC of a possible Hepatitis A outbreak in schools of two counties on 24 March 1997 (Walsh, 1997). Public health authorities invited an epidemiologist from CDC to investigate, and on 27 March, the Michigan Department of Health in collaboration with the CDC informed the FDA and USDA of the outbreak and its possible link to frozen strawberries served in school lunch programs. FDA officials contacted A&W in California, beginning an investigation of the facility and its production and distribution records. USDA officials instructed states that may have received the possibly implicated product to suspend the use and distribution of frozen strawberries in the school system until further notice (Allen, 1997). Among these states were six—Michigan, Arizona, southern California, Georgia, Iowa, and Tennessee-known to have received the implicated product (Walsh, 1997). As an additional precautionary measure, the USDA informed ten other states— Florida, Illinois, Indiana, Maine, New Jersey, New York, North Carolina, North Dakota, Washington, D.C., and Wisconsin-not to use strawberries from the California-based company until more information was available (Miller, 1997). USDA's Food, Nutrition, and Consumer Services worked with states to notify and advise individual school districts and schools.

On 28 March, in the late afternoon, the CDC concluded that the outbreak was associated with frozen strawberries served in school lunch programs (Krikorian et al., 1997). The next day, 29 March, the CDC notified state epidemiologists in states that had received the strawberries and asked them to work with school officials to identify any students that might benefit from gamma globulin. Public health officials shipped doses of gamma globulin to areas where the berries were served. Schools in coordination with local public health departments initiated mass inoculations; thousands of children in six states potentially benefited (Hong, 1997). As later mandated, A&W would pay for the \$18-per-dose inoculations of gamma globulin (Levin, 1997).

Although the Los Angeles school district received fax notification on Thursday of the possible contamination and the need to suspend use, strawberry dessert cups were still served on Friday in twelve elementary, two middle, and three high schools (Krikorian et al., 1997). After some delay, food service personnel received the notification. One school, however, served the desserts on Monday after failing to receive the notification Friday. "A clerical error left Mount Vernon off," a school district spokesperson explained. "By the time we contacted the food service manager, the fruit cups had already been served" (Altman, 1997). Southern California officials announced on Tuesday, 1 April, that within the past week some 9,000 school children and school employees in the Los Angeles School District had been served frozen strawberries from the implicated lots and could be at risk of contracting Hepatitis A (Allen, 1997; Chaung and Marquis, 1997; "Holes cannot," 1997).

Although school officials were notified on Thursday, parents and the public were not informed about the potential contamination until Tuesday (Chaung and Marquis, 1997; Holes cannot, 1997). School officials said "they wanted to confer with the county public heath department over the best method of notifying parents" (Krikorian et al., 1997). The USDA's inspector general continued to investigate why A&W intentionally and illegally mislabeled and sold the Mexican berries as domestic. Epitope, Inc., of Beaverton, Oregon, A&W's parent company, confirmed in a statement that A&W inaccurately described the strawberries associated with the outbreak as having been grown and processed in the U.S. "We have notified the USDA of our concern with regard to this matter and have today accepted the resignation of Fred L. Williamson, president and CEO of A&W," said Epitope president Adolph I. Ferro (McKenna, 1997; Walsh, 1997). Only days later, Epitope said it sued Andrew and Williamson to try to rescind its recent purchase of this company on the grounds that the company had failed to disclose that strawberries, grown in Mexico, had been mislabeled as U.S.-grown produce (Effinger, 1997).

Meanwhile, FDA officials found that containers of A&W strawberries had spread far beyond school cafeterias and were still available to consumers in Michigan. Officials found berries at distributors, restaurants, and retailers in the Detroit area. Caramagno Foods Company of Detroit had received berries from 17 May 1996, to 31 December 1996 (Siemaszko, 1997). Commercial processors used them in jams, jellies, pies, and even daiquiri mixes. However, since such products require high levels of heat during processing, spread of the virus through these products was unlikely. Also, because of the distribution dates, most of the strawberries likely had been consumed some time before the outbreak (Siemaszko). Agway, an agricultural cooperative in Syracuse, New York, said it was voluntarily recalling 779 containers of frozen strawberries from its stores after learning they came from A&W. The Syracuse-based cooperative said the recall was precautionary and was not requested by regulators (Levin, 1997).

Mexican growers, who depended on a \$1.9 billion-a-year export business, feared losing U.S. markets due to the Hepatitis A outbreak link to strawberries grown in Mexico. At the same time, Californian growers feared a negative industry impact. California's Secretary of Agriculture, Ann Veneman; Secretary of Health and Welfare Sandra Smoley; and lawmakers from strawberry-growing districts publicly assured the general public in a news conference that the state's \$552 million-a-year crop was safe (Claiborne, 1997; Levin, 1997).

On 25 April, the USDA announced that A&W and its former president, Frederick Williamson, falsely certified the strawberries as "100% grown and packed in the United States." A&W was suspended from contracting until the government's investigation and any related legal actions were completed ("USDA suspends," 1997;

Numerous agencies and stakeholders throughout the country coordinated measures to prevent and to mitigate the consequences of a food borne illness.

Kraul, 1997). A San Diego federal grand jury indicted A&W and its president on 11 June. The 47-count indictment included one count of conspiracy to defraud the government, three counts of making false statements, and 43 counts of false claim ("Indictments issued," 1997). The charges related to the sale of 1.7 million pounds of Mexican-grown strawberries for more than \$902,000 to the USDA's school lunch program (Claiborne, 1997). Each charge carried a maximum penalty of five years in prison and a \$250,000 fine (Claiborne, *LA Times* and *Washington Post Services*, 1997). The maximum fine against the corporation on each count was \$500,000.

The indictment alleged that Williamson and A&W used three food brokers in California and New York to disguise the fact that the strawberries were not grown domestically. In addition, the company "attempted to conceal the true origin" of the shipments by submitting false certificates of the strawberries' origin. A&W's strawberry salesman Richard Kershaw plead guilty to charges related to the incident and cooperated with the government; however, the company denied the charges. "We believe the charges filed today in federal court are mistaken and will be shown to be wrong," a company statement read ("Indictments issued," 1997).

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In May, Epitope and A&W agreed to rescind their purchase deal (Claiborne, *LA Times* and *Washington Post Services*, 1997). Epitope said the former owners of A&W agreed to take back their company and return the 520,000 shares of Epitope stock they had accepted as payment (Woodward, 1997). Epitope also left behind the potential liability for the Hepatitis A outbreak and, at the time, two class-action suits in California and Oregon. By late May/early June, potentially exposed individuals had likely reached the end of any hepatitis incubation time period.

The Hepatitis A outbreak affected 213 children and teachers in Michigan

and led the government to quarantine millions of pounds of frozen strawberries in 15 states and the District of Columbia (Hutin et al., 1999). School officials in several states ordered thousands of children who had consumed strawberries linked to the contaminated shipments to be protectively vaccinated (Claiborne, LA Times & Washington Post Services, 1997). Numerous agencies and stakeholders throughout the country coordinated measures to prevent and to mitigate the consequences of a food borne illness.

On 14 November, A&W pleaded guilty to fraud and to selling 1.7 million pounds of Mexican strawberries. The firm agreed to pay the federal government \$1.5 million. A&W was banned for several years from selling strawberries to the USDA school lunch program.

The multi-state, multi-agency coordination be-speaks of efficient and effective mobilization for the prevention or resolution of food borne illness outbreaks.

Conclusions

As the description of events highlights, multiple agencies at the federal, state, and local level became involved as a result of the Hepatitis A outbreak. Analysis of the outbreak and subsequent action to minimize the number of cases indicates that

coordination efforts succeeded better at the national and state level than at the local level. Additionally, direct participation of parents, primary stakeholders, was delayed and minimized.

Where they succeeded

The CDC swiftly notified the USDA and the FDA of the possible link to strawberries, which resulted in coordinated yet separate investigative efforts. The CDC continued to verify the cause, the FDA investigated the product and its possible origin, and the USDA acted to suspend the further distribution and use of the suspect product in federal food service programs, all happened within a couple of days. Soon thereafter, the CDC informed state epidemiologists who in turn worked with local health departments and school districts to inoculate any individuals who could benefit from gamma globulin inoculation. The multistate, multi-agency coordination bespeaks of efficient and effective mobilization for the prevention or resolution of food borne illness outbreaks.

Where they failed

Time-sensitive alerts require an expedient and coordinated routing procedure. The short delay and the internal fax routing resulted in the unnecessary exposure of approximately 9,000 individuals in Southern California. The Los Angeles school district's minimal yet significant delay reveals an organizational risk preparedness weakness in supportive services. When informed of the potential exposure to Hepatitis A, the school district delayed notification to parents until they could develop a game plan ("Holes cannot," 1997). While this decision did not increase the risk of contracting Hepatitis A, since incubation period of Hepatitis A is approximately one month, the decision did foster outrage among parents (stakeholders) when they became aware of the deliberate delay in notification (Krikorian et al., 1997). This potentially undermined trust between parents and the school district and diminished the perceived credibility of the school officials.

What they learned

Crisis plans must identify, or develop, and result in the use of preestablished routing procedures for the dissemination of information between agencies. The local experience in the Los Angeles school district demonstrated the consequences due to delays in information routing. Moreover, school districts are well advised to inform parents of potential risk as they become known. The Southern California school district could have shared the information, including the window of time to make decisions, and shared the process for making decisions about inocula-tions.

Implications for Best Practices

When interagency coordination in food safety issues is required, planning is the most important crisis management activity those involved can undertake (Seeger et al., 2003). Unfortunately, planning for specific food-related crises often takes place only after a tragedy, as was the case of the Hepatitis A outbreak in 1997, when the Southern California school district had not planned sufficiently for possible crises. This type of failure points to the need for every organization involved to review and update their food-related crisis plans to ensure that the inter- and intra-agency efforts will be well coordinated. Local agencies also need to focus on the public as a stakeholder with the right to timely information and to participation in the decision-making process. Each organization or institution should develop crisis plans that include how potential food-related crises will be managed. Among the components of the crisis plan should be the procedures for distributing, receiving, and handling health-related alerts and procedures for contacting and communicating with identified stakeholders.

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58 Protecting America's Food Supply

6 Monsanto's Genetically Engineered Wheat Crisis: Lessons Learned from Faulty Diffusion Strategies

Agnes N. Lyonga North Dakota State University onsanto Chemical Works of St. Louis, Missouri, was founded in 1901 by John Queeny and named for his wife, Olga Monsanto. The company's first commercially successful product was saccharin, followed shortly thereafter by refined caffeine, vanilla, and aspirin. Within thirty years, the company had expanded its business and product portfolio to include a number of manufacturing facilities in both the U.S. and abroad. In 1933 it was renamed "Monsanto Chemical Company" (*Monsanto Historic Archive*, 2004).

Intheearly 1980s, the all-encompassing term, "Bio-Technology," was eagerly

Today, Monsanto is a multinational corporation with several thousand employees worldwide and continues to be the leader in genetic engineering (GE) and genetically modified (GM) foods and the number one supplier of GMO seeds and food biotechnology. embraced by Monsanto to describe its research activities and subsequent manufacturing advances in the plant and animal sciences for the purpose of increasing food production and developing pharmaceutical products. Today, Monsanto is a multinational corporation with several thousand employees worldwide and continues to be the leader in genetic engineering

(GE) and genetically modified (GM) foods and the number one supplier of GMO seeds and food biotechnology.

Genetic engineering refers specifically to technologies involving recombinant deoxyribonucleic acid (DNA) wherein a single gene from one organism is placed into another, with the resulting organism considered genetically modified. An organism so modified, or transformed, is commonly referred to as a genetically modified organism (Janzen, Mattson & Wilson, 2001). As GE application in crop varieties become more prevalent, marketing channel participants face new opportunities, challenges, and risks associated with the development, use, and handling of the resultant products (Van Wechel et al., 2003).

There are numerous risks associated with the adoption and production of GM wheat. Arguments being made against GE wheat included opposition to GE wheat from major wheat markets, impossibility of segregating GE from non-GE wheat after commercial approval, significant agronomic problems associated with GE wheat and commensurate increases in costs for farmers, threats to organic farming, unresolved liability issues arising from farmers who face genetic contamination or market loss, and environmental and possible human health risks from GE wheat.

From its inception, GM foods, in Europe commonly referred to as "Frankenfoods," (Silk, Parrott & Dillow, 2003), have raised political, societal, and emotional issues. According to Mayon-White (2003), there is a global fear that its producers and government agencies will be unable to protect the public from GM foods, which are generally considered unsafe. One of the reasons for the distrust is that scientific risk assessments do not convince many people who make value-based judgments on the safety of consumer products (Mayon-White, 2003). Another is the question, "How safe are GM foods?" The answer to this question has a political dimension that cannot be ignored but it is not the focus of this paper.

According to Nestle (2003), some of the questions that followed the introduction of GM crops are: What are the risks GM foods? What are their benefits? How are risks and benefits distributed? Who makes decisions about them? How will GM foods affect local, national, and international food systems and economies? How should the foods be regulated? Should they be labeled? And is it ethical to create such foods in the first place?

What was disturbing in the public's mind was the fact that Monsanto, knowing the global fear and outrage concerning GM products, did not address some of these questions before introducing its GE wheat. Although coping with a product innovation is usually a challenge for a company, but to be successful new products must be properly diffused by their innovators.

In 30 July 2002, Monsanto pulled back its stated 2005 timeline for bringing the first genetically modified wheat (GE Wheat) to market. The company was

not acknowledging that the crop would be delayed, but no longer stated a timetable, saying only that it would bring the crop to market after it met certain goals, such as building demands for the product and devising a system for segregating GE wheat from other wheat (Delay is seen... 2002). The new position reflected the

What was disturbing in the public's mind was the fact that Monsanto, knowing the global fear and outrage concerning GM products, did not address some of these questions before introducing its GE wheat.

difficulty the company was having in winning acceptance for the crop. Wheat millers in Japan, Canada, and Europe—large markets for American wheat—said they did not want genetically-modified products (GMOs). And some American farmers feared that GE wheat would be mixed with other wheat, hurting exports in general. Moreover, many countries are reluctant to embrace GE foods (Gillis, 2004).

Research Question

To what extend did Monsanto succeed in its GE diffusion strategies, especially with its main stakeholders?

Database

Database for this research was drawn from online newspapers articles and Monsanto annual reports, online Monsanto-sponsored biotechnology research reports, and online GMOs studies conducted by other institutions. The online newspapers articles came from two main databases: *Proquest Newspapers* and *NewsBank Info Web (America's Newspapers)*. The search was limited to newspaper articles dealing with the Monsanto GE wheat story.

Crisis Timeline

Pre-crisis Phase

	27 February 2001	Monsanto's gene-spliced wheat stirs global fears
		of GE wheat.
	24 March 2001	North Dakota weighs 2-year ban on biotech;
		Monsanto put up a stiff fight.
	31 July 2002	Monsanto pulls back from its stated 2005
		timeline for marketing it wheat.
	22 December 2002	Farmers' worries about GE wheat continue as
		U.S. consumers reject it.
	4 October 4 2003	Monsanto ignores Canadian wheat board protest
		against GM wheat.
Cris	sis Phase	
0.10	7 April 2003	Domonstrators rally outside the offices of
	1 Mpm 2000	Demonstrators rang outside the offices of

of GE wheat.

Monsanto Canada Inc. to protest open-air trials

1 May 2003	Monsanto faces further loses from Roundup sales.
31 May 2003	Global resistance to GM foods is destroying Monsanto but the company aggressively makes moves to get its GE wheat approved for consumption.
22 November 20	03 The USDA assures foreign buyers that no GE wheat will be on market.
8 January 2004	Monsanto reports a wider net loss for its fiscal quarter. AgCan ends and abandons testing of GE wheat
10 January 2004	developed by Monsanto. Canada's Organic Farmers tell Monsanto to drop GE wheat project.
27 January 2004	Monsanto seeks support for GE wheat or it might abandon its research.
3 March 2004	Monsanto forces U.S. approval of GE wheat even if Canada says no.
19 March 2004	Japan, largest consumer and buyer, says no GE wheat or they will stop buying.
27 March 2004	Japanese coalition presents petitions signed against GE wheat.
st-crisis Phase	
11 May 2004	Monsanto pulls plan to commercialize GE wheat. Monsanto abandons worldwide GE wheat project:a victory for protesters.

Theoretical Underpinnings

Diffusion Theory

Po

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers, 1995); whereas an innovation is an idea, practice, or object perceived as new by an individual or other unit of adoption (Rogers & Singhal, 1996). The diffusion process involves both mass media and interpersonal communication. Thus, diffusion is a special type of communication in which the message content is concerned with a new idea. Although the newness of an idea gives diffusion its special character, it also indicates that some degree of uncertainty is involved which can only be reduced through information flow. Diffusion refers to the spread of something within a social system and it should be taken as far as one's constructionism permits to denote flow from a source to an adopter. Furthermore, when new ideas are invented, diffused, and adopted or rejected, leading to certain consequences, social change occurs.

In his comprehensive review and general framework of diffusion, Rogers (1995) singled out four main elements of diffusion: innovation, communication channels, time, and the social system, which are identifiable in most diffusion studies, campaigns, and programs. Each one of these elements has its characteristics, but time is the most crucial ingredient in the diffusion process because it enables the researcher to identify the characteristics of early-adopters and to establish the direction of the flow of influence (Katz et al., 1963). The time dimension in diffusion also involves the innovation-decision process of knowledge, persuasion, decision, implementation, and confirmation,

by which an individual passes from first knowledge of an innovation through its adoption or rejection; the innovativeness, i.e, the earliness/lateness with which an innovation is adopted; and the rate an innovation is adopted in a system (Rogers, 1995).

In addition to the four main elements, Rogers (1995) further explains the six main phases in the innovation-development process. First, a need or

problem is recognized. This stimulates the research and develop activities necessary to solve the problem or to fill need. This results in the development of an innovation, which is essentially the process of putting a new idea in a form that is expected to meet the need or to solve the problem. Commercialization—the production, packaging, and marketing of the product—follows, leading to the consequences of an innovation, the change that occurs in a social system as result of the adoption or rejection of the innovation.

Monsanto's early-adopters (farmers) rejected the GE wheat innovation, organizing boycotts before the GE wheat was commercialized and making it impossible for the company to be able to honor its 2005 timeline.

Monsanto's early-adopters (farmers) rejected the GE wheat innovation, organizing boycotts before the GE wheat was commercialized and making it impossible for the company to be able to honor its 2005 timeline. The question worth asking here is why, given the global fear of GMOs, Monsanto introduced its GE wheat before determining whether or not there was a felt need for any new genetically engineered product.

Analysis

Pre-crisis Phase

Prior to the introduction of GE wheat, Monsanto failed to determine whether or not there was a need for the innovation. As a result, Monsanto faced a commercialization crisis when the introduction of GE wheat generated numerous protests and rejections from Japan, Europe, and Canada, its main markets. According to Nganje and Wilson (2004), when developing the product Monsanto placed an emphasis on producer gains, the first stage benefits, and gave little consideration to consumer interests, the phase two benefits. From the beginning, Monsanto knew that GE wheat production cost of would be lower, but higher productivity would mean more profit for the company.

In giving little consideration to phase two benefits of GE wheat production, Monsanto failed to determine whether or not the public felt any need for such an innovation, carrying out research and introducing its new GE product without any prior consumers research. By failing to create a need for the new product and instigating research where there was no problem/need to be solved, their innovation created problems, which led to the crisis.

Furthermore, prior to the adoption of GM varieties, it was common simply to sell on grade and non-grade factors. National and international buyers now require varying types of information on GM varieties and agronomic information on production practices (Nganje & Wilson, 2004). As a result, information requirements and health risk awareness for GM foods have become more critical. However, when introducing the new GE wheat, Monsanto did not sufficiently inform its stakeholders about its risks and benefits, especially as consumers' perception of GM foods was changing (Martin, 2004). Because GE crops do not have a direct consumers benefit, but rather are designed to help farmers, these crops can be seen as posing a potential and unknown risk (Schubert, 2002).

In developing its GE crop varieties, Monsanto had three main stakeholders: farmers, producers, and consumers. However, the company's strategy for years has focused only on farmers because they provide direct income to Monsanto (Monsanto could be another. . . , 2003). The implication is that the company's product development strategy discounts the importance of consumers and food producers. By failing to include consumers and food producers its overall

Thus, market rejection of Monsanto's previous GE crops in one segment of the economy also influenced the market rejection of GE wheat in other segments. business model, Monsanto failed to realize that an effective stakeholders relationship involves balancing the competing needs of various stakeholders and communicating openly, honestly, and frequently with them (Ulmer & Sellnow, 2000).

Furthermore, the commercial products of food biotechnology have

caused no end of controversy. Because of consumer and farmer concerns about GM crop safety, Monsanto has failed for the past six years to get GM crops approved for import or cultivation in Europe. In the U.S., Canada, Asia, and Europe, particularly Great Britain and France, people view GM foods with suspicion, often with dread and outrage. The results of such dread and outrage are boycotts, destructions of plantings, legal bans, and trade disputes. Such reactions reflect misgivings about the risks of technological manipulations of foods, not only to human health, but also to the environment, to the world economy, and to society as a whole (Nestle, 2003). They also reflect public distrust in Monsanto's GE research activities, which are seen as designed primarily to create more benefits for the company. Consequently, numerous ethical concerns, including safety, scientific hubris, and disclosure, created a sense of unease resulting in worldwide rejection of GE wheat.

In the process of developing GE wheat Monsanto encountered two major problems: lack of consumer market acceptance and risk exposure stemming from possible genetic contamination of food crops (Monsanto could be another. .., 2003). These comprised the main risks to its stakeholders. Thus, market rejection of Monsanto's previous GE crops in one segment of the economy also influenced the market rejection of GE wheat in other segments. For example, general consumer rejection of GE foods led food producers to abandon GE foods. Similarly, farmers in North America questioned the commercialization of GE wheat due to the potential loss of lucrative markets, globally, and not just in Europe.

In the face of this rejection, many farmers and officials worried that GE wheat, not yet on the market, could harm producers because some U.S. export customers did not want it. Some farmers also worried that trial plots could contaminate fields of traditionally grown wheat or organic grain. In 2001 North Dakota lawmakers rejected a two-year ban on GE wheat seed proposed by Greenpeace activists in 30 European cities and organic farmers in Canada and called instead for a study of biotechnology issues (Brasher, 2001). This was the crisis-triggering event.

Crisis Phase

Monsanto started field-testing its GM wheat in 1997. In 2002, it applied to commercially grow the GM wheat, modified to resist the company's own herbicide, Roundup Ready, in the U.S. and Canada. The mainstream farming community, non-governmental organizations, industrial wheat sellers, processors, and users; however, all asserted their opposition to the commercial introduction of GE wheat. While some of these parties have traditionally supported the use of GE crops, few supported the introduction of Monsanto's GE wheat.

As news of Monsanto's GE wheat spread, buyers from Japan to Europe and Canada told U.S. exporters that their consumers would not accept GE wheat because of general fears about possible harm to the environment and health risks from GE crops. Some said the wheat's very presence on American farms could threaten future purchases of all U.S. wheat, since more than half of American wheat is exported, accounting for \$3.7 billion in sales and almost 20% of all agricultural products shipped abroad in 1999 (Genetically engineered wheat, 2003). Numerous protests and resistance to the commercialization of GE wheat from it Japan, Europe and Canada, the main markets, triggered the crisis.

Lack of complete knowledge of GE wheat risks was a problem for investors and farmers. For example, buyers wanted information about traits under development, approved traits, and where the product is geographically concentrated (Wilson et al., 2003). But prior to its development, the company ignored its stakeholders' demands for information about the new product. This led to the lack of market acceptance as Monsanto's early adopters questioned the credibility of the latter's decision to diffuse a new product with no specific benefits for them.

Rejection of the new product created an economic disaster for agricultural industries and for Monsanto, which had invested heavily in the new crop (Gillam, 2004). Moreover, the fact that farmers, Monsanto's direct constituents, organized boycotts against GE wheat before it was commercialized meant the company would not be able to keep to its 2005 timeline. Similarly, farmers in North America, seeing the potential loss of lucrative markets in Europe, but also in Asia, Canada, and Egypt, questioned the commercialization of GE wheat.

The economic record of Monsanto's investment in the development of GE wheat remains unclear and GE crops have been a mixed bag for developers and farmers. While Monsanto lost \$1.7 billion in 2002 due to droughts and growing competition for its Roundup herbicide for GE wheat, the financial benefits for farmers were also unclear, with studies showing both negative and positive financial results and risks in the investment of GE wheat (Monsanto could be another..., 2003). The company said it spent \$5 million annually on research to develop GE wheat, barely 1% of its research budget, yet it was still a major financial blow.

In its 2002 Annual Report, Monsanto addressed what many financial observers considered the company's most pressing issue: the loss of its patent on its Roundup glyphosate herbicide for its GE wheat. Company representatives estimated that its market share would likely drop from 77% currently, to the low 60's by around 2005. This drop, combined with increasing market rejection for GE wheat, had a negative effect on the company's profitability (*Monsanto Historic Archive*, 2004).

In addition, the effects for Monsanto of Roundup competition for have been considerable, with an estimated \$1.69 billion in lost revenues, and a 14% drop in overall revenues from 2001. In some cases, Monsanto had been driven out of the glyphosate market altogether, as was the case in Australia, where competition from cheap Chinese imports caused the company to close its manufacturing plant there (ACCC accepts undertakings, 2002). Based on Monsanto's estimates, losses in the glyphosate business to prevent the spread of GE wheat into a superweed could be anywhere in the \$400 to \$500 million range by 2005, representing roughly between \$1.50 and \$1.90 per share at current levels of market capitalization (*Monsanto Historic Archive*, 2004).

Faced with global opposition to the commercialization of its new product, Monsanto pushed back the proposed introduction of its GE wheat from 2003 to 2005, and the company stated that it would only do so then if it could can first gain pre-acceptance from buyers, as well as environmental and health clearance from regulatory authorities (*Monsanto Historic Archive, 2004*). A spokesman for Monsanto, Mark Buckingham, said the company was planning to file for

As no market acceptance was gained for the new GE crop because of consumer resistance, Monsanto was forced to modify plans to commercialize the crop. regulatory approval of GE wheat, but that Monsanto would not introduce the product until it had "industry acceptance across the board," which will take more time (Delay is seen, 2002).

As the issue gained urgency the company told industry leaders they must fully embrace the project and

help gain market acceptance or Monsanto would be forced to abandon GE wheat research after investing millions of dollars in the project (Japanese consumers tell Canada. . ., 2004). As no market acceptance was gained for the new GE crop because of consumer resistance, Monsanto was forced to modify plans to commercialize the crop. The company said it would cut most of the \$5 million it spends annually to develop the crop (Gillis, 2004). But the question here is whether Monsanto acted in good faith when it announced that it planned to realign research and defer all further efforts to develop and commercialize GE wheat until new biotechnology traits are introduced.

Post-Crisis Phase

The strong rejection of GE wheat from virtually every corner of the globe once again showed the resistance to GE foods. Due to this stiff opposition, on 10 May 2004, Monsanto abandoned plans to introduce GM wheat on the world market (Kilman, 2004). After a long struggle to impose on its stakeholders, Monsanto finally acknowledged very late that there was no consumer need or problem that necessitated research and development of a new GE crop. Thus, its decision to abandon the GE wheat was a major victory for the anti-GMO lobby, and it followed pressure from U.S. and Canadian farmers who feared that the introduction of GM wheat would lead to the collapse of their billiondollar markets in Europe and Japan (Brown, 2004).

Monsanto's efforts to develop GE wheat had been watched around the world as a bellwether for the future of agriculture, and its decision to drop the innovation, although a victory for consumers and farmers, was a bitter defeat for the company. According to Joseph Mendelson, III, legal director of the Center for Food Safety, "When you get farmers and consumers aligned about what the marketplace really wants, Monsanto doesn't stand a chance" (Martin, 2004). Others suggested, "it marks the beginning of the end of genetically engineered crops as a major force in global agriculture" (Monsanto drops plans..., 2004).

Conclusions

Where they Failed

• Little consideration was given to consumer benefits, the phase two benefits, when developing the product. As a result, Monsanto failed

to create a need for its innovation.

- Monsanto reneged on its commitment to delay the introduction of GE wheat and pressured US wheat growers to support a U.S.-only introduction.
- Monsanto kept shifting its timeline for the commercialization of GE wheat and mounted pressure for U.S. approval despite initial rejections.
- Collective boycotts and global outcries against GMOs created the need for alternative measures, e.g., labeling, but Monsanto wanted

either no labels or simple labels suggesting only that the product might contain GMOs.

• The direct actions and boycotts brought global attention to the uncertainty of GMO technology and raised public demands for GMO labeling.

Where they Succeeded

• Monsanto publicly committed

to delaying the introduction of GE wheat and changed its stated timeline in an attempt to gain market acceptance.

- As the issue gained urgency, Monsanto told industry leaders they must fully embrace the project and help gain market acceptance or the company would be forced to abandon research on GE wheat.
- Monsanto announced on 10 May 2004, that was abandoning research and development of GE wheat, calling it "realigning research and development investments." A victory for consumers and farmers.

What they learned

- Recognition of a need or a problem should precede research, development, commercialization and diffusion of an innovation.
- Establishing effective communication relationships with stakeholders well before crises erupt is beneficial for organizations during crises.
- Consumers (adopters) have the right to reject any innovations they do not want.

Implications for Best Practices

Failure is an essential prerequisite for effective organizational learning and adaptation (Sitkin, 1996). According to Seeger et al. (1998, 2003), crises are part of the natural organizational process, purging elements of systems that are outdated and inappropriate and creating new, unexpected opportunities for growth and change. Monsanto should have learned that genetic engineering, especially GE wheat, has proven controversial internationally because there is no need for its innovation. GE products have been banned in many countries because of fears that they may not be good for people and the environment.

There is no doubt that global resistance to "frankenfoods" (Alexander, 2003) is affecting Monsanto, but the company can use the GE wheat crisis as an opportunity to acquire new information, skills, insights, and capabilities on how to diffuse subsequent innovations. Lack of emphasis on consumers' benefits, failure to provide information on the environmental and health risks of GE wheat, and the absence of an original need ultimately resulted in global fear and outrage leading to product rejection (Bueckert, 2004).

There is no doubt that global resistance to "frankenfoods" (Alexander, 2003) is affecting Monsanto, but the company can use the GE wheat crisis as an opportunity to acquire new information, skills, insights, and capabilities on how to diffuse subsequent innovations. Monsanto's arguments for its innovation failed to target the core concerns of its stakeholders. The company failed to address key issues such as lack of farmers' awareness of differences between GE crop varieties and other crops, lack of information provided to farmers stating they were buying GE seeds, lack of awareness of market rejection by consumers, and environmental problems associated with GE wheat. Instead of targeting these core concerns, Monsanto framed GMOs rejection as "trade barriers" by competing governments. It also ignored GE crop contamination of neighboring farms, which led to infringement cases and lawsuits against farmers (Monsanto could be another..., 2003).

According to Seeger et al. (2003), crisis events represent a chance for an organization to acquire new information, skills, insights, and capabilities; therefore, organizations that are able to learn have the potential to emerge from crises with a renewed sense of purpose. This implies that Monsanto can use the GE wheat crisis as a significant opportunity for learning and to restore its image and research on GMOs. The company's decision to abandon development of GE wheat is a good start in its learning process, but it needs to go further, making consequential changes in order to emerge from the crisis with a renewed sense of purpose.

Crises have the potential to disrupt organizations, but if managed effectively, can also be an opportunity to create new knowledge and change. For instance, the fires at Malden Mills and Cole Hardwoods gave these companies opportunities to reconstruct modern facilities and to strengthen and reinstate their relationships with their stakeholders. Monsanto can learn vicariously and copy from these examples.

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Chapter 7 Biological Terrorism and the Local Community: Communication Needs and Response

Patric R. Spence, Ph.D. Western Kentucky University and Kenneth A. Lachlan, Ph.D. Boston College This chapter uses the example of a religious community's Salmonella virus attack on an Oregon community to outline practices local communities can employ to prepare for and respond to this and other types of crises. In 1981, the religious community known as the Bhagwan Shree Rajneesh purchased a 100-square-mile ranch south ranch in Wasco County, Oregon. The Rajneesh incorporated their commune as a city. For many members, this was the fulfillment of a dream: to build Rajneeshpuram (i.e., the city of Rajneesh), a city sacred to the cult, "America's first enlightened city" (Martin, 1992, p.356), and the new international headquarters for the movement. When

construction of the commune ran into zoning problems, the Rajneeshees decided the upcoming elections provided an opportunity to change the makeup of the country commission, thus reducing opposition to their obtaining permits and clearing the way for their plans to move forward. In order to win the

When construction of the commune ran into zoning problems, the Rajneeshees decided the upcoming elections provided an opportunity to change the makeup of the country commission, thus reducing opposition to their obtaining permits and clearing the way for their plans to move forward.

county election, the Rajneeshees developed two plans.

The first plan involved moving over three thousand homeless persons to the ranch, to take advantage of Oregon's liberal voter registration laws. However, before the registration period closed county officials noticed an increase in voter registration. Suspecting something, the county required all newly-registered voters take part in a questioning session. This persuaded the Ranjneeshees to try another plan.

About this time, a total of 751 persons became ill with Salmonella gastroenteritis (Tucker, 1999; Torok, Tauxe, Wise, Livengood, et al., 1997). The outbreak occurred in two waves, from 9 through 18 September and 19 September through 10 October. The majority of cases were associated with ten restaurants. Epidemiologic studies of customers at four restaurants and of employees at all ten restaurants pointed to contaminated salad bars as the major source of infection. Eight of the ten affected restaurants operated salad bars; only three of the 28 other restaurants in The Dalles had salad bars (Torok et al., 1997). The implicated food items on the salad bars differed from one restaurant to another.

On 17 September, the local public health department received a call from someone who reported falling ill from gastroenteritis after eating at a restaurant in The Dalles. Over the next few days, twenty more instances were reported to the Health Department. After two days, a pathologist at the Mid-Columbia Medical Center discovered Salmonella was the cause of the outbreak. Four days later, a Portland scientist identified the strain as Salmonella Typhimurium, an unusual form of the bacteria, but treatable with most antibiotics (Miller, Engelberg & Broad, 2002).

An extensive examination of food handlers at several local restaurants; local cattle, fruit, and dairy farms; and the city water supply, concluded that the contamination was unintentional. In a 1985 preliminary report, Tom Torok, a member of the Center for Disease Control and Prevention's Epidemic Intelligence Service, stated:

> [Federal scientists were] unable to find the cause of the outbreak and that food handlers were probably to blame. Because workers preparing the food at the affected restaurants

had fallen ill before most patrons had, the report reasoned, and because some minor violations of sanitary practices at a few restaurants had been detected, food handlers "may have contaminated" the salad bars. (Miller, Engelberg & Broad, 2002, p. 23)

Although some in The Dalles believed the Rajneeshees were responsible for the outbreak, this hypothesis could not be supported. It was not until over a year later that evidence emerged linking the Rajneeshees to the attack. The cult's leader, the Bhagwan, accused particular members of the attacks and of

This case demonstrates that in bioterrorist attacks, as in many crises, detection and the rapid response to the attack will be difficult. conducting tests to conspire to commit more attacks. A new investigation found invoices from the American Type Culture Collection, supporting the accusations that Salmonella had been grown at the Rajneeshees ranch.

The 1984 attacks were, in fact, only

a test, a trial run before the election. Those involved had taken the Salmonella from the ranch to The Dalles and had contaminated lettuce in the local grocery store and in coffee creamers, blue-cheese dressings, and fruits and vegetables at restaurant salad bars.

This episode still remains the most widespread, bioterrorism attack in U.S. history. The event in did not receive much attention (both media and government) for a number of reasons. First, because it was a biological attack, the characteristics exhibited during the episode allowed it to be interpreted as a natural occurrence, which did not cause the fear a biological attack would. Second, because the attack was believed to be of natural origin, it did not seem newsworthy. The heightened fear of terrorism now manifest in the United States, did not exist prior to 9/11. Moreover, the 24-hour news channels that now cover such an event were not as common. Third, without the presence of a trigger event indicating a crisis had begun it was difficult for the crisis to achieve media attention.

This case demonstrates that in bioterrorist attacks, as in many crises, detection and the rapid response to the attack will be difficult. These issues are examined in further detail in the next sections.

Defense vs. Preparedness

Preparing for crises is important because it forces individuals and communities to begin thinking about possible outcomes and consequences. Further, defensive procedures help to reassure the public, providing them a sense of security that "something is being done." However, defense in not absolute, and past terrorist events have demonstrated that those intending to cause harm will discover novel and unpredictable means to inflict that harm. Research working towards preventing a bioterrorist attack must continue, since preparedness to act after such an event can help to minimize the scope, duration and the level of harm of the event. The following are suggestions on how local communities can use existing communication channels and create new channels to communicate during such an event. In addition, message designs are offered.

Crisis and the Local Community

Any discussion of the role of local response outlets in alleviating fear and uncertainty during times of imminent danger must begin with a discussion of the

definitional and theoretical criteria surrounding crisis and risk communication. Crisis communication scholars have defined crises as "specific, unexpected, and non-routine event or series of events that create high levels of uncertainty and threaten or are perceived to threaten high priority goals including security of life and property of the general individual or community well being" (Seeger, Sellnow & Ulmer, 1998, p.233). Weick's (1995) critique defines crisis scenarios as "low probability/high consequence events that threaten the most fundamental of goals of the organization. Because of their low probability, these events

defy interpretations and impose severe demands on sensemaking" (p. 305). Since by definition crisis situations are unexpected and alarming, they typically lead to an increase in stress, fear, and uncertainty among those who are immediately affected. In the cases

A poorly constructed response can create confusion and, potentially, worsen the public reaction. In some cases, recommendations made by public agencies have actually increased the harm.

of local crises such as bioterrorism, the strongest levels of fear and uncertainty will not be confined to those areas in which people may be physically threatened by the event.

Consistent with past work in social psychology, individuals are compelled to seek out certainty, resolution, and the restoration of predictability to their surroundings. This drive to reduce uncertainty, a negative and unpleasant state of arousal and cognition, is a basic consequence of any crisis (Berlyne, 1960). The basic need to seek out additional information is especially strong in instances such as bioterrorism events, when the outcomes associated with the crisis may be extremely harmful (Heath & Gay, 1997) and these potential risks are almost completely uncontrollable (Miller, 1987).

Crises have historically been typified as situations that begin with a clear trigger event indicating the crisis has begun. However, in the case of more localized crises of biological origin, it is plausible that a clear and dramatic trigger (such as planes hitting the towers on 9/11) may not be evident, and that the existence of the crisis may evolve over days or weeks as initial information is accumulated (such as reports of widespread illness or death). In the absence of a trigger event, the realization or official declaration of a crisis will be interpreted as an indication that the current conditions are moving in an unpredictable direction which is inconsistent with routine events and procedures. Crisis then continues until a resolution is achieved.

Further, individuals tend to engage in information-seeking when faced with uncertainty (Brashears, Neidig, Haas, Dobbs, Cardillo & Russell, 2000). Media outlets can be expected to be the primary resource for obtaining this information (Murch, 1971), especially at the local level. The public need for information requires that communication during and about the crisis must be highly specific, ordered, and distributed through localized media that reaches those who most need the information: those directly affected and perceiving potential hazards.

The initial response to a crisis has several consequences, potentially positive and negative. A poorly constructed response can create confusion and, potentially, worsen the public reaction. In some cases, recommendations made by public agencies have actually increased the harm. Information during a local crisis must address both the crisis and the risk involved. Peter Sandman et al. (1998; 2003) has suggested that in these circumstances, communication is made up of two components: "scaring people" and "calming people down." Put another way, messages are intended to both alert and reassure people.

Sandman further posits that crisis and risk communication attempts to establish a level of outrage that is appropriate given the level of hazard, loosely expressed through the following formula: Risk=Hazard+Outrage. Hazard may be thought of in terms of the tangible seriousness of a risk, such as loss of life or serious illness, while outrage refers cultural seriousness including uncertainty, anger, and perceived assault on one's community (Sandman, 2003). If the public is outraged because it doesn't understand the hazard, it must be educated on the nature and extent of the hazard associated with the incident. If the hazard is understood, the outrage must be addressed.

Addressing Issues and Perceptions of Hazard

Messages addressing hazard and outrage must also satisfy the public's need for control, outlining steps that individuals can take in order to reduce their susceptibility to risk (hazard). The concern that may be the most central to a crisis event is the speed of response. The speed of the response is one measure in reducing the uncertainty that will arise within the local population. In a crisis, local communities are expected to respond to

disasters and emergencies using their own resources. Where the community lacks adequate capacity, they solicit assets from the state and neighboring jurisdictions. State and federal resources are in only after local governments discover they lack adequate capacity and therefore, request assistance from the federal government.

Messages addressing hazard and outrage must also satisfy the public's need for control, outlining steps that individuals can take in order to reduce their susceptibility to risk (hazard). Messages that focus on the public's susceptibility to risk will create fear, reducing the individual's capacity to make rationale decisions related to the situation (Aspinwall, 1999). Risk communication in localized crises should provide fear-inducing messages containing an appropriate degree of hazard and outrage, and then inform the public of practical steps they can take. Inaccurate communication of the risk factors involved will inhibit individuals from making choices that are rational in addressing these risks. Further, risk messages must address outrage appropriately in order to maintain audience attention.

After individuals have obtained the desired information, they will frequently continue to scan available media seeking repetition of the same message. In the case of localized crises, these responses may be explained in one of two ways: First, repeated exposure to the message may act as a calming agent, reducing uncertainty; and second, continual media scanning may be an attempt to reduce dissonance. This magnifies the importance of repeating messages with the goal of calming and reducing potential outrage. For example, following 9/11 New York City Mayor Rudolph Guiliani held press conferences at regularly scheduled intervals over the next few days. Often, he possessed little or no new information, but repetition of known facts helped calm the public and reassure those directly affected that events were under control.

The local community should have a pre-existing relationship with federal agencies. The federal management of a domestic crisis falls under the jurisdiction of the Federal Bureau of Investigations (FBI), but when the role of the FBI ends coordination is handed over to Federal Emergency Management Agency (FEMA). National defense planning for civil emergencies involves the FEMA, which will also handle much of the federal coordination. FEMA was given this authority under the Stafford Act (Public Law 93-288). The Department of

Defense participates in emergency response planning and supports functional groups of the Federal Response Plan, but the branches of the U.S. military cannot be used for enforcing U.S. laws or aiding civilian law enforcement and therefore will serve more of a support and labor role. Because such issues of national scope and coordination will be handled by federal agencies, the local response structure should focus on meeting the needs and desire of the immediate community and while still working with federal agencies, yielding the responsibility of worrying about communication of information on a regional or national scale to federal agencies. The local structure should work

closely with federal agencies to aid in response and coordination, but worry first about communicating to its own stakeholders (the local community where the bioterrorist outbreak has occurred).

Another reason local agencies need to have pre-existing relationships and response plans ready is the issue of convergence. In a biological event, for example, people, goods, and services will be spontaneously mobilized and

sent into the local community. This convergence of resources will have beneficial effects, but it may also lead to congestion, confusion, retard the delivery of aid, and waste scarce resources.

Individual audience members will likely worry about the recurrence of similar events in close proximity to the initial crisis. Information provided must both be as accurate as possible and disclose all available information about the situation. Under these circumstances, the public needs an accurate assessment of the probability of second event and instructions on what they should do should a second event take place. Often, in these instances, the temptation is to downplay or withhold potential information concerning hazard. This should be avoided, as past crisis research suggests that the public won't panic, and may actually respond more negatively to information that is perceived to be distorted or incomplete. For example, in the aftermath of the 1986 Challenger explosion the public was given numerous different accounts of the crisis from different sources and stakeholders; public reaction was characterized by both confusion and frustration (Seeger, 1986).

If the public communication of accurate information is followed by detailed instructions on a pragmatic response that can be employed, the public will likely follow those instructions. The ability of individuals directly affected by a crisis to make reasoned decisions is seriously reduced in comparison to everyday or normal conditions. Enabling people to take tangible measures will lead to a sense of empowerment, creating an impression that the affected individual has some kind of control over the situation (Seeger et al., 2002).

Addressing Issues and Implications of Outrage

A localized crisis such as a bioterrorism incident can be expected to produce fear and create uncertainty. A crisis of this nature has a good chance of both directly affecting persons (high hazard) and them (high outrage). Messages in the aftermath must then be directed at this outrage and at the fear that may actually be increased by simple news coverage. Outrage is the relative cultural seriousness due to the risk, or how frightened, angry, or upset people become due to the crisis. The correlation between the hazard (how many

In a biological event, for example, people, goods, and services will be spontaneously mobilized and sent into the local community. This convergence of resources will have beneficial effects, but it may also lead to congestion, confusion, retard the delivery of aid, and waste scarce resources.
people are killed or harmed by the risk) and the outrage (how many people the risk upsets) may actually be fairly low. Messages constructed to inform area individuals about the hazard must also address outrage. The induced outrage must be to a degree strong enough to encourage the vulnerable public to act upon the hazard, yet ensure that the public does not experience a collapse in sense-making.

Furthermore, in considering different component groups of a local audience, there is evidence that differences between males and females must be addressed in terms of their information-seeking tendencies. Hoffner, Fujioka,

In order to minimize potential negative outrage, the message breaking news of a developing crisis must be as accurate as possible, even if maintaining accuracy means indicating that there is much about the crisis that is unknown. Subsequent messages that later provide further information will inevitably be compared and acted upon through comparisons to the first message. Ibrahim, and Ye (2002) report that males are more likely to experience outrage reactions that may manifest themselves in behaviors or behavioral advocacy.

Primacy of messages must also be considered. The first message received by the public generally sets the standards and expectations for future messages dealing with that particular crisis (CDC, 2002). In order to minimize potential negative outrage, the message breaking news of a developing crisis must be as accurate as possible, even

if maintaining accuracy means indicating that there is much about the crisis that is unknown. Subsequent messages that later provide further information will inevitably be compared and acted upon through comparisons to the first message.

The public must know that a tangible behavioral response to the crises exists. Providing the public with such a response helps to reduce feelings of helplessness, fear, and isolation. Thus, the facts, level of hazard, and the recommended actions must be accurately presented when responding to a localized crisis. Additionally, behavioral recommendations should be framed in a positive light (CDC, 2002). For example, if people affected by a bioterrorist incident are to shelter-in-place, the message should be framed by stating, stay in the safety of your home, rather than don't go outdoors.

Federal agencies will have communication networks in place to deal with the national media; however, it is appropriate for the local community to provide a spokesperson to be the voice of the event. The situation may dictate that the local spokesperson will not act as the national spokesperson. Rather, the federal agencies will provide such a person. In the case of a biological attack, for example, the information needs of those in close proximity to the event will differ from those more removed from the area. As noted in Spence et al. (2005), individuals in close proximity to the site of the 9/11 attacks reported greater fear than those farther away, and the information needs and desires were different. In the three locations studied (Detroit, Fargo, and Little Rock), Little Rock was the only location in which respondents stated a desire for reassuring information from both political leaders and religious leaders, while those closer to New York (Detroit) reported the media as being more useful for their needs.

After such an event, many in the local community may become fixated on media forms to obtain information about several specific aspects of the event. In the aftermath of a crisis, messages are both post-crises and risk communication in nature. Selecting the medium at this point is contingent on several of the previous listed factors and is dependent upon what is available. Television is more brittle than radio. Often when television is "off the air" many radio stations are still broadcasting. During the 1997 Red River Valley flood in Minnesota and North Dakota, for example, an AM station in Fargo, North Dakota, was powerful enough to broadcast throughout the entire Red River Valley region.

[The station] dedicated its format almost entirely to flood coverage during the period when the river was at flood stage. Residents were invited to call the station and broadcast their appeals for sandbagging assistance live. This allowed for the highly efficient movement of human resources throughout the flood region. The station invited city officials and representatives from support agencies to broadcast their messages at will. (Sellnow et al., 2002, p. 282)

Although the brittleness of television may not be a factor during a biological event, the use of radio still might serve several needed functions. First, radio, more so than television, will allow several members of the local community to share stories. Second, radio can provide information that is specific to the local community, whereas television during this period may be providing news coverage to the broader audience, most of which is not in close proximity to the event. Thus, the types and scope of the information covered may be very different between the two mediums.

This chapter used the example of a bio-terrorist attack on an Oregon community as a vehicle for discussing practices community leaders and response teams may consider when preparing for and responding to all types of food related crises. The lessons learned may provide guidance in the event of future acts of intentional contamination within the American food supply.

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Chapter 8

From Farm to Fork: Communication and Best Practices in Food Safety

Matthew W. Seeger, Ph.D. Wayne State University **P**ood safety is a recurring question, both as an issue management challenge and as a crisis communication imperative. Since the industrialization of food production and processing in the late 1800s and early 1900s, questions of food safety, purity, and quality have been endemic to the industry. The 1886 debates over the oleomargarine bill epitomized these concerns. As the debate became a public relations campaign, the dairy industry lobby made vivid charges that margarine was manufactured using diseased cattle, horses, hogs, and even cats. Widespread public concern was generated and legislation followed. Similarly, Upton Sinclair's portrayal of the meat packing industry in the 1906 novel, *The Jungle* raised fundamental questions about industrial-

This extended chain of production, often expressed with the phrases, "From farm to fork," or "From seed to shelf," creates vulnerabilities. scale food production. Outbreaks of food borne illness, however, are most often traced to the home or small production facilities. Comparatively speaking, widespread industrial outbreaks are rare, although, as the articles in this volume indicate, they can be expected to generate widespread media attention and public concern.

While the food supply in the United States is one of the safest in the world, the CDC estimates that 76 million people get sick, more than 300,000 are hospitalized, and 5,000 Americans die each year from food borne illness (Mead et al., 2000). More than 200 known diseases are transmitted through food. In addition, food is susceptible to unintentional and intentional contamination by a wide range of other agents. Only in a very few documented instances has the food supply been intentionally contaminated, although the threat of such contamination is very real, particularly in a post 9/11 environment. The vulnerability of the food supply is a recurring theme in public discourse.

This volume explores six cases of food borne illness outbreaks and questions about contamination; the first four of which were accidental. This chapter outlines recurring themes and identifies overlapping concepts in these case studies. In addition, the role of communication in response to these events is explored and the issue of food borne illness is contextualized using principles of chaos theory.

Food Production as a Complex System

Recent effort to understand crises and disasters has drawn heavily on the principles of complex systems theory or chaos theory (Perrow, 1984; Seeger, Sellnow & Ulmer, 2003). These approaches emphasize the dynamic and non-linear nature of highly complex systems. As systems become larger, more complex and more tightly coupled, the probability of an unforeseen interaction increases. Such interactions have the potential to create a crisis, or what system theorists call bifurcation. When bifurcation occurs, the system is fundamentally altered in some dramatic way.

Complex systems also defy precise prediction. That is to say, they often perform in very unexpected and unanticipated ways. In addition, chaos theory emphasizes that even very small variance in a system has the potential to lead to large-scale, unforeseen consequences. What appears initially as a very small oversight, or insignificant issue can quickly create serious and even devastating outcomes. The cases discussed in this volume illustrate the performance and bifurcation of complex systems.

The modern food production system is increasingly dynamic, integrated, tightly coupled, and complex. From agricultural production systems on farms, orchards, and ranches, through processing in industrial settings to

transportation, distribution, wholesale and retail outlets on to the consumer, preparation and consumption, modern food production is very susceptible to systemic breakdowns. This extended chain of production, often expressed with the phrases, "From farm to fork," or "From seed to shelf," creates vulnerabilities. Large-scale production and width of distribution has added to the complexity and increased the chances that an adverse event will be widespread. Greater emphasis on efficiency and smaller profit margins has reduced slack resources and buffers that may reduce or contain crises. The use of technology, such

as automated production, while reducing some threats, has introduced others and enhanced overall complexity. Finally, globalization of food production and distribution has added additional levels of complexity

Effective communication is particularly critical to the successful management of food borne illness in at least three specific ways.

and reduced levels of predictability. In the global food market, food is produced under a very wide range of regulatory, cultural and economic contexts. These features of the food production and distribution system are all illustrated in the cases presented here.

The Role of Communication in Response

The food production and distribution systems face a relatively specific set of risks. As noted earlier, these relate primarily to the outbreaks of food borne illness due to some kind of systemic contamination. While the range of agents is potentially quite large, most food borne events involve one of about four agents. The most common food borne infections are those caused by the bacteria Campylobacter, Salmonella, and E. coli 0157:H7, and by the calicivirus, or Norwalk viruses (CDC, 2005). Other relatively common agents are listeria, shigella and Hepatitis A. Before modern food processing technology, botulism was also a serious threat, primarily from home canning operations. The introduction of pasteurization of milk helped eliminate the transmission of brucellosis and tuberculosis. In addition to these agents, food can be contaminated with a wide array of other infectious agents. In some cases, food additives have been shown to be dangerous and in rare cases, unintentional contamination with chemical agents has occurred. The kind of agent, level of exposure, and the number and relative health of those exposed are significant factors in the level of threat.

Effective communication is particularly critical to the successful management of food borne illness in at least three specific ways. First, outbreaks of food borne illness are more likely to be contained when there is timely identification of the agent. This requires not only carefully disease monitoring, usually by public health departments, but also effective communication and coordination across agencies and often among producers. Any delay in identification and notification can enhance harm. Coordination in such circumstances can be particularly challenging. Second, an effective response often requires that the contaminated food be withdrawn from distribution. Timely recalls require effective public communication, usually through the media. With extended distribution channels and the processing of food into other food products, such recalls are often incomplete. Finally, a food borne illness outbreak will also require effective post-event communication. Most often, this post-event communication takes the form or image restoration strategies, although explanations and accounts also follow an outbreak of food borne illness. Effective post-crisis communication is also necessary for organizational learning.

Recurring Themes

The chapters featured in this volume explore a range of food borne illness outbreaks and the associated communication strategies. Some, such as the Schwan's salmonella outbreak, are examples of successful crisis communication and response. Others, such as Chi Chi's Hepatitis A event, were handled very ineffectively. Most are unintentional episodes, although some represent cases of clear negligence while on case involved intentional contamination. The case of Monsanto's genetically modified wheat is the clearest example of an issue management challenge rather than a fully developed crisis episode per se. Only in the case of contaminated salad bars in The Dalles, Oregon was the episode

Research suggests that the most effective responses to a crisis are principled responses.

intentional. Within this range of cases, there are several important recurring themes

First, as noted earlier, these cases all illustrate the complexity of the food

production and distribution system and the tendency of this system to interact in unexpected, crisis-inducing ways. Two of the cases in particular, illustrate the role of imported food products in outbreaks of food borne illness. In addition, the Monsanto case demonstrated the risks inherent to new, complex technology, particularly when poorly understood by the public.

A second recurring theme is the role of ethics, social responsibility and organizational legitimacy. Legitimacy is also affected by previous beliefs, attitude and reputations. Crises inherently strip an organization down to its core values. Crises highlight these values and make them visible to stakeholders. If an organization privileges profits over safety, for example, these priorities are often starkly evident following a crisis. Research suggests that the most effective responses to a crisis are principled responses. In addition, a crisis calls into jeopardy the social legitimacy of an organization and requires some effort to reestablish legitimacy. This effect is particularly strong when the organization is clearly culpable in the outbreak. Several of the cases reviewed in this volume explore image restoration techniques as approaches to repairing damaged legitimacy.

An interesting third theme that emerges from the cases explored here is the role trust plays in food. Food is a very intimate product. Because food is consumed, a perception that food is somehow unsafe or impure is particularly harmful. Moreover, food borne illness that impacts vulnerable populations, such as children, may have particularly profound effects on an organization's reputation and legitimacy. The cases of Jack in the Box and tainted strawberries in school lunches illustrate this effect. Because of the intimate nature of food, trust and reputation is particularly vulnerable. Stories of tainted food if not effectively managed can become powerful narratives, even taking on the status of larger social themes.

A fourth theme emerging from these essays concerns organizational learning. Learning is the desired outcome of a crisis because it allows the organization to move beyond the event as a stronger, more resilient system. Unfortunately, most organizations experience failed learning following a crisis. Lessons are not understood, communicated successfully, or retained. The consequence is that many crises occur again.

Discussion of Cases

In "Social Responsibility: Lessons Learned from Schwan's Salmonella Crisis," McIntyre explores the important case of Schwan's salmonella outbreak. Schwan's is widely regarded as a model of effective crisis communication following a food borne illness outbreak. Specifically, McIntyre explores the intersection of crisis communication and ethics in the form of social responsibility. This case also illustrates the critical role of trust in episodes related to food.

Schwan's had a long-standing reputation as a responsible organization with a clear commitment to its customers. This analysis suggests that Schwan's reputation and positive stakeholder relations both provided a resource the company could draw on and informed the organization's response. The role of a reservoir of good will in crisis response has been demonstrated elsewhere. In addition, companies as diverse as Johnson and Johnson, with its Tylenol episode, and Malden Mills, with its manufacturing facility fire, have used

values and ethics as the cornerstone of an effective crisis response. In general, these principled, value-based responses appear to be more effective than responses based merely on economic values. Although sorting out the relationship between social responsibility, legitimacy, and corporate citizenship is beyond the scope of this analysis, subsequent efforts should be focused in this area.

The scope of harm in any event dictates much of how the event will develop. Whenever death occurs, and the organization is culpable in those deaths, the crisis becomes a profound threat to the organization.

In addition to demonstrating the role of values and ethics in effective response, Schwan's also illustrates the role of complexity in the food production and distribution system. In this case, the intersection of transportation systems and outside suppliers caused the contamination. Suppliers always have the capacity of creating unforeseen variance and transportation is a vulnerable link in the farm to fork chain. It should also be noted that while Schwan's responded effectively, the salmonella outbreak was comparatively minor. A different agent and/or more serious customer harm may have overwhelmed the company's reservoir of good will.

The third chapter in this volume is a powerful contrast to the successes of Schwan's. Chi Chi's outbreak of Hepatitis A associated with contaminated green onions imported from Mexico includes a number of very serious crisis elements combined with ineffective responses. Moreover, at the time of the outbreak, the company was already in a vulnerable position. The result was a kind of perfect storm that ultimately led to the closing of the restaurant chain.

Sjoberg's telling of the Chi Chi's story begins with the extended supply chain and global independence in the food distribution system. Green onions grown in Mexico were produced, it was later found, under unsanitary conditions. The ways in which the onions were shipped and stored allowed for further contamination of the onions making the virus more difficult to remove by washing. This incubating effect is commonly found as a factor in a crisis. In this case, the international sourcing of the onions added a level of complexity.

The agent involved, Hepatitis A, is potentially a very serious disorder. Transmitted through the fecal-oral route, Hepatitis A is a viral agent that causes liver damage. The medium incubation period is 28 days. The CDC reports that in 28% of the cases of food borne Hepatitis A outbreaks, the sources are never identified (Fiore, 2004). In this case, the extended incubation and the processing of the onions into salsa and dip made it difficult to track the source. Thus, customers continued to be contaminated and warnings and recalls were not timely, and the efficacy of vaccinations was reduced. The Chi Chi's outbreak ultimately accounted for three deaths and over 700 people became ill. The scope of harm in any event dictates much of how the event will develop. Whenever death occurs, and the organization is culpable in those deaths, the crisis becomes a profound threat to the organization.

Also complicating the response was the fact that Chi Chi's parent company was in bankruptcy proceedings at the time of the outbreak. The viability of Chi Chi's was already in question and the Hepatitis A outbreak served to further undermine the company. Coombs has described the impact of multiple crises suing the metaphor of Velcro. A previous crisis creates a condition where the

Moreover, this acknowledgement of responsibility is necessary for organizational learning to occur. This relationship is not generally emphasized in the crisis communication literature and represents an important link in effective crisis response. magnitude of subsequent events is enhanced. In this case, the ability of Chi Chi's management to mount an effective response was seriously limited.

Sjoberg notes that Chi Chi's undertook many appropriate image restoration strategies, but ultimately the company

failed to survive. She suggests that the company was too slow to shift blame to its Mexican suppliers. Several additional facts, including scope and scale, the already tenuous state of the company contributed to this failed effort at apologia and image restoration.

The third case explored here, the E. coli 0157 outbreak from Jack in the Box hamburgers is approached from the perspective of learning. Littlefield suggests that the crisis led Jack in the Box to recognize the need to accept responsibility and develop a crisis management plan. Like Chi Chi's, this was a major event involving a serious agent and organizational culpability. In this case, E. coli 0157 was present in tainted hamburger. Inadequate cooking procedures failed to kill the agent and ultimately, 400 people were treated and three people died. The outbreak had a disproportional impact on children, probably because of the nature of the Jack in the Box customer base and because children are more susceptible. Like the Chi Chi's episode, the initial outbreak was attributable to suppliers. Jack in the Box compounded the harm through the relatively small error of inadequate cooking temperature.

Littlefield notes that the ability to respond was hampered by lack of a crisis communication plan and that the initial efforts were characterized by blame shifting and ambiguous responses. Only when these responses proved inadequate did the company acknowledge its culpability. This compounded the crisis because not only did Jack in the Box need to account for its role in the outbreak, but it also needed to explain its inadequate response. This public backtracking damages the organizations credibility and is a needless distraction during a crisis.

It is interesting to note that while Sjoberg suggested Chi Chi's was deficient in shifting blame, Littlefield argues that Jack in the Box management was too quick to shift blame. Moreover, this acknowledgement of responsibility is necessary for organizational learning to occur. This relationship is not generally emphasized in the crisis communication literature and represents an important link in effective crisis response. Compelling evidence is provided that Jack in the Box did learn from this event.

The fifth chapter in this volume again involves Hepatitis A, but this time in tainted strawberries used in school lunch programs sponsored by the USDA. This case reiterates important themes described in earlier chapter and introduces others. The case again illustrates the role of complex food processing systems and food produced in other countries. In this case, the harm was compounded by the relatively small error in mislabeling of the strawberry's country of origin allowing them to be used in the school lunch program. Later investigations suggested that the mislabeling was intentional. As with Chi Chi's onions, these strawberries were grown in Mexico under unsanitary conditions. As with Jack in the Box, the impact on children was disproportional. Some 231 children and teachers were affected.

In this chapter, Novak emphasizes the role of coordination and cooperation in post crisis response. She notes, "When crisis in food safety occurs, communication plays a pivotal role." Moreover, agencies and organizations must

coordinate and cooperate with one another to both track down the source of the outbreak and contain the harm through warnings and recalls. In this case, coordination included the USDA, the CDC, the Michigan Department of Public Health, Andrews and Williams Sales, Inc., and several food vendors. The resulting complexity,

While planning is important in achieving effective coordination, it is also the case that coordination and cooperation can occur spontaneously during a crisis. This spontaneous self-organization, however, has not generally been documented in the response of complex bureaucracies to crisis conditions. Research should be directed to identifying ways in which communication, cooperation, and coordination can be facilitated.

as well as failures to acknowledge and accept the initial warnings, slowed both recognition and response. Although the Michigan Department of Public Health and the CDC were able to identify the probable source of the outbreaks within four days, strawberries were still being served in school lunches three days later and were in the distribution system for at least 20 more days. In this case, the extended distribution system from the farm to the fork made recalling the strawberries a daunting task. The task was compounded by lack of cooperation and small errors.

Novak concludes by emphasizing the importance of planning in an effective response. While planning is important in achieving effective coordination, it is also the case that coordination and cooperation can occur spontaneously during a crisis. This spontaneous self-organization, however, has not generally been documented in the response of complex bureaucracies to crisis conditions. Research should be directed to identifying ways in which communication, cooperation, and coordination can be facilitated.

The case of genetically modified (GM) wheat and the Monsanto Corporation described by Lyonga is a departure from the kinds of food borne illnesses described in earlier cases. No one became ill from Monsanto's GM wheat and in fact, the product never reached market. Rather than a crisis per se, this case represents an issue management challenge faced by an organization seeking to introduce a new food and new food production technology.

As Lyonga notes, generic modification of agricultural products is very controversial. Although spokespersons for GM companies such as Monsanto regularly discount any problems and emphasize the potential of GM technology to radically increase food production and reduce the need for chemicals, skepticism remains. Most of this skepticism comes from consumer and environmental groups as well as the organic food community. Recently, international organizations and agencies seeking protection of sustainable agriculture have also expressed concern. Critics point out that too much is simply unknown and that unforeseen consequences can occur.

Lyonga uses diffusion of innovation theory to explore the case of GM wheat.

Developed primarily through the work of Everett Rogers, this approach seeks to facilitate the engineering of adoption of new products and innovations. While diffusion of innovation works very well for those innovations, which are largely uncontroversial, it breaks down where there are powerful counter arguments and active special interest groups working against the new technology.

A significant body of research in risk communication has demonstrated that novel and exotic issues are perceived as more risky than those that are familiar. A familiar risk is, after all, more predictable. In the case of GM wheat, not only is the product novel and exotic, but also the alterations cannot be seen. GM technology has been described as defying the laws of nature to create Frankenfood. It is not surprising, then, that GM is viewed by many as very risky.

Through the Monsanto case, Lyonga demonstrates the problem of seeking to engineer acceptance of a new technology. Monsanto's tactics where heavy handed and the company refused to acknowledge the legitimacy of concerns until far too late. Ultimately, after widespread domestic and international protests, the company abandoned plans to commercialize GM wheat. Other approaches, such as issue management or even a risk-sharing model may have lead to a different process and outcome.

Finally, Spence and Lachlan explore a case of intentional food contamination by the Bhagwan Shree Rajneesh cult in Wasco County, Oregon. In 1981, the community numbered about 7,000 followers. In an effort to influence the outcome of a local election, cult members contaminated salad bars in local restaurants with a strain of salmonella. The contaminated foods differed from salad bar to salad bar, making identification of the source difficult. Although some suspected the Rajneesh cult, initial reports failed to identify the source and concluded that the outbreak was unintentional. It was not until much later, when a dispute arose among cult membership that the nature of the outbreak was confirmed. In the subsequent investigation it was determined that the salmonella bacteria had been grown at the Rajneeshees ranch.

A number of issues regarding preparation are also explored in this last case study. Spence and Lachlan describe several specific kinds of actions and communication processes that help mitigate and contain the harm a local community might experience. In addition, they discuss the social and psychological outcomes that might arise from a widespread, intentional event. Although little evidence exists as to what specific outcomes might occur, it is likely, as the authors note, that high uncertainty, fear, and outrage would accompany an intentional contamination. In addition, the faith of the public in the security of the food supply would likely be compromised.

Conclusion

Food borne illness is not certainly a recent phenomenon. People have been getting sick from eating contaminated food for as long as people have been eating. Moreover, modern production techniques have dramatically reduced the number of incidents. The advent of new, more complex food production and distribution systems, the globalization of the food supply, the phenomenon of intentional contamination and intense media coverage has significantly enhanced the profile of outbreaks. The reputation of specific organizations and industry sectors may be seriously affected by widespread events. In addition, there is a very real potential of widespread harm. It is likely that more events and more widespread events will continue to occur. Successful management of these events, through communication and recognition of warnings, through public notification and recalls, and through post events is increasingly important.

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Afterword

Risk+Crisis Communication Project

Project History

The Risk+Crisis Communication Project (RCCP) began at NDSU in 2000 with funding from a cooperative agreement with the United States Department of Agriculture-Animal Plant Health Inspection Service. The program expanded with additional funding and research opportunities from the USDA, Centers for Disease Control and Prevention, and Department of Homeland Security. At the present, the RCCP is affiliated with the Great Plains Institute for Food Safety and the National Center for Food Protection and Defense.

The Risk+Crisis Communication Project

- Seeks to unify a series of research opportunities in the consistent mission of developing best practices.
- Engages in research that is intertwined with education. The research, conducted from a variety of angles, seeks to identify best practices.
- Research process affords undergraduate, masters, and doctoral students an educational opportunity in risk and crisis communication.
- The product of the research, a rubric of best practices, serves as the foundation for education, training, and consulting with government agencies and private industry.
- Serves as an educational resource designed to inspire ethical risk and crisis communication that meets the constraints of high risk and crisis situations in a product efficient manner.

The Risk+Crisis Communication Project Staff

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What is This?

CERC as a Theoretical Framework for Research and Practice

Shari Veil, PhD Barbara Reynolds, MA Timothy L. Sellnow, PhD Matthew W. Seeger, PhD

Health communicators at the Centers for Disease Control and Prevention (CDC) have developed an integrated model titled Crisis and Emergency Risk Communication (CERC) as a tool to educate and equip public health professionals for the expanding communication responsibilities of public health in emergency situations. This essay focuses on CERC as a general theoretical framework for explaining how health communication functions within the contexts of risk and crisis. Specifically, the authors provide an overview of CERC and examine the relationship of risk communication to crisis communication, the role of communication in emergency response, and the theoretical underpinnings of CERC. The article offers an initial set of propositions based on the CERC framework and concludes with a discussion of future directions.

Keywords: crisis and emergency risk communication (CERC); risk communication; crisis communication; grounded theory; sensemaking; self-efficacy

Public health has entered a new stage of development based in part on an expanded set of responsibilities during a crisis or emergency. Although public health has always provided ancillary support during crises and disasters, the events of 9/11, the

Health Promotion Practice

Supplement to October 2008 Vol. 9, No. 4, 26S-34S DOI: 10.1177/1524839908322113 ©2008 Society for Public Health Education anthrax attacks, and the threat posed by H5N1 have positioned public health professionals more closely to the first responder community. These more recent emergency threats have created "challenges for the medical and public health community to communicate in accurate, credible, timely, and reassuring ways" (Reynolds & Seeger, 2005, p. 45). Reynolds and Seeger suggested that, within this new domain, health communication "must be strategic, broad based, responsive, and highly contingent" (p. 49). One of the most important responses to the evolving health communication challenges has been the development of a broad and integrative communication framework known as crisis and emergency risk communication (CERC).

This article focuses on CERC as a general theoretical framework for explaining how health communication functions within the contexts of risk and crisis, how risk and crisis communication are related to one another in health contexts, and how effective risk and crisis communication can help avoid crises and mitigate the impact of inevitable crises. We do not contend that CERC is a theory per se, but a useful, integrated framework of risk and crisis communication perspectives that needs further development. We first provide an overview of CERC, including a discussion of the relationship of risk communication to crisis communication. This is followed by a discussion of the role communication plays in emergency response and an examination of the theoretical underpinnings of CERC. We also offer an initial set of propositions based on the CERC framework and conclude with a discussion of future directions.

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CERC

In October 2002, the Centers for Disease Control and Prevention (CDC) launched an innovative course for public health officials following an integrated model titled CERC (Reynolds, Hunter-Galdo, & Sokler, 2002). The CERC was developed primarily as a tool to educate and equip public health professionals for the expanding communication responsibilities of public health in emergency situations. Although it is not possible to provide a comprehensive review of the CERC framework here, it is important to describe some of its unique features. First, CERC is a compilation of many risk and crisis communication principles within a general unifying framework. This includes principles that are theory driven, research driven, and practice driven. We characterize CERC as a framework or paradigm developed through grounded theory and influenced by the heath, risk, and crisis communication disciplines. Packed within this framework are communication concepts, tools, and methodologies, which heretofore have not necessarily been related in a logical and systematic way. At the heart of the CERC framework is a five-stage developmental model of risk and crisis that incorporates various communication activities and strategies.

What makes the CERC program different from classification models of crisis (Coombs, 2007; Fink, 1986; Mitroff, 1994) is the systemic approach that requires ongoing and escalating communication processes throughout the stages of precrisis, initial event, maintenance, resolution, and evaluation. In each stage, specific communication activities are described along with the expected relationships between the communication activities and outcomes. Because the recommendations are contingent on the crisis type, "the model is advanced as a tool for health communicators to assist in managing complex public health threats, including crises and disaster events as well as emergent threats to public health such as infectious disease outbreaks and potential bioterrorist attacks" (Ballard-Reisch et al., 2007, p. 207).

Traditionally, public health had a primary responsibility for educating the general public about health risks and ways those risks can be mitigated through behavioral changes. The first outbreak of H5N1 in Hong Kong in 1997, the anthrax episode in 2001, along with other events such as 9/11 and Hurricane Katrina illustrated that public health has an extensive role reaching far beyond simply informing the public about health risks. Rather, public health's role has extended beyond risk identification and crisis prevention into crisis response. In this way, the novel responsibility of public health as first responder emerged. In addition to operational activities, this role includes a complex set of communication obligations that incorporate elements of both risk communication and crisis communication.

MERGING OF RISK AND CRISIS

As the name reflects, CERC seeks to merge the traditions and best practices of risk communication into those most often associated with crisis communication (Seeger & Reynolds, 2007). Both risk and crisis communication "share an essential purpose of seeking to limit, contain, mitigate, and reduce harm" (Reynolds & Seeger, 2005, p. 48); however, the persuasive nature of risk communication and time constraints of crises have fostered distinct research traditions. Risk communication is defined as "the intentional effort to inform the public about risks and persuade individuals to modify their behavior to reduce risk" (Seeger & Reynolds, 2007, p. 9). Because much of the work in health communication has focused on reducing health risks, health communication as a discipline has similarly been defined as "the means to disease prevention through behavior modification" (Freimuth, Linnan, & Potter, 2000, p. 337). Risk communication messages can and should be crafted to match audience needs, values, background, culture, diversity, health literacy, and experience (Murray-Johnson et al., 2001; Institute of Medicine, 2002). In addition, considering the effectiveness of communication channels is crucial for effective response (Venette, Veil, & Sellnow, 2005). "Effective health communication programs identify and prioritize audience segments; deliver accurate, scientifically based messages from credible sources; and reach audiences through familiar channels" (Freimuth et al., 2000, p. 338). A significant difference between health

and risk communication campaigns and crisis communication responses is that, in addressing a risk that has not yet evolved into a crisis, communicators have the luxury of time to fully develop and test messages in an effort to maximize their effectiveness.

As a function of public relations, the purpose of crisis communication is "to prevent or lessen the negative outcomes of a crisis and thereby protect the organization, stakeholders, and industry from harm" (Coombs, 2007, p. 5). "The immediate communication needs are to reduce the uncertainty, allowing audiences to create a basic understanding of what happened so that they may act appropriately" (Reynolds & Seeger, 2005, p. 50). Responses include information alerts that instruct stakeholders of what to do to protect themselves physically, adjusting information that helps stakeholders cope psychologically with the crisis, and reputation management responses that seek to protect the reputation of the organization both during and following the crisis (Coombs, 2007). Because the crisis communication role derives from "the need for skilled communicators to strategically defend and explain the organization's position in the face of crisisinduced criticism, threat, and uncertainty" (Reynolds & Seeger, 2005, p. 46), crisis communication research has focused primarily on reputation management strategies for image restoration (Benoit, 1995a, 1995b, 1997, 2000; Coombs, 1995).

Emergency communication, most often associated with natural disasters, is designed to "protect health, safety, and the environment by keeping the public informed" and "to restore public confidence in the organization's ability to manage an incident" (Mileti & Sorensen, 1990, p. 4). "By their very nature, crises create severe threats to the public health and welfare, including the physical, psychological, emotional, and economic well-being of the public" (Seeger & Reynolds, 2007, p. 5). Communication is a key aspect of emergency response (Veil, 2007), and warnings "must be modulated so as not to create social disruption and a sense of futility and despair" (Seeger, Reynolds, & Sellnow, in press, n.p.). Seeger, Reynolds, and Sellnow (in press) recognize a challenging dilemma for public health officials in stating that they must "raise awareness and concern without inducing irrational behavior" (n.p.). The CDC has historically dealt with emergency communication as tangential to its central organizational response; however, Prue et al. (2003) suggested more must be done to integrate emergency and communication response teams. Failure to do so has a negative impact on public perception. "Public perceptions of the effectiveness of response efforts are critical" (Ballard-Reisch et al., 2007, p. 217), as "crisis may create the impression that the public health risk is somehow out of control" (Ulmer, Alvy, & Kordsmeier, 2007, p. 98).

Traditionally, risk communication concentrates on persuading individuals to take action to limit risk, whereas crisis communication focuses on responding to immediate public needs for information. However, when a crisis causes additional risk, effective persuasive messages are needed to encourage action under the time constraints of an emergency. "Effective communication before, during, and after public health emergencies is the foundation for appropriate response (Ballard-Reisch et al., 2007, p. 218). The increasingly complex demands on public health officials during emergency situations make the dynamic blending of risk and crisis communication both essential and practical.

COMMUNICATION AS EMERGENCY RESPONSE

Communication is the primary process for establishing relationships and for acquiring information necessary to make choices and adjustments. Both relationships and information are critical to crisis planning and response. Failures and breakdowns in communication can exacerbate the harm created by a crisis. Following the recommendations of officials, for example, residents evacuated from uncontaminated areas into contaminated areas during the 1986 Chernobyl episode. The public of Bhopal, India, had been systematically misinformed about the risks of the Union Carbide insecticide plant located in their city. Thus, many died because they failed to act appropriately when the company experienced a massive gas leak. Indeed the literature is filled with examples of miscommunication making a crisis much worse.

Beyond the physical harm associated with public health crises, Seeger and Reynolds (2007) noted that many crisis scenarios pose a severe threat to psychological security and the associated socioeconomic stability. Following Sandman's (2002) model of risk as a function of hazard and outrage, public health officials must first understand the public's perception of hazard, even if the fears are irrational or unwarranted. Seeger and Reynolds (2007) explained, "One of the principle [*sic*] ways by which this psychological harm and social disruption can be reduced is through effective communication" (p. 8).

Communication has the capacity to reestablish a sense of personal control and thus reduce the perception of risk (Bradbury, Branch, & Focht, 1999). This orientation places an obligation on the communicators, in this case public health officials, to understand the complex needs, background, and culture of the intended audiences. In the psychological context of a crisis, the focus is on determining what stressors the audience is experiencing and responding to and, when possible, resolving them through strategic communication that ultimately maintains and builds credibility for the communicator or organization. The CERC accomplishes this solvency by recognizing the participatory nature of a crisis and the opportunity for communication to empower individuals and communities to help themselves and recover sooner.

Although the development of the CERC training program was practice driven, the framework relied heavily on research in a variety of academic disciplines including health communication and emerging frameworks for linking risk and crisis communication. We contribute to this body of research by examining the theoretical underpinnings of CERC.

THEORETICAL UNDERPINNINGS OF CERC

Although "critics have expressed concern about a lack of strong theoretical underpinnings and an atheoretical focus in too many health communication studies" (Kreps, 2001, p. 238), health communicators have relied on a variety of theories, concepts, and frameworks to plan, test, and explain campaigns. Social marketing applies commercial marketing practices to "influence the voluntary behavior of target audiences in order to improve their personal welfare and that of their society" (Anderason, 1995, p. 7). Diffusion is "the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003, p. 5) and has been used extensively in AIDS research and other health risk campaigns. Similar to the decision process in diffusion studies, stages of change refers to the "cognitive behavioral stages that individuals move through when adopting and maintaining a new behavior" (Nelson, Brownson, Remington, & Parvanta, 2002, p. 64). Behavioral intentions (Fishbein & Ajzen, 1975) have been evaluated to predict an individual's intent to change, and the health belief model has been used to explain why individuals did not change behaviors to reduce their health risks (Janz & Becker, 1984). Although this list of applicable theories to health communication is by no means exhaustive, it demonstrates the theoretical base of health communication literature.

Backer, Rogers, and Sopory (1992) contended that "no one theory and no one model is totally adequate for designing public communication campaigns. Even the models that strive to integrate different models or approaches do not seem adequate at the present time, and much work is needed by campaign scholars to improve them" (p. 82). They further explained, "Theoretically, the models seem excellent. But the problem comes when their practicability is tested. The problem is not with the theoretical basis for the model, but that in practice they do not work that well" (p. 104). As noted, the CERC model was developed based on the experiences of health communicators at the CDC. The communicators were informed by health communication theories; however, the model was not developed to test any one theory but as a tool to address the evolving challenges of public health. This strategy aligns with Backer, Rogers, and Sopory's (1992) assertion that "theoretical models for communication campaigns provide only very general guidelines for developing good campaigns. These models must be supplemented with the experience of practitioners and verified by actual campaigns and their results" (p. 108).

We argue that CERC developed as a grounded theory through a process of seeking to understand and systematize practice. The model has been validated by the experiences of health communicators and public affairs specialists who have completed the training, conducted the training, and executed the principles over the last 5 years. Since its early inception from the work of Glaser and Strauss (1967), grounded theory has been closely associated with issues of health. Grounded theory emphasizes the development of theory from data. In general, grounded theory uses a qualitative or case study approach that allows the researcher to use his or her experience to generate systems of relationships for describing phenomenon. Disaster researchers have adopted experiential and case study approaches for decades. This is largely due to the limitations imposed on researchers by disasters themselves. The key assumption of developmental approaches is that the previous conditions systematically affect subsequent conditions. Thus, a risk may evolve over time to create a crisis (Seeger, Sellnow, & Ulmer, 2003). Developmental approaches allow for predictability within a system that is behaving in nontypical ways.

Grounded theory may also be informed by the larger research literature. Multiple theories and frameworks have been used to explain the complicated context of risk including social amplification of risk, defined as a general phenomenon comprising "the social structures and processes of risk experience, the resulting repercussions on individual and group perceptions, and the effects of these responses on community, society, and economy" (Kasperson et al., 1988, p. 179). Social amplification of risk research suggests that "hazards interact with psychological, social, institutional and cultural processes in ways that can heighten or attenuate individual and social perceptions of risk and shape risk behavior" (Renn et al., 1992 p. 139). The precede-proceed framework also includes the context of an individual's community and social structures in the planning process by examining the presdisposing, enabling, and reinforcing factors contributing to behavior change (U. S. Department of Health and Human Services [USDHHS], 2001). Similarly, the social-ecological model considers the interplay between individual, relationship, community and societal factors (Green & Krueter, 1991) and has been used by the CDC to better understand violence and the effect of potential prevention strategies (Dahlberg & Krug, 2002).

To adapt campaigns to the context in which risk is understood by those at risk, public health communication has evolved to include a two-way communication strategy described as "the scientific development, strategic dissemination, and critical evaluation of relevant, accurate, accessible, and understandable health information communicated to and from intended audiences to advance the health of the public" (Bernhardt, 2004, p. 2051). Covello (2003) argued that best practices in risk and crisis communication require "listening to people," to empathize with the audience prior to communication activities. Viewing the CERC model through systems theory, this feedback allows for improvisation based on the context (May & Mumby, 2005). According to Ray and Donohew (1990), "the responses of the system to its environment are not limited to simple mechanistic actions based on the inputs from its various components, but are complex responses based on the interaction of those components" (p. 5).

The responses offered throughout the CERC model are based on the combination of a pragmatic set of best practices emerging from the risk and crisis communication literature and the extensive experience of health communicators at the CDC. The recommendations in each of the stages address the needs of those affected, specific to the event, to assist in the understanding of the crisis and encourage action to alleviate additional risk. By focusing on the participatory nature of a crisis and encouraging action to aid in understanding, CERC also invokes the theories of sensemaking and cognitive learning.

Sensemaking refers to an individual's ability to make sense of their circumstances on the basis of past experiences and personal interpretation (Weick, 1988). "Explicit efforts at sensemaking tend to occur when the current state of the world is perceived to be different from the expected state of the world" (Weick, Sutcliffe, & Obstfeld, 2005, p. 409). When an individual finds no relevance to the current situation, she or he becomes confused and may act irrationally (Vanderford et al., 2007). Sensemaking is an "interplay of action and interpretation" (Weick et al., 2005, p. 409), where meanings materialize that inform and constrain identity and action (Mills, 2003). According to Weick (1988), "actions devoted to sensemaking play a central role in the genesis of crises and therefore need to be understood if we are to manage and prevent crises" (p. 308).

An individual's perceived ability to act in a crisis affects his or her understanding of that crisis. As Weick (1988) described,

If people are aware that volitional action may enact conditions that intensify or de-escalate crises, and if they are also aware of their actions and capacities, this heightened awareness could allow them to see more of a developing crisis. Seeing more of a developing crisis, people should then be able to see more places where they could intervene and make an actual difference in what is developing. (p. 311) Crises engage human action. (p. 308)

Efficacy is determined by whether an individual can act as needed to alleviate risk, although self-efficacy refers to an individual's belief as to whether he or she can act as needed (Egbert & Parrott, 2001; Witte, Meyer, & Martel, 2000). A belief that action is possible and will reduce harm is necessary to the sensemaking process. In social cognitive research, perceived self-efficacy has been found to regulate motivation, action, and affective arousal (Bandura, 1986). Research has also delineated ways in which perceived self-efficacy can enhance or impair cognitive functioning (Bandura, 1991). Although a sense of strong self-efficacy can heighten and sustain efforts in the face of failure, individuals with low self-efficacy are more likely to experience stress and depression when faced with daunting tasks (Bandura, 1994). In effect, the higher the level of self-efficacy, the more likely an individual will succeed in accomplishing the task at hand (Bandura, 1997).

By recognizing the participatory nature of crisis and giving people something meaningful to do, CERC encourages self-efficacy. According to the CDC, CERC is designed "to provide information that allows an individual, stakeholders or an entire community, to make the best possible decisions about their wellbeing, under nearly impossible time constraints, and to communicate those decisions, while accepting the imperfect nature of their choices" (CDC, 2007a, para 1). If individuals believe they can act effectively to alleviate risk, they are more likely to do so. Acting, then, assists in sensemaking by helping the individual to feel they have control over the situation, which can thereby decrease uncertainty and anxiety. The CD-ROM used in the CERC training program states, "The public must feel empowered in the event of a crisis to reduce the likelihood of victimization and fear" (CDC, 2003, see Step 3: Assess level of crisis).

Grounded theory provides a real-world understanding of risk and crisis in public health. This applied perspective is further informed by theories and models that consider the context and explain the interaction of multiple variables and the actions required to reduce risk. In this manner, specific propositions regarding the role of communication in an integrated crisis and risk framework are generated. Emerging disciplines, such as CERC, initially coalesce around some general framework or paradigm that shifts the research agenda and is strongly heuristic. This coalescence, in turn, provides direction for both scholars and practitioners. The following propositions are outlined to help move the development of CERC as a discipline forward by clarifying the research agenda.

PROPOSITIONS OF CERC

The six propositions offered in this section grow out of the CERC framework. They also incorporate a variety of theoretical frames that are in some ways unique to the intrinsic experience of working in the domain of CERC.

- 1. Risks and crises are equivocal and uncertain conditions that create specific informational needs and deficiencies: The literature on crisis and disaster has always emphasized the role of communication, primarily as a management tool from centralized authorities to the public through mass media channels. The CERC positions communication more centrally throughout the risk and crisis communication process. Although much is known about the role of communication, a comprehensive picture of the process in risks and crises has yet to emerge.
- 2. Ongoing, two-way communication activities are necessary for the public, agencies and other stakeholders to make sense of uncertain and equivocal situations and make choices about how to manage and reduce the threat(s) to their health: Self-efficacy and sensemaking are fundamental processes in crisis response. Traditionally, research and practice have emphasized on crisis managers communicating information to the public. The CERC builds on a more dynamic interchange between crisis stakeholders. Few investigations have explored the feedback processes, whereby the public alerts crisis mangers about the effectiveness of communication.
- 3. Communication processes (channels, needs, information, etc.) will change dramatically as a risk evolves

into a crisis introducing new risks and as a crisis evolves to postcrisis and recovery: Although CERC makes logically apparent claims about how communication needs and dynamics change as a crisis evolves, many of these assumptions are largely unexplored. In particular, the developmental model of CERC articulates a detailed set of expectations regarding how communication processes are influenced by specific stages and the associated conditions of crisis. The dynamics of changing communication processes have yet to be described in detail.

- 4. Risk and crisis communication are highly interrelated such that risk messages communicated before a crisis occurs influence perceptions, expectations, and behavior after the crisis erupts. In turn, these crisis responses then influence subsequent risk messages: One of the key features of CERC is the emphasis on developmental sequences and enactment processes to create an integrated framework. Building on the assumptions of sensemaking, CERC argues that acting toward (or communicating about) a crisis in a particular way influences the development of the event and determines the kinds of communication that subsequently occur. Research should explore how communication constrains and influences subsequent communication processes.
- 5. Communication is consequential to specific risk and crisis management outcomes by promoting self-efficacy. Messages of self-efficacy contribute to risk reduction, crisis preparation, family and community organization, and learning, among others: Some of the ways communication affects outcomes, such as self-efficacy, have been described. Other impacts, such as risk reduction, crisis preparation, family, and community organization, have not been systematically examined.
- 6. Risks and crises affect a wide variety of publics with variable needs, interests, and resources, which in turn affects their communication capacities. needs, and activities: One of the recurrent themes in CERC and in many communication models is audience diversity. Although scholars have traditionally written about audiences differences, efforts to craft a detailed understanding of audience diversity is a comparatively recent phenomenon. Health communication research has identified that risk levels are uneven across diverse populations, and unfortunately, often those with the highest frequency of health burdens have the least access to the essential "information, communication technologies, health care, and supporting social services" (USDHHS, 2000, p. 9). Given that audience diversity during a crisis often translates into uneven vulnerabilities, understanding these variables within the crisis context is a particularly important area of research.

As noted, we do not contend that CERC is a theory per se, but a useful, integrated framework of risk and crisis communication perspectives that needs further development. Moreover, specific propositions derived from CERC and other complementary frameworks can push the research agenda. These propositions, then, provide a basis for future research.

WHERE DOES CERC GO FROM HERE?

The CDC developed CERC "to address the emergency risk communication training needs of the public health infrastructure" (Courtney, Cole, & Reynolds, 2003, p. 129). "Over 100,000 individuals have been trained in CERC through Web-based and CD-Rom delivery. Another 11,000 have received training through satellite systems, and 4,500 have received the training in classroom settings" (Seeger & Reynolds, 2007, p. 16). The fast-paced, interactive course gives participants "essential knowledge and tools to navigate the harsh realities of communicating to the public, media, partners and stakeholders during an intense public health emergency" (CDC, 2007b, para 1). The CERC framework has stimulated research (Ballard-Reisch et al., 2007) and has elevated the role of communication within the context of risk and crisis.

However, there is a need for greater coherence and unified propositions for the framework. Some aspects of CERC are largely unrelated to one another. The CDC has joined with the National Public Health Information Coalition and the Society for Public Health Education to convene an expert CERC panel to begin to bring discipline to the CERC discipline. The purpose of the CERC consultation panel is to assist the CDC with the continuing refinement and enhancement of the CERC training series. Specifically the panel with help to (a) identify CERC best practices from the field and submit them for inclusion on the CDC CERC Training Web site; (b) assist with the development of new modules to the core CERC training tool and determine the need for upgrades or enhancements to current CERC modules; and (c) provide backup support for CDC CERC training requests.

As practitioners evaluate and amend the CERC curriculum, case studies of events where CERC has guided actions are needed to bridge the divide between the research and practice. In addition, there is a need for more specific, testable, propositions to move beyond descriptions. For example, future research could focus on the impact of risk messages disseminated during a crisis and the effect of those messages on individuals with differing levels of self-efficacy. Finally, although CERC has made great strides in explaining the first responder responsibilities of public health, more must be done to integrate emergency and communication response teams, not only in public health but also in emergency and disaster management.

CONCLUSION

This article focused on CERC as a general theoretical framework for explaining how health communication functions within the contexts of risk and crisis. By providing an overview of CERC and examining the relationship of risk communication to crisis communication, the role of communication in emergency response, and the theoretical underpinnings of CERC, we offered an initial set of propositions based on the CERC framework and a discussion of future directions for the rapidly growing discipline. As public health enters a new phase of development based on an expanded set of responsibilities in crisis and emergency response, continued application of CERC in both research and practice will assist in addressing the diverse and evolving health communication challenges.

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