

University of Kentucky

From the Selected Works of Glen Mays

Fall October 23, 2016

Estimating the Costs of Foundational Capabilities for the Nation's Public Health System

Glen P. Mays, *University of Kentucky*
Cezar Brian C Mamaril



Available at: https://works.bepress.com/glen_mays/270/

Estimating the Costs of Foundational Capabilities for the Nation's Public Health System

Glen P. Mays and Cezar B. Mamaril
Department of Health Management and Policy
University of Kentucky

October 23, 2016

Funding for this research was provided by the Robert Wood Johnson Foundation
through the Systems for Action Research Program.

Glen P. Mays, PhD, MPH
Scutchfield Endowed Professor of Health
Services and Systems Research
Department of Health Management and
Policy, College of Public Health
University of Kentucky
Lexington, KY 40536
glen.mays@uky.edu

Cezar B. Mamaril, PhD, MS
Assistant Professor
Department of Health Management and
Policy, College of Public Health
University of Kentucky
Lexington, KY 40536
cbmamaril@uky.edu

This is an unedited working paper and all errors and omissions are the responsibility of the authors. An earlier version of this manuscript was presented at the National Institutes of Health 8th Annual Conference on the Science of Dissemination and Implementation in Health, December 14-15, 2015, Washington, DC. A later version of this manuscript is currently under review at the journal *Health Services Research*. We thank members of the Public Health Leadership Forum and Resolve for helpful guidance and feedback on this research.

Executive Summary

The Institute of Medicine's 2012 report on public health financing called for the convening of expert panels to identify the components of a "minimum package" of public health services and cross-cutting capabilities that should be available in every U.S. community to protect and improve population health, and to identify the resources required to make these services universally available across the country. With support from the Robert Wood Johnson Foundation, an expert panel convened as the Public Health Leadership Forum developed a consensus set of **Foundational Public Health Services (FPHS)** delineating skills and capabilities that every state and local public health agency should have in place in order to protect and improve health status across the American population. This study uses data from a diverse cohort of local and state public health agencies to estimate: (1) the current costs incurred by local and state agencies in implementing FPHS; (2) the expected costs that would be incurred by local and state agencies in fully attaining the FPHS recommendations as articulated by the Public Health Leadership Forum; and (3) the resource gap (shortfall) between current and expected costs that would require new resources to fully meet FPHS recommendations.

This study estimated FPHS costs using data collected from a diverse cohort of 19 public health agencies located in 3 states that implemented the FPHS cost estimation methodology in their agencies during 2014-2016. To project cost estimates for the nation as a whole, we estimated analytic weights and applied them to the cohort of agencies and states so that they match the national population of state and local public health agencies with respect to population size, demographic and regional characteristics.

Results indicate that current FPHS costs incurred by state and local public health agencies totaled \$15.4 billion or \$48.14 per capita in 2015-16. This level of resource use was sufficient to support more than 60% attainment of the skills and capabilities represented in the FPHS recommendations. These estimates suggest that public health agencies currently devote approximately 23% of their resources to FPHS, with the remaining 77% of resources devoted to other public health programs and services. Full attainment of the FPHS recommendations developed by the Public Health Leadership Forum would require an additional \$34.29 per capita or \$10.94 billion in additional resources per year based on these estimates. Generating these additional resources from state and local government sources would require an increase in spending of 16.1% over the levels estimated in the National Health Expenditure Accounts for 2014. Alternatively, the estimated resource gap could be filled by nearly doubling federal government spending on public health activities from the \$11.0 billion level estimated in 2014.

The cost estimates generated in this study are limited to the foundational activities reflected in the Public Health Leadership Forum's FPHS recommendations. Importantly, these cost estimates do not include resources required for implementing other categorical public health programs and services, which are also essential elements for improving population health and wellbeing. Further work will be necessary to estimate the resource requirements for these other essential activities in order to provide a complete assessment of the costs required to realize a minimum package of public health services for the nation.

Rationale: Understanding Public Health’s Fundamental Components and Costs

The United States faces mounting pressure to improve population health as medical costs rise while American health status falls further behind that of other developed nations.¹ Enactment of the Patient Protection and Affordable Care Act in 2010 ushered in a series of initiatives to expand health insurance coverage and find improved models for delivering and paying for medical care. Much less attention has focused on the nation’s public health system, which is charged with preventing disease and injury in the population at large, and ensuring the safety of water, food, air and other conditions necessary for optimal health. Of the \$3 trillion spent on health and health care services in the U.S. in 2014, less than 3% supported governmental public health activities.² Studies consistently find the U.S. public health system to be highly variable in its capabilities across states and communities, fragmented with respect to governmental and private sector roles and responsibilities, and constrained by inadequate and unstable financing.^{3,4}

A 2012 report from the Institute of Medicine identified two fundamental barriers to improving the nation’s public health system: (1) lack of agreement on a core set of public health capabilities that should be present in every U.S. community; and (2) lack of knowledge about the resources required to implement these capabilities.⁵ ***The report concludes that sound policy for improving the nation’s public health system can move forward only when there is sufficient understanding and agreement about what the public health system should be able to do and how much it will cost.*** Correspondingly, the report calls for an expert panel process to identify the components of a “minimum package” of public health services and cross-cutting capabilities that should be available in every U.S. community to protect and improve population health. The report also recommended undertaking research to estimate the resources required to implement these services and capabilities universally across the U.S.

In response to these Institute of Medicine recommendations, the Robert Wood Johnson Foundation commissioned an expert panel in 2014 to begin work on identifying components of a national “minimum package” of public health services and capabilities.⁶ Working as the Public Health Leadership Forum, this panel included representatives from federal, state, and local public health agencies, public health professional associations, universities, public health accrediting bodies, and health policy advisory commissions. The Forum used available research, practical experience and expert opinion to distinguish two broad types of responsibilities or “actions” within the public health system:

- **Type 1: Categorical programs and policies** protect health and prevent disease and injury by intervening on specific risk factors and determinants of health experienced by defined population groups. These interventions are based on scientific evidence regarding efficacy and cost-effectiveness in improving health status, and reflect evidence-based guidelines and recommendations such as those profiled in the U.S. Centers for Disease Control and Prevention’s *Guide to Community Preventive Services*. Examples include comprehensive smoking ban policies, quit-lines and cessation programs that target tobacco users, school-based and worksite nutrition and physical activity promotion programs that target risk factors for obesity and diabetes, immunization campaigns for vaccine-preventable diseases, and screening and treatment programs for sexually transmitted infections.
- **Type 2: Cross-cutting capabilities** allow the public health system to deploy its available resources in ways that optimize health and wellbeing for an entire population. These capabilities allow the system to identify and track health needs and risks within a community over time, prioritize health needs and

risks based on community values and preferences, engage community stakeholders in developing shared solutions to priority health needs, mobilize community partnerships and resources to implement solutions to priority health needs, and maintain measurement and evaluation processes that track progress over time and promote shared accountability for results.

Type 1 public health actions are the most visible elements of the public health system because they are directly experienced by target populations and by the organizations and professionals involved in implementing them. Governmental and philanthropic funding mechanisms typically focus on Type 1 public health actions due in part to the constellation of interest groups, advocates, service providers, and scientific bodies that coalesce in support of these actions and their target populations.⁷ For these same reasons, research funding historically has focused on Type 1 public health actions, resulting in a large and growing body of evidence-based guidelines and recommendations. Nevertheless, the task of defining a “minimum package” of Type 1 public health actions for the nation is complicated by several factors. First, the volume and mix of Type 1 actions needed within a community depend heavily on demographic, socioeconomic, environmental, cultural, and epidemiological characteristics that shape health risks and needs, which vary widely across communities and change over time. Second, some Type 1 actions involve trade-offs between individual rights, collective health benefits, and the distribution of benefits and costs within a community that are subject to community values and preferences and therefore best resolved through democratic policy-making processes. Some communities may prefer less intrusive, coercive, or costly interventions even if they are less effective in improving health.

By comparison, Type 2 public health actions form the organizational infrastructure, decision support architecture, and collaborative capacity that supports the nation’s public health system. These actions are more diffuse and less visible within communities. The processes used to implement Type 2 actions are fluid and frequently adapted to fit specific political, legal, social, and economic contexts of individual communities. The stakeholders involved in Type 2 actions may not always recognize their roles in these actions nor attribute them as responsibilities of the public health system. Historically, the scientific community has focused much less attention on Type 2 actions than on Type 1 actions, and as a result it is more difficult to link Type 2 actions to defined and measurable outcomes. Recent research, however, suggests large gains in population health are achievable over time through efforts to build Type 2 activities and infrastructure.⁸ Unlike Type 1 actions, the need for Type 2 actions is not conditional on the presence or magnitude of specific risk factors, community conditions, or population characteristics. Importantly, Type 2 actions can be conceptualized as first-order activities that inform and support the downstream, second-order decisions about the volume and mix of Type 1 activities that are needed within communities. Type 2 actions are conceptually linked with principles of procedural justice, which stress that **how** decisions are made are at least as important as **what** decisions are made in shaping the implementation and outcomes of these decisions.⁹

Defining Foundational Public Health Services

The Public Health Leadership Forum developed a consensus set of **Foundational Public Health Services (FPHS)** delineating skills and capabilities that every state and local public health agency should have in place in order to protect and improve health status across the American population.⁶ The Forum chose to focus its work on Type 2 public health actions that reflect cross-cutting skills and capabilities. Type 2 actions were considered “foundational” by the Forum because they represent first-order activities that enable and support the array of specific programs and policies that communities use in improving health and wellbeing. In developing this recommended set of services, the Forum focused on **cross-cutting Type**

2 public health actions considered to be the primary responsibility of governmental public health agencies operating at state and local levels. The Forum recognized important federal roles in supporting and funding FPHS, but chose to focus its recommendations on public health responsibilities carried out predominately at state and local levels. The Forum developed and defined its recommended set of FPHS using an iterative process of reviewing evidence from available research studies and existing data sources, assessing the experiences of practicing public health professionals across the U.S., and examining findings from state-specific initiatives to define core public health activities. Recent state initiatives underway in Washington, Ohio, and Colorado were particularly informative in developing FPHS definitions, as was the set of national public health accreditation standards developed by the Public Health Accreditation Board.

Table 1: Foundational Public Health Services Recommended by the Public Health Leadership Forum

A. Foundational Capabilities

1. Assessment capabilities that include surveillance and data collection, epidemiological analysis, laboratory testing, and vital records management.
2. All-hazards emergency preparedness and response capabilities.
3. Broad-spectrum communications capabilities that include public information dissemination, strategic communications, crisis and risk communications, and culturally and linguistically appropriate communications.
4. Policy development, policy analysis and advocacy capabilities
5. Community partnership development and mobilization.
6. Organizational capabilities that include leadership and governance, information technology, human resources management, financial management, legal services, quality improvement, and health equity

B. Foundational Areas

1. Communicable disease control
 2. Chronic disease and injury prevention
 3. Environmental and occupational health
 4. Maternal and child health
 5. Access and linkage to clinical health care
-

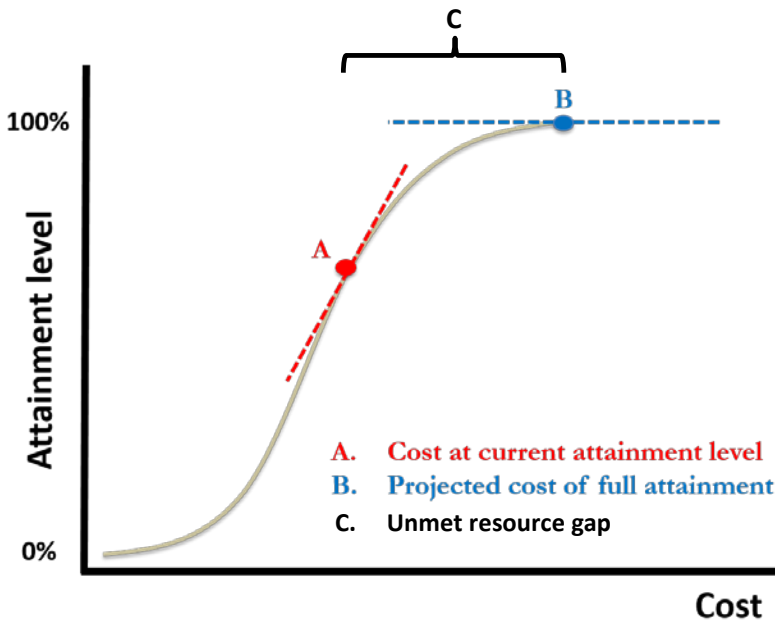
Following an 18-month development and deliberation period, the Public Health Leadership Forum released its initial version of FPHS recommendations and definitions in September 2015. The recommended set of FPHS consists of 6 broad and cross-cutting “Foundational Capabilities” along with 5 “Foundational Areas” that represent more specialized domains of activity and substantive areas of expertise. Together, these 11 FPHS elements, summarized in Table 1, comprise a significant portion of the “minimum package” of public health services and capabilities called for by the Institute of Medicine.

Estimating the Costs of Foundational Public Health Services

The resources required to implement FPHS are estimated using a micro-costing methodology that adheres closely to approaches commonly used with public health agencies, substance abuse treatment programs, and other health and social service sectors.¹⁰ This method uses a survey instrument administered to public health agency administrators to elicit information about the labor and non-labor resources currently used by their agencies to implement activities specified in the FPHS definitions. The instrument also includes

attainment measures that elicit information about the extent to which each agency currently performs all of the activities specified in each FPHS definition. After collecting detailed data on current resource use and current attainment levels for each FPHS element, we use this information to estimate the *expected costs* that would be required to fully implement FPHS elements assuming 100% attainment. Finally, we estimate the *unmet resource gap* as the difference between current costs and expected costs (Figure 1).

Figure 1: Estimating Expected Costs and Unmet Resource Needs Using Nonlinear Attainment Scaling



The cost estimation methodology we use accounts for the fact that FPHS elements are described and defined by the Public Health Leadership Forum using general terms and are not precisely specified, thereby introducing the possibility of differences in interpretation and differences in implementation across state and local public health settings. Using these general definitions, public health officials are likely to face some level of uncertainty in determining the resources currently used by their agencies to implement each FPHS element. The cost-estimation methodology is designed to account for the problem of “fuzzy” definitions and the uncertainty inherent in the current FPHS descriptions using the logic of fuzzy set mathematics and financial modeling.¹¹ Our data collection tool elicits from respondents both upper-bound and lower-bound estimates of current resource use for each FPHS and each resource category (both labor and non-labor categories), along with estimates of the most likely resource levels used in their agency. Using these three points of support for each resource category, we use Monte Carlo simulation modelling techniques to estimate both within-agency uncertainty and between-agency variation in resource use, separate these two components, and then calculate the most likely levels of resource use. We used Palisade @Risk 7.01 software to estimate 10,000 iterations of the simulation model using Latin Hypercube Sampling and assuming Program Evaluation and Review Technique (PERT) distributions for all cost parameters.

The methodology produces three sets of cost estimates:

- (1) costs currently incurred by an agency to implement each FPHS element (*current costs*);
- (2) *expected costs* that would be incurred by the agency to implement each FPHS at full attainment levels; and
- (3) *unmet resource gap* that is calculated as the difference between expected costs and current costs for each FPHS element.

We estimated FPHS costs using data collected from a diverse cohort of 19 public health agencies located in 3 states who volunteered to implement the FPHS cost survey in their agencies during 2014-2016.^a The local public health agencies in this cohort serve a mix of rural and urban communities ranging in size from less than 25,000 residents to more than 500,000 residents. To project cost estimates for the nation as a whole, we estimated analytic weights and applied them to the cohort of 19 agencies and 3 states so that this cohort matches the national population of state and local public health agencies with respect to population size, rural/urban area of residence, and U.S. Census region.

It is important to keep in mind several limitations when using the results from this analysis. FPHS elements are defined using general terms that leave considerable room for interpretation regarding resource requirements. The lower-bound and upper-bound cost estimates produced by this analysis, representing 5% and 95% percentiles of the cost distribution, reflect uncertainties that are inherent in the FPHS definitions. Moreover, the cost estimates produced in this analysis are based on detailed cost data from a limited number of states and communities that may not be fully representative of the nation as a whole, although our weighting methodology helps to reduce any differences between the study cohort and the national population of public health agencies. Finally, cost estimates reflect the resources required to implement FPHS using existing approaches for organizing and implementing public health services at state and community levels. Our models do not reflect economies of scale and scope that may be possible through alternative organizational and implementation strategies.

Results

Estimates of the current resources devoted to FPHS by local and state public health agencies totaled \$48.14 per capita in 2015-16, including \$18.46 for Foundational Capabilities and \$29.68 for Foundational Areas (Table 2). Organizational Capabilities accounted for the largest share of resources devoted to Foundational Capabilities, contributing 53% of these costs. Communication accounted for the smallest share of resources devoted to Foundational Capabilities, contributing 3.4% of these costs. The Maternal and Child Health domain accounted for the largest share of resources devoted to Foundational Areas, contributing nearly 37% of these costs. The Chronic Disease and Injury Prevention domain accounted for the smallest share of resources devoted to Foundational Areas, contributing 11.1% of these costs.

^a This cohort includes 10 agencies from the state of Washington that collected cost data using a separate measurement tool developed by researchers at the University of Washington. The Washington tool uses FPHS definitions and measures that were tailored for Washington's state-specific public health planning initiative, but these data are generally consistent with the national FPHS definitions and measures.

Table 2: Estimates of Current and Expected Cost Per Capita for Foundational Public Health Services

FPHS Domain	Current Resource Use				Expected Costs of Full Attainment			
	Mean	Percentile		Coef. Var.	Mean	Percentile		Coef. Var.
		5th	95th			5th	95th	
Foundational Capabilities								
Assessment	1.70	0.45	3.18	48.8%	3.40	0.79	3.18	53.2%
Emergency Preparedness	2.57	0.66	4.91	50.6%	5.46	1.12	11.31	57.5%
Communication	0.63	0.02	0.22	50.8%	0.98	0.28	1.80	46.7%
Policy Development	1.52	0.35	3.00	53.3%	3.21	0.83	6.31	52.6%
Community Partnerships	2.22	0.52	4.37	53.2%	3.85	0.98	7.42	51.2%
Org. Competencies	9.82	4.38	15.39	34.1%	14.91	4.68	27.17	46.1%
Total Foundational Capabilities	18.46	11.99	25.20	21.7%	31.82	19.18	45.94	25.8%
Foundational Areas								
Communicable Disease	3.40	1.11	5.94	43.2%	5.53	1.81	9.59	42.9%
Chronic Disease/Injury Prevention	3.30	0.85	6.26	50.0%	6.72	1.70	13.02	51.6%
Environmental/Occupational Health	7.49	2.92	13.34	42.7%	10.85	4.42	17.92	37.9%
Maternal Child Health	10.93	3.03	20.16	47.8%	19.08	4.15	38.27	54.9%
Access/Linkage to Clinical Care	4.56	1.10	8.82	51.8%	8.42	1.71	17.26	56.8%
Total Foundational Areas	29.68	18.84	41.37	23.2%	50.60	30.84	73.56	25.6%
TOTAL FPHS	48.14	35.32	61.50	16.4%	82.43	58.54	108.62	18.6%

Note: percentiles reflect lower-bound and upper-bound cost estimates. The Coefficient of Variation reflects variability in costs across local and state agencies.

Estimates of the expected costs to achieve full attainment of the FPHS were more than 70% larger than the estimates of current resource use. Expected costs totaled \$82.43 per capita, including \$31.82 for Foundational Capabilities and \$50.60 for Foundational Areas. Expected cost estimates were more than twice as large as current cost estimates in four FPHS domains: Assessment, Emergency Preparedness, Policy Development, and Chronic Disease and Injury Prevention. These estimates imply that reaching full attainment of FPHS in these domains would require more than a twofold increase in resources per capita.

Subtracting expected costs from current costs yields an estimated resource gap that totals \$34.29 per capita (Table 3). More than 60% of this resource gap is attributable to Foundational Areas, while 39% is attributable to Foundational Capabilities. Scaling the estimated resource gap to the total U.S. population size yields an estimated resource gap of \$10.94 billion, including \$4.26 billion for Foundational Capabilities and \$6.67 billion for Foundational Areas. This estimated resource gap amounts to 16.1% of total state and local governmental public health spending in 2014 as estimated in the National Health Expenditure Accounts.

Table 3: Estimated Resource Gaps for Full Attainment of Foundational Public Health Services

FPHS Domain	Resource Gap \$ Per Capita			Resource Gap \$Millions		
	Mean	Percentile		Mean	Percentile	
		5th	95th		5th	95th
Foundational Capabilities						
Assessment	1.70	0.34	0.00	542	108	0
Emergency Preparedness	2.89	0.46	6.40	922	147	2,042
Communication	0.35	0.26	1.58	112	83	504
Policy Development	1.69	0.48	3.31	539	153	1,056
Community Partnerships	1.63	0.46	3.05	520	147	973
Org. Competencies	5.09	0.30	11.78	1,624	96	3,758
Total Foundational Capabilities	13.36	7.19	20.74	4,262	2,294	6,616
Foundational Areas						
Communicable Disease	2.13	0.70	3.65	679	223	1,164
Chronic Disease/Injury Prevention	3.42	0.85	6.76	1,091	271	2,156
Environmental/Occupational Health	3.36	1.50	4.58	1,072	479	1,461
Maternal Child Health	8.15	1.12	18.11	2,600	357	5,777
Access/Linkage to Clinical Care	3.86	0.61	8.44	1,231	195	2,692
Total Foundational Areas	20.92	12.00	32.19	6,673	3,828	10,269
TOTAL FPHS	34.29	23.22	47.12	10,939	7,407	15,031

Conclusions and Implications

We estimate that the current costs incurred by state and local public health agencies in implementing FPHS totaled \$15.4 billion or just over \$48 per capita in 2015-16. This level of resource use allows the U.S. public health system to implement more than 60% of the skills and capabilities represented in the FPHS recommendations. These estimates imply that public health agencies currently devote approximately 23% of their resources to FPHS, with the remaining 77% of spending devoted to Type 1 activities representing categorical public health programs and services.

Full attainment of the FPHS recommendations developed by the Public Health Leadership Forum would require an estimated \$34.29 per capita or \$10.94 billion in additional resources per year based on these estimates. Generating these additional resources would require state and local governments to increase their spending on public health activities by 16.1% over the levels estimated in the National Health Expenditure Accounts for 2014. Alternatively, the estimated resource gap could be filled by nearly doubling federal government spending on public health activities from the \$11.0 billion estimated in 2014. Consistent with these estimates, the Institute of Medicine’s 2012 report recommended a doubling of the federal government’s expenditures for public health activities in order to fund a minimum package of public health services.⁵

The cost estimates generated in this study are limited to Type 2 activities reflected in the Public Health Leadership Forum’s FPHS recommendations. Importantly, these cost estimates do not include resources

required for implementing Type 1 activities, which are also essential elements for improving population health and wellbeing. Further work will be necessary to estimate the resource requirements for essential Type 1 activities in order to provide a complete assessment of the costs required to realize a minimum package of public health services for the nation.

References

1. Institute of Medicine of the National Academy of Sciences. U.S. Health in International Perspective: Shorter Lives, Poorer Health. Washington, DC: National Academies Press; 2013
2. U.S. Centers for Medicare and Medicaid Services, Office of the Chief Actuary. National Health Expenditure Accounts, Historical 1980-2014. Baltimore, MD: CMS.
3. Mays GP, Scutchfield FD, Bhandari MW, Smith SA. Understanding the organization of public health delivery systems: an empirical typology. *Milbank Q.* 2010 Mar;88(1):81-111.
4. Mays GP, Smith SA. Geographic variation in public health spending: correlates and consequences. *Health Serv Res.* 2009 Oct;44(5 Pt 2):1796-817.
5. Institute of Medicine of the National Academy of Sciences. For the Public's Health: Investing in a Healthier Future. Washington, DC: National Academies Press; 2012
6. Resolve. Articulation of Foundational Public Health Services and Capabilities. Washington, DC: Resolve. <http://www.resolve.org/site-foundational-ph-services/>
7. Oliver TR. The politics of public health policy. *Annu Rev Public Health.* 2006;27:195-233.
8. Mays GP, Mamaril CB, Timsina L. Multi-sector contributions to population health activities lead to reductions in preventable deaths. *Health Affairs*, in press 2016.
9. Tsuchiya A, Miguel LS, Edlin R, Wailoo A, Dolan P. Procedural justice in public health care resource allocation. *Appl Health Econ Health Policy.* 2005;4(2):119-27.
10. Mays GP 2014. Estimating the Costs of Foundational Public Health Capabilities: A Recommended Methodology. University of Kentucky. [accessed on December 2, 2015]. Available at http://works.bepress.com/glen_mays/128
11. Guerra ML, Sorini L. Incorporating uncertainty into financial models. *Applied Mathematical Sciences* 2012;6(76):3785-3799.