Spring April 25, 2018

The Distribution and Dynamics of U.S. Health Security: Lessons for Priority-setting and Evidence Review

Glen P. Mays, *University of Kentucky*

The Distribution and Dynamics of U.S. Health Security:

Lessons for Prioritizing & Grading the Evidence on Preparedness

Glen Mays, PhD, MPH
Professor of Health Services and Systems Research
University of Kentucky

glen.mays@uky.edu
www.nhspi.org

UNIVERSITY OF KENTUCKY
Center for Public Health Systems and Services Research

PREPARED
NATIONAL HEALTH SECURITY PREPAREDNESS INDEX

Overview

- Brief review of the Index
  - Rationale
  - Methodology
  - Highlights from 2018 results
- Aspects that may inform priority-setting and grading evidence on preparedness
  - Measure selection
  - Measure weighting
  - Analysis of geographic variation
  - Analysis of inter-temporal change
- Questions and discussion

Health security requires collective actions across many activities and sectors

- Surveillance
- Environmental monitoring
- Laboratory testing
- Communication systems
- Response planning
- Incident management
- Emergency response
- Surge capacity
- Management & distribution of countermeasures
- Continuity of healthcare delivery
- Community engagement
- Workforce protection
- Volunteer management
- Education & training
- Drills & exercises
- Information exchange
- Evacuation & relocation
- Infrastructure resiliency
- Protections for vulnerable populations

Why a Health Security Index?

Track national progress in health security as a shared responsibility across sectors

- Raise public awareness
- Identify strengths and vulnerabilities
- Detect gains and losses
- Encourage coordination & collaboration
- Facilitate planning & policy development
- Support benchmarking & quality improvement
- Stimulate research & innovation

PREPARED
NATIONAL HEALTH SECURITY PREPAREDNESS INDEX

What does an Index do?

Characterize the behavior of a complex phenomenon

- Distinguish signal from noise using multiple imperfect data sources and measures
- Detect direction of change over time
- Characterize magnitude of change
- Identify components of change
- Characterize distribution of change (geography)

A Brief History

2012
- **Collaborative Development**: CDC, ASTHO and >25 collaborating organizations

12/2013
- **1st Release:** Initial model structure and results
  - 5 domains and 14 subdomains
  - 128 measures

12/2014
- **2nd Release**: Revised model and results
  - 6 domains and 18 active subdomains
  - Measures: 119 retained + 75 new = 194 measures

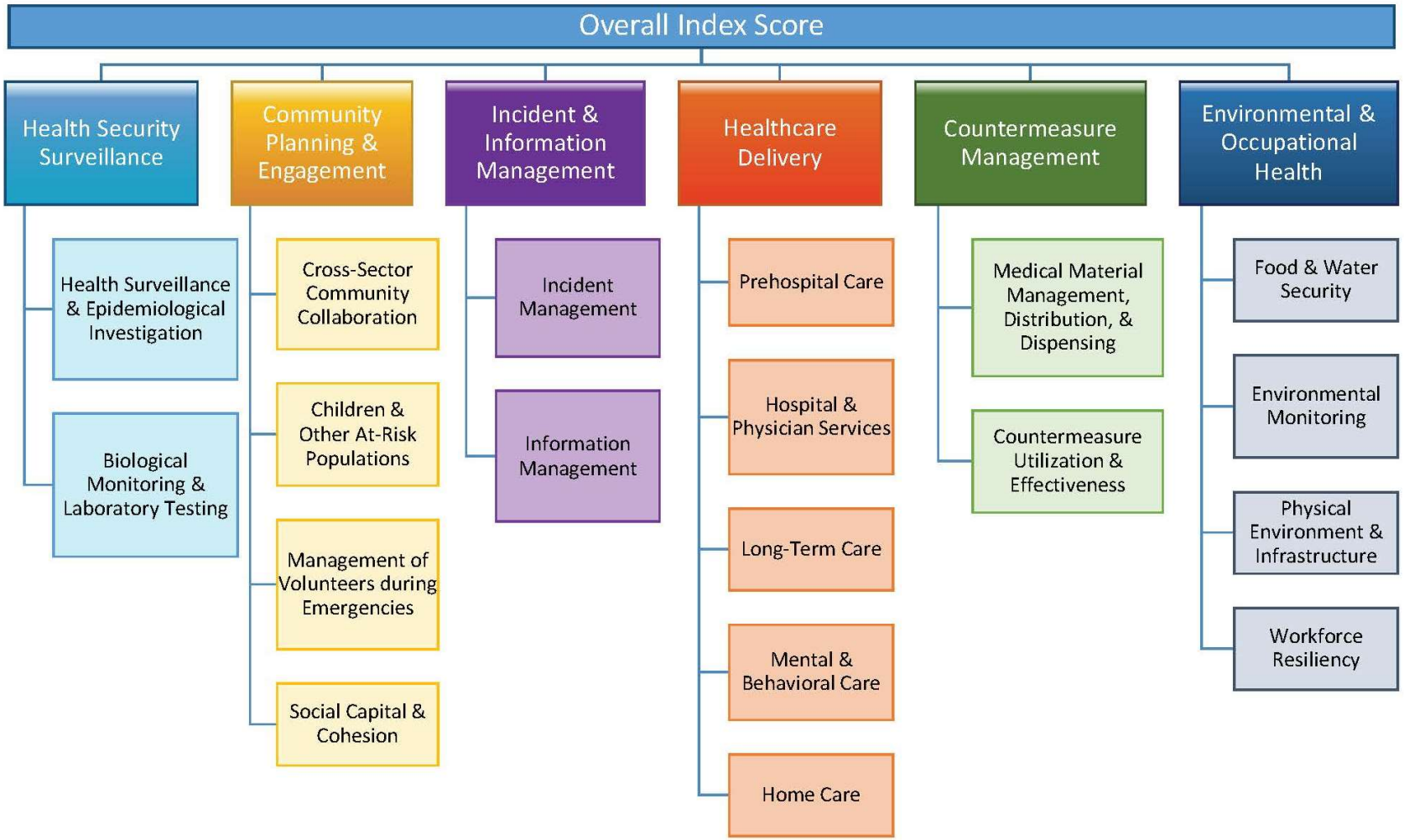
1/2015
- **Transition to Robert Wood Johnson Foundation**
  - Validation studies and revision to methodology & measures

4/2016
- **3rd Release:** Revised model and results
  - 6 domains & 19 active subdomains
  - Measures: 65% retained, 12% respecified, 8 new = 135 total
  - Valid comparisons over time + confidence intervals

4/2017
- **4th Release:** Refined model and results
  - Added District of Columbia
  - Measures: 4 dropped, 7 respecified, 8 new =139 total

4/2018
- **5th Release:** 4 dropped, 5 new = 140 total

Measuring capacities & capabilities through Index domains & subdomains



Generating Composite Measures

- **140 individual measures, 64 data sources**

Weighted average

- **19 subdomains**

Weighted average

- **6 domains**

Weighted average

- **State overall values**

Unweighted average

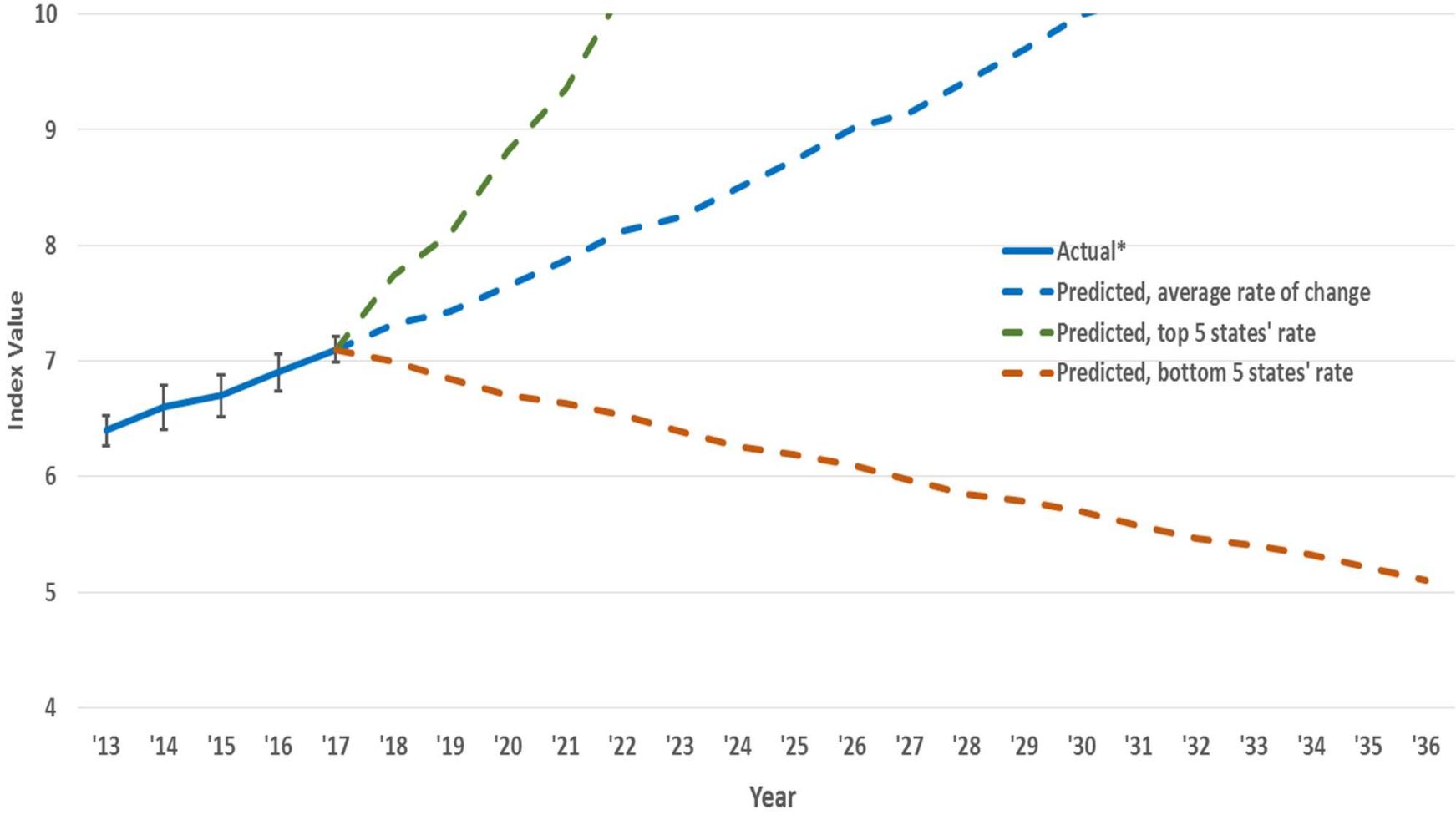
- **National overall values**

PREPARED
NATIONAL HEALTH SECURITY PREPAREDNESS INDEX

- Normalized to 0-10 scale using min-max scaling to preserve distributions
- Imputations based on multivariate longitudinal models
- Empirical weights based on Delphi expert panels
- Bootstrapped confidence intervals reflect sampling and measurement error
- Annual estimates for 2013-2017

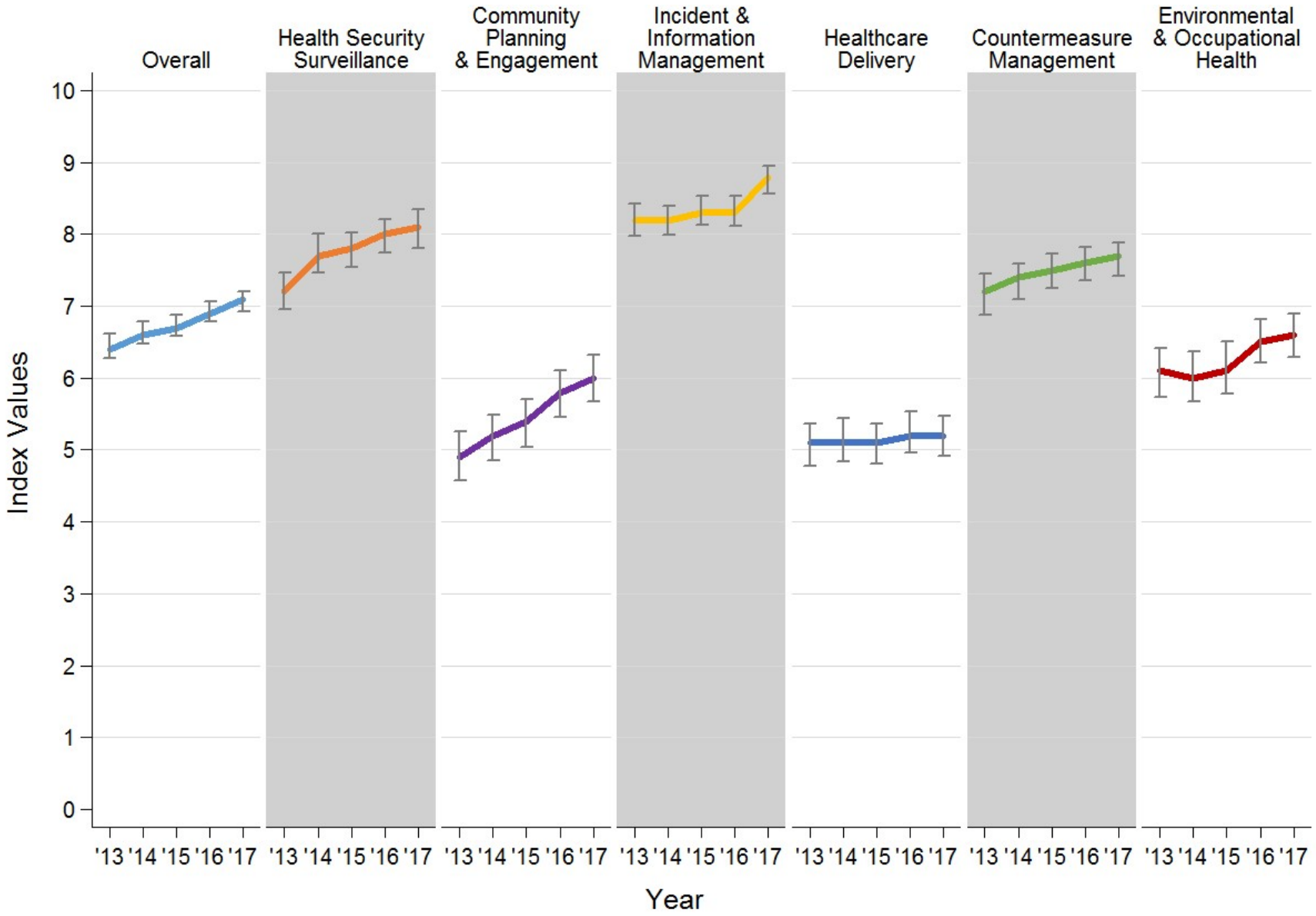
Reliability by Domain	Alpha
Health security surveillance	0.712
Community planning & engagement	0.631
Incident & information management	0.734
Healthcare delivery	0.596
Countermeasure management	0.654
Environmental/occupational health	0.749

Steady progress, uneven pace



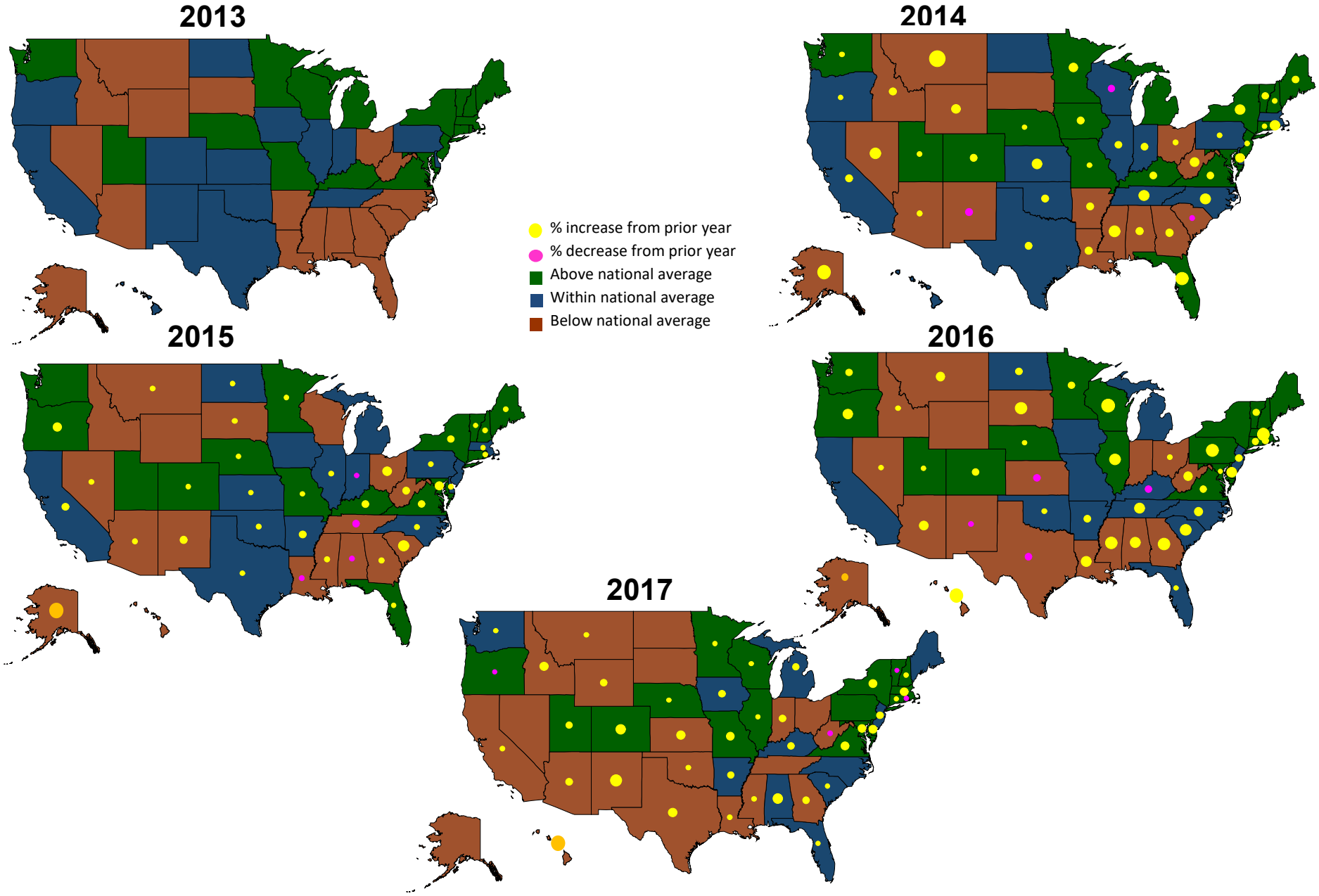
*statistically significant change

The U.S. improved in most domains during 2013-17, except healthcare delivery

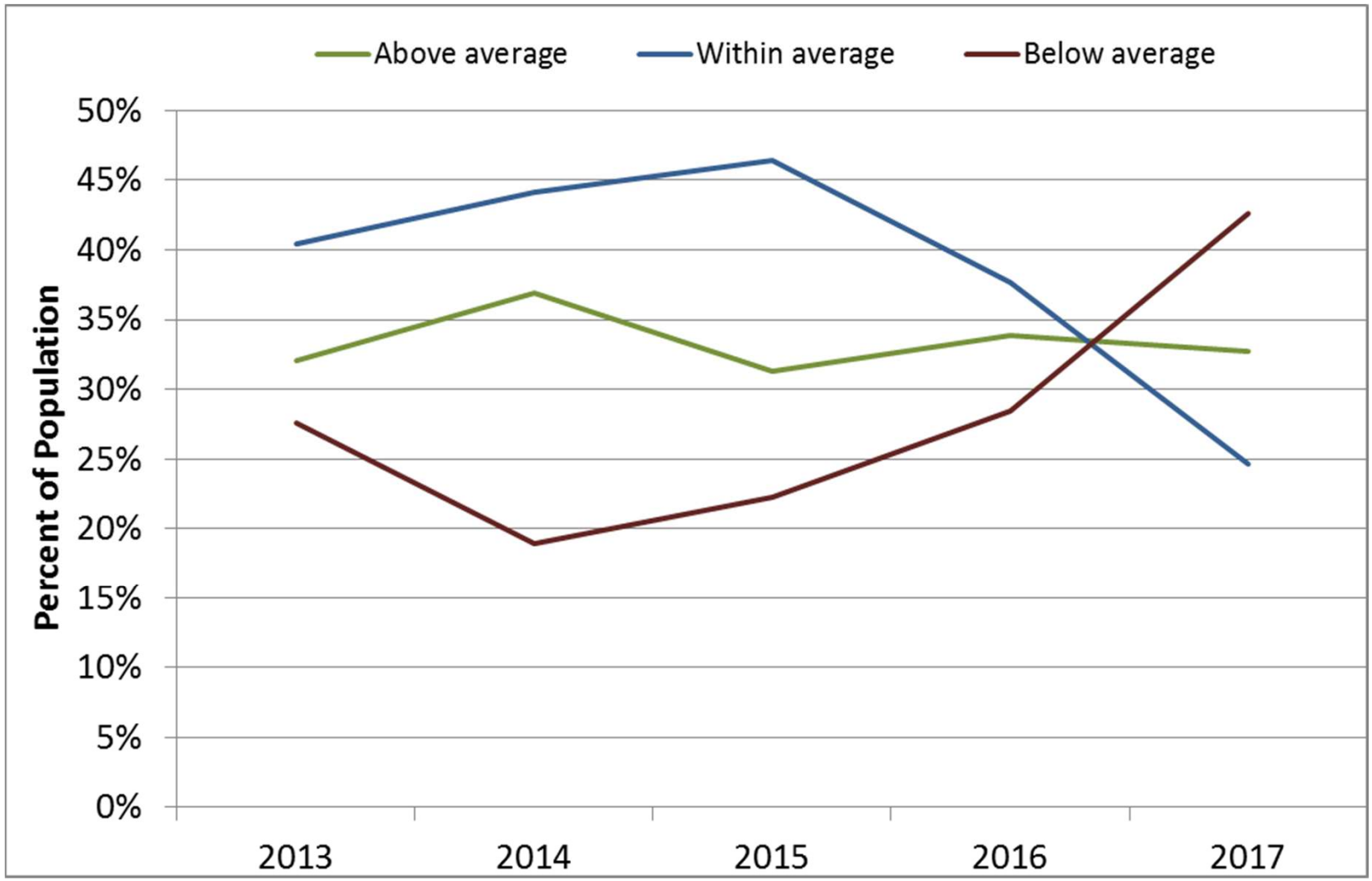


Highlights from the 2018 Index Results

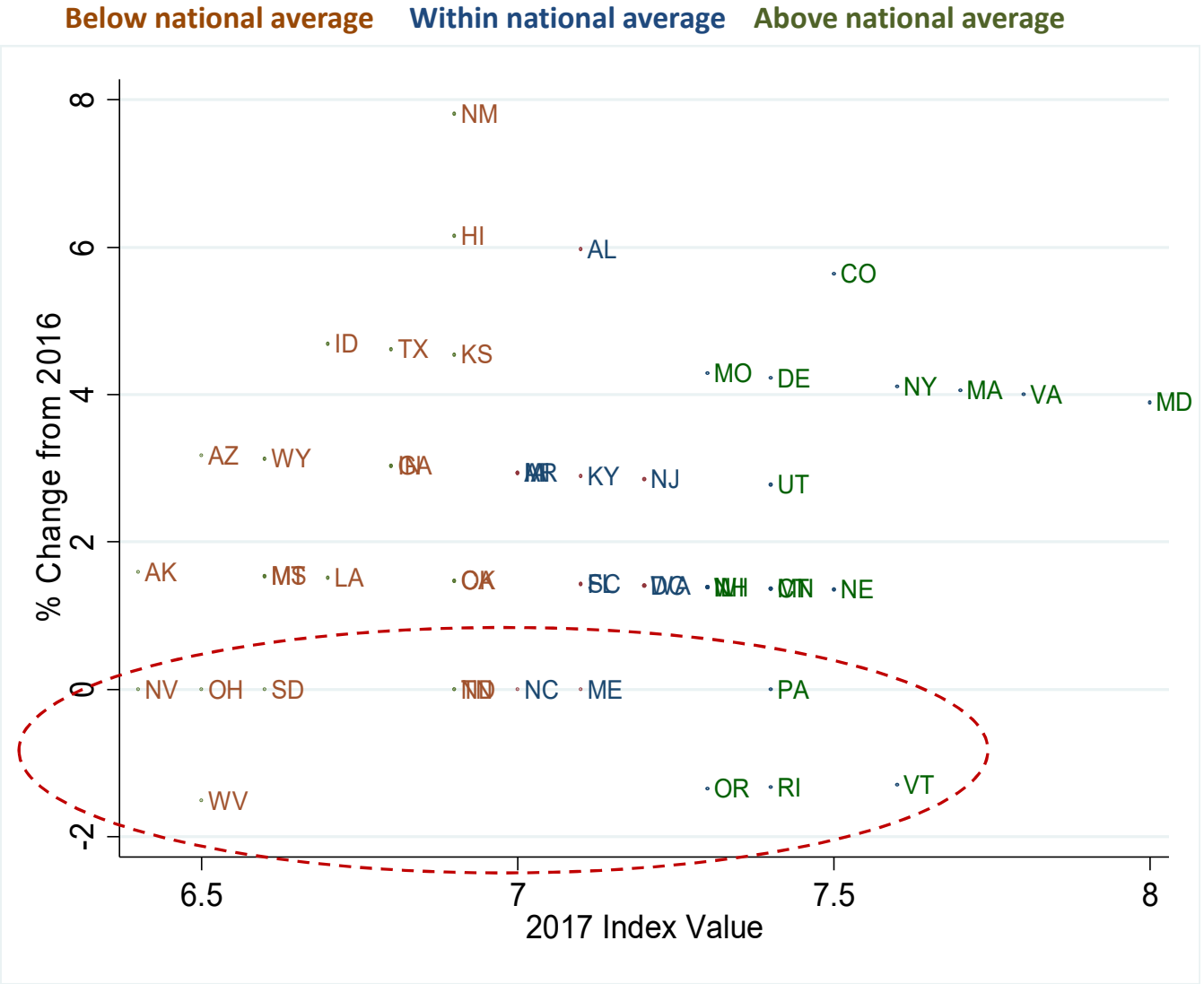
Geographic differences in health security are large and growing



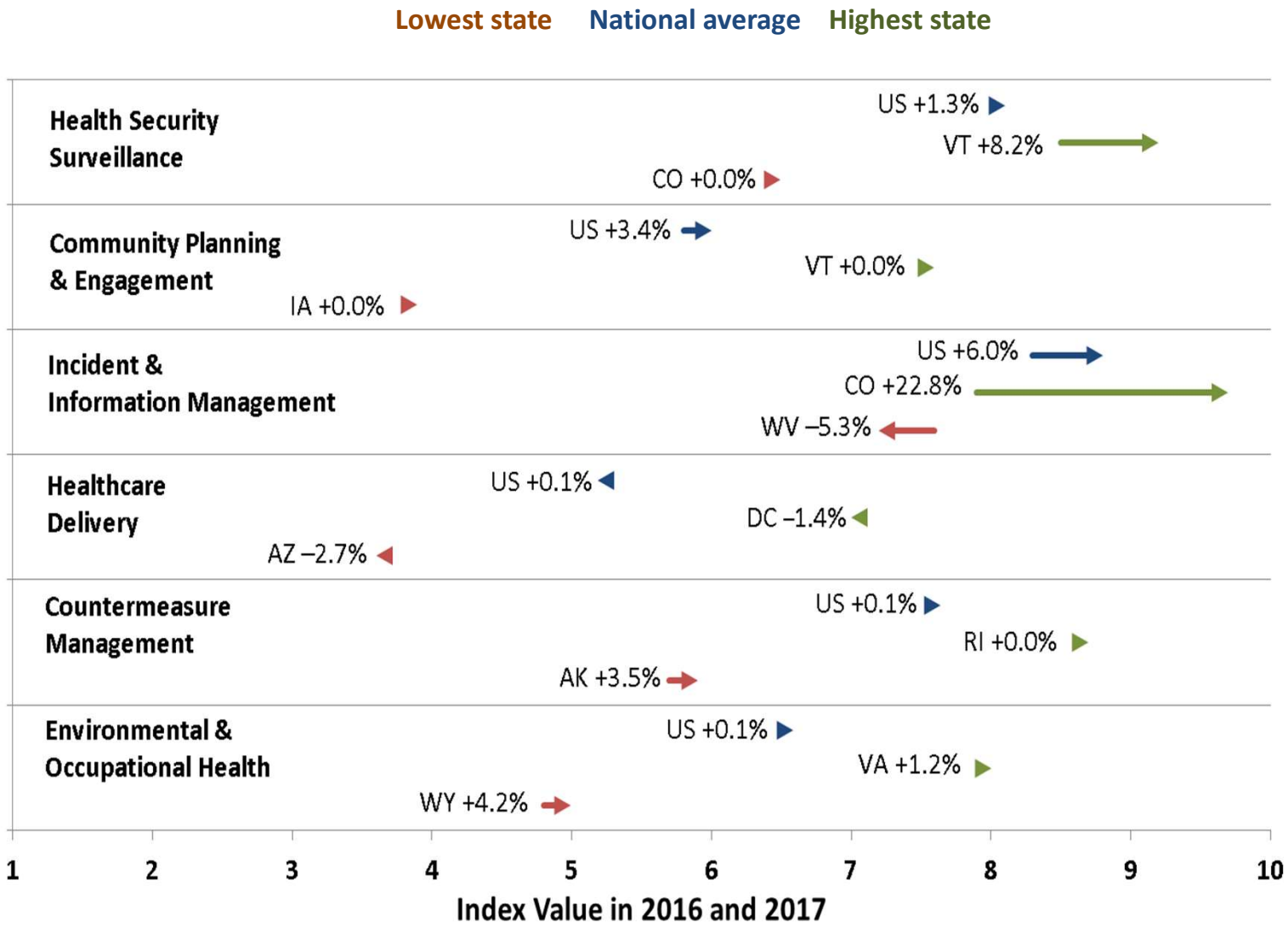
A growing share of US residents live in regions with below-average health security



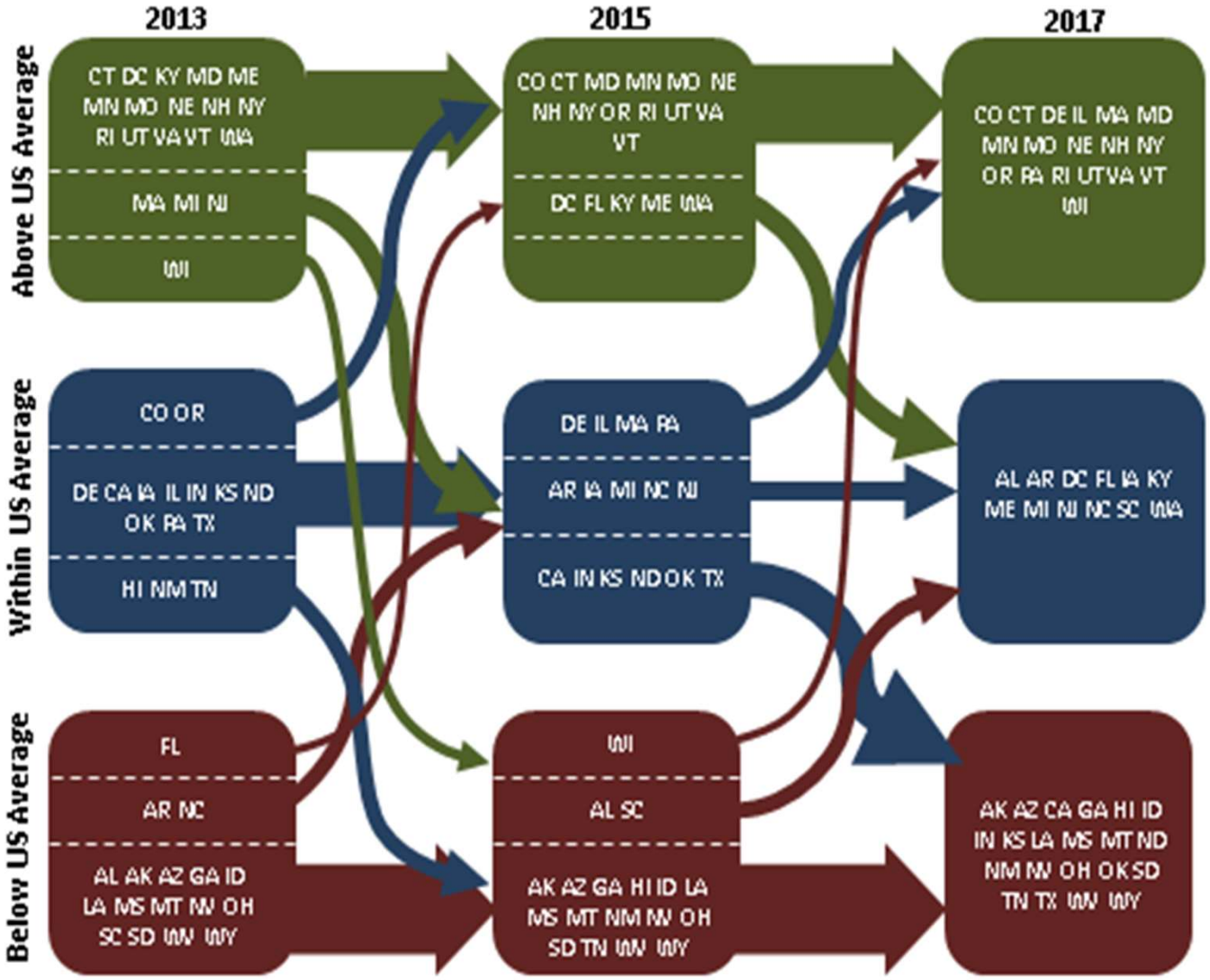
Improvements occurred across the U.S., but 12 states were steady or lost ground



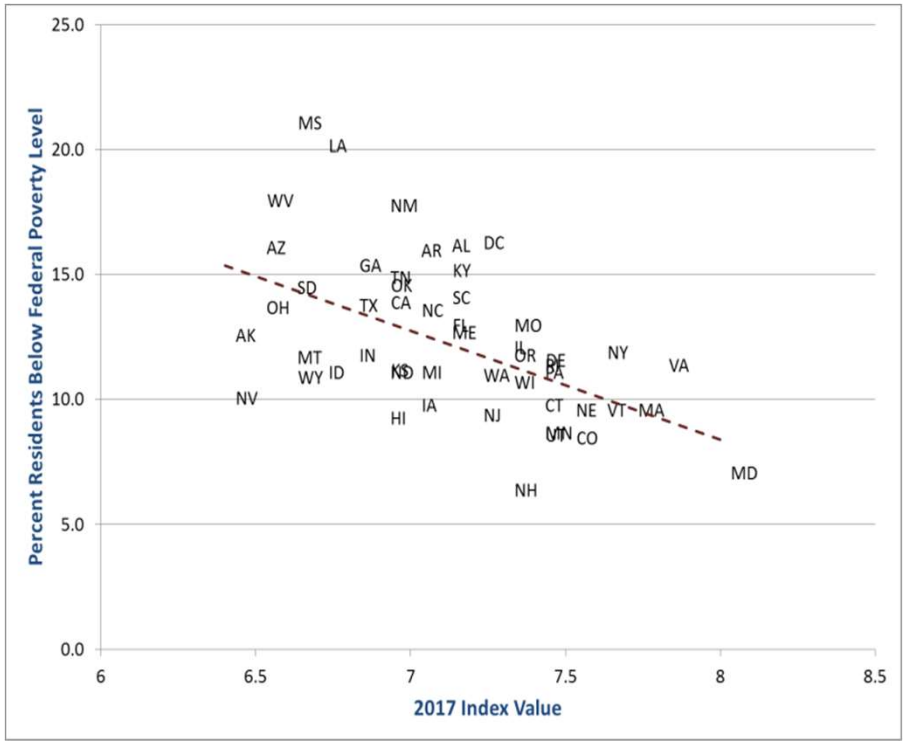
Changes in health security varied widely by domain



State transitions health security levels are common & bidirectional

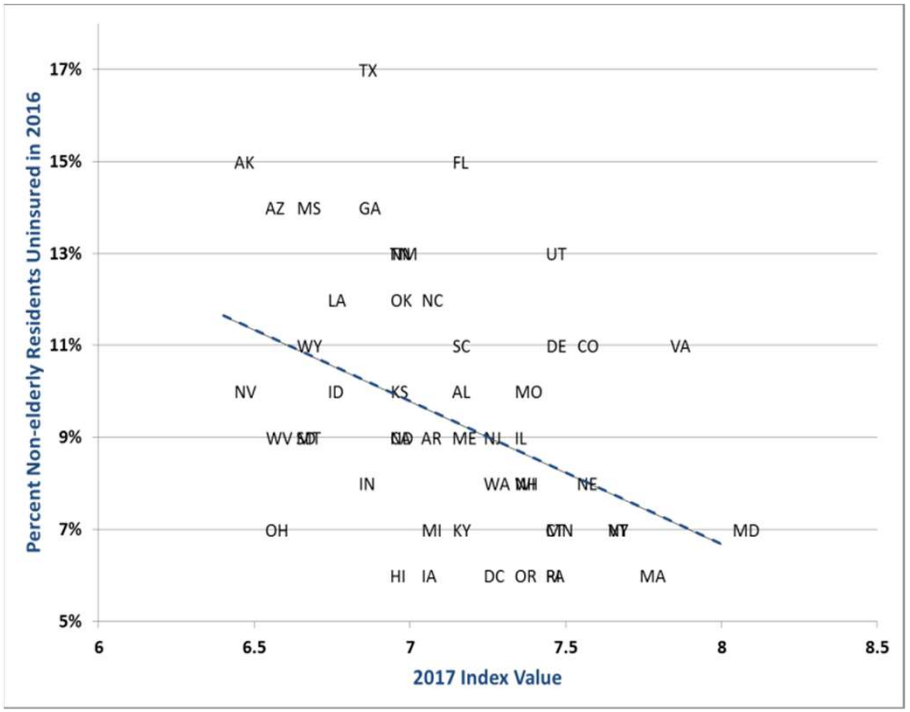


Health security tracks closely with social & economic determinants of health

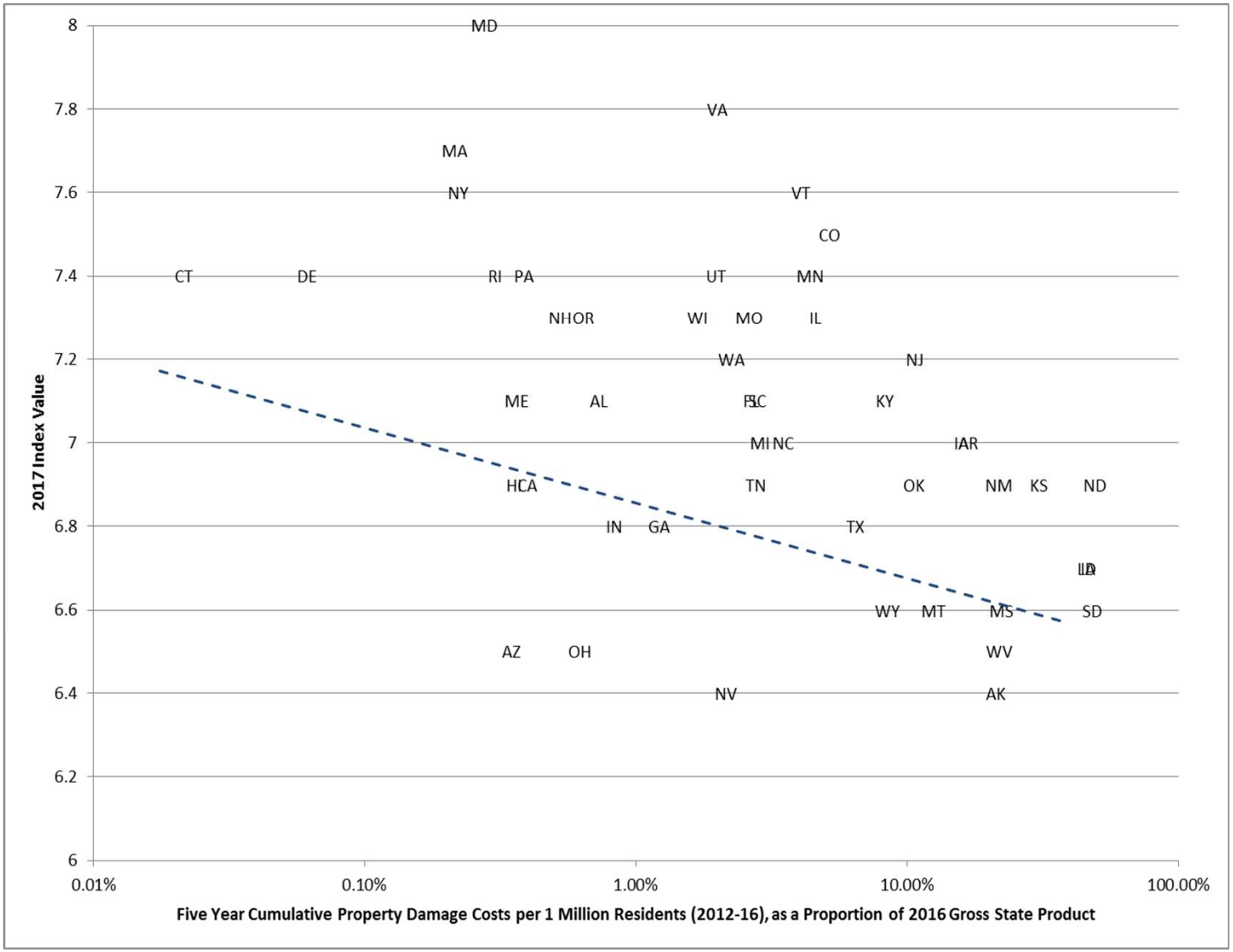


Percent of population below federal poverty threshold

Percent of population without health insurance coverage

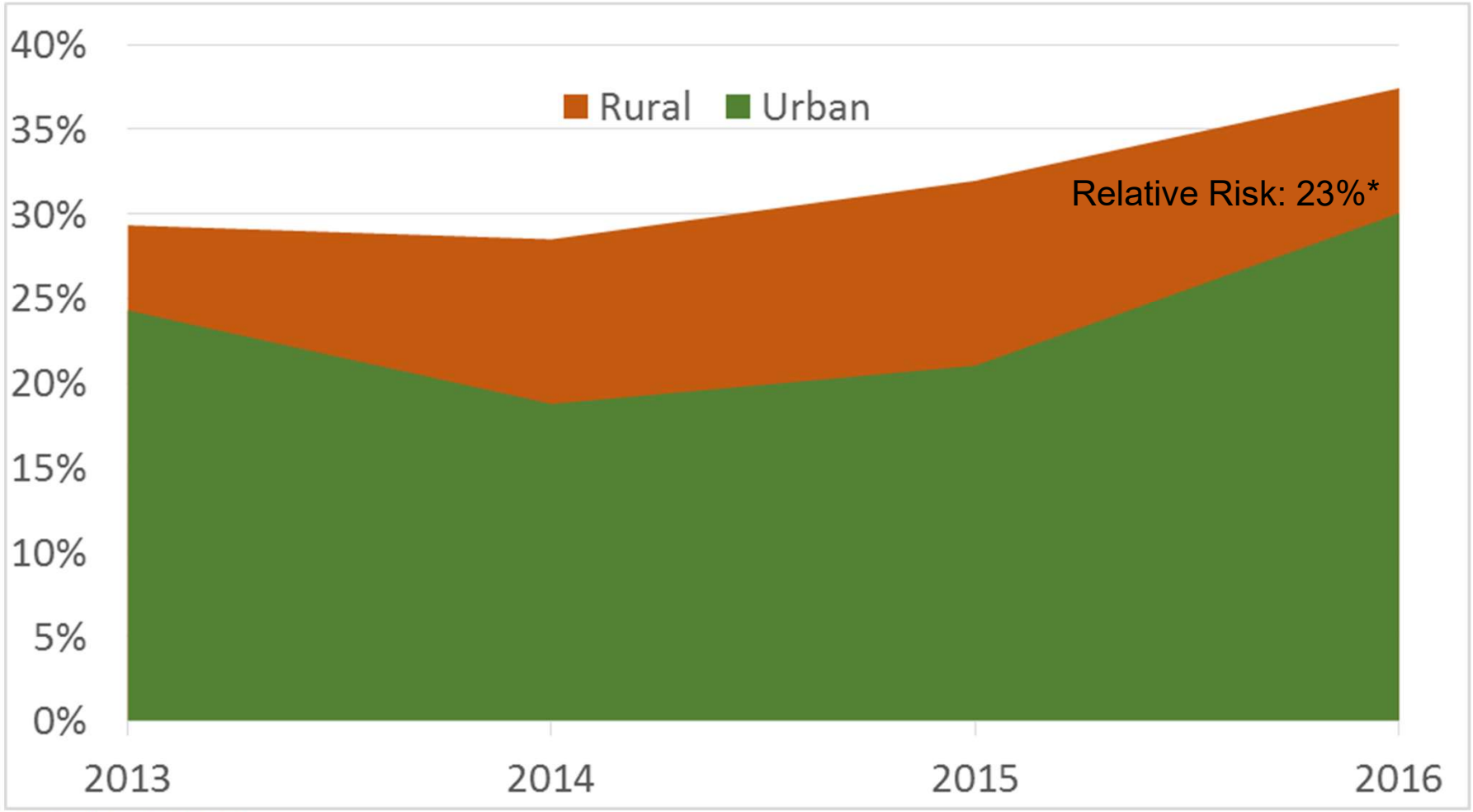


Health security levels vary inversely with the economic impact of past disasters



Rural-Urban differences in health security

Percent of population residing in a state with below-average health security

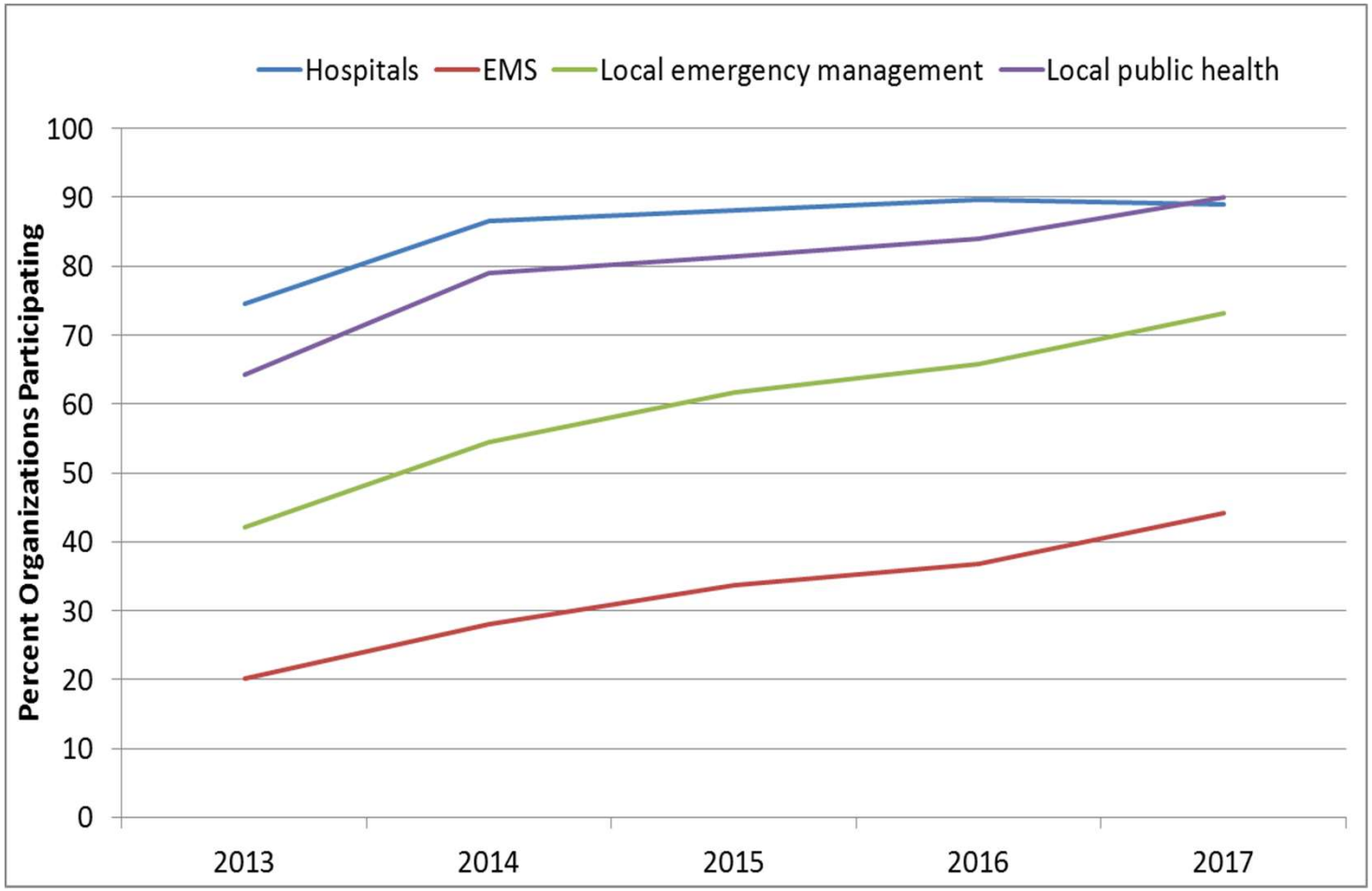


PREPARED
NATIONAL HEALTH SECURITY PREPAREDNESS INDEX

*statistically significant difference

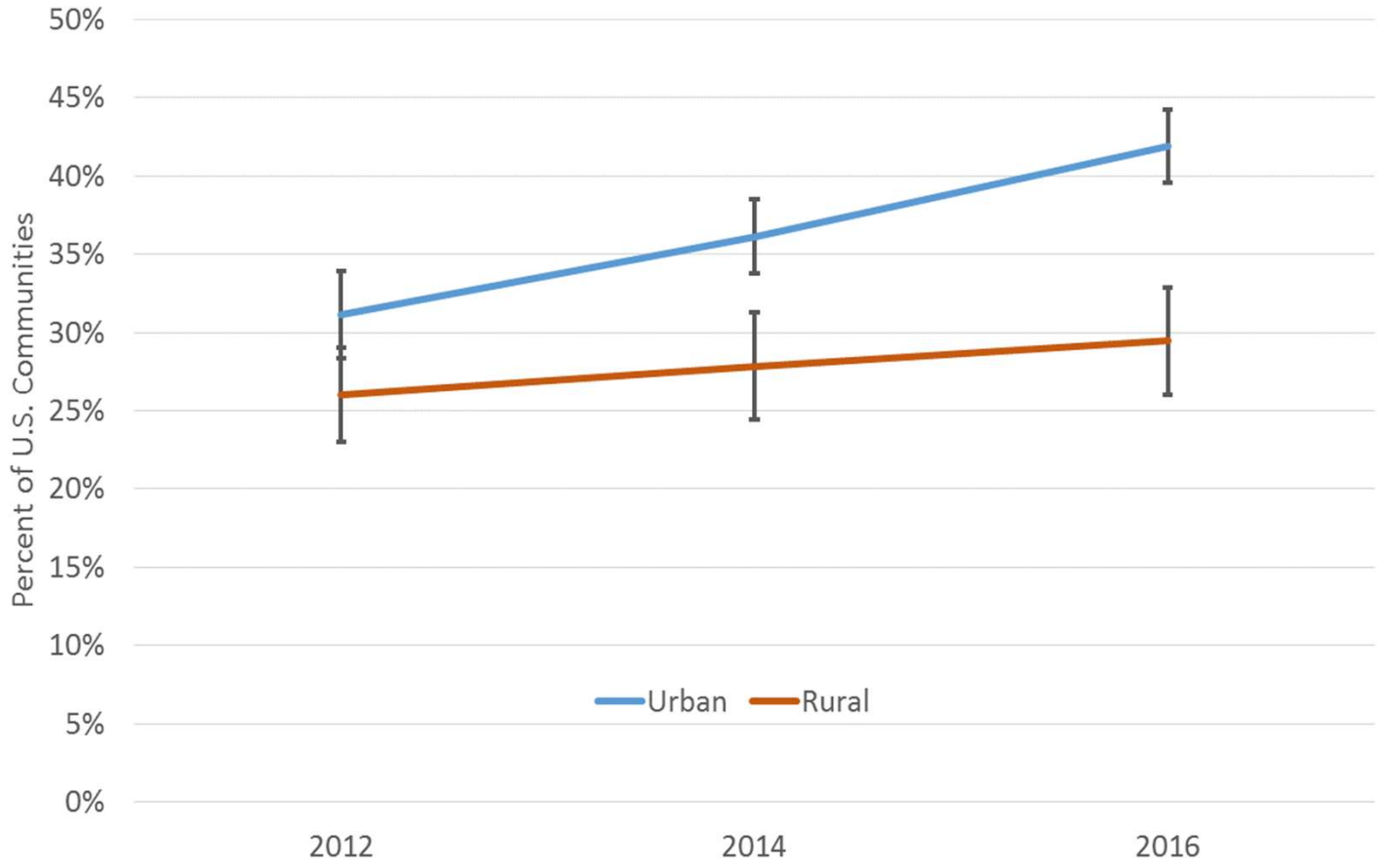
Underlying drivers: organizational

Participation in Healthcare Preparedness Coalitions



Underlying drivers: community and systems

Communities with Strong Multi-Sector Networks (Comprehensive Public Health Systems)

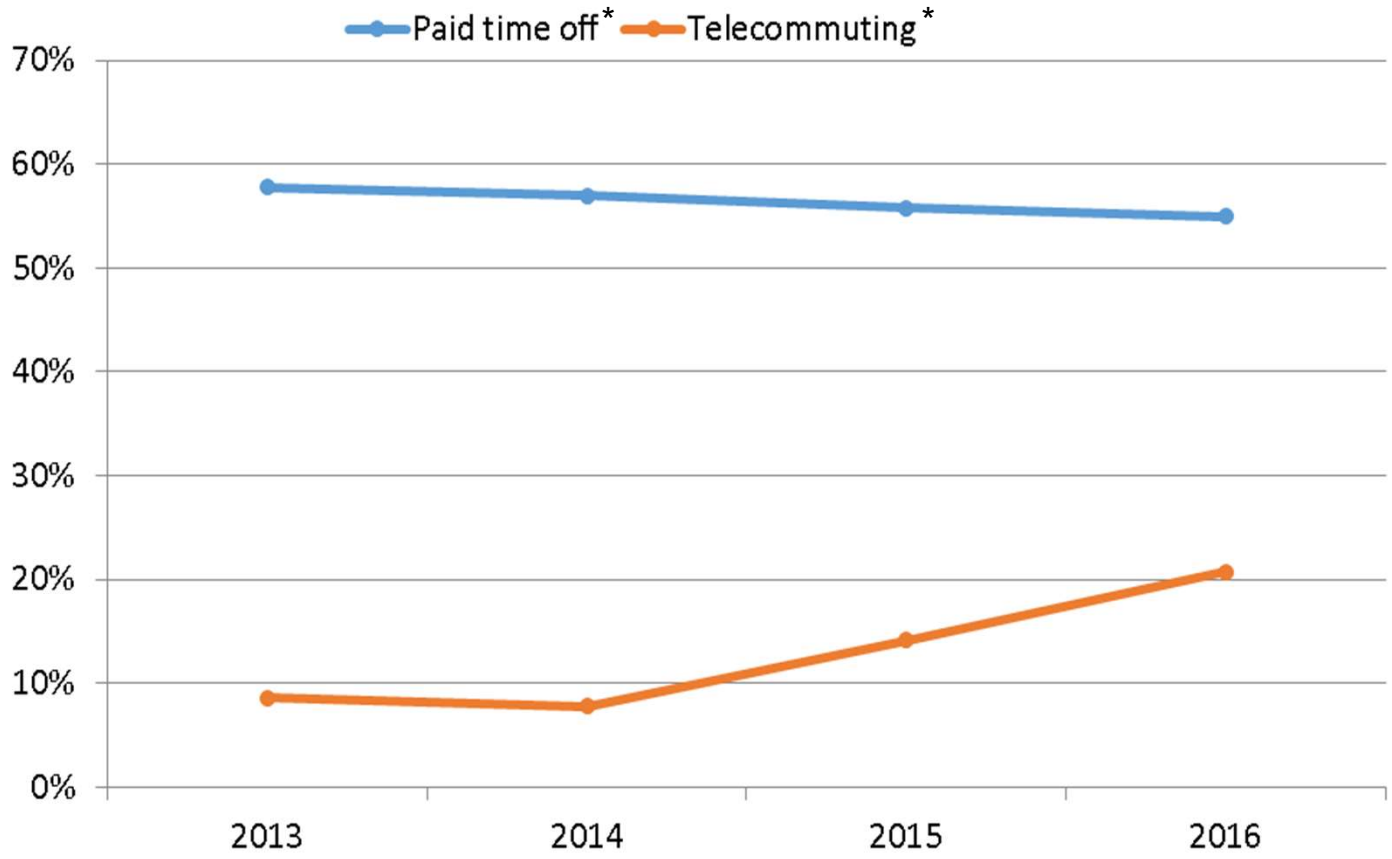


PREPARED
NATIONAL HEALTH SECURITY PREPAREDNESS INDEX

*statistically significant difference

Underlying drivers: occupational

Percent of workers with paid sick leave and telecommuting opportunities



*statistically significant change

PREPARED
NATIONAL HEALTH SECURITY PREPAREDNESS INDEX

Overview

- Brief review of the Index
  - Rationale
  - Methodology
  - Highlights from 2018 results
- Aspects that may inform priority-setting and grading evidence on preparedness
  - Measure selection
  - Measure weighting
  - Analysis of geographic variation
  - Analysis of inter-temporal change
- Questions and discussion

Measure Selection Criteria

1. **Importance**: the measure must reflect an activity, skill, resource or capability that contributes to improved preparedness for minimizing adverse health consequences caused by disasters, outbreaks, and/or other emergencies.

2. **Validity**: the measure must have evidence supporting its validity and reliability.

3. **Coverage**: data for the measure must be available for each U.S. state and the nation as a whole, with valid solutions available for resolving missing data problems.

4. **Periodicity**: data for the measure must be collected consistently over time at least once every 3 years.

5. **Timeliness**: the most recent year of data available for the measure must be no more than three years older than the Index release year (2018).

6. **Accessibility**: data for the measure must be in the public domain or agreements must be formed with owners to access data for inclusion in the Index.

7. **Parsimony**: the measure must add new or superior information to the Index compared to that of other measures included in the Index, and should not duplicate or compete with other measures.

Measure Identification

Candidate measures are identified through:

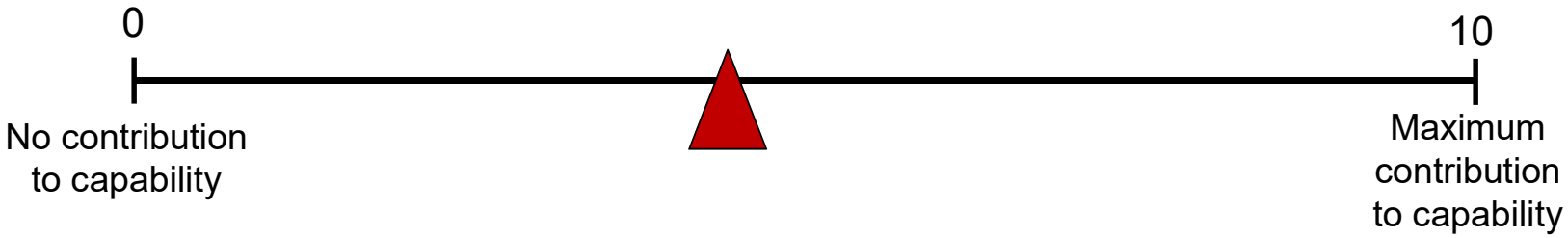
- Annual Open Call for Measures
- Literature reviews
- Advisory Committee and Workgroup discussions
- Briefings with Index stakeholders and user groups
- Annual public comment period on Index updates

Measure Weighting

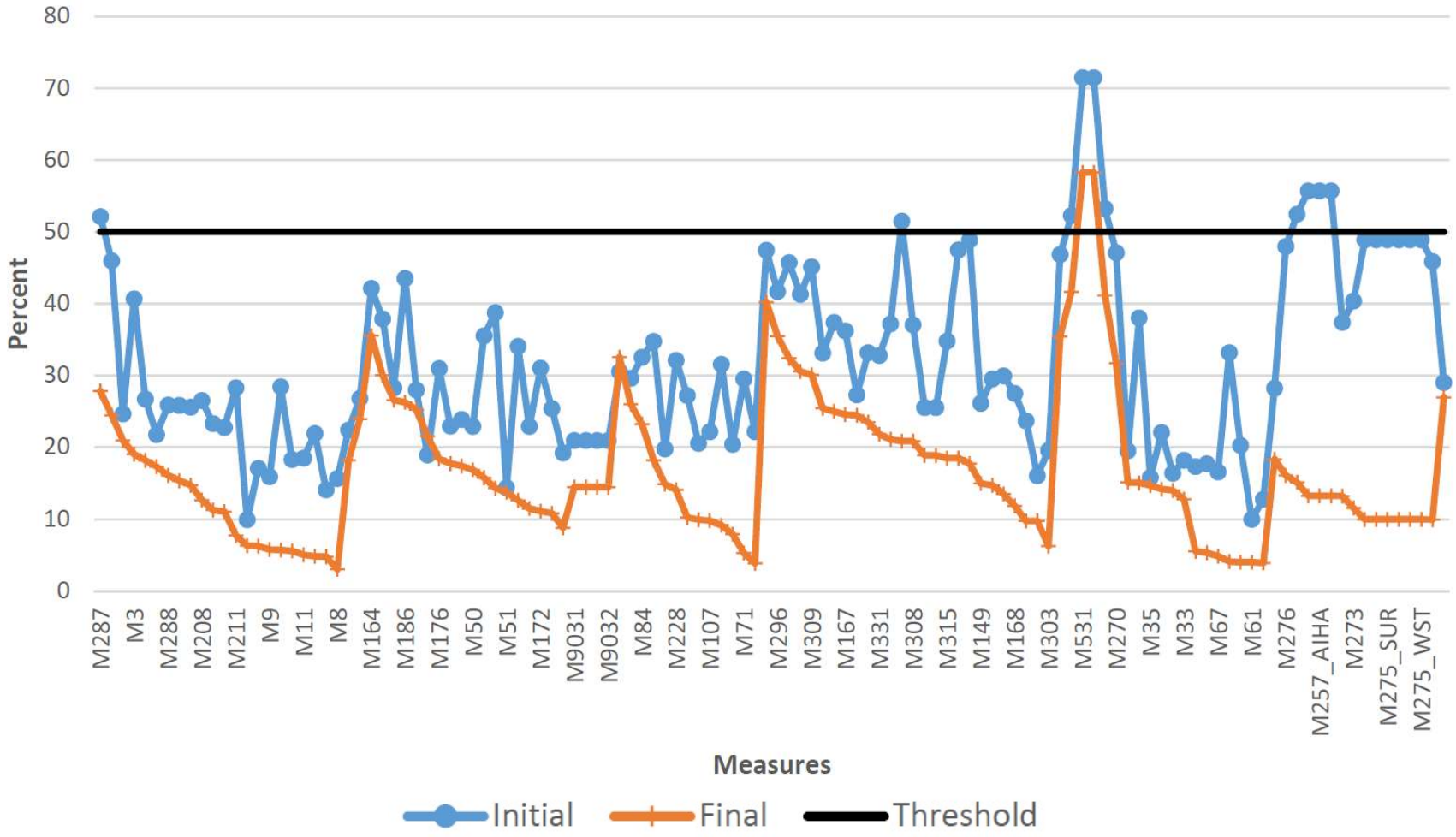
Weights derived from an iterative Delphi survey process:

- 15-18 subject matter experts in each domain
- Visual analog scale to rate importance
- Three rounds of rating to achieve convergence

How important is this measure to the capability reflected in the domain/subdomain?



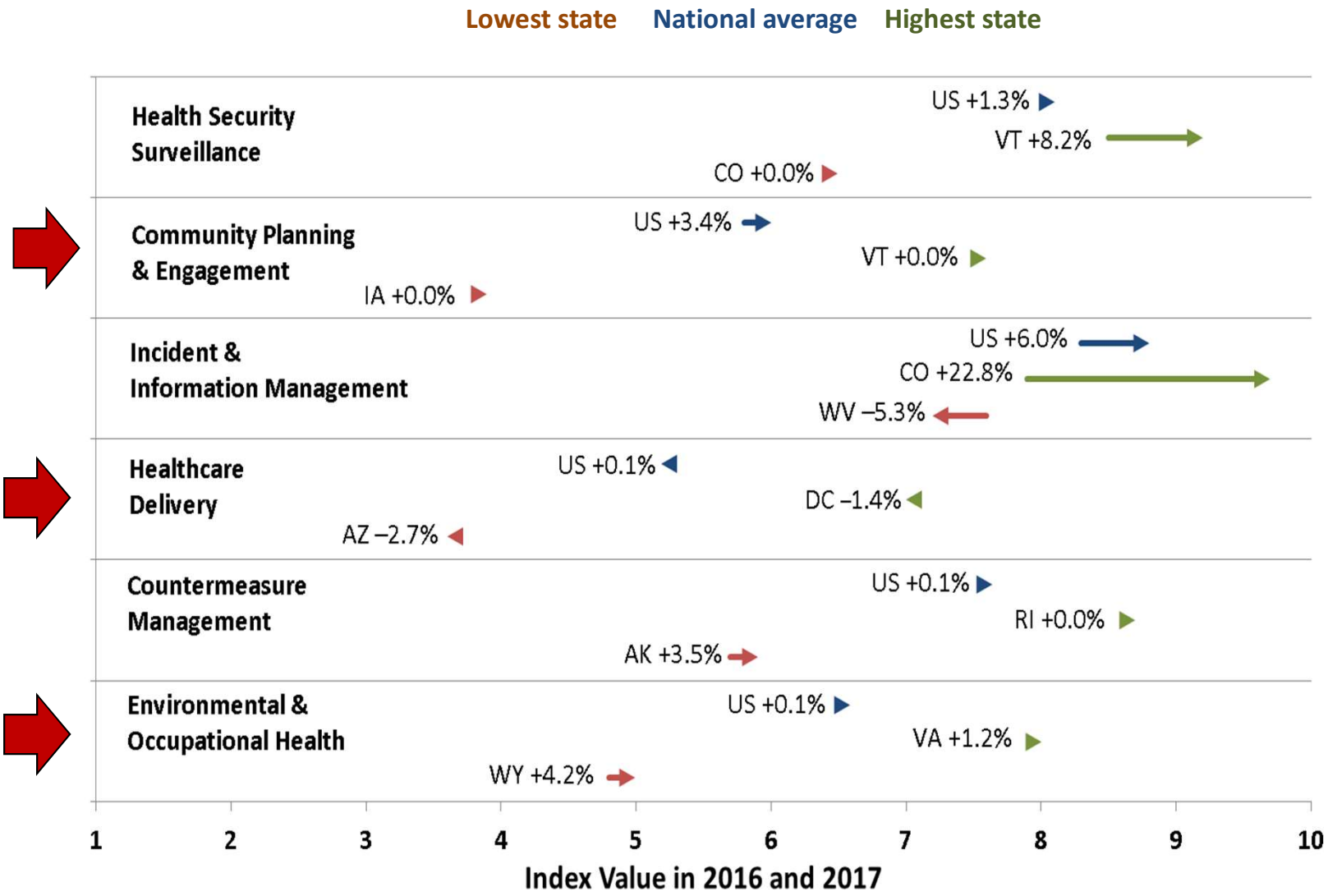
Coefficient of Variation Across Delphi Rounds



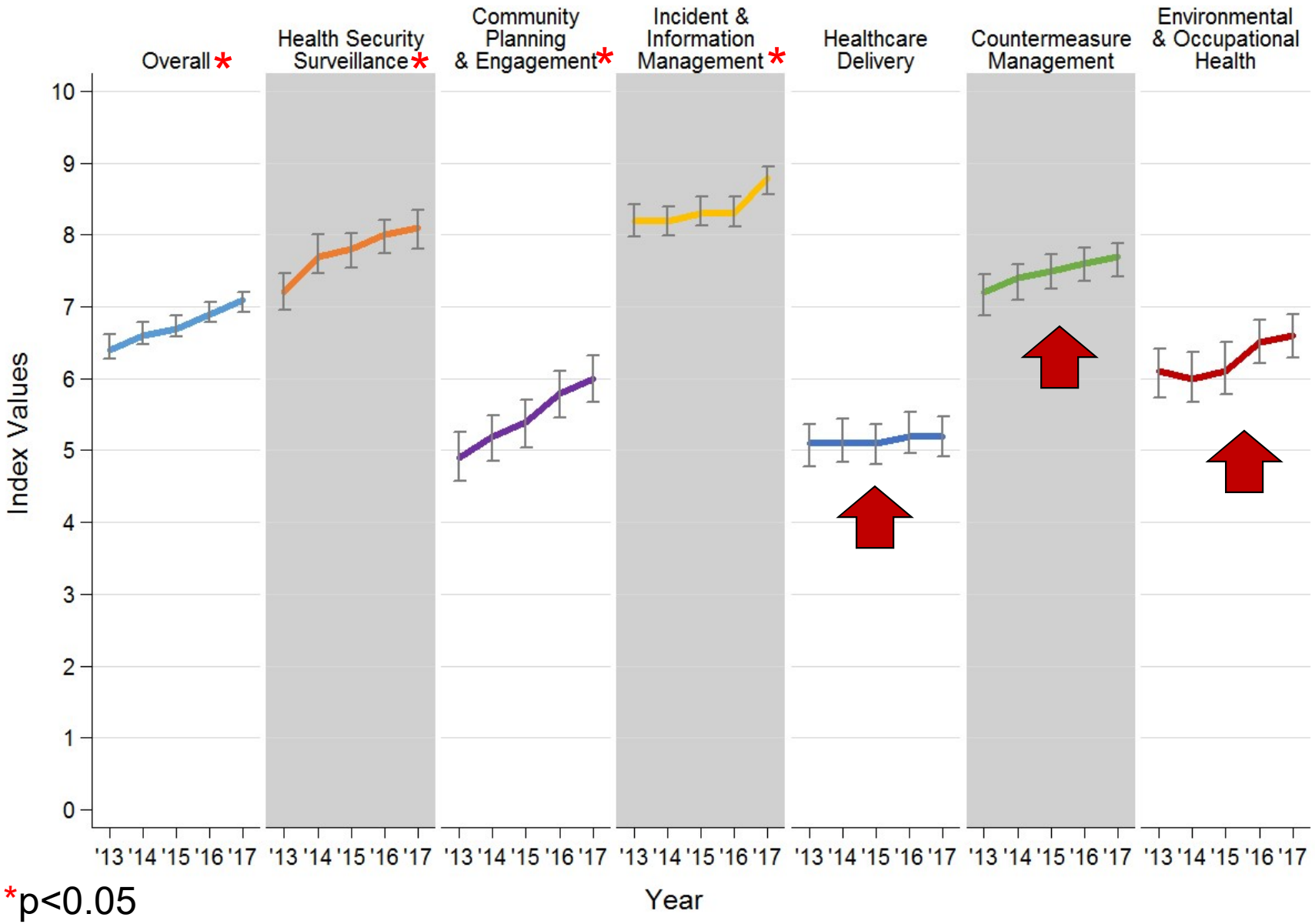
Delphi Weights for Selected Measures

Measure	Weight
State has electronic syndromic surveillance system	10.0
Public health lab proficiency tests passed	10.0
Public health lab has plan for 6-8 week surge in testing	10.0
Child care providers required to have evacuation/reunification plans	9.2
EMS provider participation in healthcare preparedness coalitions	9.0
State has preparedness plan for animals	8.8
FEMA NFIP flood insurance coverage	8.0
Average minutes from ED arrival to hospital admission	7.3
Percent workers with paid time off benefit	7.3
Medical Reserve Corps volunteers who are health professionals	6.9
Physicians demonstrating EMR meaningful use	6.0
Percent workers who telecommute	5.5
Public health lab provides/assures drinking water testing	1.8

Priority-setting based on geographic variation



Priority-setting based on inter-temporal change



*p<0.05

Conclusions & Implications

- National progress is clear, can we accelerate & spread?
- Geographic stratification is a vulnerability -- address geographic differences with regional partnerships
- Networks and coalitions are key drivers
- Private sector contributions are important
- Social determinants matter
- Strengths & weaknesses are state-specific, flexibility and tailoring are key
- Better data & measures are needed

Caveats and cautions

- Imperfect measures & latent constructs
- Timing and accuracy of underlying data sources
- Unobserved within-state heterogeneity
- Observational, not causal, estimates
- Trends limited to 5 years

Acknowledgements

National Advisory Committee Members | 2017-18

Supported by the Robert Wood Johnson Foundation

Thomas Inglesby, MD (Chair), Johns Hopkins University
Robert Burhans, Health Emergency Management Consultant
Anita Chandra, DrPH, RAND
Mark DeCourcey, U.S. Chamber of Commerce Foundation
Eric Holdeman, Emergency Management Consultant
Harvey E. Johnson, Jr., American Red Cross
Ana Marie Jones, Interpro
Dara Lieberman, MPP, Trust for America's Health
Nicole Lurie, MD, MSPH, ASPR (through 1/2017)
Suzet McKinney, DrPH, MPH, Illinois Medical District Commission
Stephen Redd, MD, CDC Office of Public Health Preparedness & Response
John Wiesman, DrPH, MPH, Washington State Secretary of Health

Special appreciation to Index collaborators at CDC, ASPR, ASTHO, APHL, NACCHO, RAND, members of the Model Design and Analytic Methodology Workgroup, and the Stakeholder Engagement and Communications Workgroup.
Visit or join an Index workgroup at http://nhspi.org/get-involved/

For More Information

PREPARED
NATIONAL HEALTH SECURITY PREPAREDNESS INDEX

National Program Office

Supported by The Robert Wood Johnson Foundation

Glen P. Mays, Ph.D., M.P.H.

Email: **healthsecurity@uky.edu**
Web: **www.nhspi.org**

To receive updates from the Health Security Index, email listserv@lsv.uky.edu with “Subscribe NHSPIndex” in the body

Systems for Action
National Coordinating Center
Systems and Services Research to Build a Culture of Health

UK
UNIVERSITY OF KENTUCKY
Center for Public Health Systems and Services Research