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Cost Estimates of Foundational Public Health Services: Results from Piloting the Expert Consensus Methodology in Kentucky

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Cost Estimates of Foundational Public Health Services:
Results from Piloting the Expert Consensus Methodology in Kentucky

C.B. Mamaril, Ph.D.
Glen P. Mays, Ph.D., MPH

APHA Public Health Finance Roundtable | New Orleans, LA | 16 November 2014
Acknowledgements

- Robert Wood Johnson Foundation
- Washington PBRN Delivery and Cost Study (DACS) Research Team (Univ. of Washington)
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  - Justin Marlowe, Ph.D.
- Kentucky Health Departments Association (KHDA)
  - Georgia Heise, DrPH (2014 NACCHO President)
  - KHDA Finance Workgroup
- Graduate Research Assistance of:
  - Keith Branham, UK DrPH student
  - Carrie Holsinger, UK DrPH student
  - Scott Secamiglio, MPH
# Workgroup on Public Health Cost Estimation

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Institution</th>
</tr>
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<tbody>
<tr>
<td>Terry Allan, MPH</td>
<td>Cuyahoga County (OH) Board of Health</td>
<td>Research Triangle Institute</td>
</tr>
<tr>
<td>Ricardo Basurto-Davila, PhD</td>
<td>Los Angeles County (CA) Health Department</td>
<td>Temple University</td>
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<tr>
<td>Patrick Bernet, PhD</td>
<td>Florida Atlantic University</td>
<td>International Health Economics Association</td>
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<td>Yu-Wen Chiu, DrPH</td>
<td>Louisiana State University</td>
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<td>Phaedra Corso, PhD</td>
<td>University of Georgia</td>
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<td>Dwight V. Denison, PhD</td>
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<td>Laura Dunlap, PhD</td>
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<td>Herminia Palacio, MD</td>
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<td>Jeanne S. Ringel, PhD</td>
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<td>Rexford Santerre, PhD</td>
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<td>Sergey Sotnikov, PhD</td>
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<tr>
<td>Lizeth Fowler, MS, MPA</td>
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</table>

Study Manager: Lizeth Fowler, MS, MPA

University of Kentucky
Toward a deeper understanding of costs & returns

2012 Institute of Medicine Recommendations

- Identify the components and costs of a minimum package of public health services
  - Foundational capabilities
  - Basic programs
- Implement a national chart of accounts for tracking spending and flow of funds
- Expand research on costs and effects of public health delivery

Defining what to cost: the public health package

- Washington State’s Foundational Public Health Services
- Ohio’s Public Health Futures Committee: Minimum Package of Services
- Colorado’s Core Public Health Services
- National Workgroup on Foundational Public Health Capabilities
Defining what to cost: the public health package

The National Workgroup developed definitions of foundational public health capabilities, specified in the Public Health Leadership Form’s *Articulation of Foundational Capabilities and Foundational Areas*

http://www.resolv.org/site-healthleadershipforum/defining-and-constituting-foundational-capabilities-and-areas/
## Defining what to cost

<table>
<thead>
<tr>
<th>Additional Important Services</th>
<th>Communicable Disease Control</th>
<th>Chronic Disease &amp; Injury Prevention</th>
<th>Environmental Public Health</th>
<th>Maternal/Child Family Health</th>
<th>Access/Linkage with Clinical Health Care</th>
<th>Vital Records</th>
</tr>
</thead>
</table>

**Foundational Programs**

**Foundational Capabilities**

- Assessment (surveillance and epidemiology)
- Emergency preparedness and response (all hazards)
- Communications
- Policy development and support
- Community partnership development
- Business competencies
Cost-Estimation Workgroup – Review

- **Workgroup on Public Health Cost Estimation** convened to develop a methodology for estimating the resources required to develop and maintain foundational capabilities by governmental public health agencies at both state and local levels.

- First Meeting at RESOLVE – November 22, 2013
- Series of conference calls to specify methodology
- January 30, 2014 in person meeting to finalize cost-estimation methodology
- Final report on recommended methodology:

  **Estimating the Costs of Foundational Public Health Capabilities: A Recommended Methodology**

Cost estimation methods

- Prospective “expected cost” methods
  - Vignettes
  - Surveys with staff and/or administrators
  - Delphi group processes

- Concurrent “actual cost” methods (micro-costing)
  - Time studies with staff
  - Activity logs with staff
  - Direct observation

- Retrospective “cost accounting” methods
  - Modeling and decomposition using administrative records
  - Surveys with staff and/or administrators
Key issues: What’s the cost of capability?

- Delineating state vs. local roles and division of effort
- Identifying scale and scope effects
  - By population served
  - By range of programs supported (portfolio effect)
- Identifying input factors that affect costs
  - Resource prices
  - Case mix
- Identifying key output differences across settings
  - Intensity
  - Quality
  - Reach
Background and Overview: Piloting the Methodology in Kentucky

- Discussions with Kentucky Health Department Association (KHDA) to introduce & explain *Foundational Public Health Services (FPHS)* framework using RESOLVE FPHS articulation/definitions document

- Buy-in: KHDA formed a finance workgroup to evaluate how to incorporate FPHS framework into current financial & performance reporting system.
  - Crosswalk of chart of accounts with FPHS framework

- Participation in Cost-Estimation Pilot Project (6 members of workgroup serving as a representative sample – from small rural to large urban to multi-county health districts)

- Development of a cost data collection instrument
Drawing from and Building on FPHS Cost Estimation in Washington State

- Use Public Health Improvement Partnership’s September 2013 Report on estimating the cost of Foundational Capabilities (Berk and Associates)

- Use Washington Delivery and Cost Studies (DACS) to cost out FPHS with additional granularity – disaggregate labor resource use from non-labor costs, etc.

- Adapt Washington’s Excel based data collection instrument to national FPHS definitions and national sampling frame
FPHS Cost Estimation
Costing Methodology (1/2)

- Adapt Washington DACS instrument as a starting template and modify & enhance accordingly.

- Goal is for cost data collection instrument to be efficiently self-administered and capture estimates that account for uncertainty (i.e. dynamic nature of public health - FPHS demand and supply).

- Empirical approach: Estimate FPHS Costs by modeling uncertainty associated with cost data collected.
  - Given sample size, quantify uncertainty through model simulation.

- Generate probability distribution – the range of all possible values and the likelihood of their occurrence.
  - Independent variables / Inputs → Input Distribution
  - Dependent variable / Output → Distribution of output values calculated from all possible combinations (‘scenarios’) of input values.
  - Best of all, these probability distributions can be graphed!
<table>
<thead>
<tr>
<th>Health department director</th>
<th>Public health manager</th>
<th>Registered nurse</th>
<th>Licensed practical or vocational nurse (LPN/LVN)</th>
<th>Nursing aide and home health aide</th>
<th>Public health physician</th>
<th>Environmental health worker</th>
<th>Laboratory worker</th>
<th>Epidemiologist</th>
</tr>
</thead>
</table>

**FOUNDATIONAL CAPABILITIES** (Hours per week per individual for LHD employee/labor functions or services performed that may cut across multiple if not all foundational areas)

<table>
<thead>
<tr>
<th>Assessment (surveillance and epidemiology)</th>
<th>min</th>
<th>ave</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Preparedness (All Hazards)</td>
<td>min</td>
<td>ave</td>
<td>max</td>
</tr>
<tr>
<td>Communication</td>
<td>min</td>
<td>ave</td>
<td>max</td>
</tr>
<tr>
<td>Policy Development and Support</td>
<td>min</td>
<td>ave</td>
<td>max</td>
</tr>
<tr>
<td>Community Partnership Development</td>
<td>min</td>
<td>ave</td>
<td>max</td>
</tr>
<tr>
<td>Organizational Competencies</td>
<td>min</td>
<td>ave</td>
<td>max</td>
</tr>
</tbody>
</table>

**FOUNDATIONAL AREAS** (Hours per week per individual for LHD employee/labor functions or services performed specific to each foundational area or responsibility that is not related to any foundational capability as to avoid double-counting)

<table>
<thead>
<tr>
<th>Communicable Disease Control</th>
<th>min</th>
<th>ave</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic Disease and Injury Prevention</td>
<td>min</td>
<td>ave</td>
<td>max</td>
</tr>
<tr>
<td>Environmental Public Health</td>
<td>min</td>
<td>ave</td>
<td>max</td>
</tr>
<tr>
<td>Maternal/Child/ Family Health</td>
<td>min</td>
<td>ave</td>
<td>max</td>
</tr>
<tr>
<td>Access/Linkage with Clinical Health Care</td>
<td>min</td>
<td>ave</td>
<td>max</td>
</tr>
</tbody>
</table>

**Survey Instrument (1/4) Labor Resource Use**

Minimum, average or most-likely, Maximum

**weekly hours conversion rate: 37.5 hrs/week = 1 FTE**
<table>
<thead>
<tr>
<th>OCCUPATION CATEGORIES</th>
<th>Annual Salary + Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(per 1 FTE basis)</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>Public health manager</td>
<td></td>
</tr>
<tr>
<td>Registered nurse</td>
<td></td>
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<tr>
<td>Licensed practical or vocational nurse (LPN/LVN)</td>
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<td>Nursing aide and home health aide</td>
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<tr>
<td>Public health physician</td>
<td></td>
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<tr>
<td>Oral health care professional</td>
<td></td>
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<tr>
<td>Environmental health worker</td>
<td></td>
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<tr>
<td>Laboratory worker</td>
<td></td>
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<tr>
<td>Epidemiologist</td>
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<tr>
<td>Health educator</td>
<td></td>
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<tr>
<td>Community health worker</td>
<td></td>
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<tr>
<td>Nutritionist</td>
<td></td>
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<tr>
<td>Information systems specialist</td>
<td></td>
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<tr>
<td>Public information specialist</td>
<td></td>
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<tr>
<td>Behavioral health professional</td>
<td></td>
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<tr>
<td>Emergency preparedness staff</td>
<td></td>
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<tr>
<td>Administrative or clerical personnel</td>
<td></td>
</tr>
<tr>
<td>Communication Staff</td>
<td></td>
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<tr>
<td>WIC Coordinator</td>
<td></td>
</tr>
<tr>
<td>Other (please indicate positions below)</td>
<td></td>
</tr>
</tbody>
</table>

Survey Instrument (2/4) Wage Scale
## Survey Instrument (3/4) Non-Labor Costs

| FOUNDATIONAL CAPABILITIES (Estimated annual NON-Labor costs in dollars) | Communication | Supplies / Materials | Travel / Registration | IT | Vehicles | Printing | Contracts / Services | Training | Other | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Assessment (surveillance and epidemiology) | min | $0 | ave | $0 | max | $0 |
| Emergency Preparedness (All Hazards) | min | $0 | ave | $0 | max | $0 |
| Communication | min | $0 | ave | $0 | max | $0 |
| Policy Development and Support | min | $0 | ave | $0 | max | $0 |
| Community Partnership Development | min | $0 | ave | $0 | max | $0 |
| Organizational Competencies | min | $0 | ave | $0 | max | $0 |

### FOUNDATIONAL AREAS (Estimated annual NON-Labor costs in dollars specific to each foundational area that is not related to any foundational capability as to avoid double-counting)

| Communicable Disease Control | min | $0 | ave | $0 | max | $0 |
| Chronic Disease and Injury Prevention | min | $0 | ave | $0 | max | $0 |
| Environmental Public Health | min | $0 | ave | $0 | max | $0 |
| Maternal/Child/ Family Health | min | $0 | ave | $0 | max | $0 |
| Access/Linkage with Clinical Health Care | min | $0 | ave | $0 | max | $0 |

**Minimum, average or most-likely, Maximum**

**Annual total non-labor costs**
### Crosswalk of FPHS with Kentucky’s Chart of Accounts

<table>
<thead>
<tr>
<th>Foundational Public Health Programs “Responsibilities”</th>
<th>Additional Services</th>
<th>Programs/Activities Specific to Local Community Need</th>
<th>Cost Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicable Disease Control</td>
<td>801, 806, 807, 842, 843, 845</td>
<td>722, 723, 738, 765, 805, 809, 818, 832, 836, 841, 856, 857</td>
<td>715, 718, 730, 748, 769, 810, 813, 858, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 882, 891</td>
</tr>
<tr>
<td>Chronic Disease &amp; Injury Prevention</td>
<td>500, 520, 540, 560, 580, 591</td>
<td>722, 723, 738, 765, 805, 809, 818, 832, 836, 841, 856, 857</td>
<td>760, 766, 767, 768, 803, 804, 808, 816, 833, 848, 852, 853, 854</td>
</tr>
<tr>
<td>Environmental Public Health</td>
<td>760, 766, 767, 768, 803, 804, 808, 816, 833, 848, 852, 853, 854</td>
<td>760, 766, 767, 768, 803, 804, 808, 816, 833, 848, 852, 853, 854</td>
<td></td>
</tr>
</tbody>
</table>

**Foundational Public Health Capabilities**

- Assessment (Surveillance and Epidemiology) - 844, 890
- Emergency Preparedness & Response (All Hazards) - 746, 747, 749, 757, 759, 763, 771, 815, 821, 822, 823, 824, 825
- Communications
- Policy Development & Support - 836, 890
- Community Partnership Development - 735, 736, 740, 756, 761, 837, 893
- Organizational/Business Competencies (Governance, Equity, IT, HR, etc.) - 724, 750, 888, 894, 897, 898

**Across all Programs (i.e. cross-cutting)**

- 844, 890
- 746, 747, 749, 757, 759, 763, 771, 815, 821, 822, 823, 824, 825
- 836, 890
- 735, 736, 740, 756, 761, 837, 893
- 724, 750, 888, 894, 897, 898
Survey Instrument (4/4): Current Attainment Scale Used to derive FPHS Projected Costs

“Based on your understanding of how each public health foundational capability and foundational area is defined, please provide your **global or overall assessment** on the following question: *For each foundational category, what is the estimated percentage currently being met by your health department?*”

<table>
<thead>
<tr>
<th>FOUNDATIONAL CAPABILITIES</th>
<th>Point Estimate</th>
<th>Range (Min, Most Likely, Max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment (surveillance and epidemiology)</td>
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<table>
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<tr>
<th>FOUNDATIONAL AREAS</th>
<th>Point Estimate</th>
<th>Range</th>
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<tbody>
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Estimation of “projected” costs from current attainment ratings

A. Cost at current attainment level
B. Projected cost of full attainment
Costing Methodology (2/2)

- **Latin Hypercube Sampling**
  - A sampling technique that will accurately recreate the probability distributions specified by distribution functions in fewer iterations, when compared with Monte Carlo sampling.
    - All possible values in input distribution are “sampled” for use in calculating total FPHS Costs (i.e. output values).
    - Output distribution generated from output values computed from “bins” or sets of scenarios containing all possible input values.
    - Iteration – Each time the outcome value is recalculated using a new set or combination of possible input values (i.e. cost estimate of each FPHS category)

- **Sensitivity Analysis**
  - Determine which inputs (i.e. FPHS categories) have the greatest impact on overall FPHS costs
Costing Methodology Outputs

- Methodology produces a *cost distribution* for each Foundational Capability (FC) and Foundational Area (FA) specified in the National FPHS Definition document.

- Separate estimates of “current” and “projected” costs
  - **Current**: cost of resources currently used to produce FCs and FAs
  - **Projected**: cost of resources estimated to be required to fully meet FC and FA definitions, based on current levels of attainment
Costing Methodology Outputs

- Foundational Capabilities (FCs) Costs
  - Health Assessment
  - Emergency Preparedness
  - Communications
  - Policy Development and Support
  - Community Partnership Development
  - Organizational Competencies

- Foundational Areas (FA) Costs
  - Communicable Disease Control
  - Chronic Disease & Injury Prevention
  - Environmental Health
  - Maternal and Child Health
  - Access and Linkage to Clinical Care

- Total costs = \( \sum FC + \sum FA \)
Foundational Capability (FC) – Assessment (per capita $)

Current

Projected

Mean = 2.3490
5% = 0.6352
95% = 4.5867

Mean = 3.8989
5% = 1.0887
95% = 7.0801

Mean = 7.3460
90.0% = 5.0%
5.0%
FC_Emergency Preparedness-All Hazards Response (per capita $)

**Current**
- Mean = 4.5238
- 5% = 1.5693
- 95% = 8.5419

**Projected**
- Mean = 8.342
- 5% = 2.837
- 95% = 14.871
FC_Communications (per capita $)
FC_Policy Development & Support (per capita $)

Current

- Mean = 2.4427
- 5% = 0.9216
- 95% = 4.4298

Projected

- Mean = 3.9134
- 5% = 1.3200
- 95% = 6.9197
FC Community Partnership Development (per capita $)

Current

Projected

5.0% 90.0% 5.0%

Mean = 3.4246

5% = 1.5055

95% = 5.6883

5.0% 90.0% 5.0%

Mean = 5.066

5% = 1.641

95% = 9.063

FC Community Partnership Development (per capita $)

Projected

0 2 4 6 8 10 12

Mean = 5.066

5% = 1.641

95% = 9.063

0 2 4 6 8 10 12

Mean = 5.066

5% = 1.641

95% = 9.063

PUBLIC HEALTH

SERVICES & SYSTEMS RESEARCH

PRACTICE-BASED RESEARCH NETWORKS
FC_Organizational Competencies (per capita $)

**Current**

- Mean = 13.258
- 5% = 8.539
- 95% = 17.958

**Projected**

- Mean = 21.064
- 5% = 10.187
- 95% = 33.106

FC_Organizational Competencies (per capita $)

Projected vs Current

- Current
- Projected

**PUBLIC HEALTH**

SERVICES & SYSTEMS RESEARCH

PRACTICE-BASED RESEARCH NETWORKS
Foundational Area (FA)_Communicable Disease Control (per capita $)

Current

Projected
FA_Chronic Disease & Injury Prevention (per capita $)

**Current**

Mean = 5.0486

5% = 2.2900

95% = 8.2576

**Projected**

Mean = 7.977

5% = 2.7600

95% = 14.033
FA_Environmental Public Health (per capita $)

Current

Mean = 7.322
5% = 3.874
95% = 11.330

Projected

Mean = 8.316
5% = 3.948
95% = 13.108
FA_Maternal Child and Family Health (per capita $)

Current

Mean = 15.850
5% = 7.820
95% = 25.110

Projected

Mean = 28.559
5% = 10.700
95% = 49.200
FA_Access to & linkage w/ Clinical Care (per capita $)

Current

Projected

Mean = 6.0262
5% = 3.1826
95% = 9.0417

Mean = 8.291
5% = 3.564
95% = 13.561
Foundational Capability – Total Costs per capita (Current & Projected)

Current

- Mean = 26.341
- 95% = 19.569
- 90% = 33.375

Projected

- Mean = 42.836
- 95% = 29.207
- 90% = 56.527
Total Local Per Capita Cost Estimates: Current and Projected

Current

Projected

Mean = 65.036
5% = 52.750
95% = 78.323

Mean = 101.82
5% = 76.75
95% = 127.46
Drivers of Total Current Costs: Which FCs and FAs are Most Influential?

Sensitivity Analysis for Total FPHS Costs per capita (current)
Drivers of Total Projected Costs: Which FCs and FAs are Most Influential?

Sensitivity Analysis for Total FPHS Costs per capita (Projected)
Sensitivity Analysis for Total FPHS Costs per capita (current & projected) – standardized beta coefficients

How Sensitive Are Total Costs to FCs and FAs

Current

Projected
Comparison of Cost Estimates

Washington PHIP - BERK Foundational Cost Report

- $328 million total annual cost projected (state+local)
- $165 million local annual cost projected
- $47 total per capita cost projected
- $24 local per capita cost projected

Kentucky Pilot Project Baseline (i.e. most likely)

- $286 million local annual current cost
- $65 local per capita current cost
- State cost estimates TBD

Other State Estimates (different definitions & methods)

- Ohio: $32 local per capita current cost
- Colorado: $37 local per capita current cost
Next Steps: National Estimates

- National stratified, nested sample of state and local jurisdictions
- Selection of 6 states stratified by administrative structure:
  - Centralized: AR, SC
  - Shared: FL, GA (KY)
  - Decentralized: NY, CA (WA)
- Selection of 3 local jurisdictions in each state, stratified by population: <50k | 50-299k | >=300k
- Supplement data already collected from KY, WA
- Web-based survey administration with telephone support
For More Information

Supported by The Robert Wood Johnson Foundation

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859-218-0113

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