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

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Workgroup on Public Health Cost Estimation

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ESTIMATING THE COSTS OF FOUNDATIONAL PUBLIC HEALTH CAPABILITIES:

A RECOMMENDED METHODOLOGY

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Prepared for:
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I. Purpose and Background

The Institute of Medicine's 2012 report on public health financing recommended the convening of expert panels to identify the components and costs of a "minimum package of public health services" that should be available in every U.S. community. [1] The report recommended that this minimum package include a core set of public health programs that target specific, high-priority preventable health problems and risks, along with a set of "foundational public health capabilities" that are deemed necessary to support the successful implementation of public health programs and policies. In response to this recommendation, the Robert Wood Johnson Foundation, in collaboration with the US Centers for Disease Control and Prevention and other national professional associations, formed the ***Public Health Leadership Forum***, an expert consensus panel process to identify a recommended set of core programs and foundational capabilities for the nation. The Forum's initial charge focused on the specification of foundational public health capabilities. The ***Foundational Capabilities Workgroup*** was formed as a part of the Forum to identify and define the elements to be included as foundational capabilities for governmental public health agencies at both state and local levels.

The Robert Wood Johnson Foundation asked the National Coordinating Center for Public Health Services and Systems Research based at the University of Kentucky to convene a second expert panel workgroup, the ***Workgroup on Public Health Cost Estimation,*** 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. Working in parallel with the Foundational Capabilities Workgroup, this Cost Estimation Workgroup has considered relevant cost-accounting models and cost estimation methodologies, and reviewed related cost estimation studies, in order to make recommendations on an approach for generating first-generation estimates of the costs associated with developing and maintaining foundational capabilities.

II. Defining Foundational Public Health Capabilities

The Public Health Leadership Forum's Foundational Capabilities Workgroup used an expert consensus panel process to identify a set of 11 organizational skills and practices that are deemed essential for governmental public health agencies to carry out in supporting successful health promotion and disease and injury prevention strategies at state and local levels. The Workgroup groups these elements into two broad categories: (1) ***foundational capabilities*** that represent broad and cross-cutting organizational skills and strategies; and (2) foundational areas that represent organizational skills and strategies that are more narrowly targeted at specific health risks, conditions, and population groups that are priorities for prevention and control initiatives. These 11 domains were based largely on the 11 "foundational public health

services" that the state of Washington's Public Health Improvement Partnership identified as priorities for development within their statewide public health capacity-building initiative.[2]

The Workgroup's six foundational capabilities include:

- Assessment, including surveillance, epidemiology, laboratory capacity, and vital records
- All-hazards preparedness for and response to public health emergencies
- Communications
- Policy development and support
- Community engagement and partnership development
- Organizational competencies, including leadership and governance, quality improvement, legal services, health equity, and the management of human, financial, and information resource

And the five foundational areas include:

- Communicable disease control
- Chronic disease and injury prevention
- Environmental public health
- Maternal, child and family health
- Access and linkage to personal health services

Collectively, these 11 capability domains are the object of the cost estimation methodology recommendations summarized below.

III. Cost Estimation Approaches

Three basic methodological approaches are available to estimate the costs of foundational public health capabilities. First, a ***retrospective approach*** to cost estimation can be used when existing data and information are available regarding the resources consumed during the development and implementation of the relevant tasks and activities. Retrospective estimation may use either ***micro-costing*** methods that involve combining data on each of the individual inputs consumed by the component activities, or ***gross costing*** methods that use aggregate data to estimate the average costs of the activities as a whole. [3] Existing data from accounting and billing records, inventory records, financial reporting systems, surveillance systems, or similar sources are required to support a retrospective approach to cost estimation. These methods are often among the least resource-intensive approaches to cost estimation because of their ability to rely on existing data, but the accuracy and reliability of the methods can vary widely depending on the quality of the underlying data sources.

Second, a ***concurrent approach*** to cost estimation can be used when it is possible to collect data during the process of implementing the tasks and activities of interest. Methods such as direct-observation, activity diaries, time logs, and random-moment time surveys are commonly used with the personnel responsible for implementing the tasks and activities under this

approach. When applied appropriately, these methods often yield the most accurate cost estimates, but they are also among the most time-intensive and resource-intensive approaches to use. [4 5 6]

Third, a ***prospective approach*** to cost estimation can be used when it is not possible to measure past or contemporaneous resource consumption associated with the tasks and activities of interest. This approach involves eliciting expectations about resource use from stakeholders who are knowledgeable about the implementation of relevant tasks and activities (production processes). This approach typically involves presenting stakeholders with detailed descriptions of the tasks and activities to be accomplished (scenarios), and then eliciting expectations of the resources required using surveys and/or group-process methods such as Delphi expert panel processes. [7] Like other economic evaluation methods that rely on reports of hypothetical behavior rather than observations of actual behavior, this method is vulnerable to measurement error and bias, particularly when respondents face real or perceived incentives for distorting their estimates. Moreover, research indicates that people tend to be heavily influenced by their current status and past experiences when reporting expected values under hypothetical scenarios. [8 9]

IV. Application of Costing Methodologies in Public Health and Related Settings

All three cost estimation approaches have been used productively in public health and closely related programmatic areas. Retrospective micro-costing studies have been conducted for a wide range of specific public health programs, including many of the federally-funded programs administered by CDC and HRSA.[4 10 11 12] Non-programmatic costing studies that focus on larger domains of public health activity, or on cross-cutting organizational capabilities and infrastructure, are less common. [13 14 15] As one recent example, a study completed recently by Patrick Bernet and Ohio's public health practice-based research network used a retrospective, gross-costing approach to estimate local governmental spending for a minimum package of public health services as defined by the Ohio Governor's Office of Health Transformation. [16] This study relied primarily on an existing data source containing annual financial reports on revenues and expenditures submitted by Ohio's local health departments. The study used regression-based modeling to produce estimates of how local public health agency spending on a core package of services and activities vary with agency institutional characteristics and with population socio-demographic characteristics.

Another instructive example is the ***Substance Abuse Services Cost Analysis Program (SASCAP)*** developed by Research Triangle Institute for the U.S. Substance Abuse and Mental Health Services Agency (SAMHSA). [17] SASCAP uses a retrospective micro-costing approach that relies primarily on detailed questionnaires administered to program directors who are familiar with the day-to-day operations of substance abuse treatment programs. The questionnaires ask these managers to report data on resource use incurred over the previous fiscal year, along

with estimates of how labor costs (staff time) were allocated across key program tasks and activities during the previous month. The resulting data have been used to support an array of economic evaluation studies.

Examples of concurrent approaches to cost estimation are much less prevalent in public health settings, with the notable exception of Medicaid-financed program administration activities carried out by public health agencies. Federal Medicaid regulations require states to conduct cost studies using approved methodologies in order to receive federal reimbursement for administrative activities that are not classified as direct services to enrolled program recipients. In many states, state and local public health agencies carry out some of these administrative activities, such as outreach and enrollment activities, eligibility determination, case planning and management, and referrals to community programs. In these states, state and local public health agencies participate in periodic time studies — typically ***random moment time studies*** using telephone and/or web-based data collection — to estimate the reimbursable costs associated with these activities. Beyond these Medicaid examples, the Ohio public health PBRN has a current study underway that uses direct-observation methods to estimate costs associated with environmental public health protection activities. These methods involve trained observers that accompany environmental inspectors during parts of their work day, recording structured information on activities, time, and materials used.

Prospective approaches to cost estimation have been used widely in medical care costing studies for several decades, and more recently have begun to be tested in public health settings. [6] The most prominent example in the health services research literature is the Harvard Medical Practice Study funded by the U.S. Department of Health and Human Services in the mid-1980s to serve as the empirical basis of a new Medicare physician payment system that is now known as the ***Resource Based Relative Value Scale (RBRVS)***. [18] A prospective method was chosen for this study because Medicare's existing administrative data captured physician charges and payments rather than true costs, and because direct observations of physician resource use are distorted by differences in patient case mix, severity, and complexity across physicians. This study developed detailed descriptions of 600 clinical services commonly delivered by physicians to Medicare beneficiaries (including descriptions of a "standardized" patient for whom each service was indicated), and used telephone and/or mail surveys of national samples of physicians to elicit expectations of the resources required to perform each service for each standardized patient, including time, effort, and practice expenses. Because this method of eliciting expected costs of individual services fails to capture possible synergies and complementarities across groups of related services (such as resources that could be jointly used by multiple services), this study also used an expert panel Delphi process to adjust survey-based resource estimates to account for these possible efficiencies.

More recently, the state of Washington's legislatively-commissioned Public Health Improvement Partnership (PHIP) used a prospective approach to estimate the cost requirements for a set of foundational public health services to be delivered by state and local governmental public health agencies. [2] The choice of a prospective method in this case was driven primarily by the study's intent to estimate costs for activities that many public health

agencies may not be currently performing in full. The study collected data from the state health agency and a purposive selection of 9 of the state's 35 local public health agencies using a standardized data collection form that elicited information on expected resource requirements for each of 6 program areas and 6 cross-cutting capabilities. The form was designed to capture data on expected staffing levels, salary and benefit costs, supply and equipment costs, and indirect costs for each of the 12 program/capability areas. Assumptions about fixed and variable costs and scaling parameters were developed based on interviews with state and local public health personnel and used to extrapolate from the sample data to produce statewide cost estimates.

V. General Principles for a Recommended Costing Methodology

A review of the capability definitions developed by the Foundational Capabilities Workgroup suggests several general principles for the costing methodology to be employed:

1. A prospective costing approach is necessary due to the primary goal of estimating the resources required to achieve ***desired levels of capability*** rather than currently existing levels of capability among governmental public health agencies.

2. The relatively broad and diffuse nature of the capability definitions suggests the need for a ***sampling approach*** to costing that can account for variability in how state and local public health stakeholders interpret the capabilities and in how they form expectations about resource requirements.

3. Because the capability definitions do not include *a priori* assumptions about the expected division of effort between state and local agencies, it will be desirable to develop empirical estimates of this division as part of the costing methodology. This will require a sampling strategy that is broadly representative of the intergovernmental relationships and administrative structures found between U.S. state and local public health agencies.

4. Because the capability definitions do not include *a priori* assumptions about how capability levels and resources should vary with the size of a public health agency jurisdiction and the scale of its operations, it will be desirable to develop empirical estimates of these scaling parameters as part of the costing methodology. This will require a sampling strategy that includes public health agencies of different sizes that are broadly representative of the scales of operation found within U.S. public health settings.

5. Recognizing the inherent trade-off between estimation precision and estimation cost, we recommend pursuing an initial estimation strategy designed to produce estimates relatively quickly and at relatively low cost. The sampling strategy to be

used should allow the study to broadly characterize variability in costs across settings, but a high level of precision and statistical power is not required for this study. This approach is consistent with the field's very early stage of development in defining capabilities and testing cost estimation methods, which will likely undergo iterative refinement and improvement over time.

VI. Specific Elements of a Recommended Costing Methodology

Approach: We recommend using a prospective costing approach that will estimate resources required to achieve desired levels of capability as specified in the Foundational Capabilities Workgroup's definitions. Because the capabilities of interest are newly defined and may not fully exist in all practice settings currently, we recommend a micro-costing approach that will collect detailed measures of both the quantity of resources consumed and the prices of these resources for each capability defined by the Workgroup.

Perspective: Costs should be estimated from the perspective of state and local government for consistency with the perspective that the Foundational Capabilities Workgroup employed in defining capabilities.

Time horizon: We recommend estimating costs for a one-year time horizon that is consistent with the budget cycles used by most state and local governments. The acquisition costs for resources that have useful lifespans exceeding one year should be amortized over this lifespan, factoring in depreciation costs, in order to derive annualized cost estimates.

Sampling design: A stratified national sample of state and local public health agencies is recommended in order to support empirical estimates of cost variation across different types of state-local intergovernmental structures and across different scales of agency operation.

Stratification: Two levels of stratification are recommended. The first level of stratification reflects intergovernmental structure and includes three categories based on the empirical typology of DeFriese et al. as updated by Meit et al.: [19] [20] (1) centralized or largely-centralized structures in which local public health agencies operate primarily as administrative units of the state health agency; (2) decentralized or largely-decentralized structures in which local public health agencies operate primarily as administrative units of local government and are administratively independent from the state health agency; and (3) shared structures in which local public health agencies operate under administrative mechanisms controlled by both state and local governments.

The second level of stratification reflects the scale of operation of local public health agencies, which is commonly measured by the size of the population that resides within the geopolitical jurisdiction served by the agency. The variability in this scale parameter is notoriously high, with more than 60% of the nation's 2800 local public health agencies serving jurisdictions of

less than 50,000 residents (about 10% of the U.S. population), and about 5% of these agencies serving jurisdictions of more than 500,000 residents (about 50% of the U.S. population). [21] To achieve balance among the competing priorities of measurement precision, data collection cost and respondent burden, we recommend sampling stratification based on three categories of agency scale: (1) agencies serving populations of less than 50,000 residents; (2) agencies serving populations of between 50,000 and 300,000 residents; and (3) agencies serving populations of more than 300,000 residents. Sampling across these three strata will allow for estimates of cost variability based not only on scale, but also on closely related characteristics such as rural-urban designation and population density.

Sample Size: We recommend sampling with replacement for non-response so as to yield a minimum of 12 state-local agency dyads for each of the 9 cells that result from the two-level stratification design, requiring a total sample size of 108 dyads (Table 1). This modest sample size (and the implicit sampling rates) will not provide a high degree of precision in the cost estimates, but it will be minimally adequate for characterizing cost variability across public health settings with different intergovernmental structures and scales of operation.

Table 1: Stratified Sampling Design Proposed for Cost Estimation

	Centralized	Shared	Decentralized	Total
<50k	12 dyads	12 dyads	12 dyads	36 dyads
50k-299k	12 dyads	12 dyads	12 dyads	36 dyads
≥300k	12 dyads	12 dyads	12 dyads	36 dyads
Total	36 dyads	36 dyads	36 dyads	108 dyads

Two-Stage Complex Sampling: In order to minimize respondent burden at the state level, we recommend a two-stage sampling methodology that involves: (1) randomly sampling two states from each of the three intergovernmental structure strata for a total of 6 states; followed by (2) randomly sampling 4 local agencies from each of the three scaling strata within each of the 6 states. This design will require data collection from a total of 6 state health agencies and a total of 108 local agencies, yielding 108 state-local dyads clustered within 6 states.

Agency Recruitment: We recommend working directly with the Association of State and Territorial Health Officials (ASTHO) to recruit the 6 sampled state health agencies into study participation. Incentives for participation will include customized, comparative state-specific cost reports that can be used for strategic planning, policy development, financial management and benchmarking. Once the 6 participating state health agencies have been confirmed, we recommend working in conjunction with the state health agencies and the National Association of County and City Health Officials (NACCHO) to recruit the 12 sampled local agencies from each state. Local participation incentives should include customized comparative cost reports at the local level.

Data collection method: We recommend collecting measures of resource use and cost using a web-based survey instrument. The instrument should be organized around each of the

capability domains defined by the Foundational Capabilities Workgroup (currently there are a total of 11 domains including 6 "capabilities" and 5 programmatic "areas"). The instrument should contain a standardized description of each capability domain, followed by a series of questions that elicit the respondent's expected values of quantity and price for each type of resource required to implement the tasks and activities in the domain.

Respondent selection: Similar to the SASCAP instrument[17] and the instrument used in the Washington cost study,[2] the instrument developed for this study should be designed for completion by the public health agency director or other senior program administrator within the agency, with assistance and input from other staff members knowledgeable about resource use and costs within the agency. The data collection process should allow and encourage respondents to seek specialized staff input for each of the 11 capability domains.

Measures: For each capability domain, the instrument should include questions that elicit the following types of measures: (1) expected quantities of employed, contracted and volunteer labor by occupational category; (2) expected labor prices for salary and benefits by occupational category; (3) expected supply and equipment costs; (4) expected contracted services costs; and (5) expected building, facilities, depreciation and other indirect administrative costs. All quantity and cost measures should reference a one-year time period anchored to the agency's current fiscal year.

Respondents should be instructed to answer questions about expected resource requirements under the assumption that the current division of effort between state and local public health agencies is maintained. Each capability domain should include a question that asks each respondent to estimate the current state-local division of effort for that domain (e.g. "Thinking about the total amount of state and local resources that currently support this capability in your agency's jurisdiction, what proportion is contributed by your agency?").

Following the detailed set of resource measure questions for each capability domain, we recommend including a separate set of questions that ask respondents to consider their agency's total expected staff time and allocate this time across the 11 capability domains. These questions should be modeled after the SASCAP's time allocation module, prompting respondents to conceptualize a typical 7-day work week.[17] These questions will serve as a cross-check to the domain-specific resource questions, allowing the study to avoid double-counting of staff time across domains and to account for staffing synergies and complementarities across domains.

Norming and Anchoring: To reduce measurement biases and inaccuracies due to the subjective nature of eliciting prospective cost and resource use estimates from respondents via survey, the instrument should include an anchoring vignette that describes a standardized public health activity to be performed by a standardized public health agency, and then elicits each respondent's expectation about the resources required for the agency to perform the activity. This anchoring vignette methodology will allow the study to adjust for systematic differences across respondents in their optimism or pessimism about resource requirements.[22]

Additionally, the instrument should include questions that elicit each respondent's estimates of their agency's ***current*** resources used for foundational capability areas so that they can be compared and normalized against the ***prospective, expected resource use*** measures.

Instrument Piloting and Testing: The instrument should be pilot-tested with a small sample of public health agency administrators to assess clarity and difficulty of items. Items should be revised based on feedback from cognitive interviews with pilot respondents.

Analytic Approach: Survey data should be used to generate average cost estimates for the sample by capability domain, by type of resource, by state vs. local source, and overall. Estimates of variability in costs by state-local structure and by agency scale should be generated using range tests and coefficients of variation. Sampling weights can be used to generate total cost estimates and confidence intervals for the U.S. as a whole.

Regression-based modeling can be used to estimate cost elasticity parameters based on agency scale and state-local structure, accounting for the clustering of local agencies within states. Although relatively imprecise in small samples, these parameters can be used to generate crude synthetic projections of state-specific cost estimates using information on the state-local structure and local agency scale distribution in each state. These parameters can also be used to simulate the cost effects of policy changes designed to increase the effective scale of small agencies through consolidation or joint production of capabilities (e.g. shared services).

Reporting: Customized, comparative cost reports should be generated for each participating agency. Reports should allow each agency to compare their cost estimates to sample norms overall and by subgroups defined by state-local structure and scale of operations.

Implementation Timeline: The use of a relatively small sample will allow the cost estimation methodology to be implemented over a compact 7 month period, as outlined in Table 2.

Table 2: Recommended Implementation Timeline for Cost Estimation

Activity	Time Period
Instrument development and pilot testing	Feb-Mar 2014 (8 weeks)
Agency sampling and recruitment	Feb-Mar 2014 (6 weeks)
Data collection	Apr-Jun 2014 (12 weeks)
Data cleaning and processing	Jun-Jul 2014 (2 weeks)
Data analysis and reporting	Jul-Aug 2014 (8 weeks)
Final reporting and dissemination	Aug-Sept 2014 (8 weeks)

VI. Implications and Next Steps

The recommended cost-estimation methodology should be considered an important first step in building evidence about the components and costs of public health capabilities.

Implementation of this methodology will reveal limitations in the measurement strategy, sampling design, instrument design, and analytic approach that can be improved in subsequent iterations of cost estimation. Moreover, methodological findings from a parallel set of cost estimation studies that are currently underway through the Robert Wood Johnson Foundation's Public Health PBRN Program will be able to inform subsequent cost estimation activities.

One important byproduct of the first iteration of this work will be the ability to revise the measurement instrument based on estimation experience and make it publicly available on the web for public health agencies to use for their own planning, self-assessment, financial management, and policy development activities. Mechanisms for collecting ongoing feedback on the instrument from state and local public health users could be designed into the web-based survey tool. Additionally, the ability to generate automated, comparative cost reports could be incorporated into the tool using benchmarks and norms from the sample.

The findings and lessons learned from the proposed cost estimation methodology will also directly inform efforts to develop a uniform public health chart of accounts (COA). The measurement strategies that prove successful in this methodology can be directly incorporated into a model COA for use by state and local public health agencies.

As part of future cost estimation activities, it will be important to examine the correspondence between prospectively generated "expected cost" estimates and "incurred cost" estimates generated through concurrent and/or retrospective approaches. These types of comparisons will help to validate and improve prospective approaches to cost estimation, and generate valuable information about measurement error that can be incorporated into subsequent analytic strategies. The development and testing of a public health COA may provide opportunities for collecting "incurred cost" data in the same capability domains that can be compared against "expected cost" data to support improvements in measurement and analysis.

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