

**Measuring the Value of Governmental
Public Health Systems
Final Report**

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ABSTRACT

Research Objectives:

- Understand how the value of services provided by governmental public health systems (GPHS) can be defined and measured
- Determine what methodologies can be used to measure value
- Develop an analytical framework for measuring the value of GPHS

Research Design:

We conducted critical synthesis of the literature to examine: 1) how various methodologies have been applied to similar efforts; 2) how other systems (public and private) define and measure value; and 3) economic evaluations of GPHS activities. We interviewed national, state, and local public health practitioners, policymakers, and academics (N=46) to ascertain participants' views of research questions

Principal Findings:

Literature Reviews. Researchers have used cost-benefit/cost-effectiveness analyses to value health services, but few studies address public health. Government efforts to value public health through performance-based and outcomes-based management techniques lack rigor and standards. Literature from other sectors indicates no definition or measurement of value that can be easily extrapolated to public health.

Interviews. No consensus definition of or metrics to measure value emerged, but respondents identified certain component parts: core principles of prevention; social justice and other intangibles (difficult to measure); quality of services provided; the importance of process to obtain community input and staff consensus; and communication to policymakers and the public. Respondents offered several potential models for measuring value, including: cost-accounting; performance-based contracting; logic models; performance standards/accreditation; numbers (counts).

Based on these results, we have developed a framework using the cost-accounting model as a point of departure. The proposed framework considers four elements: external factors (i.e., mandates and community input); internal actions (strategic planning and staff assessment); data collection/analysis; and evaluation. For methods, we recommend using cost-utility analyses. Key challenges to implementation are obtaining data, standardizing metrics, feasibility, and incorporating tangible and intangibles measures of value.

Implications for Policy, Delivery, or Practice:

For public health to restore its former prestige, practitioners will need to demonstrate to policymakers and the public that investments in public health services add value to population health. This must involve the development of better outcomes measures, improved data collection and analysis, and communications. Public health practitioners must also become more entrepreneurial without losing core public health values.

EXECUTIVE SUMMARY

Introduction

The 20th century witnessed dramatic achievements attributed to public health. Despite these achievements, actually valuing the return on investments in governmental public health systems (GPHS) presents many challenges. In this report, we consider ways in which the value of GPHS can be defined and measured. The research will enable public health practitioners to explain the overall benefits of GPHS to policymakers and the public.

Research Methods. The research design consists of three integrated tasks. First, we conducted an extensive analysis of economic evaluations of various activities (including GPHS). Second, we conducted a critical synthesis of the literature to examine how other governmental structures define and measure value. Third, we interviewed national, state, and local public health practitioners, policymakers, and academics (N=46) to ascertain participants' views of how the public health system can define and measure value.

Literature Reviews

Reviewing the Economic Literature. Researchers have attempted to measure the rate of return on investments in public health programs in various ways, focusing on the monetary costs and benefits, much as a financial analyst would calculate the rate of return for competing alternatives in a portfolio. Some researchers have used cost-benefit analysis (CBA) to estimate in monetary terms the net social benefit of a program or intervention (i.e., the incremental benefit minus the incremental cost). Others have used cost-effectiveness analysis (CEA), in which interventions are measured in terms of net costs per unit of health gain (e.g., life years gained).

Findings from the Tufts-NEMC Cost-Effectiveness Registry. We searched the Tufts-NEMC Cost-Effectiveness Registry, a comprehensive database of 789 original cost-utility analyses (CUAs) published from 1976-2003. In cost-utility analysis, health gains are expressed in terms of "quality-adjusted" life years or QALYs to incorporate both the prolongation and quality of life. Our search revealed 48 U.S.-based CUAs on community-level public health interventions, such as screening and surveillance, immunization, and injury prevention.

Alternative Valuation Methodologies. We examined other approaches to valuing public health programs that consider the impact of public health programs through management techniques and accountability efforts. Several governmental initiatives, such as Healthy People 2010, are limited because they do not evaluate formally and quantitatively the impact of the programs. State and local officials have used frameworks for state budgeting and financial reporting that attempt to connect funding to public health programs and outcomes.

Other Sectors. The literature on measuring the value of public health is thin, except for a robust literature on public health performance standards. Thus, we examined the literature from three separate fields, port authorities, public education, and welfare, to determine how value is defined and measured in those areas.

Port Authorities. This literature defines value largely in economic terms as the networks (called value chain constellations and nodes) linking the port to inland distribution centers. Ports contribute value based on geographic location, having adequate capacity, and handling cargo efficiently in terms of cost and service-time. Ports also contribute value to their chains through intangibles, such as their effect on the environment, the local labor market, and the economy. GPHS can envision functional units situated among a series of interconnected nodes working within a system that includes other public and private stakeholders.

Education. In education, value is typically defined as student achievement or progress, particularly in light of resources spent. One common methodology used to measure value is the education production function, which views schools as producing student achievement. Intangibles that must also be considered include effects of education on the labor market and on political awareness, citizenship, and moral values. As with public health, it is difficult to attribute student achievement to education alone.

Welfare. Researchers and policymakers concerned with welfare typically look at aggregate program expenditures and broad welfare reforms over time to define value. As measures, they then calculate the number of welfare recipients served, their employment rates, and their earnings. In a sense, value is based on the ability of individual programs to reach those who are eligible for services and to improve their status.

Key Findings:

- Growing attempts by researchers to value public health services with CBAs/CEAs
- Lack of standards and gaps in the research (variations in quality and notable gaps in methods used for valuation)
- Dearth of studies taking the perspective of the state or local health department official (not clear to what extent LHDs have used the information from existing CEAs)
- Some increase in government efforts to value investments in public health through performance-based and outcomes-based management techniques (but generally lack a formal framework for valuation methodology)
- Lack of rigor and standards for government efforts to measure value (difficult to compare across GPHS programs because of varied outputs or outcomes)
- No robust definitions or frameworks that can be easily extrapolated to public health (most of the reviewed articles do not specifically define value)
- Nearly all of the articles reviewed use an economic methodology to measure value (the articles also attempt to estimate the value of intangibles)
- The three industries studied diverge in the balance of tangible products (easily measured) and intangible values (difficult to measure). The literature provides little guidance for measuring the intangibles, relying on economic measures.
- Focus on performance measurement (program effectiveness) when discussing value
- Parallels between these three industries and public health include the importance of multiple measures to determine value rather than relying on a single measure, the importance of communication to policymakers and the public, and a concern for social cohesion and social justice (such as reducing inequality)

Interview Results

Value Definition. The central question for the interviews was to define the component parts of value for public health services. The component parts represent the elements that comprise public health's accumulated value.

Prevention. Respondents generally cited the core principles and values of public health as prevention, social justice, and social interconnectedness. Respondents consistently stressed prevention (i.e., harm avoided) as defining value.

Intangibles. A unique trait of public health is the intangible value it has. These intangibles were characterized in various ways, but center on notions of social justice. Improving the population's health thus depends on more than measurable economic constructs.

Quality of Services. A third component is quality of care, focusing specifically on performance standards, accreditation, and community assessment tools. Attention to measuring the quality of public health services is recent and lags far behind the quality of care movement in personal health care services. An explicit goal is to hold public health officials accountable.

Communication. A fourth component is communication. Many argued strongly that communication to the public and to policymakers is an essential attribute of value, though there was disagreement as to including personal stories in what is being communicated.

Process. The final component is the importance of process. Respondents discussed various processes they use to define value, including how they organized to determine which services to provide and which to cut given budget limitations (i.e., making tradeoffs at the margin in choosing between services to equally deserving populations).

Systems. Respondents expressed concern that the value of sustaining public health systems, other than as an abstract construct, is not considered.

Models for Measuring Value. Our interviews reveal several potential models for defining the value of public health services.

Cost-Accounting. The most well-developed model we encountered is a creative combination of cost accounting methods, community assessment, and a process that is tantamount to deliberative democracy. The overall process, and its consensus-building feature, is the model's most important aspect. It ranks program priorities given available resources.

Performance-Based Contracting. Wisconsin is experimenting with performance-based contracts to have state and local public health departments negotiate contracts for the state to buy products and services from LHDs. Respondents characterized the model as a quasi-market process that "moves away from the entitlement or social goods mentality." Implementing the Wisconsin approach has been difficult, generating LHD resistance.

Logic Models. Several LHDs in our sample operate logic models to evaluate programs using specific performance indicators. The stated purpose is to connect themes of performance management, continuous quality improvement (CQI), and strategic planning to improve the

quality of services provided, which, in turn, is a measure of value (by linking expenditures to outcomes).

Performance Standards/Accreditation. The academic and national respondents in our sample are the primary proponents of using performance standards and accreditation to measure value. Proponents assert that evidence-based performance standards indicate best practices of what services LHDs should provide to the community and will enhance accountability. LHD respondents were split on the utility of performance standards.

Numbers (Counts). Our interviews suggest that numbers are necessary but not sufficient as an approach to measuring value. Respondents generally characterized numbers as important process measures that can be used for tracking productivity and community engagement over time. No respondent equated numbers with outcomes.

Methods for Measuring Value. Our interviews did not reveal a consensus on what metrics to use to measure value. Most respondents coalesced around outcome measures as the key criterion, but disagreed as to whether changes in morbidity and mortality were feasible indicators.

CBA/CEA. Numerous respondents identified cost benefit/cost-effectiveness analyses (CBA/CEA) as potential instruments to measure the value that certain services bring to the community. Despite the attraction of these methods for demonstrating value, very few respondents felt that LHDs were currently able to undertake these analyses.

Return on Investment. Many LHD respondents would like to demonstrate that public health services provide communities with a strong return on investment (ROI). Those favoring ROI as a measure noted that they do not necessarily know how to translate that empirically.

Morbidity/Mortality Data. No respondent disagreed with the proposition that collecting and analyzing morbidity and mortality data would seem to be an essential activity for assessing the value of public health services. At the same time, LHD respondents consistently argued that the methods for connecting programs to outcomes were under-developed.

Community Needs Assessment. Community Assessment is another important tool for measuring value. It provides an understanding of recent trends that can help practitioners identify new programs and funding sources, as well as which programs are no longer needed.

Public Health as Insurance. Two respondents suggested an analogy between public health and insurance. Based on actuarial concepts of pricing risk, an insurance model could be used to price the mitigation of risk through prevention activities.

Limitations to Measuring Value. Measuring value must overcome some important limitations. One of the key limitations is, noted one respondent, “The cowboy on the white horse isn’t selling today.” Added another, “Economics sells public health; intangibles don’t sell.”

Attribution. The heart of the difficulty in measuring value is the attribution problem, the difficulty of demonstrating that the investment in public health contributes to decreased morbidity and mortality (i.e., that the outcomes are related to the intervention). It is hard to

demonstrate the “correlations between prevention and disease reduction” (i.e., quantifying the disease epidemic that public health intervention prevented).

Politics. Politics as a limitation emerged in several ways. First, certain services are either legally mandated or championed by political bodies regardless of supporting data. Second, politicians have a short-term focus, while public health is based on long-term benefits.

Staff Capacity. Staff capacity to conduct the data analyses needed to measure value is a serious limitation. This has two aspects. First, outcomes data are not readily available and may be very expensive to collect and analyze. Second, respondents recognized staff resistance to the need to measure value, especially for making trade-offs at the margins.

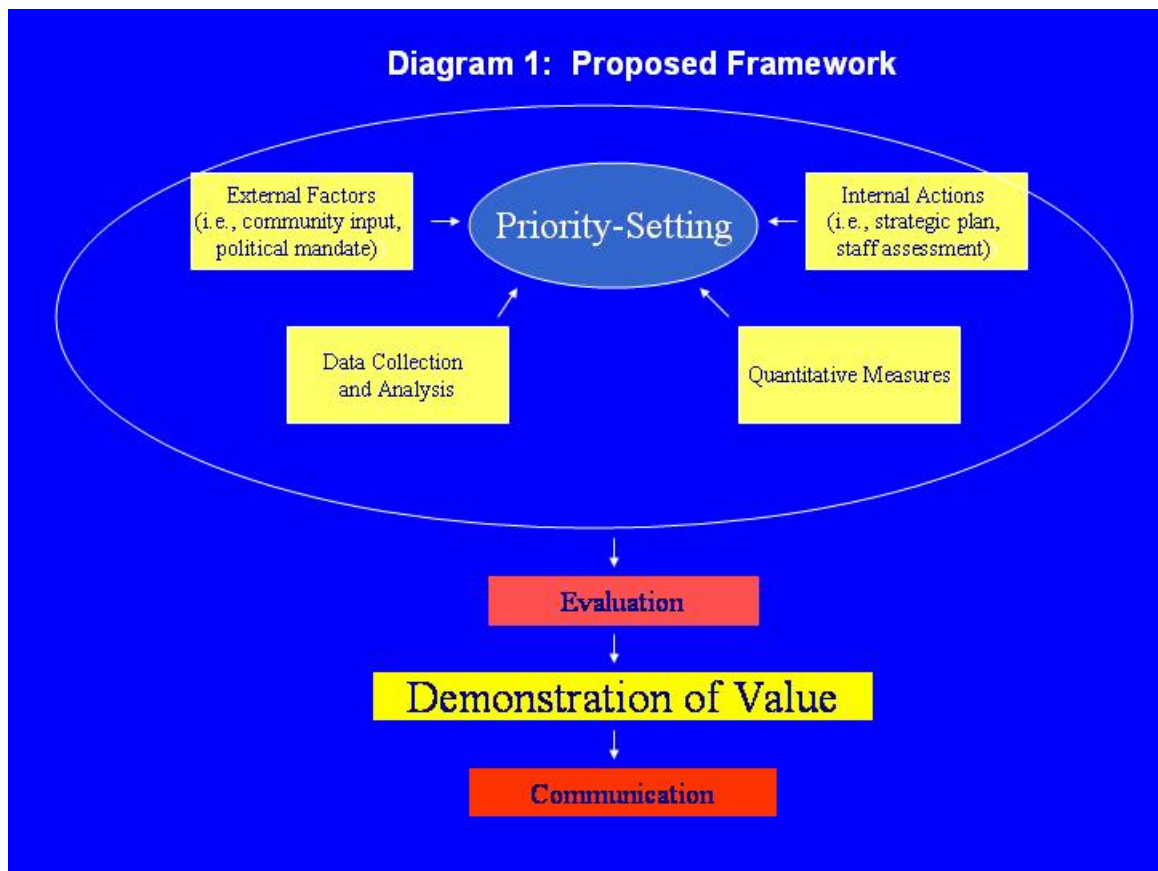
Developing a Framework for Measuring Value

Goals. In our view, the framework needs to achieve seven goals. First, it should be a general measure of overall value of the public health system’s goods and services. Second, the framework should enable practitioners to make tradeoffs at the margins between desirable services. Third, the framework should distinguish between the value of public health as a system and the value of specific services. Fourth, the framework should be able to incorporate both tangible and intangible measures of value. Fifth, the framework should be a vehicle for communicating the value of GPHS to the community and its political representatives. Sixth, the framework must be feasible. Seventh, the framework should hold practitioners accountable.

The Framework. When we combine the systematic models with the interview responses, the cost-accounting approach stands out as the model that best incorporates the important component parts of value and meets the above goals. Our proposed framework, shown in Diagram 1, considers four component elements to determine program priorities.

External Factors. First, the external factors that must be taken into account are: 1) a community needs assessment; 2) service delivery mandates; 3) revenue sources; and 4) program alternatives (i.e., private sector) if not publicly-funded.

Internal Actions. Second, the key internal actions that an LHD must take to implement the framework are: 1) developing a strategic plan; 2) assuring staff assessment and consensus on program priorities; 3) examining quality of services provided; 4) developing adequate data collection and analysis techniques; and 5) evaluating the results.



Methods. Third, the appropriate quantitative methodologies to assess value must be selected. Neither our review of the economic evaluation literature nor our interview responses provide a single, obvious choice of an applicable methodology. Cost-utility analysis (CUA) has emerged as a favored analytic technique for economic evaluation in health care. It presents the impact of services or programs in terms of incremental costs per incremental quality-adjusted life years or QALYs. CUA incorporates the impact in terms of both the prolongation and quality of life. CUAs have their own limitations, but they provide a way to compare diverse programs.

Communication. The final element of our framework is the need to communicate value to policymakers and to the public. We suggest that LHDs experiment with a variety of approaches.

Analysis

Defining and Measuring the Value of Public Health Services. On the core question of our project, no one definition of value or measurement approach emerges. Aside from the intangible values that suffuse public health practice, obtaining adequate data, identifying appropriate methodologies, and conducting the analyses are resource-intensive activities under the best of circumstances. For any individual LHD to undertake the process requires considerable expertise and fortitude. Defining and measuring the value of public health services is at a nascent stage—similar to where quality of care for personal health services was about 20 years ago. To be successful, this effort must likewise be viewed as a long-term endeavor.

Challenges. Our results suggest a few key challenges that researchers and practitioners must address in the short-run to ensure long-term success in defining and measuring value.

Defining Public Health. A precondition to defining value is to have a clearer definition of public health itself. This has been a vexing problem for the field that remains troublesome.

Data. Perhaps the most consistently recognized challenge is the lack of core data sets. Compounding the lack of data sets is the lack of agreement on input, output, and measures. A high priority for public health is to establish consensus on what data LHDs should routinely collect, which outcome measures should be examined, and how the data should be analyzed. Integral to defining and measuring value is developing standardized data collection approaches.

Staff Capacity. Respondents identified staff capacity as a major impediment to measuring value. Of the many possible frameworks and methodologies that could be selected, the reality is that they must be feasible for overworked public health staff to use. At the same time, the framework must be robust enough to achieve results.

Measurement Techniques. In terms of the measurement techniques used to value public health, our study revealed some progress but also challenges. The peer-reviewed literature contains numerous studies using varied conceptual approaches, including formal CBA and CEA methodologies, as well as cost-utility analysis, which allows decision makers to compare diverse programs using a standardized metric. Variations in quality and notable gaps in the methods used for valuation remain. Even within the cost-utility approach, studies differ considerably in their valuation methodologies.

Perhaps a larger issue pertains to the reality that these studies do not seem to have penetrated into the decision maker's mindset. None of the interviews revealed any connections between this body of literature and the practical working needs of LHDs.

LHD Isolation From One Another. An issue that emerges from our interviews is the difficulty LHDs have in sharing innovations and information. At least across states, there does not appear to be a mechanism for LHDs to share information. As a result, there were few synergies across LHDs, little building on prior initiatives, almost no testing of innovations, and lots of time spent re-inventing the wheel (i.e., duplicating previous or ongoing efforts). National organizations should take the lead in developing improved ways of sharing innovations.

Public Health Entrepreneurialism. Relying on the moral high ground alone is no longer a tenable strategy—it simply is not selling to politicians or to the public. An alternative is to develop public health entrepreneurialism. Quantification is no longer an option—it is a necessity if the intangible, core values of public health are to survive. A key challenge is how to become more entrepreneurial without losing the core values that our respondents articulated.

Policy Implications. The primary policy implication of our study is that the demand to demonstrate value through quantitative measures is likely to increase. If public health's moral imperative is no longer a compelling factor in policy decisions, the alternative is to provide a better understanding of the value of public health investments.

Next Steps. The immediate next steps are to trim, test, and refine the framework. For the first version of the framework, we have erred on the side of over-inclusiveness to make sure that the key elements are captured. To maintain feasibility, it is likely that the framework will need to be streamlined and adjusted to reflect staff capacity concerns. As part of the funding for the current project, we will share the framework with our respondents for their feedback and revise accordingly. We plan to convene a conference to discuss our results generally and to obtain feedback on the framework specifically.

Future Research. Our results suggest some lines of future research that might be productive. One is measuring the value of the public health system itself, but we lack a framework for that. Our literature review reveals some interesting possibilities of looking to port authorities as organizational models for public health. Port authorities are likely to offer examples of ways in which public health practitioners can become more entrepreneurial without abandoning core values. Another is to understand better what is unique about governmental public health (i.e., population concerns, preparedness) that the private sector cannot easily address. Finally, an intriguing suggestion from our interviews was to think about public health in terms of insurance.

Conclusion

For public health to restore its former prestige, practitioners will need to demonstrate to policymakers and the public that investments in public health services add value to population health. Short of conducting the painstaking work of developing better outcomes measures, along with improved data collection and analysis, there is no easy way to define and measure value.

Measuring the Value of Governmental Public Health Systems Final Report

I. INTRODUCTION

The Manifest Value of Public Health

The value of governmental public health systems (GPHSs) may seem obvious in light of progress in public health over the past century. The 20th century witnessed dramatic increases in health and life expectancy attributed mostly to public health: control of infectious disease, the development of vaccines; motor vehicle safety, safer workplaces, safer food and drinking water, and recognition of tobacco use as a health hazard (MMRW, 1999). (By GPHS, we refer to the state and local governmental apparatus designed to assess and respond to threats to the public's health (IOM, 1988)).

Looking back on the progress, a report from the Centers for Disease Control and Prevention (CDC) underscored the importance of changes in the public health infrastructure, including the growth of institutions at the federal, state, county, and local levels, as well as schools of public health and nonprofit foundations devoted to public health issues. CDC highlighted a host of infrastructure changes, such as disease and mortality surveillance systems, reporting and data collection requirements, public health training programs, and advances in methods and application of epidemiology, health surveys, biostatistics, health services administration, and the behavioral and environmental sciences.

One might argue that there is inherent value in maintaining GPHSs to protect the population against the spread of disease. But the reality of severe budgetary constraints and chronic underfunding of public health suggests that the public is unaware of public health's value. It is thus essential that GPHSs demonstrate measurable contributions to the population's health and allocate resources to those activities likely to achieve maximum value for improving the public's health. This is especially true at a time when public health systems are expected to incorporate multiple mandates (both funded and unfunded), such as bioterrorism preparedness. Choices need to be made regarding which services to preserve, which to shift to the private sector, and which need the most resources.

Challenges in valuation

Despite public health's achievements, actually valuing the return on investments in governmental public health systems presents many challenges. Ideally, we would like to know the return on specific investments and whether the investments were efficient. After all, the resources devoted to public health systems might conceivably have been used in other, more effective ways. Such information could help policy makers provide public health infrastructure in the most efficient manner possible. We would also like to have some objective metrics to determine whether spending on public health to determine whether the investments were "worth it."

Valuing governmental public health systems is not easy. Attributing health gains to investments in infrastructure requires many assumptions about the causal links between policies and outcomes. Governmental public health infrastructure interacts in complex ways with community, business, and academia institutions. Moreover, research from many quarters has shown that population health is shaped by a wide variety of factors and involve not only public health policies, but policies that affect education, housing, the environment, and the economy (IOM, 1998).

Reports touting the value of public health systems, or calling for more public health infrastructure have often sidestepped or downplayed the valuation question. The CDC report noted above, for example, did not attempt to place a value on different forms of investments.

Similarly, a recent Institute of Medicine (IOM) report on the Future of Public Health in the 21st Century focused on governmental public health infrastructure but gave scant attention to valuation (IOM, 1998). The report called for strengthening public health infrastructure at many levels, including building partnerships among diverse stakeholder groups, developing systems of accountability, improving evidence and communication, developing public health workforce, training, laboratory capacity, surveillance and epidemiological systems, communication networks, domestic preparedness, emergency response capabilities. It recommended improvements in the public health workforce and public health laboratory system, a national commission to develop a framework for state public health law reform, a National Health Information Infrastructure, a National Public Health Council to provide a forum for communication and collaboration, and a comprehensive plan for public health infrastructure. Yet little attention was given to how such investments would be valued.

Study Objectives and Outline

In this report we consider ways in which the value of services provided by governmental public health systems can be defined and measured. The primary research question to be addressed is: How can the value of the services provided by GPHSs be defined and measured? Subsidiary research questions include: How do other public or quasi-public entities (e.g., port authorities, education systems) define and measure value? What methodologies (e.g., contingent valuation, cost-benefit or cost-effectiveness analyses) can be used to measure value? What are the criteria for determining and measuring value? Can an analytical framework be developed for measuring value? How would measuring value affect other important dimensions of public health systems such as accountability?

We begin by reviewing the economic literature on the value of investments in public health. In section 3, we present the results of an investigation of the Tufts-NEMC Cost-Effectiveness Registry, a unique database of some 800 medical and public health interventions whose cost-effectiveness has been measured in terms of incremental costs per quality adjusted life years (QALYs) gained. Section 4 discusses alternative methodologies for valuing governmental public health systems, drawing from researchers who have examined performance-based budgeting and government accountability programs. The final section discusses the implications of the findings.

II. REVIEW OF THE ECONOMIC EVALUATION LITERATURE

In this section, we focus on the methodologies that researchers employing techniques of economic evaluation have used to measure the value of public health programs. The goal is to critique existing methodologies and determine which aspects are applicable to GPHS activities and public health systems. We summarize the literature, identify key gaps, and critically evaluate each of the methodologies used to value public health services.

Conceptual Overview: Valuing Investments in Health Care

The idea of quantifying the value of investments in public health has a long history. The first formal application of cost-benefit/cost-effectiveness analysis has been attributed to Richard Petty, who in the 1600s argued for greater social investment in medicine on grounds that the value of a saved human life exceeds the cost of investment (Warner and Luce, 1982). Researchers also point to recommendations of U.S. Secretary of the Treasury, Albert Gallatin, in 1808 to compare the costs and benefits of water-related projects (Hanley and Splash, 1993), and to recommendations of Lemuel Shattuck who used similar arguments to appeal for sanitary reforms in Boston in the mid-19th century (Warner and Luce, 1982).

While the logic of comparing costs and benefits as a means of ascertaining value seemed unassailable, it remained unclear how analysts would actually measure the benefits of health programs. The issue lies at the heart of attempts to assess the relative worth of different health and medical interventions. If we know the value people attach to the health improvement they receive from different interventions, it could help to determine how to provide most efficiently more of the outcomes that people desire and fewer that they do not (Neumann et al., 2000).

Approaches to Valuing Public Health Programs

Cost-Benefit Analysis. A longstanding valuation approach in health care involves calculating the rate of return on investments in programs, focusing on the monetary costs and benefits, much as a financial analyst would calculate the rate of return for alternative investments in a portfolio analysis. In a cost-benefit analysis (CBA), an analyst estimates the net social benefit of a program or intervention as the incremental benefit of a program minus the incremental cost. All costs and benefits are measured in monetary units (e.g., dollars). The approach is useful because it leads to a simple decision rule: if a program's net benefits exceed its net costs then it should be adopted. However, CBA also raises measurement difficulties and ethical dilemmas in that it requires the monetary valuation of health benefits.

Early on, cost-benefit analysts tended to quantify health benefits with a "human capital" approach. That is, the value of reduced health was measured as the lost earnings of affected individuals. The advantage of the human capital approach was that it approximated value as the "productive potential" of society lost through morbidity and mortality. It also permitted a relatively straightforward calculation. The disadvantage, as critics such as (Schelling, 1968) and (Mishan, 1971) noted, is that the approach has no basis in economic theory—because it ignores underlying consumer preferences, and implies that unproductive periods such as leisure time and retirement were without value.

These observers noted that a superior approach would consider the fact that consumers make tradeoffs between health and other goods and services. People don't spend all of their money to relieve their symptoms or to reduce their risk of death; instead, they consume to the point at which the improvement justifies the costs. Therefore, health should be valued by determining how much individuals are willing to pay for it. Unlike human capital, willingness to pay measures are preference-based. The metric is monetary, which allows tradeoffs with costs and non-health consequences.

A number of researchers have attempted to measure the value of public health programs by assessing what people are willing to pay for specific health benefits. Economists typically measure value by examining the prices of goods and services bought and sold in the marketplace. But since private markets for public health program benefits do not generally exist, it is difficult and often impossible to measure the value of health by appealing to market data. Therefore, researchers have turned to other measures. Some have taken "revealed preference" approaches by imputing willingness to pay from comparable market prices or wages (e.g., the willingness to accept risk could be valued as the incremental wage paid to workers in "risky" jobs (Viscusi, 1993)). The problem is that prices and wages may not be truly comparable (i.e., unique properties of risk and benefit associated with a job may be confounded with the magnitude of the risk itself (Pauly, 1995)).

Others have used direct surveys of consumers, called willingness-to-pay or "contingent valuation" surveys because responses are contingent upon a hypothetical market for the good or service of interest. Analysts could value public health programs, for example, by asking people what they would be willing to pay for them. The advantage of the approach is that it is grounded explicitly in principles of welfare economics, and provides a means to quantify the benefits of difficult-to-estimate factors such as the intangible benefit of reassurance that comes with the presence of a local public health department. The disadvantage is that researchers have often found that the method does not produce reliable estimates (Kartman et al., 1996).

Cost-Effectiveness Analysis. In recent years, cost-effectiveness analysis has emerged as a favored analytic technique for economic evaluation in health care. A major appeal of cost-effectiveness over cost-benefit analysis is that it allows analysts to quantify health benefits in "health" rather than in monetary terms.

CEAs show the relationship between the net resources used (costs) and the net health benefits achieved (effects) for a specific intervention compared to a specific alternative strategy. CEAs involve comparisons between two alternatives, or between the presence and absence of an intervention—the cost per effect (C/E) ratio reflects the difference in the interventions' costs divided by the difference in their health effectiveness (Gold et al., 1996). If ratios are expressed in similar units, they can be compared to determine the most efficient ways to furnish health benefits.

The widely-recommended approach is to measure health outcomes in terms of "quality-adjusted" life years or QALYs in order to incorporate both the prolongation and quality of life. The advantages of QALYs are twofold: they capture in a single measure gains from both reduced morbidity and reduced mortality, and they incorporate the value or preferences people have for different outcomes (Gold et al., 1996).

QALYs represent the benefit of a health intervention as time in a series of “quality-weighted” health states, where the quality weights reflect the desirability of living in the state, typically from “perfect” health (weighted 1.0) to death (weighted 0.0). Once the quality weights are obtained for each state, they are multiplied by the time spent in the state; these products are summed to obtain the total number of quality-adjusted life years. Researchers have used a number of techniques over the years to construct the quality weights. One option is to use the standard gamble and time trade-off techniques, which have a sound theoretical basis in economic utility theory. These methods involve asking respondents to value health states by explicitly considering how much they would be willing to sacrifice to avoid being in a particular health state. Alternative elicitation techniques include rating scales, in which respondents are asked to express the strength of their preferences for particular health states by marking a point on a scale. Several research groups have developed universal or “generic” health-state classification systems, such as the Rosser Index, the Health Utilities Index (HUI), the Quality of Well-Being Scale (61), the EQ5D (31), and the Health and Limitations Index. These systems are designed to be complete and general enough to apply across many different types of conditions and treatments. They provide an indirect means of obtaining preference weights: patients are assigned a health state classification based on responses to health status questionnaires, and pre-specified preference weights obtained from other populations are then applied.

Other approaches are also possible, including “person tradeoffs,” in which community samples are asked to express the number of people obtaining one kind of health outcome that would be considered equivalent to a given number of people obtaining another outcome (Nord, 1999), healthy-years equivalents (HYEs) (Mehrez and Gafni, 1989), saved young life equivalents (SAVEs) (Nord, 1992), and disability-adjusted life years (DALYs) (Murray, 1994).

Some observers have argued that CEAs should consider values other than efficiency, such as fairness or equity (Nord, 1999; Williams, 1997) or other intangible benefits, such as the moral value of public health. Analysts could weight QALYs gained by particular subgroups to incorporate equity considerations, or they could weight changes in QALYs more heavily for members whose initial level of health is lower (Gold et al., 1996; Ubel, 2000). At the very least, qualitative descriptions of equity and fairness might be presented to decision makers. Doing so could be particularly important for GPHSs because of their broad social mission.

A. REVIEW OF THE ECONOMIC LITERATURE

Search Strategy

For our literature review, we examined multiple sources in order to cast the net broadly. Our search proceeded in three steps. We started with a broad search of the peer-reviewed literature on prevention and public health interventions using PubMed. Second, we investigated articles that had been cited in, or themselves cited four key review articles on the topic. Third, we searched for government reports in the area.

We searched English-language publications in PubMed using a variety of search terms (Table 2-1). We started with a broad search using terms such as “prevention” and “cost-effectiveness analysis” (Search #1), but found that this search strategy had low sensitivity/specificity. Subsequently, we used more targeted search terms, such as “prevention and “value measurement,” and generated a more manageable list (Searches # 2, 3, and 4). We

retrieved all abstracts of articles using Search's #2 through #4 in Table 2-1, including methodological papers, reviews of economic evaluations, and applications of economic evaluations.

Key Review Articles. Our search uncovered four relatively recent review papers on the measurement of the value of public health interventions that we used as guides for the second stage of our search (Table 2-2):

- (Brownson and Simoes, 1999). Measuring the Impact of Prevention Research on Public Health Practice. *Am J Prev Med*, 16 (3S): 72-79.
- (Messonnier et al., 1999). An Ounce of Prevention...What Are the Returns? *Am J Prev Med*, 16 (3): 248-263.
- (Carande-Kulis et al., 2000). Methods for Systematic Reviews of Economic Evaluations for the *Guide to Community Preventive Services*. *Am J Prev Med*, 18 (1S): 75-91.
- (Saha et al., 2001). The Art and Science of Incorporating Cost Effectiveness into Evidence-Based Recommendations for Clinical Preventive Services. *Am J Prev Med*, 20 (3S): 36-43.

We searched the references provided in these articles, and also searched using Google Scholar (Table 2-3) to find articles that have cited these review papers since their publication.

Government Reports. To supplement the literature search, we also searched for government reports on the websites of four agencies, AHRQ, CDC, CMS, GAO using the terms, "prevention" or "public health" (Table 2-4).

Business Literature. Using ProQuest Smart Search, we searched several business literature databases for relevant publications on valuation methodology. Search terms, such as "benefit cost-analysis" with a subcategory of "economic models" or "decision making" resulted in large numbers of studies (242 and 125 results respectively), and a review of titles and abstracts did not yield results that we deemed relevant to public health systems. Searches on other terms, such as "cost-effectiveness analysis," also did not yield useful results.

Key Findings

In sum, we identified 154 articles through our four-phase search (please see Appendix A for references), 58% applications, 24% reviews, and 18% methods papers (Table 2-5). In terms of the types of applications (Table 2-6), most valued health benefits using a willingness-to-pay approach (43%), followed by studies using "natural units" (17%), a human capital approach (12%), a "rate of return" methodology (9%), and QALYs (8%).

PubMed. Review articles varied by disease and intervention type including a review of costutility analysis in prophylaxis in haemophilia (Carcao et al., 2004), a review of cost-effectiveness in mammography screening (Hall, 1989), and a review of the cost-effectiveness of health promotion interventions. (Rush et al., 2004) Methodological studies focused on different approaches for valuation. One study examined short-term versus long-term time-trade off measurement in pertussis vaccinations. (Lee et al., 2005). One analysis discussed how to avoid bias in contingent valuation approaches for complex environmental policies (Christie, 2001).

Others (Morrison and Gyldmark, 1992) compared contingent valuation, QALYs, and Healthy Year Equivalents (HYEs) valuation methods. Johnson-Masotti et al., (2004) explored net health benefits as a metric for valuing HIV prevention.

Application articles covered a range of topics. Willingness to pay studies have focused on valuation of global health programs like mosquito netting (Onwujekwe et al., 2000) and local ivermectin distribution schemes in Nigeria (Onwujekwe et al., 1999), of prevention efforts of adverse drug events (Rodriguez-Monguio et al., 2003) and diabetes risk reduction (Johnson et al., 2006), and of environmental health in cardio-respiratory morbidity from air pollution (Stieb et al., 2002).

Rate of return approaches were used in global prevention programs ranging from a study on a preventative blindness program (Frick et al., 2005) and prophylactic anthelmintic treatments in sheep (Ankers et al., 1998) in Gambia to one on Chagas disease prevention in Argentina (Basombrio et al., 1998) to one on controlling salmonella outbreak in England. (Roberts, 1989)

Human capital approaches have been used to value perinatal screening for group B streptococci (Haberland et al., 2002) and preventive intervention for HIV (Schrappe and Lauterbach, 1998). It was also used in cost-of-illness studies for influenza (Szucs, 1999), diabetes (Dawson et al., 2002), musculoskeletal disorders (Coyte et al., 1998) in Canada, with HIV/AIDs' economic impact in India (Anand, 1999).

Several studies valued benefits in terms of cost per life years gained, including applications to screening programs (i.e., for colorectal cancer (Frazier et al., 2000) and cervical cancer (Mandelblatt and Fahs, 1988)) as well as immunization initiatives (i.e., for hepatitis B (Margolis et al., 1995) and pneumococcal pneumonia (Sisk and Riegelman, 1986)). Section 3 of this report contains a complete review of cost-utility studies.

Finally, applications valued interventions using cost-effectiveness methodology where benefits are measured in physical or natural units. This included cost-effectiveness ratios with the metrics of cost per additional vaccination in a study on influenza vaccination in the elderly (Frank et al., 1985), cost per case of prevented in a study on Chlamydia trachomatis (Haddix et al., 1995), cost per life saved in a study of neonatal screening for sickle cell disease (Tsevat et al., 1991), and cost per death averted in a study on newborn hemoglobinopathy screening within state health (Gessner et al., 1996).

Other Information. Other literature identified discussed various aspects of valuation, including the need to carefully measure prevention program costs in comparison with other health expenses (Mushlin and Fintor, 1992; Chabot et al., 2004); the difficulty of conducting cost-effectiveness analyses for prevention at the community level due to lack of cost data and hard-to-measure indirect costs (Brownson and Simoes, 1999); the importance of varying programs by sub-populations, i.e., mass versus selective screening (Kattlove et al., 1995 ; Mushlin and Fintor, 1992; van der Weijden et al., 1998); the importance of considering actual patient adherence to recommended protocols (Saha et al., 2001); and the advantages of economic modeling studies over direct studies which would require very large sample size and many years of implementation. (Pignone et al., 2005)

The two GAO reports consider measurement in prevention in government programs. The first (United States Government Accountability Office, 1992), a review and methods piece, combines 17 studies and uses cost-benefit analysis to demonstrate “cost-savings potential” to not just the federal but also the state and local level. The report outlines obstacles to data collection on social programs and necessary analytical methods including discounting and sensitivity analyses. The second (United States Government Accountability Office, 2005) summarizes challenges for the use of cost-benefit and cost-effectiveness analysis in assessing federal program performance including “unquantifiable” benefits and a lack of standardization of methods.

B. FINDINGS FROM THE TUFTS-NEMC CEA REGISTRY

Search Strategy

To further explore U.S. governmental public health system interventions that have been analyzed using the cost/QALY framework, we searched the Tufts-NEMC cost-effectiveness registry, a comprehensive database of 789 original cost-utility analyses (CUAs) published from 1976-2003. A search of the database revealed 111 studies that have focused on public health interventions.

Classifying the Public Health Interventions. For purposes of this analysis, we restricted our search to those of the 111 studies that pertained to the U.S. We further categorized these studies as being either population-level community programs or individual-level clinical preventive services. For example, a community-level public health program to prevent heart disease might provide community training in cholesterol monitoring while another might mandate that food vendors improve the nutritional value of their products. In contrast, an individual-level clinical preventive intervention at a clinic might screen individuals for personal risk factors and educate him/her on the risk of heart disease (Gold et al., 1996).

To distinguish community-level interventions in the public health CUAs, we searched for PubMed abstracts using selected key terms, including “campaign”, “CDC”, “communities”, “general population”, “immunization rates”, “intervention”, “population-based”, “population group”, “program”, “public health”, “regulation”, “restrictions”, “systems”, and “universal standards.”

Key Findings

Our final sample includes 48 U.S.-based CUAs on community-level public health interventions (please see Appendix B for references). The majority of these were published in the 2000s (79%), focused on primary prevention (67%), and government sponsored (52%). (Table 3-1) Also in this table are the classifications of these studies by intervention type: screening program; immunization, regulatory/education policy, care delivery, health behavior, injury prevention, blood testing, surveillance program; and “other.” Table 3-2 describes each of these interventions in more detail along with author and year of the publication.

The selected studies contains a broad range of interventions. For example, they include 11 population-level screening programs, which cover a variety of conditions, ranging from different forms of cancer to diabetes to human papillomavirus (HPV).

As the tables illustrate, CUAs have addressed a number of immunization strategies, including population-based immunization for conditions such as Hepatitis A/B, HPV, pneumonia and measles. In several cases, studies have focused on subgroups defined by age or ethnicity. Analyses addressing immunization programs have covered national-level initiatives such as a *Haemophilus influenzae* type b universal vaccination program, as well as state and local initiatives such as a hepatitis A/B vaccination at public sexually transmitted disease (STD) clinics or supplementary pre-school measles vaccination.

Table 3-2 also includes cost-utility analyses of several regulatory or educational policy interventions, such as an FDA regulation for folic acid supplementation to enriched grain products and a national policy for tobacco education. Other studies have assessed a policy of shifting nicotine replacement drugs to over-the-counter status and regulating cell phone use in cars. One CUA examined environmental policy, analyzing a public transport agency effort to alter bus propulsion technology. A handful of CUAs assess health behavior interventions, including community-based HIV prevention programs focusing on education, counseling, cognitive-behavioral treatment, and condom distribution. Further, four studies in our sample analyzed the cost-effectiveness of public health programs for injury prevention. One investigated air bags in motor vehicles by seating position, while another two investigated transport and public safety interventions within the Native American community. Still another analyzed the cost-effectiveness of hip protectors for preventing falls in the elderly. Finally, other CUAs addressed interventions, such as surveillance systems (e.g., for latent tuberculosis amongst immigrants and for cancer risk in patients with Barrett's esophagus), automatic external defibrillators (including a local-level police initiative to train laypersons in its use), national guidelines for HIV post-exposure prophylaxis, and a State AIDS Drug Assistance Programs.

Table 3-3 displays the cost-utility ratios for each of these studies by intervention type. Of the 125 ratios, 63% are cost-saving (and QALY increasing) or less than \$50,000/QALY, and 80% are less than \$100,000/QALY (the benchmarks of \$50,000/QALY or \$100,000/QALY are often taken as rough measures of what society considers "reasonable" value for money). Cost-saving interventions include: one-time colonoscopic screening at older ages for men or for women compared to no screening, college-based vaccination against hepatitis A/B versus no vaccination or less inclusive vaccination, and statewide condom social marketing programs as opposed to no condom social marketing program in African-American men and/or women. Researchers found that several Native American tribal-system injury prevention programs were cost saving compared to no intervention. Certain kinds of blood-testing for donation or for transfusion had the potential to be highly cost-ineffective compared to alternative testing strategies (more than a million dollars per QALY).

Discussion

Investigators have used cost-utility methodology to examine a range of public health programs and services. The methodology provides a useful technique for valuing outcomes in consistent fashion and in a manner that reflects preferences for states of health. The body of literature identified here demonstrates the potential for the methodology to be applied to government public health systems. Public health officials could use cost per QALY measurements to help guide priority setting.

As noted in our literature review, while cost-utility analysis offers advantages it also has important limitations. Methods vary across analyses, for example. Moreover, the framework may not capture certain important components of value, such as the desire to help the most vulnerable citizens, and other distributional considerations apart from efficiency considerations.

The body of CUAs published on public health to date illustrates some of these limitations. While the CUAs have covered a broad range of programs or services, however, they have generally not addressed the value of public health systems or infrastructure, per se. Rather, they have focused on specific public health services, such as screening or surveillance programs. In a handful of cases, CUAs have focused on a system-wide level. For example, CUAs have addressed national programs for tobacco education, influenza vaccination, and grain fortification. Other CUAs have addressed state-level programs, including an AIDs Drug Assistance Programs, vaccination at public STD clinics, and propulsion technology alternatives within a public transport agency.

An additional challenge in the existing literature is that investigators have often not clarified the perspective or audience for their analysis. It is not entirely clear who the ultimate decision maker should be, which makes the analyses difficult to interpret or use for public health decision makers. Presumably, many of the public health interventions included here would be initiated by government agencies. In the fragmented and largely private U.S. health care system, however, private as well as public providers would likely play a major role in implementation. In many analyses, authors did not specify who the decision maker would be. Researchers also did not typically specify what kinds of implementation costs or institutional hurdles might have to be overcome. It is also not at all clear to what extent public health departments or other agencies have actually used the information from CUAs.

In sum, the CUA literature to date shows the potential of the methodology to help public health officials who wish to value their investments but also illustrates its limitations. Public health officials might best view the methodology as offering a guide to be used alongside other methodologies discussed in this report.

C. ALTERNATIVE VALUATION METHODOLOGIES

Alternative Approaches

In this final section, we turn to other approaches to valuing public health programs. Public officials as well as budget analysts and scholars who study the efficiency of government programs have emphasized outcomes-focused performance measurement and government accountability for public programs in recent years (Kelman, 2000; Kelman, 2001; Kelman, 2006a; Kelman, 2006b). The movement has influenced public health policy as well.

We examine several initiatives that have been pursued at the federal, state, and local levels for valuing public health services and programs. These approaches depart from traditional economic methods for valuing public health with cost-effectiveness or cost-benefit analyses. Instead, they represent a growing movement to consider in explicit ways the impact of public health programs through management techniques and accountability efforts. The initiatives listed here emerged in our review of the literature on the topic and through interviews with selected experts. They are provided as illustrative examples to convey the kinds of efforts

underway in the U.S. They also reveal the limitations of the approaches in that they generally lack efforts to evaluate formally and quantitatively the impact of the programs.

Federal Initiatives

Healthy People 2010. The Healthy People initiative represents a public health accountability effort (Tilson and Berkowitz, 2006). In its latest incarnation, Healthy People 2010 consists of 476 objectives within 28 “focus” areas, including public health infrastructure. “Targets” for each objective were derived either through maintenance of a year 2000 target, statistical analysis using current data, or expert judgment. One of the stated goals of the 2010 initiative is to “increase quality and years of healthy life,” as approximated by quality-adjusted life years gained in the denominator of a cost-utility ratio (Pennsylvania Department of Health, 2006; National Center for Health Statistics, 2007).

The National Center for Health Statistics tracks the achievement of targets using data from numerous sources (National Center for Health Statistics, 2007). Additionally, Healthy People indicators offer a “menu” from which state and local public health systems can develop their own objectives for performance measurement. They can customize their priorities while maintaining a certain level of comparability by drawing from the same core set of measures as the nation and other communities (U.S. Department of Health and Human Services, 2001). Such use was seen with the Healthy People 2000 initiative where 44 States and 70% of local health departments utilized the national objectives to formulate their own (U.S. Department of Health and Human Services, 1997).

One of the initiative’s goals, motivated by a desire to “increase accountability for dollars invested,” is to increase the proportion of state and local public health agencies that meet national performance standards for essential public health services. Another goal calls for accurate data collection on public health expenditures at agencies from all levels of government “to allocate resources appropriately and to ensure efficient performance”

The Guide to Community Preventive Services. A more pre-emptive attempt to bolster the accountability of population-based and public health programs is led by the Guide to Community Preventive Services under the umbrella of the CDC (Task Force on Community Preventive Services, 2006). This effort involves systematic reviews of the research evidence base and recommendations on those population-level interventions and policies that merit support. Those initiatives considered to be notably effective are then further assessed for their cost-effectiveness. Economic evaluations – including cost analysis, cost-benefit analysis, cost-utility analysis and cost-effectiveness analysis – are studied to identify vaccines, tobacco use prevention, and motor vehicle injury prevention worthy of sponsorship. Where possible and to improve comparability, the Community Guide adjusts the different metrics and methods of these varied analyses into quality-adjusted life years using the recommended Panel on Cost-Effectiveness in Health and Medicine protocol (Carande-Kulis et al., 2000).

Federal Accountability: The Program Assessment Rating Tool (PART). The Government Performance and Results Act of 1993 (GPRA) outlines an ambitious blueprint for outcomes-oriented performance measurement for federal governmental programs. The legislation was reinforced and extended by the Office of Management and Budget’s Program Assessment Rating Tool (PART), a diagnostic tool designed to evaluate formally Federal

program effectiveness and spur results-oriented plans for program improvement (Executive Session on Public Sector Performance Management, 2001; U.S. Office of Management and Budget, 2006b). The PART's 25 questions cover annual and long-term performance goals for programs in an attempt to integrate performance measures with targets.

PART focuses on "outcomes" performance goals to reflect the ultimate aim or intended results of a program, i.e., the number of measles cases avoided. In contrast, output performance goals reflect process activities (i.e., products and services provided) that delineate how an outcome was reached such as the number of measles vaccinations provided (U.S. Office of Management and Budget, 2003; U.S. Office of Management and Budget, 2006a). Programs are still encouraged to measures of inputs and outputs remain key ingredients for cost-effectiveness analysts, and to determine the best return on specific investments (Executive Session on Public Sector Performance Management, 2001).

PART demonstrates a commitment to the measurement of efficiency. A 2005 OMB Guidance (U.S. Office of Management and Budget, 2006a) sent to all OMB Resource Management Offices and agency equivalents asserts that all PART programs, to maintain "green" status, must maintain at least one efficiency measure by which improvements are made annually. Programs are expected to report on quantified savings including: reduced per unit cost (outcome or output), administrative cost savings, time savings (translated into dollar savings), and cost avoidance. An explanation must also be provided as to how annual savings were achieved and how they were spent.

Measurement may also include the use of an "input productivity" measure that reflects a benefit to cost ratio of an outcome or output to an input. Applications to public health programs appear to be uncommon but can be seen in the evaluation of a DHHS program that funds health centers for underserved individuals in rural and urban areas. The input productivity ratio provided tracks the "cost per individual served at health centers" (Centers for Disease Control and Prevention, 2007a).

State and Local Initiatives

Public Health Performance Standards. In the late 1990s, CDC collaborated with several national public health organizations to create model standards and measurement tools for state and local public health systems and governing bodies (Centers for Disease Control and Prevention, 2007a; Public Health Foundation, 2006). The resulting National Public Health Performance Standards Program emphasizes a community's public health system holistically rather than the singular performance of each local agency. The process calls for public health officials to grade their system on dozens of objective nationally-based indicators that measure progress toward ten public health areas (Tilson and Berkowitz, 2006).

Separate assessments target the "local public health governance," the "local public health system," and the "state public health system." In a few places the assessments mention the need to measure value explicitly. For example, one standard involves assessing the internal capacity of a local governing body or state public health system to conduct economic analyses (Centers for Disease Control and Prevention, 2007b; Centers for Disease Control and Prevention, 2007c). In addition, the state assessment targets whether the governing body has an evaluation plan for personal and population-based care that "includes an evaluation of the cost-effectiveness of

service delivery?” The respondent answers either “yes” (> 75% of this condition is met), “high partially” (>50% but < 75% of this condition is met), “low partially” (> 25% but < 50% of this condition is met), or “no” (< 25% of this condition is met).

Accreditation. The accountability movement has also led to efforts to accredit public health entities. Again, while not a conventional approach for measuring value, the efforts represent a step towards value consideration in that they attempt to differentiate higher quality providers using formal metrics. The roots of this effort originate in activities of national public health organizations including the Assessment Protocol for Excellence in Public Health (APEXPH) of 1991, the Mobilizing for Action through Planning and Partnerships (MAPP) of 2001, and the NPHPSP of 2002 (as discussed above). The instruments developed in these initiatives have served as the building blocks for accrediting processes that exist in eight states (Michigan, Washington, Missouri, North Carolina, Illinois, New Jersey, Ohio, and Florida) (Thielen, 2004).

Under IOM urging and RWJF and CDC funding, an effort involving ASTHO, NACCHO, and other partners has sought to build upon this existing foundation with a recommended framework for national voluntary accreditation of state, territorial, tribal and local public health departments (as opposed to systems as addressed in the NPHPSP) in an effort to recognize success, “drive continuous quality improvement”, and create a mechanism to assist in fortifying the public health infrastructure (Salinsky and Gursky, 2006; Tilson and Berkowitz, 2006; National Association of County and City Health Officials, 2007). These Planning Committee organizations released a final report with recommendations is in late 2006.

These groups propose the creation of a non-profit organization that would oversee the accreditation movement including the development of accreditation standards, the administration of the accreditation process, and the assessment of those applicants that meet accreditation criteria. The formulation of standards and measures should be based on existing efforts at establishing performance standards such as by NACCHO, ASTHO, NPHPSP, and some state and local health departments. They should cover 11 domains including a department’s record in assessing and improving program quality, putting research evidence to use, and managing resources. The purported long-term outcomes desired include quality of life and decreased costs though these are not associated within a cost-effectiveness equation (Exploring Accreditation, 2006).

Performance-Based Budgeting. Performance-based budgeting represents another approach towards value consideration in that it links program funding to program accomplishment. Hepburn et al., (2007), in a Georgia-based case study, examined a framework for state budgeting and financial reporting that connects funding to clearly defined public health budget categories. They emphasize the importance of a structure that portrays local spending activities programmatically rather than by function or line item as an aid to performance measurement.

Wisconsin’s County Health Rankings. The *Wisconsin Country Health Rankings* initiative is a four-year project from the Population Health Institute of the University of Wisconsin and funded by the Wisconsin Partnership Fund for a Healthy Future. The aims of the effort are to: 1) monitor and measure the state’s population health in comparison to that of other

states; and 2) create an evidence-based strategy to sustain the ranking of Wisconsin as the healthiest U.S. state in an efficient manner (University of Wisconsin, 2006).

In November 2006, the University of Wisconsin published a supplement to its *2006 Wisconsin County Health Rankings* that describes in-depth the health determinants and the health outcomes used to derive population health assessments for each county in the State (Vila et al., 2006). The health determinants include measures of health care (i.e., access to care), of health behaviors (i.e., physical inactivity), of socioeconomic factors (high school non-completion), and of physical environment (i.e., housing with increased lead risk). In a handful of cases, the report ranks the quality of government-funded care such as the percentage of Medicare recipients who received poor diabetic care or no biennial mammography in that year.

The initiative quantifies health outcome measures in two ways: by number of years lived (with a unit of YPLL = years of potential life lost before 75 years) and by health-related quality of life (using the national Behavioral Risk Factor Surveillance System survey or Wisconsin's Family Health Survey). The rankings do not, however, examine government program performance on measures of value. There is no explicit measurement of the costs or cost-effectiveness of specific program interventions, for example.

Local Government Initiatives. Several cities have advanced their own accountability efforts led by their executive officers, though metrics of progress are limited. Mayor Bloomberg of New York City, for example, initiated his "Campaign Accountability Report" in 2003 to document his administration's success achieving the 381 proposals upon which he campaigned (Bloomberg, 2004). Public health activities of the Department of Health and Mental Hygiene were monitored such as initiatives in tuberculosis detection and treatment, anti-smoking campaigns, nutrition education efforts, integration of preventive medicine services with prevention efforts in the larger community, and maintenance of data on city health profiles. The report is limited to a narrative summary describing achievements towards each objective and a demarcation of "done", "not done", or "launched" indicated the status of each objective's advancement. This report had an additional edition in 2004.

In the late 1990s, the NYPD created CompStat, an accountability tool that has had spin-off attempts in other cities. Mayor O'Malley of Baltimore City used this model for his Citistat, an instrument to monitor progress in city agencies ranging from public works to health (Baltimore Citistat, 2007). A commitment to value can be identified with its aim to assure citizens that "their tax dollars are well-spent" (Do Wire Wiki, 2007).

Mayor Adrian Fenty of Washington D.C. campaigned in 2006 on a "Capital Accountability Program" platform derived from CompStat, promising to use similar management techniques of "aggressive Executive oversight and "relentless follow-up and assessment" to "root out waste and discover efficiencies, saving taxpayers millions of dollars" in the pursuit of value. He promoted the extension of this tool to the operations of the city's Department of Health (Fenty, 2006).

Quasi-Market Models and Other Approaches

Policy makers have also experimented with other approaches to valuing governmental public health programs. Chapin and Fetter (2002), for example, describe an initiative of

performance-based contracting for public health funding between the state and local governments in Wisconsin. The system relies on a “quasi-market” process where traditional cost-based reimbursement by the state for local public health programs is replaced by negotiations between the state (the “buyer”) and the locality (the “seller”) for the price of the public health outputs based on outcomes.

The idea is to reward performance—and penalize failure—through financial incentives tied to outcomes. Value, set by the buyer, is established through a negotiation process. Regional and central staff of the State Department of Public Health—cognizant of the local program’s aims and potential value, and aware of competing demands on state resources—must come to agreement on an acceptable price with which to bargain with local authorities. This proffered price “approximates” the State department’s opportunity price for funding this program over others, in essence representing its value.

D. DISCUSSION

Growing Attempts by Researchers to Value Public Health Programs with Cost Benefit and Cost-Effectiveness Analysis

This part of the literature review yields several key findings. Our review underscores attempts on the part of researchers and analysts to be more explicit about the value of investments in public health. The peer-reviewed literature contains numerous studies using varied conceptual approaches, including formal cost-benefit and cost-effectiveness methodologies. It also reveals applications to diverse areas of public health.

Lack of Standards and Gaps in the Research. There remain variations in quality and notable gaps in the methods used for valuation. In the research literature, studies differ considerably in terms of their valuation methodologies. In addition, the literature contains few cost-effectiveness analyses applied to public health programs, as opposed to the abundant cost-effectiveness research applied to clinical services, pharmaceuticals and surgical procedures. Despite the attempts at valuation, there remain some notable variations in the quality of published research and gaps in existing efforts. Studies differ considerably in terms of their methodology for valuation, as well as in their time horizon and overall scope of the costs and benefits considered (Rush et al., 2004).

As others have noted, we found that researchers have used different methods for valuing the costs of programs, for example (Mushlin and Fintor, 1992; Chabot et al., 2004), and have sometimes used terms, such as cost-savings vs. cost-effective loosely or interchangeably (Elixhauser, 1991; Chabot et al., 2004). They have also differed in their approaches to measuring the value of programs at the community level due to lack of cost data and hard-to-measure indirect costs (Brownson, 1999). Studies vary considerably in terms of the extent they focus on key sub-populations, i.e., mass vs. selective screening (Kattlove, 1995; Mushlin and Fintor, 1992; van der Weijden et al., 1998). There are also inconsistencies in the manner in which they include patient adherence (Saha et al., 2001).

Some other research has pointed to gaps in cost-effectiveness analyses related to public health programs as opposed to clinical services (Neumann et al., 2005). Neumann et al. (2005), for example, found that cost-utility analyses, in which health impacts are valued in terms of

quality-adjusted life years (QALYs) gained, have largely overlooked Healthy People 2010 priority areas such as physical activity, environmental exposures, or tobacco use. In general, the cost-effectiveness field has paid a great deal of attention to pharmaceuticals and surgical procedures, and relatively little attention to public health strategies. Arguably, medical services receive much more funding than public health activities because their value is more comprehensively understood and measured.

Dearth of Studies Taking the Perspective of the State or Local Health Department Official

While cost-effectiveness analyses have covered a broad range of public health programs or services, they have generally not addressed the value of public health systems or infrastructure, per se. Rather, they have focused on specific public health services, such as screening or surveillance programs. In many analyses, authors did not specify who the decision maker would be. Nor did researchers typically specify what kinds of implementation costs or institutional hurdles might have to be overcome. It is also not at all clear to what extent public health departments or other agencies have actually used the information from existing cost-effectiveness analyses.

Some Increase in Government Efforts to Implement Performance-Based and Outcomes Based Management. The review of governmental attempts to value investments in public health programs also reveals some initiative and innovation. Public officials have used outcomes-focused performance management and government accountability efforts with an emphasis on objectives and targets and formal evaluation.

Lack of Rigor and Standards for Government Efforts to Measure Value. The review of government accountability and measurement programs also reveals limits in existing efforts. There is a need for better metrics, for example, and a need for a repository of experiences in valuation efforts. It is difficult to compare across government programs and initiatives because of varied outputs or outcomes. There is a need for more sophistication and technical accuracy.

Opportunities for Future Research

Our study highlights several opportunities for future research. Researchers and policy analysts should focus efforts on more consistent and rigorous methods for valuing public health programs. Studies should be more transparent about their methodology, and researchers should monitor the field and measure progress. They should also focus broadly on the systemic impact of programs rather than on the impact of specific services. For their part, public officials would be well served by adopting formal evaluation components in programs and publishing results for the benefit of the entire public health community.

It also underscores opportunities for future research. In the future, researchers and policy analysts should focus efforts on more consistent and rigorous methods for valuing public health programs, and focus broadly on the impact of programs rather than on specific services.

III. LITERATURE REVIEW OF OTHER SECTORS

Introduction

One might argue that there is inherent value in maintaining governmental public health services (GPHSs) to protect the population against the spread of disease. But the reality of severe budgetary constraints and chronic underfunding of public health suggests that the public is unaware of public health's value. It is thus essential that GPHSs demonstrate measurable contributions to the population's health and allocate resources to those activities likely to achieve maximum value for improving the public's health. This is especially true at a time when public health systems are expected to incorporate multiple mandates (both funded and unfunded), such as bioterrorism preparedness. Choices need to be made regarding which services to preserve, which to shift to the private sector, and which need the most resources.

Defining and measuring value is closely linked to deciding what functions GPHSs should meet and how the system should be organized to meet them. Having a better understanding of the value public health services provide will facilitate that determination. Yet one of the glaring gaps in the literature is how to measure the value of public health programs. What is lacking is how to measure whether the returns generated by GPHSs are worth the money invested, particularly for the population-based services that are generally invisible to the public. By contrast, there is abundant research about the value of clinical services (especially acute care). Arguably, medical services receive much more funding than public health activities because their value is more comprehensively understood and measured.

Public health is not the only social policy realm facing the challenge of communicating its value to a skeptical public. The nation's education system, for instance, is under similar scrutiny. In this section of our report, we examine the literature from three separate fields to determine how value is defined and measured in those areas and whether lessons can be extrapolated to public health. The three areas chosen are port authorities, public education, and welfare. As combined public-private entities, port authorities offer intriguing analogues to the increasing public-private partnerships that characterize public health practice. As public programs, education and welfare struggle to articulate the value of public investment.

Literature Search Strategy

For the literature review of other sectors, we used electronic sources available from the University of Michigan library website. In 2006, we conducted 24 individual searches, using the parameters below:

Source	Search Terms
InfoTrac	"public health AND value"
Proquest	"public health value"
Proquest	"value public services"
HighWire	"value public services"
HighWire	"valuing public health services"
Education Abstracts	"valuing education"
PAIS International	"port authority"

Blackwell	“valuing public services OR programs”
ABI Inform	“evaluating public programs”
IngentaConnect	“ports value”
Health Reference Center Academic	“public AND service AND value”
InfoTrac	“public service value”
InfoTrac	“public services and value”
NLM	“public health and value”
Ingenta Connect	“valuing public services”
Ingenta Connect	“value-chain”
Proquest	“value added (AND education)”
InfoTrac	“value added (AND education)”
InfoTrac	“prevention AND health AND value”
InfoTrac	“preventive service AND value”
InfoTrac	“health prevention AND value”
InfoTrac	“health promotion AND value”

Of the articles that were returned from these searches, roughly 70+ were further reviewed to determine relevance to the research project. In 2007, we updated the literature search by re-examining the literature in the following sectors:

Port Authorities. We searched databases ArticleFirst and ProQuest and GoogleScholar for:

“port authorities” and “value”
“port authorities” and “measuring” and “value”
“ports” and “value”

For the port authority literature, we also considered industry reports and white papers.

Education. We searched databases ArticleFirst and ProQuest for:

“education” and “measuring” and “value”
“measuring value” and “public education”

Welfare. We searched databases ArticleFirst and ProQuest for:

“welfare” and “measuring” and “value”
“public assistance” and “value”

This search returned approximately 150 articles, of which 70 were relevant to the topic. We also conducted a cursory search of the banking literature, returning approximately 5 relevant articles.

Literature Defining and Measuring the Value of Public Health.

The literature on measuring the value of public health is thin. Rohrer (2004, p. 24), puts the matter bluntly: “...we should not be surprised that legislators question the value of public health, since even [local health department] directors doubt that they are influencing population

health very much.” To be sure, a robust literature has emerged on public health performance standards, but this literature focuses largely on the process of meeting CDC’s ten essential public health services as opposed to characterizing the broader value-added features of public health services and systems (see, e.g., Mays et al., 2004; Mays et al., 2006). In fairness, this literature argues that these measures may be “useful in identifying productive pathways for improving performance” (Mays et al., 2004, p. 201)

An exception is an attempt to use a performance-based budgeting process to link program expenditures to population health needs and the community impact of core public health functions (Hepburn et al., 2007). The authors tested a framework that facilitates the identification and analysis of expenditure trends over time. According to the authors, implementing this type of framework will help local health departments (LHDs) plan for future investments. While very useful for understanding the budgeting process, the framework does not provide insight into how to measure the value of the investments or assess which programs should receive funding priority.

An interesting example of one way to measure value is a Wisconsin experiment to have state and local public health departments negotiate contracts for the state to buy products and services from LHDs (Chapin and Fetter, 2002). Although the goal in the Wisconsin experiment is to use contractual negotiation to set the value of services, researchers have not reported on how the participants defined and measured value. As a home-rule state, LHDs in Wisconsin have considerable flexibility to design and operate their public health efforts as they deem appropriate, but the state contributes financial resources. For those resources, the state and LHDs negotiate (through an independent arbiter) exactly what the LHD will provide for the state’s investment. In this way, an LHD sets priorities for how the state’s money will be spent and what outcomes will result. If the LHD can provide the expected results on less money, it keeps the difference. If the LHD does not meet its expected performance targets, it must reimburse the state for a portion of the money. As we report below in the section detailing our interview results, implementing the Wisconsin approach has been difficult.

In contrast to a performance-based approach, Thacker et al. (2006) set forth the characteristics that should be incorporated into a framework measuring the value of public health services. After exploring the difficulty in relying on available morbidity and mortality statistics and measures, the authors conclude that no one summary number of the disease burden would accurately capture the population’s overall health status or the contribution of public health services to reducing that burden. Instead, the authors offer four characteristics for measuring the usefulness of public health services in improving population health. The first is to “detect either an absolute or a relative change in health status over time.”¹ Second, the measure must be valid (i.e, it must measure what it professes to measure). Third, a population health measure must reflect changes in public policy. Fourth, the measure must be “reliable, stable over time, and equivalent across settings.”² Aside from suggesting that the selected measure should reflect CDC’s broad goals for meeting population health needs, the authors do not specify the appropriate measure or suggest an alternate framework. In this context, Carande-Kulis, Getzen, and Thacker (2007) suggest a research agenda for public health economics that would address positive externalities of public health services and the impact on the population’s health.

Beyond this literature, there is no available work on comparing the value across various aspects of public health activities. To date, there is no agreement on what the appropriate

methodology is, how to incorporate both monetary and non-monetary objectives, and what criteria should be used. By contrast, it is much easier to estimate value of private goods and services than to assess the value added of public goods and services. The public sector has other goals besides efficiency that a private sector organization may not have, including capacity, responsiveness to the entire population, and trust (Kettl, 1993).

A. PORT AUTHORITIES

Defining Value

When seeking best practices in defining and measuring value, port authorities are useful organizational structures for public health to examine. As public entities, both face similar challenges and share an organizational structure that balances public and private sector components (partnerships for LHDs).

Despite independent governance, ports do not act as wholly autonomous units. Even as far back as 1912, public port officials recognized their interconnectivity and founded the American Association of Port Authorities³ to communicate and share knowledge. In fact, as shipping customers make choices about how to transmit their cargo, it becomes clear that ports are not only intimately tied to one another, but to their neighboring mainland distributors like railroads and trucking companies as well.

Poirier (1999) calls these webs or lines of interconnectivity value-chain constellations. These constellations (essentially a regional or territorial strategy) are organized networks of firms that share resources to obtain the benefits from pursuing targeted markets and customers. To take advantage of the networks, firms must shift their focus to consumers and use the value created through the network to secure loyalty from profitable customers (Poirier, 1999; see also, Robinson, 2002). Applying this concept to public health is problematic in two senses—the vagueness of how to measure the added value, and the resource constraints inherent in adding additional consumers. Even so, value-chain constellations suggest a way of thinking about networks and partners that can facilitate the delivery of public health services.

The literature on ports and port authorities defines value in two additional ways. As independent entities, ports contribute value, mainly conceptualized as economic in nature, based on geographic location, having adequate capacity, and handling cargo efficiently in terms of cost and service-time. The second aspect is what a port offers in the context of other ports and service providers to which it connects consumers. Here, geographic location, especially in relation to competing ports, relationships with inland partners, and ties to distant ports are key components in defining value.

Ports contribute value to their chains through intangibles, such as their effect on the environment, the local labor market, and the economy. DeLanger and Visser (2004) argue that although most ports use throughput (i.e., a capacity measure) as a performance indicator, the value added generated in a port region should capture indirect and spillover effects as well. Focusing on throughput has overemphasized factors such as depth, location, and terminal handling charges. That focus has underestimated indirect factors, such as the presence of knowledge, quality of the hinterland access, and the quality of the labor pool, which in turn support the port as an overall cluster of economic activity. In this way, port authorities can be

thought of as “collective action regimes.” This requires organizational infrastructure in which leading firms are the innovators, but communicate and share resources with smaller (public and private) firms through these networks.

Measuring Value

When it comes to measuring the interconnectivity aspect of value, Robinson (2002) contends that multiple value-chains run through any given port, connecting it to various other ports and inland routes. Shippers will measure and calculate the value-added by transporting their goods along any chain that connects location A to location B. In this way, Robinson asserts, “chains compete, not individual ports,” and hence value must be defined and measured in chains and not in stand-alone ports.⁴ Individual consumers, who will calculate the cost of their route using alternative chains and choose the highest-value option, then measure the value of the chain. In fact, Yap (2004) contends that some container ports have recognized that they can increase their individual value more effectively by focusing on activities that add value to the chains in which they function, rather than simply trying to attract cargo and shipping tonnage themselves.

In attempting to define the overall value of a port, therefore, its performance on measures of efficiency or geographic location alone is insufficient. Knowing that ports fit into a larger network of supply chains that include the inland community, it becomes clear that achievement depends on a port’s ability to maximize the benefits of its position within the system. According to Notteboom and Rodrigue (2005), capitalizing on the availability of information channels and knowledge transfer between the ports increases their potential for success. Conceptually, the value of a port is intimately tied to its inland partners, as customers will calculate their total costs to transport goods, and much of the cost burden occurs inland. The codependent relationship between ports and the inland distributors linked to them creates a dynamic in which the benefits of investments in the port are likely to “leak” to inland players as well. For example, when measuring the value of dredging a channel for a given port, the benefits that will accrue to inland commerce from increased inflow of business should be considered. The negative externalities that the increased traffic to the ports would cause, such as increased pollution, should also be measured.

When it comes to measuring the value of individual ports, Bassan’s (2007) methodology is among the most sophisticated. Port authority value measurement tends to be primarily based on economic calculations. To evaluate seaport operation to optimize future port investment and capacity growth, Bassan uses a range of variables that connect cost to performance (i.e., balancing cost and efficiency). Bassan uses specific input and output values to determine the optimal level of service for a given port. The inputs include: number of berths; cargo-handling rate per berth; annual cargo quantity; probability distributions for potential port activities; costs of potential improvements; port operation costs; and institutional related costs (i.e., labor and security). For output values, Bassan includes: average vessel waiting and service time; berth occupancy; optimum capacity; congestion percentage; vessel waiting to service time ratio; and actual annual cargo per capacity. Other intangible variables, including environmental and institutional considerations such as “labour, property values, [and] customs’ regulation,” are considered in a further step that refines the basic measures.⁵ In the end, the level of service output can be compared against the current capacities to establish priorities and value for future investment.

While the majority of value measurement within the port industry is economic, some efforts have been made to go beyond these limits. One example is the Value Management Program at the Port Authority of New York and New Jersey. This program involves a three-step process to consider the value of any project before the port authority undertakes it. The program is “not just about saving money,” but about “getting the best possible project” and “the right timing.”⁶ The process includes a planning phase to examine the objectives of the project and whether it is necessary, a comprehensive review by an outside value planning team, and a third management review step during and after construction to gather information that can be applied to future projects. During the review phase, the port used over three hundred outside experts. The port concluded that the outside review contributes significantly to the process.

Harvey (1995) emphasizes that the goal of the Value Management Program is significantly more than cost savings. The program allows the port to focus on the project choice that “offers the most value, anticipates and controls the risks, and best supports our public service mission.”⁷ Unfortunately, the article does not specify any criteria for determining value or how Harvey defines it, other than a broad statement to consider more than the economic worth of a project. The alternative analyses that are built into the Value Management program allow for consideration of the noneconomic intangibles. Harvey explains that the objective of the overall process is to balance the “technical, ethical, aesthetic, and cost factors,” keeping in mind “capital costs, life-cycle costs, and long-term ecological considerations.”⁸

Analysis

Borrowing the port authorities’ concept of the value chain constellation, public health can envision its functional units situated among a series of interconnected nodes working within a system that includes other public and private stakeholders. In the broader public health system, as with the interconnectedness of the chains in port authorities, people receive public health services from a variety of sources along the chain in which local public health departments (LHDs) also play a role. The medical system certainly occupies much of the chain along with mental health professionals, insurers, and various other private and public institutions. As with port authorities, LHDs should consider their role within this broader chain constellation and which programmatic aspects add value or could be redesigned to improve the value added. The port authority literature also suggests the need and the struggle to measure the intangible attributes of their services as well as the more tangible goods and services.

Even if one envisions the whole public health infrastructure as making up its own exclusive interconnected constellation, there still seems to be some need to independently evaluate the “nodes” or units to determine which investments will most effectively increase the overall value of the system. Here is where borrowing from Bassan (2007) might be useful—to develop a methodology that incorporates quantitative and qualitative performance variables to develop an optimum level of service for each node within the value-chain. In particular, Bassan’s emphasis on identifying specific input and output variables is a useful strategy for public health practitioners to adopt. In this way, public resources could be allocated to the units most in need and capable of handling them efficiently. Then, if LHDs were to institute a Value Management Program such as Harvey (1995) describes, they would be able to identify the highest-value programs.

An important aspect of measuring value in the port authority literature is the need to build capacity. What both fields share is the importance of capacity for responding to rare but high volume events (i.e., pandemic flu).

B. EDUCATION

Defining and Measuring Value

In the field of education, value is typically defined as student achievement or progress, particularly in light of resources spent. The question of how best to increase value in education—how to improve student achievement with expenditures also in mind—has long been of national concern. One common methodology used to measure value is the “education production function,” which conceptualizes the relationship between school inputs and student achievement outcomes like a factory, and “views schools as producing achievement.”⁹

When it comes to value in education, the connection between the input of spending and the output of student achievement is tenuous at best. Hanushek (1996) argues that three decades of research make it clear that aggregate increases in education spending do not result in enhanced student achievement. These poor outcomes come despite the fact that what has been funded are what have been popularly agreed upon to be the appropriate inputs into education. These inputs include the drop in pupil-teacher ratios from 26:1 in 1960 to 17:1 in 1990; lengthened teacher education from 23 percent in 1960 compared to 53 percent holding a masters degree in 1990; and more teacher experience, with the median length 11 years in 1960 and 15 years in 1990.¹⁰ Standardized test scores have not shown that these structural measures for providing a sound education have had much of an effect on student achievement. Hence, Hanushek argues that “spending per pupil is not a good index of school quality.”¹¹ His analysis critiques the disconnect between policymakers and the public defining value in education based on student achievement and progress, but measuring value through both test scores and, importantly, resources spent. When high spending per pupil becomes the indicator of high-quality education, accountability is lost.

One of the measurement challenges associated with education is that teachers and schools are valued as effective or not based on the test scores of an ever-changing population of students, leaving the measurement open for selection bias if the students are not representative of successive groups the school serves. Combining multiple measures of school effectiveness when assessing value is one approach to combat this bias. Chester (2005) provides a matrix of measures that can be combined and used in tandem to minimize bias. In particular, applying measures of “different constructs, different measures of the same construct, and multiple opportunities to demonstrate performance” are all useful techniques.¹² To be used simultaneously with those techniques are four measurement methods that he recommends:

Compensatory approaches permit stronger results on some measures to compensate for weaker results on other measures. *Complementary* methods are employed where standards are set on each of the multiple measures and attainment of the standard on one of the measures suffices. *Conjunctive* approaches require the attainment of performance standards on each of multiple measures. *Confirmatory* methods employ information from one measure to validate or compare information from another measure.¹³

For example, these techniques have been put to use in Ohio to measure adequate yearly progress (AYP), a requirement of the *No Child Left Behind Act*. Combining a conjunctive approach with using measures of different constructs, students must “meet proficiency targets in reading and math, participation targets in reading and math, [and] graduation and attendance rate targets for each group to meet AYP.”¹⁴ Or, to illustrate Ohio’s combining of a compensatory and multiple opportunities approach, they allow the “stronger of two-year average or most recent years’ proficiency rate used to determine AYP.”¹⁵ Utilizing multiple measures can help limit the effects of selection bias.

In another approach, communities are using district and school-specific report cards that share student learning outcome information to measure and increase the value and accountability of the educational system. The most common outcome measures of value used in this instance are “completion rates, student achievement on tests, reduction in the number of dropouts, and rates of high school graduation and college placement.”¹⁶ The expectation (perhaps the hope) is that public reporting of measures will drive improvement.

Measuring Intangibles

Within the field of education, many researchers have gone beyond measuring and defining value simply as student knowledge or achievement at the time they are in school. Many of their considerations of value have been economically oriented, while some have also considered the noneconomic intangibles that add to the value of education.

Hanushek (1979) argues that the value of schooling is more than simply the information or skills gained that achievement test typically conceptualize and measure. One substantial economic value of education is its effect on the labor market, the impact of which can be measured and quantified. The other substantive contribution of education that is missed in definitions of value concerned only with student achievement is its effect on socialization—that is, “political awareness, citizenship, moral values, etc.”¹⁷ Thus, Hanushek suggests a two-pronged approach to measure the value of schools through their effects on students’ future economic contributions to the labor market and on appropriate student socialization.

One interesting economic technique that has been used to measure the value of public schools and municipal services is to infer their worth through the sale prices of houses that receive their services. Bogart and Cromwell (1997) used this method in Cuyahoga County, Ohio, and found that “high-quality school districts provide services valued in excess of the higher taxes that they levy.”¹⁸

CEAs. Cost-effectiveness analyses (CEAs) in education have typically not tended to capture noneconomic intangibles such as student or teacher satisfaction, self-esteem, or citizenship.¹⁹ Two studies of preschool programs are notable exceptions for their considerations of the intangibles. The cost-benefit analysis of the High/Scope Perry Preschool Program in Ypsilanti, Michigan was conducted after following participants (and a control group) from preschool until age 40.²⁰ The program was found to yield \$12.90 of value for every dollar invested in it. Although the value considered was largely economic in nature, such as the additional taxes collected from an active labor force, some noneconomic intangibles were considered. Program participants were less likely to engage in criminal behavior, and that benefit to potential crime victims was captured not just for its cost aspects, but also for the

intangible losses associated with crime. Other benefits to preschool participants, such as reduced smoking and drug use, were tracked as well.

In recent years, California has investigated the value of providing universal access to preschool for all its children (with economic evaluation and intangible cost estimation). A RAND cost-benefit analysis estimated that a one-year high-quality program would generate roughly \$7,000 in net present value benefits per child.²¹ The benefits and savings accrue over child's lifetime, in categories such as reduced remedial education services and education attainment, reduced child welfare, reduced crime, increased compensation and taxes, and the value of child care. The RAND researchers believe the net present value of the benefits is actually underestimated because certain noneconomic intangible benefits were difficult to estimate. These include "reductions in the intangible costs experienced by victims of child maltreatment and crime, improved health and well-being of preschool participants, and the potential intergenerational transmission of favorable benefits."²² When estimates of the intangibles costs of crime were included (such as reduced child abuse and neglect), the estimated benefits to Californian society increased by nearly 50 percent. Karoly and Bigelow (2005) add that "improving educational attainment for future cohorts of California children will help reduce income disparities, lower poverty, and narrow gaps in economic and social outcomes across racial and ethnic groups."²³ Clearly, this social justice benefit is important, but it was not measured in the RAND evaluation.

Analysis

In education, goals, measures, targets, and consequences for performance come together to form a system of test-based accountability for instructors.²⁴ These elements are found in legislation like the No Child Left Behind Act of 2001, a component of which is measuring the value of education offered at schools through testing, and then forcing those schools that fail to measure up three years in a row to offer alternative choices to parents at the district's expense.²⁵ Because of the nature of this "high-stakes testing," teachers report spending more time teaching on subjects related to these tests.²⁶ Policymakers and researchers must remain cognizant of these behavioral incentives when designing their exams; putting in place an audit mechanism can help limit these incentives. Attribution errors must also be kept in mind when attempting to measure the value of teachers or an institution by the performance of students being educated within it. While educators certainly can have a tremendous impact, ultimately the students themselves dictate the highest degree of control over their own educational outcomes.

This is the same dilemma that public health practitioners face in attributing the role of public health interventions in improving population health. As good as a given public health initiative or professional may be, ultimately it is often the individual or recipient being treated who has control over the "success" of the program.

One aspect from the education literature might be of value to LHDs. Public health might adopt community wide report cards as a way to inform the public about specific achievements and to drive improvements in value through increased accountability. States could consider requiring LHDs to issue report cards on a regular basis with a pre-determined collection of health measures and their achievements and progress in promoting the public's health. The report cards could also serve as a tool for educating the public about the value of public health services.

An important lesson for public health practitioners from the education literature is to consider how teachers react to high-stakes testing. They spend a disproportionate amount of time on preparing for the test, rather than on broadly educating the students. It is unrealistic to think that without alternative incentives even well-intentioned public health professionals would not allocate their limited time and resources the same inefficient way as teachers.

C. WELFARE

Defining and Measuring Value

Researchers and policymakers concerned with welfare typically look at aggregate program expenditures and broad welfare reforms over time to define value. As measures, they then calculate the number of welfare recipients served, their employment rates, and their earnings. In a sense, value is based on the ability of individual programs to reach those who are eligible for services and to improve their status. Although nearly all research on welfare is primarily economic in focus, some studies do take into account the more intangible aspects of welfare and welfare reform, accounting for various aspects of recipients' quality of life in assessing value.

RAND's evaluation of CalWORKs in 2002 is a classic example of measuring value in welfare. They measured work activity participation rates, welfare caseloads, and outcomes for former welfare recipients.²⁷ In explaining their choice of metrics, they write:

By itself, the caseload is an ambiguous measure of welfare program success. If the goal was only to cut the caseload, one approach would be to eliminate the program. Instead, the goal appears to be to have recipients leave welfare for work and a better life.²⁸

The authors explain that this is why the caseload measures are supplemented with studies that follow the well-being of former recipients to track their poverty status post-welfare. Whether or not all the subtleties of value can be accurately measured, value for welfare policymakers encompasses more than economic considerations—it includes some intangibles associated with a “better life.”

On a larger scale, certain welfare programs, public health initiatives, and education initiatives have been targeted at whole communities, neighborhoods, or schools, as opposed to just particular populations.²⁹ The value of a welfare program can be more than the specific economic impact it has on just the individual participants. It is designed to help alter neighborhoods suffering from intense poverty through increased employment rates and earnings and transforming social norms and relationships within each housing development.³⁰ One way to achieve these results would be to provide services to a cluster of individuals housed together. If so, the benefits of the program could have greater cumulative effects on improving the community than typical welfare programs that improve the economic situations of more dispersed individuals.

One project of this type is the Jobs-Plus Community Revitalization for Public Housing Families program, which the Manpower Demonstration Research Corporation (MDRC) studied.³¹ The methodology they used to measure value in the experiment was to have participating cities select public housing developments that are comparable in demographics and

character, which the researchers then randomly assigned to receive the program or to serve as a control. Even though developments within cities were matched for similarities, studies such as these will often suffer from low statistical power because they are based on the number of aggregate units, not the number of individuals served within the developments. Using quasi-experimental methods to supplement this approach, such as comparative interrupted time series analysis, can help yield a richer analysis of the program's value.

MDRC's long-term analysis of the data revealed that while Jobs-Plus produced a positive impact on the earnings of individual participants in the program, their improved economic wellbeing did not have spillover effects that increased the quality of life for others living in the housing development community (such as higher household income, improved social capital, and improved safety).³²

When it comes to increasing the value of welfare, employment training programs have frequently been used as a strategy, as they are intended to help move recipients into work quickly and keep them there long-term. A serious issue with defining the value of these programs is duplication of services, given that many private training programs already exist. Realistic models measuring their value account for any participation that would have occurred in other programs if the public program were not available.³³ However, given that many welfare recipients do not enroll in the other available programs in the market, the social rate of return for the government in providing the training program itself (and sometimes requiring participation for receipt of welfare) frequently ends up being higher than simply transferring funds to decrease poverty.³⁴

In the numerous cost-benefit analyses of government employee training programs, there has been little attempt to measure the loss of participant leisure time when entering the workforce.³⁵ Although this intangible loss is not particularly easy to measure, Greenberg (1997) asserts that studies that leave it out are overstating the true net social benefit of the program, particularly as the cost to participants of the lost hours of leisure time can be sizeable. Some programs actually leave participants worse off. When lost leisure time is ignored, the cost-benefit analysis favors programs that simply increase work hours and encourage long work days as opposed to programs that increase salaries of workers by providing basic education and skills training before job placement.

Analysis

An important lesson from the welfare literature regarding value is that the whole can be greater than the sum of its parts. This is evident in the MDRC's evaluations of the Jobs-Plus Public Housing Program, where the hypothesis was that greater value could be realized through services to individuals who lived in close proximity. Although the MDRC's measurement of the intangible effects that economic gains for some members of the community could have on others did not yield positive results, it is certainly plausible to imagine other approaches where these effects could occur, especially in the field of public health. The methodology of matching similar communities between cities to measure value is useful, despite its statistical limitations. Following up with measurement of quality of life indicators to determine an additional intangible gains provides crucial information about the value of the intervention.

In the case of the government training programs, accounting for duplication of services in value measurement is a key, even when the dynamics of poverty or other access or market failures ultimately mean that replicating a service that is privately available may provide a higher return. Measuring the value of training programs also yields a lesson about the significance of positive results. Numerous studies have led policymakers to conclude that there is strong evidence that training programs are successful for adult women. But with an average effect across programs of approximately \$1,400 per year, the results are not great enough to raise the average family out of poverty.³⁶ When defining value in a program, it is important to be specific about the magnitude of a positive result that is necessary to be meaningful. If a training program still leaves families in poverty and dependent on public assistance, more valuable uses for those dollars for that population may exist.

Ignoring the intangibles that affect quality of life makes it possible for policymakers to favor an entirely different design structure for the program than might be optimal. Careful consideration of all of the economic and noneconomic costs and benefits that affect the program's value from each stakeholder's perspective is advisable for policymaking.

For public health, probably the key application from the welfare literature lies in the somewhat banal conclusion that the whole is greater than the sum of its parts. As our interview results will show, our respondents note the importance of measuring the value of the public health system separately from the value of individual services.

D. DISCUSSION

Overall, what lessons can we learn from the literature on port authorities, education, and welfare for defining and measuring value? In sum, our literature review reveals tantalizing clues as to how public health might define and measure value. But there do not appear to be any robust definitions or frameworks from the areas we reviewed that can be easily extrapolated to public health. In fact, most of the reviewed articles do not specifically define value. Those articles that focus on value primarily examine a performance measurement or management approach. We provide a summary of these results in Table 1 below.

In each field, finding some consensus on a definition of value has evolved more easily than developing an effective methodology for measuring it. To varying degrees, the three industries studied diverge in the balance of tangible products (easily measured) and intangible values (difficult to measure). Perhaps because none of the three industries is as dependent on intangible values to define itself as public health is, the literature provides little guidance for measuring the intangibles. The literature in each sector comments on the general difficulty of quantifying and transferring non-monetary impact (i.e., the intangibles) into a definition of value. As a result, most still rely on monetary quantities to translate value.

For our purposes, this theme is important because public health practitioners must quantify intangible components that are essential to the organization and delivery of public health services (as our interview results demonstrate). The difficulty of incorporating intangibles into a measure of value is especially acute for public health, a field that traditionally places great emphasis on non-monetary core values such as social justice and the social determinants of health (Gollust and Jacobson, 2006).

Table 1: Definition of Value	
Port Authorities:	<ul style="list-style-type: none"> • <i>Economic Focus</i>: economic impact or contribution of ports and port authorities in their respective local and regional markets; the creation and maintenance of competitive advantage generates value • <i>High Performance of Individual Ports</i>: high number of berths, cargo, port activities, low cost, while maintaining low average vessel waiting and service time, low congestion, minimal negative environmental impact, positive labor and economic market impact • <i>Value Chains or Constellations</i>: part of highly trafficked chain of high performing ports, high performing/low-cost inland partners, good geographic location
Education:	<p><i>Education Production Function</i>: student achievement or progress measured by test scores in light of resources spent or structural inputs such as student-teacher ratios, years of teacher experience, or years of teacher schooling</p> <p><i>Intangible Aspects of Value</i>: preparation for labor market, socialization, reduced crime, child maltreatment, and improved health (latter three for preschool)</p>
Welfare:	<p><i>Economic Focus</i>: the efficient use of resources to improve the lives of beneficiaries as seen through the effects of aggregate spending on the number of welfare recipients served, their employment rates, and their level of earnings</p> <p><i>Quality of Life Consideration</i>: the effects of incentives to maintain cohesive family units tracked by marriage and divorce rates</p>

Nearly all of the articles reviewed from these industries utilize a methodology to measure value that could be fairly categorized as economic. The articles fall along a spectrum regarding the degree to which they emphasize the importance of intangibles and actually attempt to estimate their value and include them in their analyses, or simply list them as an additional consideration. A breakdown of some of the main variables that the three fields consider when defining and measuring value, both quantitative and economic in focus, and alternatively more intangible in nature follows below in Table 2:

Table 2: Key Variables Used to Measure Value

	Quantitative/Economic Measures	Intangible Measures/Considerations
Port Authorities:	Port Operation <ul style="list-style-type: none"> • <i>terminal throughput capacity-TEUs/year</i> 	Local Community Impact <ul style="list-style-type: none"> • <i>labor effects-changes in personal income and</i>

	<ul style="list-style-type: none"> • <i>total processing time</i> • <i>vessel processing time</i> • <i>optimal waiting to service time ratio</i> • <i>degree of occupancy</i> • <i>tax effects</i> • <i>economic impact of tourism</i> 	<i>unemployment rates</i>
	<p>Cost Considerations</p> <ul style="list-style-type: none"> • <i>vessel time cost</i> • <i>potential improvement costs</i> • <i>vacant berth costs</i> 	<p>Environmental Impact</p> <ul style="list-style-type: none"> • <i>pollution levels</i> • <i>ecological concerns</i>
Education:		
	<p>Structural Inputs</p> <ul style="list-style-type: none"> • <i>pupil-teacher ratios</i> • <i>teacher education</i> • <i>years of teacher experience</i> 	<p>Appropriate Socialization</p> <ul style="list-style-type: none"> • <i>future criminal behavior</i> • <i>future drug dependence/health issues</i>
	<p>Student Outcomes</p> <ul style="list-style-type: none"> • <i>completion rates</i> • <i>student achievement on tests</i> • <i>dropout rates</i> • <i>high school graduation rates</i> • <i>college placement</i> 	<p>Social Concerns</p> <ul style="list-style-type: none"> • <i>rates of child maltreatment</i> • <i>child welfare usage</i>
	<p>Economic Measures</p> <ul style="list-style-type: none"> • <i>infer value from sale prices of houses</i> • <i>quantify value of preparation for labor market</i> • <i>comparisons of spending per student</i> 	<p>Inequality</p> <ul style="list-style-type: none"> • <i>disparities in educational facilities and quality of teachers by race ethnicity</i> • <i>disparities in poverty rates by race/ethnicity</i>
Welfare:		
	<p>Program Evaluation</p> <ul style="list-style-type: none"> • <i>welfare recipients served</i> • <i>recipient employment rates</i> • <i>recipient earnings</i> 	<p>Family Impact</p> <ul style="list-style-type: none"> • <i>marriage and divorce rates among welfare recipients</i>
	<p>“Leaver” Studies</p> <ul style="list-style-type: none"> • <i>rates of returning to welfare after leaving</i> • <i>earnings after leaving welfare</i> 	<p>Community Impact</p> <ul style="list-style-type: none"> • <i>program effects on social norms and relationships</i>
	<p>Economic Measures</p> <ul style="list-style-type: none"> • <i>return on investment</i> • <i>average economic effect of a program (ex. increase income \$1,400 per family)</i> 	<p>Quality of Life</p> <ul style="list-style-type: none"> • <i>value of loss of leisure from mandatory work or work training programs</i>

Of the three industries, the education literature probably has the most advanced methodologies to offer when it comes to measuring the intangibles. One possible reason is that

while the inputs measured are sometimes economic (dollars spent per pupil), they can also be noneconomic (teacher to student ratio, etc.), and the outputs are almost always noneconomic (test scores). As a consequence, it may be that educational frameworks coalesce more easily with intangibles than in the other fields. One of the clearest attempts to measure intangibles comes from cost-benefit measurements of preschool education that include estimates of noneconomic benefits, translated into dollar amounts.

In the port authorities literature, intangibles are mostly mentioned in passing, except in the unique case of the Value Management Program at the Port Authority of New Jersey and New York. Economic considerations of value seem to drive most decision-making in that field. In the welfare literature, MDRC theorized that targeting one housing community with intensive intervention could have both the intangible benefit of improving the living conditions and of increasing the economic indicators of success. To test their hypothesis MDRC measured not only the economic, but also the intangible aspects of quality of life to determine the effects of the initiative. The welfare literature also demonstrates an effort to measure explicitly the value of leisure time lost with mandatory work programs and to include that estimate in program design evaluations.

Another theme emerging from our literature review is the focus on performance measurement when discussing value. Performance measurement across sectors is used to evaluate how effectively a program operates in order to monitor its progress. This monitoring function differs from assessing the components of value that exist in a program or system and determining how much of that defined value exists. One could work backwards and use what is measured to define value, but that process seems risky because it limits definitions of value to what is measurable. The evaluative function of performance measurement assumes the initial justification or existence of a program and skips the step of creating a decision model to assess trade-offs among programs. When defining and measuring the value of public health systems, therefore, the emphasis should be on defining value first and then measuring it.

A consistent theme throughout the literature we reviewed is the recognition that even when some consensus has emerged, value definitions can differ within the same sector according to the stakeholder being considered. Public health interventions and delivery systems are equally susceptible to stakeholder perceptions. In determining a definition of value for public health systems, it is important to include all viewpoints.

Beyond these themes, there are additional parallels between these three industries and public health that can be the basis for further analysis. These include the importance of multiple measures to determine value rather than attempting to rely on a single measure. Another is that the port authority literature particularly reveals interesting possibilities for identifying and analyzing positive spillover effects in public health practice. A third is the idea of community report cards, which dovetails nicely with the interview results regarding community needs assessments. Three other themes complement our interview results. Several articles underscore the importance of communication to policymakers and the public. Next, the concern for social cohesion is consistent with our interview respondents' description of public health as a mechanism for social interconnectedness. And lastly, social justice (such as reducing inequality) is an important attribute in the education and welfare literatures.

Looking forward, it will be important for public health systems researchers to consider best practices and strategies for defining and measuring value in other industries. Even in banking, a purely economic arena, the importance of intangibles is increasingly being recognized.³⁷ Beyond looking to other industries, future research within public health should focus not only on how to measure noneconomic costs and benefits that accrue to individuals from a particular initiative or project, but on the intangibles that concern an entire community or population, especially over the long-term.

IV. INTERVIEW RESULTS

In this section, we present the results of our interviews. The section is organized into sub-sections reflecting the most important cross-cutting themes: component parts of value definition; prevention; communications; quality of services; and intangibles. As the results include findings from a variety of organizations and contexts, we will identify patterns as well as noteworthy examples of where these patterns diverge.

After setting forth the cross-cutting themes, we will describe the methods for measuring value that our respondents suggested. We will then note the barriers to defining and measuring value that our respondents identified. Based on these results, we will present our proposed framework for measuring the value of public health.

Interview Methods

To understand the practitioner perspective on how to define and measure the value of public health services, we conducted a series of interviews with leaders of national public health organizations, state and local public health practitioners, academics, and elected officials (such as local boards of health). We developed an interview protocol that is attached as Appendix D to this report. Altogether, we interviewed 46 respondents: 24 from local health departments; 7 from state health agencies; 8 representing national organizations; 4 academics; and 3 members of local boards of health. Everyone we contacted agreed to be interviewed. We promised confidentiality to all respondents. (As noted in the Framework section, two respondents agreed to reveal their names.)

For this part of the project, Jacobson conducted all of the interviews and took detailed notes (the interviews were not recorded). Most of the interviews were in-person with one individual. Two interviews were small focus groups (5 and 10 respondents, respectively), three interviews were with two respondents, and one was via telephone. (We plan to conduct two more telephone interviews after submitting the report.) A research assistant coded the interview notes. Jacobson reviewed the coding, suggested collapsing the categories, and the RA recoded the interview notes. Jacobson separately reviewed the interview notes to verify the coding.

To conduct the analysis, Jacobson read and re-read the coded interview notes to identify common themes and key differences across the interview respondents. The analysis synthesizes the interview data and available documentary evidence to portray the ways in which public health practitioners and officials think about how to define and measure the value of public health services. The primary form of analysis is descriptive, comparing and contrasting information across respondents along several dimensions of interest.

A. VALUE DEFINITION

The central question for the interviews was to define the component parts of value for public health services. Respondents were virtually unanimous in agreeing that defining and measuring value is critical to generating public support for public health services. In defining value, respondents focused on what public health achieves for the community and on what it prevents or helps a community avoid. A typical response was that value is avoiding harm and is inherent in the public health mission. But many found it difficult to offer a concise definition, relying instead on vague, almost tautological depictions. For example, one respondent stated that public health has “value as both noun and verb and how its value is viewed is reflective of its value.” Somewhat surprisingly, respondents often noted that neither local boards of health nor elected officials routinely asked for measures of value.

Reflecting a widely expressed viewpoint, a respondent said that “Values spring from the mission of public health,” i.e., those services which public health departments uniquely provide or of a public health system that falls short. “A big measure of value is what can go wrong if [we] fail to invest.” Beyond value as being what public health helps a community avoid, others saw that the value is the ability of public health to maximize quality of life in its role as “giving people information to make good decisions about health behaviors.” But as most respondents observed, “What’s avoided cannot be monetized.”

In sum, practitioners note that the value of public health services, particularly prevention, should seem obvious in light of progress in the public’s health over the past century. Yet our interviews reveal palpable frustration that neither the public nor politicians adequately acknowledge how important public health services are to reduced mortality and morbidity rates. Without the ability to measure and communicate value to the public, public health systems will continue to have difficulty competing for scarce governmental resources.

B. COMPONENT PARTS

When the interviewer asked respondents to define the component parts of value, the responses became more instructive and functional. Three distinct categories of how to think about value emerged. For the most part, respondents coalesced around specific components. Taken as a whole, the component parts represent the elements that comprise public health’s accumulated value. Second, our interviews suggest that value may be considered differently as applied to specific public health programs or to the system as a whole.

Third, public health practitioners uniformly stressed that understanding the science drives public health delivery and value. No action regarding services to provide should be made without considering the available scientific data. “Value that is consistent with good science tells us what is good public health.” To respondents, science includes the basis for sound public health programs, as well as the methods to measure outcomes and then assign value.

Specific Components

Although no one respondent set forth a compelling list of component parts of value, the following distinct components appeared most often across respondents. Many described these components as being public health’s core principles, while also observing the difficulty in

measuring or quantifying their value. Repeatedly, respondents noted that preventing disease is the most important aspect of public health delivery. A typical description of the importance that prevention has in the value for the community is that “prevention at the population level is where public health has had its greatest success.” We will discuss each of these components in greater detail in subsequent sections.

The two most frequently mentioned components are prevention and intangibles. One respondent captured both in suggesting that the core principles and values of public health are prevention, justice, voice, and leadership. As an aside, it is worth noting that respondents consistently (though not unanimously) rejected the utility of the three core public health functions (assessment, policy development, and assurances) or the ten essential services for defining value identified in the Institute of Medicine’s 1988 report on public health.

As for intangibles, many respondents mentioned that a unique trait of public health is the intangible value it has. These intangibles were characterized in various ways, but center on notions of social justice. As one respondent put it, “public health is both a moral and economic enterprise.” Improving the population’s health thus depends on more than measurable economic constructs. Investments in immunization, for example, should not be based on an economic measure, such as return on investment. Rather, a more appropriate measure of value is the equitable distribution of goods and services to the entire population.

A third component is quality of services. According to our respondents, the important aspects of quality are performance standards, accreditation, and community assessment tools. While these techniques help to assure value, they do not produce value in and of themselves. Attention to measuring the quality of public health services is recent and lags far behind the quality of care movement in personal health care services. Yet an explicit goal of developing performance and accreditation standards is to hold public health officials accountable for the services they provide. In particular, the academic respondents tended to define value in terms of quality of care based on performance and accreditation standards (discussed separately below). This finding perhaps reflects the current policy emphasis on developing credentialing mechanisms to evaluate the performance of state and local public health departments.

A fourth component is communication. Though far from uniform among our respondents, many argued strongly that communication to the public and to policymakers is an essential attribute of value, the need “to communicate to the public that the value of public health is a coefficient of intrinsic value.” Most of the time, those arguing for the importance of communication stressed that even where value can be demonstrated empirically (such as a return on investment for vaccines), public health does not receive appropriate credit for its contribution to improving the public’s health.

The final component is the importance of process. As a subtext to many of the interviews, respondents discussed various processes they use to define value. These processes included how they organized to determine which services to provide, which services to cut given budget limitations, and how to communicate these decisions to policymakers.

Application

In analyzing the interviews, meaningful differences are apparent when the definitions are applied to different aspects of public health delivery. For example, respondents expressed concern that the value of public health systems, other than as an abstract construct, is not considered. According to several respondents, the public health infrastructure is not concrete enough for the public, and there are disagreements about what the components of the infrastructure should be. Other respondents saw the value of public health as how it fits into society as part of the composite health care delivery system, as opposed to the contribution of specific services. Several respondents stressed that public health practitioners need to emphasize a “sustainable infrastructure as a high value that public health provides to a community.” One respondent added that we “cannot look at tobacco or obesity without considering the infrastructure,” while admitting that this is difficult to measure.

Respondents were also concerned about value when asked how they would make tradeoffs at the margin (i.e., cuts between services to equally deserving populations, such as AIDS vs. maternal-child health), or how they would determine which programs to retain or cut. Being forced to make choices between equally desirable programs is among the most difficult decisions public health officials need to make. More than one respondent argued, on moral grounds, that it is “never okay to cut programs.”

It is therefore not surprising that understanding value is more pressing for deciding which programs to cut than for describing the general value of public health systems. The framework we discuss below is thus designed to assist public health officials to make such choices as opposed to defining value at the systems level.

Prevention

Every one of our respondents views prevention as central to the mission of public health. Not only is prevention integral to the value of public health, respondents characterized it as the core rationale for why public health systems were established. It is also an important part of the stories that are used to communicate with policymakers and the community.

In terms of promoting value, however, our interviews reveal an important split of opinion. On one side, respondents argue that despite years of presenting the benefits of prevention for the population’s health, the public and policymakers have basically ignored its importance. Therefore, a new strategy is needed. “We should sell preparedness (i.e., bioterrorism, pandemic flu)—not prevention.”

On the other side, practitioners argue strenuously that because prevention is the core of public health, it cannot be abandoned, regardless of public and policymakers’ indifference to date. Proponents of this approach largely argue that “it is the right thing to do and that we need to sell it” better to policymakers and the community. This argument is closely related to the role of public health’s intangible values discussed below.

Empirical Basis of Prevention as Value. The argument against the inherent value of prevention is three-fold. To be clear, all of our respondents accept the intrinsic value of prevention. Even so, proponents of a new approach start with the premise that policymakers and

the public have essentially rejected the value of prevention for its own sake. One reason for the rejection is a harsh one, that practitioners have adopted a “holier-than-thou” attitude toward policymakers. In this view, “it should be obvious to politicians how good prevention is.” Yet the intangible benefits of prevention as harm reduction alone seem insufficient to obtain policymakers’ support.

Since LHDs can no longer rely on the argument that “we prevent worse outcomes or that it is cheaper to invest in public health,” practitioners need to change how the issue is framed and presented. Prevention needs to be monetized. A proponent of this approach argued that “quality of care plus CEA equals value.” In short, practitioners need to shift from a moral to an empirical frame. The empirical frame would focus on quality, timeliness, and the cost-effectiveness of the services provided. Another advantage of the empirical approach would be to drive improvements in public health. “Pushing economic value will force improvements to the system.”

The crux of this view is that policymakers only care about the value of a bundle of services being purchased with general revenues. “Policymakers want to say to the public ‘Here’s what I bought for you.’” They cannot easily make that statement based on harm avoidance. At this point, “public health lacks sound data to demonstrate that it makes a difference.” If practitioners prove what prevention can accomplish in saving lives, politicians can justify the investment. “Prevention can be sellable, but it needs to be credible.” To achieve more credibility, concrete outcomes data are needed.

Moral Basis of Prevention as Value. Proponents of thinking about the moral basis of prevention as the key consideration offered several reasons. To begin with, because it is difficult to make the economic argument, the investment in prevention requires a non-economic rationale. In this view, the moral basis is a more persuasive rationale. Thus, proponents focused on the need to invest to minimize the potential for disease outbreaks. While this might not be as compelling as fighting fires or crime, the public health system requires the emergency preparedness capacity to confront emerging diseases.

Proponents of the moral basis tended to be wary of characterizing prevention as cost-saving. Many respondents believe strongly in the inherent value of prevention, including arguing that it can save money, but cautioned that prevention does not always save money. Accordingly, they continue to argue the value of prevention as harm avoidance and avoiding more costly subsequent medical treatment. In turn, they argue that the value of public health needs to be found in prevention and preparedness and that saving money should not be the primary criterion of value. One respondent argued that there is no investment in prevention which leads it to be a less effective component for public health. Another observed that “sometimes, public health is a costly, but good investment for the totality of improving the quality of life and good health.” Hence, the moral and social justice values of health promotion and prevention should be the primary roles of public health. “Over a lifetime, prevention does not work to save money. But for moral and social justice reasons, prevention is essential” to meet the values of public health.

Interestingly, a proponent of the empirical strategy recognized the dangers of monetizing the value of preventive services in “undermining the core values of public health and [could] fail to keep specific services.” Likewise, a respondent who recognized both sides of the argument

noted that public health is caught in a trap. While it is “a better investment than pharmaceuticals, triple by-passes, etc., clinical medicine is not held to a similar standards (witness adoption of the latest technology without adequate testing of cost-effectiveness).”

Communications

One of the most interesting and unexpected findings of the interviews is how respondents view the importance of communicating value to the public. Communication refers to the level of discourse between public health practitioners and its various constituencies, along with the potential styles that public health practitioners could use for effective communication. The two primary issues raised were communication as value vs. communication as marketing, and whether to frame the communication around personal stories. Our interviews suggested little agreement on either issue.

Even so, our interviews suggest considerable agreement that public health practitioners and advocates have not been effective communicators to policymakers and the public. Repeatedly, respondents indicated that they were not as effective as firefighters, police, and the highway construction industry in competing for scarce resources. Almost all respondents expressed considerable frustration at “the lack of public acceptance for public health’s worth,” and the declining investment in public health. All respondents supported the need for public buy-in. “What will the public exchange for a safer, hazard-free environment?”

Communicating Value vs. Marketing. One of the tensions in the interview results is whether communication in and of itself constitutes an intrinsic measure of value. Our respondents were split on the issue. A minority of respondents argued that just the act of communicating was more important than the substance of what was being communicated. In this view, information alone has intrinsic value. For example, the core of surveillance is designed to generate information that can be translated into effective public health activities. Proponents of this strategy described it in marketing and branding terms—creating a consistent public health identity.

For four reasons, they argued that the process of engaging the public was as important as the actual message being articulated. First, engaging the public would most likely increase the number of people receiving public health services. Second, such engagement could help individuals take responsibility for their own health by providing information needed to make good health behavior decisions. (Changes in individuals’ health literacy and health behavior would be one measure of value.) Third, “it creates a constituency for LHDs to market public health expectations” and to obtain recognition for improvements in the public’s health. Fourth, public health needs to communicate to connect the dots between prevention programs and improvements in population health (such as declines in infant mortality or improved vaccination rates).

The opposition to that perspective was nicely captured when a national respondent said that “It’s not a value until the public says it’s a value!”—meaning that the ultimate definition of value resides with policymakers and the public. A further limitation of the communication alone as value approach is that a significant component of the value is intangible. One respondent noted that public health practitioners “can’t sell on intangibles alone. [We] need to illuminate the downside of not having a secure infrastructure, surveillance, vaccines, or consumer protections.”

To opponents, the evidence is strong that the public has rejected a strategy of selling intangibles as values. The most damning statement came from a national respondent who argued that public health has lost connection with the public. As a result, communication must include tangible performance measures to be successful.

The Use of Personal Narratives. Our interviews indicated a lack of agreement on how to sell public health to the community. One set of respondents insisted on telling personal narratives; the other respondents said doing so was considerably oversold. Neither standing alone is sufficient, but some combination of weaving the human drama into the public health data is necessary.

The advantage of using personal narrative is that the most affected people, the individuals benefiting from public health interventions, tell their own stories. Starting with a compelling human story provides a context and a reason to pay attention. “Personal stories humanize the larger issues,” and are more effective than a barrage of statistics. In short, “The stories are the tangibles that the public will understand.”

Yet many respondents were skeptical about personal stories, arguing that they have proliferated too much and have lost potency. Critics suggest that personal narratives have become too fashionable, though they admit that putting a human face on the problem can be useful. They also argued that policymakers need specific outcomes and numbers, along with a coherent message showing the process of how a particular intervention led to specific results.

Our analysis of the interview results suggests that epidemics (such as flu pandemic) or specific outbreaks (i.e., water-borne contaminants) require little more than the event itself to provide public health with a “stage presence” as one respondent said. Instead, the dispute about the use of personal stories is how to sustain the “stage presence” during the routine and often mundane daily activities that do not inherently show public health’s importance.

Reasons for the Communication Deficit. Although our interviews were not designed to ascertain the reasons for the public health communication deficit relative to other professions, several potential explanations emerged. For one thing, the very invisibility of public health contrasts with the almost-daily visibility of police and firefighters. Public health gets attention only during an emergency. As one respondent suggested, we “need to create a message and take credit when it goes right. [We] need to define the disease burden, [because] the public has no concept of risk, the disease burden, or what kills people.” A related point is that the public easily forgets the historic gains from public health, especially “the historical evidence that adverse outcomes will happen when part of the public health infrastructure is removed.”

For another, practitioners have relied on selling the intangibles or moral high ground as opposed to providing outcome and quality data. Without these indicators, “harm avoided is too abstract.” More pointedly, a few respondents criticized public health advocates for being purists and moralists who refuse to compromise.

A third explanation was that the benefits of prevention have been oversold in the past, though this was a contentious issue among respondents. Fourth, the absence of strong evaluation programs limits what is being communicated to the public, which “cannot value what it doesn’t know.”

Fifth, one respondent lamented the absence of an effective national public health spokesperson such as former Surgeon General C. Everett Koop. Another respondent made a related point, arguing that it is difficult to communicate the value of public health because there is still ambiguity around the definition of public health. Before value can be communicated effectively, there needs to be a coherent operational definition of public health. Interestingly, only one respondent saw the local board of health as having an integral role in communicating the value. “Boards are the liaison to community; they should engage citizens to get input.”

Quality of Services

Many respondents agreed that “quality of care is an intrinsic part of value,” but observe that “performance management and an accreditation system are tools to assure value, but do not produce value in themselves.” Respondents also note that how to measure quality is troublesome because of its imprecision. One example a respondent offered is with self-reports from smoking cessation programs. Absent a biological measure about 12 months following termination of the program, there is no way to determine whether the program achieved its objectives based solely on self-reports.

Proponents of performance standards and accreditation argue that these mechanisms are promising techniques for measuring value and determining quality of care. Respondents note that performance standards will establish best practices and benchmarking of public health services that will measure improvements in quality assurance and will demonstrate “areas of strengths and weaknesses” to policymakers. Establishing expected outcomes will move practitioners away from merely using counts of services delivered as quality of care indicators.

Yet our interviews reveal some obvious challenges associated with performance standards. First, they are in many ways nascent strategies that have not been fully developed or tested. To date, they remain more as planning documents than as fully formed instruments. In addition, one respondent indicated that performance standards are hard to “match to actual money” even though the need is for the standards to be monetized. The strengths of performance standards and accreditation were seen as being more important for building infrastructure and periodic health assessments, along with developing staff skills and competencies, than for monitoring program outcomes.

Intangibles

One of the most pervasive and consistent interview themes is the importance of the intangible aspects of delivering public health services. If there is one concept that captures our respondents’ sentiments regarding the intangible attributes of public health, it is the moral imperative of safeguarding the public’s health. The interview responses coalesce around two particular themes: public health’s core values and the role of maintaining a public health system. At the same time, most respondents acknowledge that there is a big difference between articulating the moral imperative and “selling” it to the public.

Nevertheless, a substantial minority of respondents generally agree that while the intangible values of public health are integral to its mission, intangible values standing alone are not sufficient to sustain a public health department absent economic value or importance.

Indeed, one proponent of social justice as being essential to public health recognizes that “public health is both a moral and an economic enterprise.”

Values. An underlying theme in our interviews is the need to defend the government’s unique role in providing public health services. For public health, core values center on communal well-being—disease prevention and health promotion for populations—and distributional justice. A typical statement of this theme was, “What’s the right thing to do. Humanitarian reasons are equally important as economics. That’s why people go into public health and why we have it.” As a result, the mission of public health is to alleviate poor health in the population as well as the social determinants of poor health. Unlike medical care services, therefore, the measurement of value cannot easily reside in the choice of methodologies. Instead, such measurement must incorporate a broader array of factors, including the social value of public health, that are difficult to quantify. Our respondents consistently stated that quantitative measures alone will not always help. Programs that do not produce revenue may still serve a market, provide early warning or identification of a public health program where early intervention will save lives. “The communication of broader values is more important on some issues.”

Respondents noted that a social justice intervention model is used or can be used for many public health aspects and programs. In particular, numerous respondents argued that human or social interconnectedness is important to overall health, so that LHDs should invest in neighborhood development and community. For example, if a public health department is working on reducing infant mortality, it is necessary to address the matter in a holistic approach and look at access to better nutrition in addition to other causes. Nonetheless, these respondents recognized the difficulty of measuring the interventions. “Public health makes disease not happen—can’t quantify what didn’t happen.”

The Public Health System. As noted earlier, several respondents commented on the importance of the public health system in defining value. One respondent captured the prevailing sentiment in asking “What’s the cost to the population of a failed public health system?” According to another respondent, “The hardest thing to measure is the value of sustained efforts.” For vaccination rates, the respondent’s LHD has attained a 93% immunization rate because the effort has been sustained for 15 years.

Thus, the public health system itself embodies intangible value to be measured. As a social enterprise, the system is unique in the number of people affected, its impact on individuals in preventing disease, and protecting the environment, *inter alia*. One respondent argued that every community needs programs across the public health spectrum because each contributes to and “demonstrates a return on improving public health.” To this respondent, the implications are that the value of public health occurs at the public health system level, not that each program needs to accrue a specific rate of return.

Analogies. Many respondents compared the intangibles of public health to those of fire fighters and police. An intriguing suggestion from an academic respondent was to think about prevention in health security or protection terms. Likewise, a respondent described value as “domestic tranquility—no uncontrolled disease outbreaks.”

Two respondents tied this to an economic argument that people would choose to live elsewhere if public health is not protected. To put it differently, employers consider the health of

a workforce when considering where to locate. A healthier community (such as reducing obesity) means lower health care costs for employers and employees alike.

C. MODELS

Despite the often vague definitions of value noted above, our interviews reveal several potential models for defining the value of public health services. The following models are listed in descending order of development and specificity. Our subsequent framework borrows elements from these models.

Cost Accounting

The most well-developed model we encountered is a creative combination of cost accounting methods, community assessment, and a process that is tantamount to deliberative democracy. All three aspects are integral to its use. Indeed, the respondents indicated that the overall process, and its consensus-building feature, is the model's most important aspect. Although the creators of this approach have presented it at conferences, it has not yet been published. First developed in the 1980s, it is a process to rank program priorities given available resources. The goal is to list services by priority, determine how much funding is allocated to the service, and then change the allocation based on the overall rankings.

Several underlying assumptions animate the approach: 1) public health services are not equal given budget constraints; 2) it is difficult to discontinue an existing service; 3) once established fees stay the same for years; and 4) decisions to begin new programs are usually driven by grants, rather than community need. (Other respondents would suggest that politics plays an equally important role.) The key substantive component is a chart with public health importance on the x-axis, and the number of people served on the y-axis. Points are awarded for each criterion. Initially, the key process component is that each division director works with staff to rate each of their programs.

To determine the x-axis (public health importance), each division starts with the community needs assessment that the LHD conducts every 5 years. Programs the community identifies as high priority receive more points than others with lower priority. The same goes for the second criterion, whether the program is legally mandated or discretionary. The third category is the estimated financial impact, determined through cost-accounting of income relative to expenses. Next, the division determines whether the service would be available elsewhere in the community for the same number of people. Finally, if the service is eliminated, would morbidity and mortality increase? The points assigned to each criterion are then summed to provide the x-axis score.

For the y-axis, the primary criterion is the number of people served. Does the entire community benefit from the service or does it only benefit a subset of the population? All services in the department are then ranked in priority order.

After the rankings are completed, each director meets with the board of health to describe the rationale for each ranking. This meeting is what we are calling the deliberative democracy aspect of the process. It is the mechanism through which the LHD and the political process determine how to allocate public health resources each year.

The model has four key advantages. First, the deliberative process allows for staff involvement in program decisions, as well as a defensible method for making decisions at the margin. According to its developers, it provides justification for eliminating a program (such as the recently dropped home health program) and helps define what the community wants to provide that is not a current service. (It also serves to discard non-mandated programs of limited interest to the community.) Second, it informs the political process and provides transparency for political decisions and accountability. Third, the cost-accounting mechanism clarifies how fees are set and how tax dollars are allocated. Fourth, in an era of declining resources for public health, this is an avowedly business model, recognizing that difficult choices must be made. The developers of the cost-accounting approach argue that it adds to their credibility because the model looks at the cost of doing business each year and assesses whether the services being provided are the right ones. In sum, they argue, the cost-accounting model is effective as both an internal management tool and externally as a means of communicating relative importance of public health services to the public.

At the same time, the model has several limitations. One critique of this method is whether it presents an inherent measure of value. Second, it does not measure quality of care. Third, it is very time-consuming. Fourth, much of it is subjective (especially the values derived for the x-axis). Fifth, many of our respondents could argue that there is no accounting for the intangibles. In response, the developers argue that the divisions take into account both the tangible and intangible values during their discussions over valuing the x-axis.

Performance-Based Contracting

As noted briefly in the literature review, Wisconsin is experimenting with performance-based contracts to have state and local public health departments negotiate contracts for the state to buy products and services from LHDs (Chapin and Fetter, 2002). The goal in the Wisconsin experiment is to use contractual negotiation to set the value of services, but researchers have not reported on how the participants defined and measured value. As with the cost-accounting model, it is not clear whether the Wisconsin approach measures intrinsic value or simply creates a process for better local decisionmaking. One respondent argued that the model “uses market transactions to negotiate value,” but does not establish a service’s intrinsic worth.

Our interviews suggest that the model had considerable support at the state level, but was less enthusiastically received at the local level, at least in part because it allocated resources away from politically connected LHDs. For this model to work, respondents noted, it requires strong and continuous political support and a willingness to sanction failure to meet the contractual productivity goals.

As a home-rule state, LHDs in Wisconsin have considerable flexibility to design and operate their public health efforts as they deem appropriate. But the state contributes financial resources. For those resources, the state and LHDs negotiate (through an independent arbiter) exactly what the LHD will provide for the state’s investment. In this way, an LHD sets priorities for how the state’s money will be spent and what outcomes will result. If the LHD can provide the expected results on less money, it keeps the difference. If the LHD does not meet its expected performance targets, it must reimburse the state for a portion of the money.

Our respondents characterized the model as a quasi-market process that “moves away from the entitlement or social goods mentality.” It is a social exchange based on value—in essence a social willingness to pay. In this model, LHDs determine the social value of the services they are willing to provide given the amount of the state’s investment. One implication is that each LHD will negotiate to provide different levels and types of services reflecting local needs. To avoid categorical price setting (i.e., the state imposing a price it is willing to pay), the model requires the involvement of an independent third party (equivalent to a messenger) who transmits bid and offer prices between the state and LHDs.

Within some boundary constraints, an LHD has considerable flexibility to pool or allocate funds across service lines as long as the LHD can justify the expenditure through the negotiation process. A major advantage of this model is the flexibility it provides to LHDs to explore cross-program synergies. LHDs are responsible for meeting goals; how they deliver the product is at their discretion. Respondents argued that the model facilitates difficult choices because of the flexibility and the opportunity to pool funding with other LHDs (i.e., environmental health across several rural LHDs). The model also shifts the focus away from monitoring budget allocations and toward meeting contractual objectives.

As with the cost-accounting model, the intangibles are captured in the negotiation process. If an LHD wants to factor in core public health values such as social justice, for instance, it is free to do so. As long as it meets the objectives of the state funding, an LHD can invest in environmental justice if it values that over competing uses of the funding. In this way, LHDs bargain for what it values most. Still, the state buys a specific activity or product, not the social values *per se* that may be incorporated into the product.

Also similar to the cost-accounting model, the process is democratic in the sense that neither side can impose its will on the other. If the state thinks the LHD’s program is a bad idea, it can refuse to fund it. If the LHD thinks that the state’s productivity demands are excessive, it need not bid. Since each side needs something from the other, the process, through the intermediary, usually results in a negotiated market-clearing (equilibrium) price. The onus is on the intermediary to make the entire transaction transparent. The intermediary can say that the state is being an unrealistic steward of the funds or that the LHD’s goals are set too low. As an alternative, the intermediary is allowed to open the bidding to another LHD. The resulting agreement approximates the value of a particular service to both the state and an LHD.

A third similarity to the cost-accounting strategy is that the contractual approach is a business model. According to one respondent, this is not “selling the process of doing good. Rather, it is the product [being sold] that incorporates doing good.” Unlike the cost-accounting model, a respondent argued that the social exchange is best viewed as product-driven, not process-driven. A proponent noted that its “front-end value is determined by negotiations; the back-end value is determined through evaluation.” Proponents also argue that the model encourages cross-program synergies because it provides considerable flexibility for the LHD to meet the contractual expectations. “The state values the product, not how the LHD delivers it.”

Regardless of its potential advantages, implementing the Wisconsin approach has been difficult. The primary problem is that the model was enacted under a Republican Governor who favored a market approach. When the political climate changed, the willingness to sanction under-performing LHDs evaporated. A second problem is that it requires a substantial

investment in evaluation. Whether the model works can only be determined after several years of data collection and analysis. Third, our respondents pointed out that it is not a true market transaction because the state has an interest in making sure that the services are provided and that LHDs do not fail. Fourth, according to state-level respondents, LHDs resisted changing the *status quo*. They feared that because so many aspects of meeting productivity goals (such as increased vaccination rates) were out of their control they would lose funding in the next round. Fifth, the state developed an elaborate information technology system that was beyond the capacity of most LHDs. Sixth, the state was not willing to pay for infrastructure support, only for specific services.

Logic Models

Several LHDs in our sample are using logic models to evaluate programs using specific performance indicators. (Logic models are defined as systematic and visual displays of the sequence of actions that describe what a program is and will do, what the outcomes are, and how the program will be evaluated. A logic model links investments to results, and will typically display inputs, activities, outputs, outcomes, and impact.)¹ The stated purpose is to connect themes of performance management, continuous quality improvement (CQI), and strategic planning. Doing so will improve the quality of services provided, which, in turn, is a measure of value.

Proponents of this approach suggest that using logic models is a way to assure value because the exercise links expenditures to outcomes. Logic models have the added attraction of providing context for the data to be collected and analyzed and allowing politicians to follow the process to results. At least two LHDs use a logic model as both a direct connection to strategic planning and as a zero-based budgeting tool. Both stressed the importance of connecting the logic model to the strategic plan as an iterative process in developing the database to show value.

The logic model is a useful tool for identifying existing data, gaps in data, and how data can be obtained. Developing the data based to show outcomes is an important element in demonstrating value. An integral aspect of the logic model approach is that each program develops an evaluation plan to show that the program makes a difference and what the impact is. As part of implementing its strategic plan, the logic model is used to determine how much each program contributes to population health (i.e., through reductions in morbidity and mortality). Through a rigorous evaluation process, the logic model helps articulate why money should be invested in “x” or “y” program.

An unanswered question in our interviews is whether logic models measure value. One respondent argued against, saying that “logic models move toward value, but do not constitute a cost-effectiveness analysis (CEA) tool.” A related critique was that logic models do not adequately define either output or outcome measures.

Performance Standards/Accreditation

The academic and national respondents in our sample are the primary proponents of using performance standards and accreditation to measure value. They argue that these models

¹ See, e.g., <http://www.uwex.edu/ces/pdande/evaluation/evallogicmodel.html>; <http://www.wkkf.org/Pubs/Tools/Evaluation/Pub3669.pdf>.

will help improve quality and efficiency, and therefore enhance value. In particular, proponents assert that evidence-based performance standards indicate best practices of what services LHDs should provide to the community. By improving workforce competency and efficient delivery mechanisms, this approach will improve quality and enhance the system's credibility with policymakers. Perhaps most importantly, proponents assert that performance standards and accreditation will enhance accountability.

At this point, they note, performance standards do not provide an evidentiary base showing quality improvements. The absence of a research base linking inputs to outputs is an impediment to using performance standards to identify quality or other outcome measures. But in the sense that performance standards lead to better value for what is being purchased, the model is complementary to the Wisconsin approach discussed above.

LHD respondents were split on the utility of performance standards. Proponents argued that the standards are helpful for defining quality of care, but limited for defining or measuring the value of the services provided. Most LHD respondents suggested that performance standards could be an important part of the mix, though likely to matter more at the margins. For instance, an LHD respondent noted that "Performance management and accreditation are tools to assure value, but don't produce value in themselves. Continuous quality improvement (CQI) is a way to assure better value" for the money invested. Two respondents suggested using performance standards to determine a broad set of public health goals akin to the Institute for Healthcare Improvement's saving 100,000 lives campaign for improving the quality of medical care. LHDs that "meet performance standards/CQI outcomes will have better success in showing economic and political value to policymakers." Improved quality enhances accountability to the public and to policymakers, but respondents noted that public health currently lacks the evidentiary base to move in this direction.

A related issue is the importance of the ten essential services and the three core functions of public health (surveillance, policy development, and assurances—IOM, 1988) in serving as standards to measure value. A few respondents, especially the academic and national respondents, argued that since these services represent the core of public health, meeting them would signify value. The majority of LHD respondents, however, were lukewarm at best to this approach, arguing that they are too broad to be useful as measures of value. "Accreditation and performance standards are more important for building infrastructure than for measuring value."

Numbers (Counts)

Our interviews suggest that numbers are necessary but not sufficient as an approach to measuring value. For most respondents, the role of numbers depends on the type of program or service. For instance, vaccination rates and infant mortality are important indicators of program productivity, yet the number of home health visits has little meaning in and of itself.

Respondents generally characterized numbers as important process measures that can be used for tracking productivity and community engagement over time. A typical LHD response is that "numbers are important as outputs, or measures of productivity—not as outcomes." Another respondent suggested that measuring behavioral change rather than number of encounters would be a better indicator of program effectiveness. This respondent does not deprecate the importance of numbers and the need to quantify outcomes. Indeed, the respondent argues that

numbers are a significant indicator of program value when tied to broader measures of quality, and the LHD uses a quality assurance matrix for each program.

No respondent equated numbers with outcomes. An additional concern about numbers is that they are hard to communicate effectively to policymakers. “Burying people with numbers loses the human drama. People don’t receive information that way. [We] need to communicate the impact of public health on people—how it affected someone’s life.”

D. MEASURING VALUE

Our interviews did not reveal a consensus on what metrics to use to measure value. About the only general agreement is that respondents are struggling to demonstrate the value of their services and believe that rigorous science is the key to understanding and measuring value. “Measuring value requires a connection between programs and scientific methods to determine whether the programs can effectuate better outcomes.”

The national respondents in our sample stressed the need to develop data-driven methods of value. While not disagreeing, the LHD respondents in our sample tended to stress the difficulties in collecting and analyzing the data.

Criteria

Our respondents offered differing views on what criteria should be used for measuring value. The various approaches included looking at outcomes, the determinants of health, core values, return on investment, the implications of taking some action vs. doing nothing, the effectiveness of the intervention, and the level of engagement. Most respondents coalesced around outcome measures as the key criterion, but disagreed as to whether changes in morbidity and mortality were feasible indicators. While agreeing that morbidity and mortality are important aggregate measures, respondents focused on individual program outcomes as more meaningful because of the difficulty in attributing changes in morbidity and mortality to public health interventions. A few respondents also noted that developing multiple methods would be beneficial.

CBA/CEA

Numerous respondents identified cost benefit/cost-effectiveness analyses (CBA/CEA) as potential instruments to measure the value that certain services bring to the community. Despite the attraction of these methods for demonstrating value, very few respondents felt that LHDs were currently able to undertake these analyses.

One of the most significant barriers regarding the implementation of CBA/CEA is lacking enough or skilled staff to conduct the analyses. Respondents consistently mentioned several other challenges for using CBA/CEA: availability of adequate data; communicating the results to the public and policymakers to help them understand the value of the services provided; and the political willingness to base allocations decisions based on the results of CBA/CEA. Repeatedly, respondents indicated that they were unsuccessful in conducting CBA/CEA given current staff capacity and resources.

To deal with the capacity concerns, several respondents recommended developing academic-practice partnerships. Academics bring the methodological skills needed to develop rigorous scientific measures to connect programs to outcomes. Academic resources can also provide insight into program development.

Return on Investment

Many LHD respondents would like to demonstrate that public health services provide communities with a strong return on investment (ROI). A national respondent argued that ROI should be based on more than lives saved, using, for instance, the net present value of public health services. Those LHD respondents favoring ROI as a measure of value were quick to point out that they do not necessarily know how to translate that empirically.

One concern expressed about using ROI is that it could devalue certain important public health initiatives. Suppose, for instance, ROI for vaccination is \$10, but the ROI for WIC is \$3. Should resources be shifted to the higher value ROI solely on that basis? Even if the conceptual challenges can be surmounted, there are at least two practical limits to ROI as a measure of value. In many prevention activities, the return on investment may be harm avoided. For instance, suppose a state invests \$5 million in stockpiling antivirals for a threatened bioterrorism attack. But if the attack does not occur, there is no ROI. In addition, the actual return on the investment may not be determined for many years. Other than stopping a disease outbreak, many of these investments do not show benefits until many years have passed. Over a lifetime, prevention is an essential component of public health. Yet the ROI may not be very high.

Another proponent of ROI noted that some public health services, such as epidemiology labs, could be marketed as profit centers, where the measures of productivity could be turn around time, workload units, and quality of the testing (i.e., accuracy of results). In this approach, the ROI could actually be a reduced number of tests and a focus on avoiding test mistakes.

Morbidity-Mortality Data

No respondent disagreed with the proposition that collecting and analyzing morbidity and mortality data would seem to be an essential activity for assessing the value of public health services. At the same time, LHD respondents consistently argued that the methods for connecting programs to outcomes were under-developed.

Several LHD respondents indicated the difficulty of measuring morbidity and mortality or life-years saved at the local level. Surveys are too expensive and willingness to pay (WTP) or CBA/CEA analyses are beyond the LHDs' capacity. In Wisconsin, the state is taking the lead on developing these measures and providing the information back to LHDs. Wisconsin is developing community profiles to rank counties (relative to each other and to other states based on aggregate measures), understand changes over time, and, perhaps, identify what works.

A small number of respondents (particularly national and academic respondents) focused on showing the value of public health services in extending life (i.e., years of lives saved) and enhancing individuals' productivity. For example, what are the productivity gains from avoiding chronic disease? After the fact, how many lives did public health intervention save? Before the

fact, what resources will be needed to save lives? A national respondent argued that years of productive lives lost could be an interim measure that translates into tax income lost, hence justifying the need to intervene. One way to do so is to translate the number of visits into health status changes/years of lives gained. In this approach, LHDs would need to collect data on health status indicators or conduct health impact assessments.

Community Needs Assessment

Community Assessment is another important tool for measuring value and impact. Many respondents noted the importance of obtaining community input in establishing program priorities. One respondent offered an analogy to community assessment with the voting process for setting priorities for community partners and participants.

Community assessment provides an understanding of recent trends that can help practitioners identify new programs and funding sources, as well as which programs are no longer needed. “Managers can expand programs where data and assessment suggest they are advisable if resources are available.” Another respondent observed that community assessment had added value as a marketing tool, but noted enigmatically that while it can be useful, there are some difficulties with “attributing value of past [activities] to get to value in the present.”

An interesting experience to examine as a potential trend is an LHD community assessment finding that there was little variation in views of public health importance between the LHD staff and the community. The CHO attributes the convergence to people absorbing the same news headlines (i.e., obesity).

Public Health as Insurance

Two respondents suggested an analogy between public health and an insurance model. Based on actuarial concepts of pricing risk, they argued that an insurance model could be used to price the mitigation of risk through prevention activities. Value would thus be the mitigation of risk. In this sense, public health produces and disseminates information, such as surveillance data, which can be used to assess risk and then value its mitigation.

E. LIMITATIONS TO MEASURING VALUE

The End of the Moral Imperative

One of the key limitations to measuring value is, as one respondent graphically put it, “The cowboy on the white horse isn’t selling today.” Added another LHD respondent, “Economics sells public health; intangibles don’t sell.” Not only is it hard to sell intangible values, but public health practitioners must often try to sell the value of a negative—quantifying what did not happen (i.e., the disease epidemic avoided) as a result of public health intervention. Perhaps the most trenchant comment (reflecting a position of cynical realism) regarding intangibles is the following: “In this world, value is the political capital purchased, not the public health produced or its intrinsic social value.”

Consistently, respondents noted the difficulty in selling the value of downstream savings from prevention and other long-term improvements in the public's health. Neither the value of avoiding disease nor the beneficence of "doing good" seems to resonate with the public. Even if policymakers agree in concept with the long-term efficacy of prevention, they are much more concerned with what works now and how much it will cost. "Good results cost money; the benefits accrue in 20 years." Respondents were persistently cynical that politicians cared about anything other than deflecting constituent anger. As one respondent pointedly said, "The board of health is more interested in balancing the budget than in mortality and morbidity."

A concern that several respondents mentioned is the potential that success could lead to budget reductions. As an example, one respondent noted that funding was eliminated from a successful syphilis control program, only to face a current resurgence. "When there's a crisis, money is available; when successful, money goes away." This, LHDs are legitimately concerned that do lower disease rates (say, of tuberculosis) can actually result in reducing the need for public health clinics and intervention at the expense of long-term population health.

Attribution

The heart of the difficulty in measuring value is the attribution problem, the difficulty of demonstrating that the investment in public health contributes to decreased morbidity and mortality (i.e., that the outcomes are related to the intervention). Numerous respondents conceded that it is hard to demonstrate the "correlations between prevention and disease reduction." Further, "People don't attribute value to public health and its impact on community health." In a political environment that focuses on short-term benefits, the inability to show short-term population health gains only exacerbates the attribution problem. Just as important, the value of an LHD's intervention cannot be measured alone. It is often a systems issue which can only be measured through the combined inputs of various factors and collaborators. A good example is maternal/infant home visits which can measure infant mortality for 1 year outcomes. But the overall economy might be more important than public health intervention (same with low birthweight)

A conceptual problem that two respondents mentioned is that the mission of governmental public health is to experiment and demonstrate a service's utility and then shift it to the private sector. Over time, governmental public health systems are left with "the losers," as more valuable programs move to the private sector. To be sure, this allows LHDs to develop new programs that have value, but it reduces LHDs' overall value and visibility.

Politics

Politics as a limitation emerged in several ways. First, respondents noted that certain services are either legally mandated or championed by political bodies regardless of supporting data. According to respondents, lawmakers too often favor retention of programs, such as dog-bite efforts, that have little connection to improving public health. Arguing the science in response is a losing proposition. Second, as noted above, politicians have a short-term focus, while public health is based on long-term benefits. Politicians want to be able to say "Here's what I bought for you," but "costs are up-front, and savings don't accrue to current policymakers." Third, public health operates in a political environment, and public health practitioners are accountable to elected officials. Fourth, in an era that emphasizes and values

private sector activity over government, public health practitioners have an added burden in justifying the investment in public health relative to firefighters and police. Fifth, some respondents explicitly recognized that some issues were untenable in their jurisdiction, regardless of value, such as family planning services in some politically conservative areas. To be fair, the converse is also true. Several respondents noted that in their more politically liberal areas, social justice was politically tenable.

Staff Capacity

As suggested at various points above, staff capacity to conduct the data analyses needed to measure value is a serious limitation. This has two aspects. First, outcomes data are not readily available and may be very expensive to collect and analyze. For the more sophisticated quantitative methods recommended in our interviews, the lack of data could well be fatal to any serious attempts to measure value. Equally significant, “some of public health is just too difficult to measure (i.e., defining the outcomes from investing in farmers markets in low-income neighborhoods).” One suggestion was to measure value for a few selected programs as opposed to the entire range of programs. Another was to pool resources across jurisdictions to conduct some CBA/CEA analyses.

Second, respondents also recognized staff resistance to the need to measure value, especially for making trade-offs at the margins. Several respondents noted that public health practitioners are reluctant to cut any program. A few went so far as to criticize practitioners as being “purists who won’t compromise.” While this was not a prevailing attitude among our respondents, the concern that public health practitioners have a “holier-than-thou” streak can certainly be an impediment to the fundamental tradeoffs that LHDs now face.

V. DEVELOPING THE FRAMEWORK

Not surprisingly, our interviews do not reveal any easy answer to the question of how to value public health goods and services. One reason is that most practitioners are too busy to develop mechanisms to measure value, even where they have the skills and recognize the need to do so. In any event, few practitioners seem to have these skills and requisite training, nor do LHDs have funding to evaluate their programs. Another reason is that there have not been opportunities to share information to build and learn from one another. LHDs operate largely in isolation from one another, focusing on local needs and political considerations; they have lacked the opportunity to build a common framework. Those respondents who have been developing strategies have only sporadically shared their vision and experiences with others in the field.

Despite these limitations, our respondents indicated a strong belief in the value of GPHSs and a strong desire to formally measure the value of their services. The interviews demonstrate that being able to measure value would be a necessary (though not sufficient) step to secure political support for investing in public health services. Absent measures of value, it is difficult for LHDs to compete for scarce resources. Nonetheless, our interviews did not identify a fully objective approach with clear criteria for measuring value. Perhaps even more than in the other sectors we reviewed, the importance of intangible values in public health virtually ensures that some element of subjectivity will be a factor in measuring value.

A. GOALS

One way to approach the valuation question is to consider the goals a framework should accomplish. In our view, the framework needs to achieve seven complementary goals. First, it should be a general measure of overall value of the public health system's goods and services. Second, the framework should operate to enable practitioners to make tradeoffs at the margins between desirable services. In an era of constrained resources, LHDs may need to choose which programs to retain, which to eliminate, or which to cut. Third, the framework should distinguish between the value of public health as a system and the value of specific services. Fourth, the framework should be able to incorporate both tangible and intangible measures of value. Fifth, the framework should be a vehicle for communicating the value of public health services to the community and its political representatives. Sixth, the framework must be feasible. As attractive as the performance contracting model is in theory, our interviews suggest that it may not be feasible to implement in practice. And seventh, the framework should function as a mechanism to hold practitioners accountable for public health activities. Thus, the model should encourage the use of evidence-based public health in driving service delivery choices.

Whether these are inherently incompatible and whether any one framework can address all of these dimensions simultaneously remains to be tested. At this exploratory stage, any framework will raise feasibility concerns. It may well be that the choice of a useful framework will be which one is more feasible than the alternatives. Our interviews also suggest that it will be manifestly difficult to achieve the first and third goals. At this point, the best we can recommend is to focus initially on individual programs and then subsequently develop a mechanism for measuring the value of a sustainable public health infrastructure.

From the LHD perspective, our interviews make it clear that valuation must incorporate community views (beyond the normal political input). To do so, many respondents noted the need for some type of community needs assessment. Respondents differed on the specific mechanisms (APEXPH vs. COMPASS, for instance), but all were sensitive to the need to incorporate significant, substantive community involvement. We should note that no respondent even hinted at using community involvement for either window dressing or to impose LHD priorities.

In addition, the framework should guide the data collection and analysis process. Key to successfully using the framework is developing the evidentiary base. As our interviews suggest, scientific effectiveness should guide program decisions. A framework can help LHDs decide which data to collect and how the data should be analyzed, along with identifying gaps in the data and how those gaps can be filled. Equally important, implementing the framework can identify lost opportunities (and related opportunity costs) resulting from investments in public health services that do not provide value to the public's health.

Rationale for Selecting a Model

Since there are no obvious measures or strategies that will capture intrinsic value, the best alternative is to develop a framework that can be useful in articulating relative value. Our interviews suggest that we can determine some of the component indicators of value and a process for how to approximate value. As noted above, our results suggest five basic ways or

models for thinking about the value of public health services: cost-accounting; performance-based contracting; logic models; performance standards/accreditation; and numbers (counts). None of the models is a stand-alone product. That is, each model can incorporate aspects of the other approaches in very creative ways.

In the results, we discussed how respondents perceive the advantages and limitations of each model. As academics, we are mindful that the pros and cons of any given approach (or combination of strategies) could look very different to practitioners. Even so, we have the advantage of obtaining input from a wide range of practitioners, other academic researchers, and national leaders to suggest meaningful alternative approaches.

We see no reason for re-inventing the wheel. When we combine the systematic models with respondents' individual views of how to measure the value of public health services, the cost-accounting approach stands out as being the model that best incorporates the most important component parts of value as articulated through our interviews. Therefore, we use the cost-accounting approach as our point of departure. Because we rely so heavily on this model, we have asked the developers, whom we interviewed, to waive confidentiality so that we can attribute due credit to them. They, Joel Lucia and Jeff Campbell of the Lake County, Ohio, Department of Health, have agreed.

We note, however, that while respondents' views of this approach were largely favorable, there were some critiques. For instance, this approach does not specify the criteria for establishing priorities, lacks an adequate scaling mechanism to assess community input, and may not facilitate tradeoffs at the margins. We agree that the model can be improved and might be used in conjunction with other models. Rectifying the methodological limitations of the cost-accounting approach and other valuation techniques is beyond the scope of this report. In the next phase of this project, we propose to test the general framework outlined here. That project will include the next iteration of the cost-accounting methodology.

Whatever its shortcomings, we believe that the cost-accounting model, particularly the way it is structured, provides an excellent starting point for subsequent analysis, testing, and discussions with practitioners. Compared to the other models we examined, the cost-accounting approach comes the closest to meeting the goals set forth above. It also has the advantage of the experience gained in using the model to make programmatic choices, indicating that the model is feasible. After systematically reviewing the possible choices, the alternative models will not encompass a sufficient number of the goals to serve as useful frameworks. As described in more detail below, we have incorporated elements from the other models into our recommended framework.

Scope of the Framework

In setting forth the framework, we have erred on the side of being overly expansive at this stage. We recognize that the framework will need to be streamlined based on feedback from practitioners. Nevertheless, it is appropriate to establish some parameters (or organizing principles) for what should be included. Otherwise, the framework will collapse of its own weight.

Our interviews suggest various categories that should be included in the framework. Among the features are whether the service: is mandated; is available elsewhere; would increase morbidity/mortality if not provided; is financially viable; is effective; serves a critical mass of people; and reflects core public health values. Based on our interviews, several other facets of public health must also be captured. Quality of care is a crucial aspect of public health service delivery that has not been adequately considered in the past. Just as important, the intangible values and investments in prevention that form the core of public health must be included in setting program priorities. Along with these aspects, several of our respondents suggested that developing a strategic plan and conducting a community needs assessment are necessary steps toward measuring value.

Process. An important aspect of the framework is to develop a process for defining value through priority-setting to determine how the community and public health practitioners assess the importance of specific services. Lucia and Campbell argue forcefully that the process they pursue is important for gaining consensus among the staff. Other respondents agreed with this assessment. In fact, at least one other Chief Health Officer encourages competition among the LHD's divisions for determining program priorities/value.

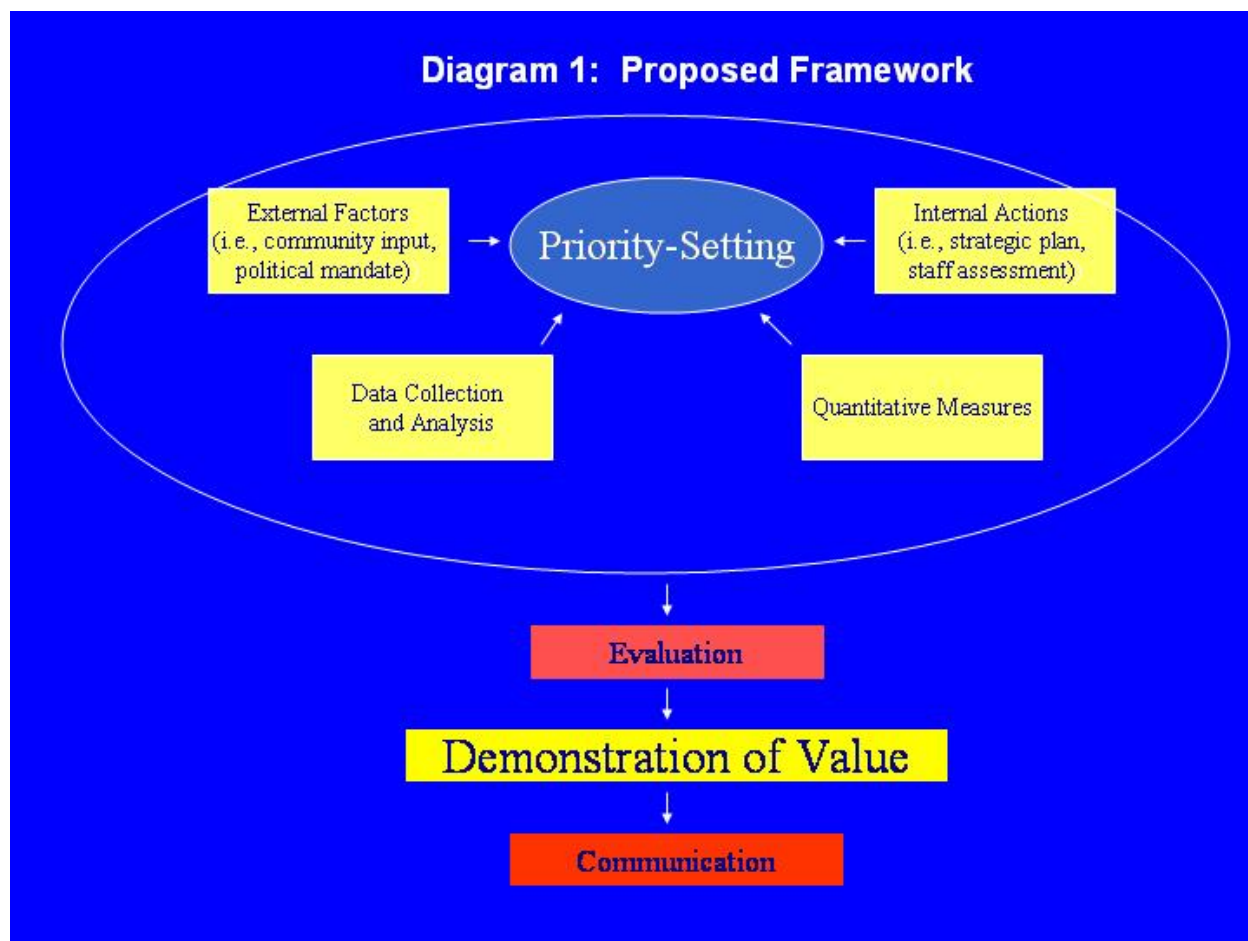
The second key process component is communication to politicians and to the public. In the Lucia-Campbell approach, each division director presents his or her case to the elected officials. In this way, the dialogue over defining priorities extends to and involves the political system. No other respondent indicated such an explicit process of the staff-political interaction.

Evaluation. One of the areas where public health has been deficient is in program evaluation. Our results confirm this deficiency. For numerous reasons, program evaluation appears to be, at best, an afterthought. Very few respondents include an evaluation component to determine whether the services are achieving their stated goals or whether the services could be achieved in a more cost-effective way. Resource limitations, along with a general lack of staff expertise, make it difficult for LHDs to invest in program evaluation. But if LHDs are to be successful in measuring value, implementing rigorous program evaluations will be a necessary component.

Implementing the Framework. There are significant challenges for implementing the framework. As our interviews found, currently data available for measuring value may be inadequate. Combining intangibles and tangibles within one framework may be difficult, at best. In the next phase of this project, we plan to pilot test our proposed framework to ascertain its feasibility at the practitioner level.

B. THE FRAMEWORK

Our proposed framework considers four component elements to determine program priorities. First, what are the external factors that must be taken into account? Second, what are the key internal actions that an LHD must take? Third, what are the appropriate quantitative measures to assess value? Fourth, how can value be communicated to politicians and to the public? Diagram 1 presents a schematic overview of the framework.



External Factors

LHDs do not operate in a vacuum. Each LHD has an array of external stakeholders, constituents, and responsibilities that must be factored into programmatic decisions. Understanding the external factors and demands is therefore important for the context in which value will be measured. Four external factors (discussed in no particular order) should be considered.

Community Needs Assessment. The first involves developing a process for assessing community needs, identifying gaps in services the community wants, and engaging the community in deciding what services to provide. Although there are countless ways of obtaining community input, our respondents mentioned surveys (mail or web-based), focus groups, and stakeholder priority-setting sessions as their primary methods. Among the questions to be addressed are:

- Which services does the community value or want?
- Do constituents believe that programs are operated fairly?
- How do community partners and external constituencies (particularly other health care providers) value public health programs and the public health infrastructure?

In constructing the survey instrument, LHDs should determine the criteria for both priority-setting and how existing services will be ranked.

Mandates. Next, the LHD should determine which services are legally mandated. Along with federal mandates, each state and even each county may mandate that an LHD provide specific services. Beyond the legal mandates, there are also what amount to political mandates. As our interviews disclosed, some services are politically taboo in certain areas, while some politicians expect specific programs to be retained regardless of any objective metrics of the service's value or need.

Revenue Sources. Third, the cost-accounting framework examines extensively each program's revenue sources. Those sources include general revenue, grants, contracts, local taxes, and fees. Eventually, revenue needs to be compared to cost (and its impact on the community) to assess the program's viability. The salient questions include:

- What are the fiscal consequences of cutting, eliminating, or expanding specific programs?
- Can the fee structure be enhanced?
- How would savings be allocated?
- Is the service receiving funding from another source (such as a grant)?
 - Is that funding categorical or discretionary?
 - Is the funding ongoing or temporary?

Program Alternatives. Fourth, the LHD must determine alternative program delivery options. In an era of private sector dominance, LHDs have little choice but to look to the private sector to avoid duplication of services and, more importantly, to assess whether the private sector would provide services no longer feasible or cost-effective for an LHD to offer. Some of the questions to address include:

- Is some other provider in the county currently delivering or would be willing and able to deliver the service?
- If so, can current funding levels and quality be maintained?
 - What is the long-term impact to the population being served and to the community if services are shifted to the private sector?
 - How would the private sector provider be monitored?
 - Is a switch to the private sector politically feasible?
- How much money would be saved if shifted to an alternative provider?

Internal Factors

Not only do most LHDs operate in isolation from one another, they are organized and operate differently internally, even relative to others in the same state. The problems each Chief Health Officer (CHO) faces in leading an LHD, such as the LHD's organizational structure, staff capacity, available resources, the level of political interference, deviate substantially across LHDs. As a result, CHOs face different incentives (and limits) in weighing these factors based on their LHD's distinct cultures and options. Four internal factors (discussed in no particular order) should be considered.

Strategic Plan. Several respondents (though not a majority) mentioned the importance of developing and implementing a strategic plan as part of the process of measuring value. Those who raised this issue were quite emphatic about its utility, noting that it is especially useful in setting forth broad strategic goals that can then be linked to specific programs. Though potentially a useful tool, a strategic plan is not a necessary component of deriving measures of value.

Staff Assessment. Both as a process mechanism and for the substantive determination of a program's value, involving all staff in program assessment is central to implementing the framework. Whether an LHD follows the Lucia-Campbell process is less important than engaging staff in developing program priorities and in making decisions to cut programs if resources are not available. Whatever the process, management should consider setting forth criteria for rating and then ranking each program. That will facilitate comparisons across programs that serve different constituencies and provide differing types of services. While we recognize how painful it can be to cut long-standing programs, resource constraints now virtually compel difficult choices. Ranking programs is one way to inform policymakers of which programs to retain, cut, or eliminate.

In setting forth criteria, LHDs might consider the following:

- What are the core public health services the LHD provides?
 - How are they determined?
 - How are program priorities established (i.e., through a strategic plan)?
 - If the LHD started from scratch, would you retain the service?
 - Is a program legally (or politically) mandated?
 - Does the program support the LHD's mission?
 - Does a program help the entire population or only a narrow group?
 - Does the program offer long-term benefits (i.e., dental hygiene)?
 - What would the impact be on vulnerable populations from the failure to maintain current spending levels (i.e., on Hispanics and low birth weight infants)?
- Which programs are unique to population health (i.e., social justice)?
- Which aspects of a given program are crucial for assessing health at the population level?
- Who is not being served by current programs?

Once the criteria are established, the key questions are straightforward:

- Which programs do staff value most and why?
 - Are reports generated showing program benefits, activities, expenditures, and money saved?
 - Repeated discussions of "why are we doing this" should be encouraged
 - Staff should also discuss and specify the tangible and intangible attributes or benefits of a given program or service
- For each program, if there's a cut, could the program still achieve current outputs?
 - Can core staff or administrative services be cut first?

- Would there be a critical mass of work in the area to be credible?
- What aspects of public health are unique and need to be guaranteed at the population level?
- Is a cut in services morally defensible? Would it increase health care disparities or access differentials?
- Which individuals/groups are most at risk (by zipcode)?
- Would money be saved?
- Would cuts endanger preparedness activities?
- Is the need for the program supported by or connected to priorities in the strategic plan?
- How many people is the program currently serving?
 - Are people not being served who should be included?
 - What is the number of expected vs. actual contacts?
- What are the implications of doing nothing (i.e., eliminating the service)?
 - Are vulnerable groups involved?
 - Would cuts reduce the broad spectrum of available public health services?
- Is there a strong political or public constituency for the program?

Quality of Services. In the Lucia-Campbell cost-accounting model, impact on the community is a factor in determining the public health importance of a particular program or service, but the approach does not describe how to measure the impact. In our interviews, the quality of a service emerged as an important component of value. Thus, LHDs might address several questions relating to quality and its impact on population health.

- Is the LHD the most efficient and effective service provider?
 - Are programs based on the best available scientific evidence?
 - What data are collected and analyzed?
 - What data are needed that are not currently available?
 - How is effectiveness determined?
 - Are the programs cost-effective?
 - On what basis did the program contribute to improving the public's health?
 - If no tangible contribution, what are the program's intangible contributions to population health?
 - What is known about how people are responding to the services (i.e., evidence of behavior change)?
- How well is each program working? How is quality assessed?
 - What are the criteria for determining whether a program is working?
 - Are program outcomes defined and measured?
 - What are the performance indicators?
 - What outcomes or other program data are being collected? If outcome data are not being collected, what are the current measures of program success?
 - What evidence-based standards are being used to measure program success?
 - What measures of program efficiency are being used?

Beyond these specific questions, our interview results support the use of performance standards and the accreditation process as mechanisms for examining quality of care. Logic models may be an effective way of implementing performance standards. We are cognizant that

performance standards are at a nascent stage in public health and may be of limited utility right now.

Data Collection and Analysis. Our results suggest that LHDs have generally not developed data collection and analysis strategies. A shortcoming many of our respondents noted with regard to measuring value is the paucity of outcomes measures and data. Without adequate outcomes data, it will be difficult to assess the value of any given service or program. As others have noted, GPHSs lack sophisticated information technology infrastructure and data collection systems, limiting their ability to measure program outcomes. Unfortunately, our interviews were not designed to develop either a methodology or a specific set of questions to ascertain outcomes. Nevertheless, part of the LHD process for setting priorities should be to identify program outcomes, specify the data needed to assess outcomes, and develop appropriate data collection and analysis strategies.

Evaluation. It is beyond the scope of this report to specify any particular evaluation strategy. What we recommend is that LHDs should require periodic, if not yearly, program evaluation. Not every program needs to be evaluated yearly, but over a five year cycle, each program should be evaluated for effectiveness and cost-effectiveness at least once. There is no way to determine whether public health services are actually achieving their goals without a rigorous evaluation plan. It follows that any measure of value is dependent on rigorous and systematic evaluations.

C. METHODOLOGIES

The third feature of the framework is to select the quantitative methodologies for measuring value. Our review of the economic evaluation literature does not provide a single, obvious choice of an applicable methodology. While the Lake County cost-accounting approach stands out as the existing model that we believe best combines important component parts of value, as articulated through our interviews and analysis, and best provides a feasible point of departure in moving forward, it has some important limitations.

In particular, the approach assigns points to categories in an arbitrary manner. For instance, the approach incorporates community needs, but it may not capture the public's preferences in terms of priorities for public health programs. There is no reason to believe that the various criteria in the approach should receive equal weight, or that simply summing up the points for the various categories will reflect actual preferences. The criteria presented are not designed to be measured on an interval scale—a scale on which equal intervals have an equivalent interpretation. Thus, a difference in a change from 5 to 10 points for one category may be very different from similar change in another category. For example, two programs with very different characteristics might be given the same score, yet people in a community may strongly favor one program over another. To the best of our knowledge, the cost-accounting model has not been independently validated. Nor have the psychometric properties of the data collection been tested instrument to determine if the model has construct validity.

This critique is not intended to condemn the Lake County approach. As we emphasize above, it includes many desirable features, and we believe provides a feasible and attractive model going forward. However, we suggest that it might be presented alongside other approaches and tested alongside other models. As we highlight in our report, cost-utility analysis

(CUA) has emerged as a favored analytic technique for economic evaluation in health care. It presents the impact of services or programs in terms of incremental costs per incremental quality-adjusted life years or QALYs. CUA thus incorporates the impact in terms of both the prolongation and quality of life, two crucial aspects of showing value for public health services.

The advantages of QALYs are twofold: they capture in a single measure gains from both reduced morbidity and reduced mortality, and they incorporate the value or preferences people have for different outcomes. They incorporate interval scaling which means that comparisons in the incremental gains of QALYs are valid across programs or interventions, and that they can be used in cost-effectiveness analyses. CUAs have their own limitations as we also note, but they provide a means for comparing diverse programs in a consistent and defensible fashion. Therefore, the best approach going forward may be to use the Lake County model as the centerpiece of valuation efforts. Where possible, other metrics such as the results of cost-utility analysis should also be presented.

D. COMMUNICATION

The final element of our framework is the need to communicate value to policymakers and to the public. As our results suggest, LHDs may need to communicate and engage each of these audiences differentially. At this point, we are not prepared to suggest potential ways of resolving the split results from our interviews. We suggest a separate research project that would address communications strategies. (As an aside, we note that the Robert Wood Johnson Foundation has a current solicitation on just this issue—to assess the impact of communication and advocacy campaigns).

In the interim, we suggest that LHDs experiment with a variety of approaches, some of which are indicated in our results. We hypothesize that providing specific measures of value will facilitate communication with policymakers and engagement with the public. While we acknowledge that many interview respondents made a cogent case for the intrinsic worth of communication regardless of substance, we are skeptical that policymakers will be receptive to that strategy. In contrast, we postulate that demonstrating tangible value from investments in public health will resonate with policymakers and enhance the presentation of individual stories.

VI. ANALYSIS

A. DEFINING AND MEASURING THE VALUE OF PUBLIC HEALTH SERVICES

On the core question of our project, we reach the none-too-surprising conclusion that defining and measuring the value of public health services and the public health system remains a daunting task. No clear definition or measurement methodology emerged from our project. Both our interviews and our literature review identify many of the reasons why it is so difficult to accomplish. Aside from the prevalence of intangible values that suffuse public health practice, obtaining adequate data, identifying appropriate methodologies, and conducting the analyses are resource-intensive activities under the best of circumstances. For any individual LHD to undertake the process requires considerable expertise, fortitude, and resources.

At the same time, our respondents were virtually unanimous about the need to assess and communicate the value of public health services to a political system that has devalued public health over time and to a skeptical public that resists tax increases to pay for such services. What needs to be kept in mind is that it has taken two decades of extensive research on personal health care to begin to understand the value of specific services and how to measure the quality of health care delivery. Even there, despite millions of dollars invested in research, answers to key questions remain elusive.

Defining and measuring the value of public health services is at a nascent stage—similar to where quality of care for personal health services was about 20 years ago. To be successful, this effort must likewise be viewed as a long-term endeavor. While we believe that the framework we are proposing can have significant short-term benefits in understanding value, the process of testing, refining, and implementing the framework will require a considerable investment of time and resources. Even though our project is limited in scope, our results suggest that the investment is necessary and can be successful. We would go further and argue that without a sustained effort to define and measure the value of public health services (and, over time, of the public health system itself) the public health system will have an increasingly difficult time in competing for scarce public resources.

B. CHALLENGES

Our results suggest a few key challenges that researchers and practitioners must address in the short-run to ensure long-term success in defining and measuring value.

Defining Public Health

To begin with, we agree with respondents who noted that a precondition to defining value is to have a clearer definition of public health itself. This has been a vexing problem for the field that remains troublesome. A few years ago, the American Public Health Association sponsored a branding project, but little seems to have come of it. Defining public health is more than a marketing issue. Absent a clear definition of the field, defining and measuring value will be susceptible to a shifting target. As an example, our interview respondents were decidedly lukewarm about the use of the three core functions and 10 essential services that currently define public health practice.

Data

Perhaps the most consistently recognized challenge is the lack of core data sets. Compounding the lack of data sets is the lack of agreement on input and output measures, along with outcome measures. In our view, a high priority for the field of public health is to establish consensus on what data LHDs should routinely collect, which outcome measures should be examined, and how the data should be analyzed.

In the classic cliché, practitioners are likely to focus on what is being measured. Up until now, so little of public health has been measured that there is no standard data collection and analysis. Integral to defining and measuring value, therefore, is to develop standardized data collection approaches. Our study was not designed to develop such approaches. The best we can do right now is to encourage the field to make the standardization of data collection a high priority. Getting agreement on the “right” outcome measures and appropriate data to collect will be difficult, but doing so is necessary to move toward measuring value.

To be sure, doing so will not be easy. Take morbidity and mortality data as an example. In theory, morbidity and mortality data should be the *sine qua non* of public health practice. In reality, they have not been effective in generating ongoing political support for investing in public health. One reason is that as an end-point, morbidity and mortality data have such a long time-lag that the (presumably) positive effects on the population’s health occur too late to affect most investments. Add to that the attribution problem described in our results section, and the efficacy of relying on morbidity and mortality data is attenuated. As an alternative, LHDs might creatively think about using these data as leading indicators or early warning signs to project where investments could improve the public’s health.

Staff Capacity

As academics, we face the conundrum of trying to develop elegant solutions that will satisfy peer reviewers without ignoring realities that practitioners face in implementing proposed solutions. This project is a good example. Of the many possible frameworks and methodologies that could be selected, the reality is that they must be feasible for overworked public health staff to use. If not feasible, the frameworks will be dismissed out of hand. At the same time, the framework must be robust enough to achieve results that would otherwise be unavailable.

It comes as no surprise that our respondents identified staff capacity issues as a major impediment to measuring value. Workforce concerns have generally been at the forefront of discussions regarding the delivery of public health services. Indeed, many CHOs noted that they lack staff capability to conduct even rudimentary CBAs/CEAs. Several suggested the need for academic partnerships to provide the analytical capability to conduct these analyses. (RWJ is now funding a project to link academics with practitioners.) We certainly support and encourage such collaborations as a starting point for providing added analytical capacity.

In this context, it is worth mentioning what did not arise during the interviews. Only one respondent mentioned surge capacity, and no one discussed high-risk events. For instance, should public health systems be concerned with averting high-risk events (such as pandemic flu or bioterrorism), chronic disease prevention, screening, or alleviating health disparities for

vulnerable populations? The question of staff capacity to address both issues was strikingly absent in our interviews.

More interesting, given the research that Glen Mays and Susan Zahner are conducting, is that none of our respondents suggested that measuring value must take into account nongovernmental inputs. Not only do the Mays and Zahner studies suggest networks of public health services provided by both public and private sectors, recent trends in public health practice suggest an increasing role for the private sector. There is now a substantial literature documenting these trends. Thus, it is curious that our respondents did not directly incorporate the benefit of private sector providers into their definition and measurement of value.

Measurement Techniques

In terms of the measurement techniques used to value public health, our study revealed some progress but also challenges. The peer-reviewed literature contains numerous studies using varied conceptual approaches, including formal cost-benefit and cost-effectiveness methodologies. It also reveals applications to diverse areas of public health. Our review uncovered several dozen studies that use cost-utility analysis, a recommended approach for the field, which allows decision makers to compare diverse programs using a standardized metric. However, there remain variations in quality and notable gaps in the methods used for valuation. Even within the cost-utility approach, studies differ considerably in their valuation methodologies.

Perhaps a larger issue pertains to the reality that these studies do not seem to have penetrated into the decision maker's mindset. None of the interviews revealed any connections between this body of literature and the practical working needs of LDHs. Indeed, respondents did not identify the existing research on valuation at all as an important source of information. They did not use the opportunity to discuss their own struggles to evaluate the value of public health with any existing research on the topic.

Several reasons might explain these results. Even if they were to locate it, the decision makers would likely find it difficult to connect the research to their own decisions. The analyses generally contain a "societal perspective," which is appropriate in the sense that they incorporate all costs and benefits that accrue to society. But the societal perspective analyses are difficult to use because they ignore the working realities and lack of expertise in most LDHs. The studies do not include implementation costs, for example, nor do they take into account actual budget constraints facing LDHs. They contain abstractions like quality-adjusted life years.

An additional problem may be a disconnect between cultures. On the one hand, the academic research being conducted uses abstract approaches and is usually published in somewhat obscure journals. On the other hand, there is a lack of training and resources at LDHs. At best, the research remains elegant but inaccessible.

All of this points to the need for more training and resources for LDHs, but also for the development of a framework and of tools that consider the perspectives and requirements of the people making decisions.

LHD Isolation From One Another

An issue that emerges from our interviews is the difficulty LHDs have in sharing innovations and information. At least across states, there does not appear to be a mechanism for LHDs to share information. For instance, our interviews revealed various attempts to define and measure data, with little knowledge of how other LHDs were approaching the issue. Some were aware of the cost-accounting strategy, though not necessarily conversant with the details. Most simply developed their own systems *ad hoc* or just decided that it was too difficult to measure value given current staff capacity concerns.

As a result, there were few synergies across LHDs, little building on prior initiatives, almost no testing of innovations, and lots of time spent re-inventing the wheel (i.e., duplicating previous or ongoing efforts). Although we suspect that within state sharing of information is more effective than across-state activity, our interviews were not designed to answer that question.

To remedy the isolation from one another, national organizations should take the lead in developing improved ways of sharing innovations across LHDs. As a start, perhaps these organizations can secure foundation support for developing web-based information-sharing mechanisms on a few selected issues.

C. PUBLIC HEALTH ENTREPRENEURIALISM

There are certainly aspects of our interview results that will be gratifying to public health practitioners and advocates. Aside from the dedication and commitment to public health, the unwavering support among our respondents for the importance of measuring the value of public health services expresses a commitment to core public health values. Yet other aspects may be less welcome. Relying on the moral high ground alone is no longer a tenable strategy—it simply is not selling to politicians or to the public. Business as usual is not resonating with either audience. As one respondent put it, “What’s the value and what sells may be two different questions.” Relying on the intangibles to propel public health is not a winning strategy; public health practitioners need to be more explicit about the value the intangibles add to population health. In a world of scarce resources, quantification facilitates choices that are necessary, if not particularly desirable. The intangibles need to be defined and quantified as much as possible.

Regardless of the centrality of intangibles to what advocates and practitioners have viewed as the core rationale for public health (i.e., the moral imperative), a paradigm shift may be appropriate at this time. In fact, our interviews reflect some willingness to consider alternative business models, as long as core values are not abandoned. While our respondents generally supported the social justice core of public health, a number of respondents were willing to articulate a realist or economic view of public health’s future.

Conventional wisdom now favors public-private collaborations as the way to sustain the public health system. (One of us, Jacobson, has written critically of that model. A concern is that this option will eventually shift most services to the private sector, leaving a public health shell for disease pandemics or bioterrorist attacks.) An alternative is to develop public health entrepreneurialism.³⁸ In short, the struggle for the future of public health is one of a moral (i.e., core values) frame vs. an economic (or entrepreneurial) model. Quantification is no longer an

option—it is a necessity if the intangible, core values of public health are to survive. Developing the business case for public health will neither be easy nor welcomed in the public health community. This should not be confused with the question of whether public health services should be shifted to the private sector.³⁹ Instead, it is a question of the purpose and structure of the public health system in the 21st Century. One of the key challenges will be to move toward quantification without sacrificing core public health values. To do so, public health advocates will need to be creative in linking the moral imperative with economic reality—the business case for governmental public health.

If our observations about public health entrepreneurialism are accurate, a key challenge facing public health professionals is how to become more entrepreneurial without losing the core values that our respondents articulated. In comparison to private businesses, public health has other values besides efficiency that a private sector organization may not have, including effectiveness, responsiveness, and trust.

D. POLICY IMPLICATIONS

The primary policy implication of our study is that the demand to demonstrate value through quantitative measures is likely to increase. If public health's moral imperative is no longer a compelling factor in driving favorable policy decisions, the alternative is to provide policymakers and the public with a better understanding of the quantitative value of public health investments.

E. NEXT STEPS

The immediate next steps are to trim, test, and refine the framework. For the first version of the framework, we have erred on the side of over-inclusiveness to make sure that the key elements are captured. To maintain feasibility, it is likely that the framework will need to be streamlined and adjusted to reflect staff capacity concerns. As a first approximation, however, we prefer a framework that incorporates the most important elements of the models our interviews suggested rather than relying exclusively on one approach.

We will attempt to secure funding to trim and test the framework. At a minimum, and as part of the funding for the current project, we will share the framework with our respondents for their feedback and revise accordingly. We plan to convene a conference to discuss our results generally and to obtain feedback on the framework specifically. We will work with NACCHO and other national organizations to determine the best mechanism for obtaining practitioners' feedback.

Future Research

Our results suggest some lines of future research that might be productive. Our interviews strongly suggest the need to measure the value of the public health system itself (i.e., social justice, sustainability, social connectedness), but we lack a framework for that. It is difficult to aggregate value of individual services to estimate value at the systems level. It is equally difficult to measure the intangible value that the existence of the public health system brings to a community.

Two particular aspects of this should be considered in future research. First, our literature review reveals some interesting possibilities of looking to port authorities as organizational models for public health. Further research into the structure of port authorities might provide more effective and efficient public health alternatives for elected officials to consider. With regard to the public health entrepreneurialism discussion above, port authorities are likely to offer examples of ways in which public health practitioners can become more entrepreneurial without abandoning core values.

Second, and related, is to understand better what is unique about governmental public health (i.e., population concerns, preparedness) that the private sector cannot easily address. For instance, which services must remain in the public domain relative to those that can safely be shifted to the private sector? What is the cost of a failed or nonexistent public health system?

Implicit in this set of questions is how to address the problem of public health's intangibles. Are the intangibles more measurable than our respondents believe? The conundrum is that what harms are avoided through prevention or other public health interventions cannot easily be measured, yet such intangibles lie at the heart of why society invests in public health in the first place. This conundrum complicates measuring value and then making political decisions about public health investments. For example, it might make sense from a societal perspective to implement a prevention program with downstream savings, but it appears as a short-term budget cost from the political/LHD budgetary standpoint.

An intriguing suggestion from our interviews is to think about public health in terms of insurance. We did not have time to pursue this issue, but we believe that it is an idea that could provide great insight into valuing public health, particularly in terms of understanding risk in public health.

VII. CONCLUSION

For public health to restore its former prestige, practitioners will need to demonstrate to policymakers and the public that investments in public health services add value to population health. Short of conducting the painstaking work of developing better outcomes measures, along with improved data collection and analysis, there is no easy way to define and measure value. In competing for scarce resources, public health will never be as visible and compelling as firefighters and police. In a previous era when sanitation improvements brought daily attention to public health's value, the moral imperative was compelling. But in recent decades, public attention and public funds have shifted to the medical care system. To regain lost momentum, public health practitioners will need to develop and adopt new strategies. Our research project opens some possibilities for new ways of thinking.

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Table 2-1: Results of PubMed Search

SEARCH #1: BROAD SEARCH	# of RESULTS
Prevention AND cost-effectiveness analysis	7981
Prevention AND cost-benefit analysis	7641
Prevention AND cost-utility analysis	123
“Public health” AND cost-effectiveness analysis	2824
“Public health” AND cost-benefit analysis	2688
“Public health” AND cost-utility analysis	78
SEARCH #2: SEARCH FOR APPROPRIATE TERMINOLOGY	# of RESULTS
Prevention AND “valuation method*”	10
Prevention AND “valuation methodology”	1
Prevention AND “method of valuation”	32
Prevention AND “value estimation”	1
Prevention AND “valuation estimation”	12
Prevention AND “value measurement”	2
Prevention AND “measure value”	0
Prevention AND “health benefits” AND valuation	5
Prevention AND “health benefits” AND estimation	6
Prevention AND “willingness to pay” AND “measure*”	15
SEARCH #3: “VALUATION”	# of RESULTS
1. “Public health” AND cost-benefit analysis AND valuation	32
2. “Public health” AND cost-utility analysis AND valuation	3
3. “Public health” AND cost-effectiveness analysis AND valuation NOT #1 NOT #2	0
4. “Public health” AND rate of return AND valuation	0
5. “Public health” AND cost-benefit analysis AND rate of return NOT #13	3
6. Prevention AND cost-benefit analysis AND valuation	37
7. Prevention AND cost-utility analysis AND valuation	7
8. Prevention AND cost-effectiveness analysis AND valuation NOT #6 NOT #7	2
9. #3 NOT #8	0
10. #1 NOT #6	25
11.#2 NOT #7	3
12. Prevention AND rate of return AND valuation	0
13. Prevention AND cost-benefit analysis AND rate of return	26
14. Prevention AND “willingness to pay” AND valuation	40
SEARCH #4: “HUMAN CAPITAL”	# of RESULTS
Prevention and “human capital” AND methods	17
Prevention and “human capital” AND methodology NOT methods	2
Prevention and “human capital” AND “method*” NOT methods NOT methodology	3

The symbol “*” serves as a wild card, e.g. “method*” would retrieve all words beginning with “method-“: methods, methodology, etc.

Table 2-2: Results from Reference Lists of Four Key Articles

ARTICLE	DESIGN
Brownson, RC et al. (1999). Measuring the Impact of Prevention Research on Public Health Practice. <i>Am J Prev Med</i> , 16 (3S): 72-79.	A proposed framework for measuring effects and effectiveness in prevention research
Carande-Kulis, VG. (2000) Methods for Systematic Reviews of Economic Evaluations for the <i>Guide to Community Preventive Services</i> . <i>Am J Prev Med</i> , 18 (1S): 75-91.	An application of methods to review economic evaluations to vaccination intervention studies
Messonnier, ML et al. (1999). An Ounce of Prevention... What Are the Returns? <i>Am J Prev Med</i> , 16 (3): 248-263.	A systematic review of prevention programs and their cost-effectiveness
Saha, S. et al. (2001). The Art and Science of Incorporating Cost Effectiveness into Evidence-Based Recommendations for Clinical Preventive Services. <i>Am J Prev Med</i> , 20 (3S): 36-43.	A discussion of the relationship between cost-effectiveness analysis and prevention policy and the role of the US Preventive Services Task Force in this interface

Table 2-3: Results from Google Scholar Search of Four Key Articles

ARTICLE	CITED BY
Brownson, RC et al. (1999). Measuring the Impact of Prevention Research on Public Health Practice. <i>Am J Prev Med</i> , 16 (3S): 72-79.	None relevant
Carande-Kulis, VG. (2000) Methods for Systematic Reviews of Economic Evaluations for the <i>Guide to Community Preventive Services</i> . <i>Am J Prev Med</i> , 18 (1S): 75-91.	7 reviews 1 method paper
Messonnier, ML et al. (1999). An Ounce of Prevention... What Are the Returns? <i>Am J Prev Med</i> , 16 (3): 248-263.	3 reviews
Saha, S. et al. (2001). The Art and Science of Incorporating Cost Effectiveness into Evidence-Based Recommendations for Clinical Preventive Services. <i>Am J Prev Med</i> , 20 (3S): 36-43.	4 reviews

Table 2-4: Results from Search of Government Agency Websites

ORGANIZATION	SEARCH TERMS	RESULTS
AHRQ	Prevention AND valuation AND cost-utility analysis	Final Reports on Quality-of-Life Data – but based on treatment not prevention
CDC	ALL	Too broad – scores of results
CMS	ALL	None relevant
GAO	<ol style="list-style-type: none"> 1. “Prevention AND valuation AND cost-effectiveness analysis” 2. “Economic AND value AND measurement” 	<ol style="list-style-type: none"> 1. GAO Report: “Early Intervention: Federal Investments Like WIC Can Produce Savings” 2. GAO Workshop: “Highlights of a Workshop on Economic Performance Measures”

Table 2-5: Summary of Literature Search Findings

	REVIEWS	METHODS	APPLICATIONS	TOTAL
Total Number	37	28	89	154
Percentage	24%	18%	58%	100%

Table 2-6: Number and Type of Economic Evaluations Applied to Public Health & Prevention Strategies

	Willingness to Pay/Accept	Human Capital	QALY	LY	Natural Units	Rate of Return	Other	Total
Total Number	38	11	7	6	15	8	4	89
Percentage	43%	12%	8%	7%	17%	9%	4%	100%

QALY=quality-adjusted life years

LY=life years

Table 3-1: Cost-Utility Analyses of US-based Public Health Interventions, 1976-2003* (n=48)

Variable	Frequency	Percent
Year (n=48)		
1990s	10	20.8
2000-03	38	79.2
Intervention Type		
Screening	11	22.9
Immunization	9	18.8
Regulatory/Educational Policy	7	14.6
Care Delivery	6	12.5
Health Behavior	5	10.4
Injury Prevention	4	8.3
Blood Testing	3	6.3
Surveillance	2	4.2
Other	1	2.1
Prevention Stage		
1	32	66.7
2	10	20.8
3	6	12.5
Sponsorship**		
Government	25	52.1
Could not determine	13	27.1
Foundation	6	12.5
Pharmaceutical or medical device	4	8.3
Other	3	6.3

Health Care Organization	1	2.1
None	1	2.1
Distribution of Ratios (n=130) in US\$2002**		
Cost Saving	19	14.6
\$0-\$50,000	63	48.5
\$50,000-\$100,000	22	16.9
>\$100,000	26	20.0

*From the Tufts-NEMC CEA Registry, www.tufts-nemc/cearegistry. The Registry contains 789 original cost-utility studies published from 1976 through 2003. Of these, 111 were coded as having a “public health” focus.

**One article may have more than one ratio, country, sponsorship, and intervention type.

***One article did not report the intervention type.

Table 3-2: Types of Interventions Studied in Public Health CUAs, 1976-2003

Intervention Type	Intervention	Author / Year	Reference Number
Screening			
Cancer	Mammography for women with cognitive impairment	Messecar; 2000	1
	One-time colonoscopic screening for colorectal cancer	Ness et al.; 2000	2
	HPV testing to screen for cervical cancer	Mandelblatt et al.; 2002	3
Diabetes	Screening for Type 2 diabetes	Centers for Disease Control and Prevention; 1999	4
	Intervals for diabetic retinopathy screening in patients with type 2 diabetes mellitus	Vijan et al.; 2000	5
Infection	Gene-testing strategies for prevention of Rheumatic Fever	King et al.; 2002	6
Kidney	Screening for Proteinuria in US adults	Boulware et al.; 2003	7
Pre/Post-natal	Screening for Cystic fibrosis carriers	Rowley et al.; 1998	8
	Newborn screening with tandem mass spectrometry	Insinga et al.; 2002	9
	Universal tandem mass spectrometry	Schoen et al.; 2002	10
	Screening by tandem mass spectrometry for medium-chain Acyl-CoA dehydrogenase deficiency	Venditti et al.; 2003	11
Immunization			
Blood-borne Illnesses / STDs	Hepatitis A vaccination	Arguedas et al.; 2002	12
	Hepatitis immunization	Jacobs et al.; 2003	13
	Potential vaccine for human papillomavirus	Sanders & Taira; 2003	14
	Hepatitis A/B vaccine versus hepatitis B vaccine	Jacobs & Meyerhoff; 2005	15
Respiratory Infections	Hypothetical respiratory syncytial virus vaccine	Gessner; 2000	16
	Increasing measles immunization rates	Zwanziger et al.; 2001	17
	Pneumococcal vaccine	Pepper & Owens; 2002	18
	Haemophilus influenzae type b vaccination	Zhou et al.; 2002	19
	Vaccination against invasive pneumococcal disease	Sisk et al.; 2003	20
Regulatory / Education Policy			

	Regulations against using a cellular telephone while driving	Redelmeier & Weinstein; 1999	21
	Public postsecondary education subsidies	Muennig & Fahs; 2001	22
	Intensive national school-based anti-tobacco education	Tengs et al.; 2001	23
	Vitamin therapy to lower plasma homocysteine levels	Tice et al.; 2001	24
	Switching smoking cessation drugs to over-the-counter status	Keeler et al.; 2002	25
	Fuels for urban transit buses	Cohen et al.; 2003	26
	Restrictions on the use of cell phones while driving	Cohen & Graham; 2003	27
Care Delivery			
External Defibrillators	Public defibrillation	Nichol et al.; 1998	28
	Automated external defibrillators	Groeneveld et al.; 2001	29
	Automated external defibrillator deployment	Cram et al.; 2003	30
	Defibrillation by targeted responders	Nichol et al.; 2003	31
HIV	Human immunodeficiency virus post-exposure prophylaxis	Scheid et al.; 2000	32
	State AIDS Drug Assistance Programs	Johri et al.; 2002	33
Health Behavior – HIV / STDs			
	HIV prevention intervention	Tao & Remafedi; 1998	34
	HIV risk reduction intervention	Pinkerton et al.; 2000	35
	Condom distribution	Bedimo et al.; 2002	36
	Prevent HIV and sexually transmitted diseases	Chesson et al.; 2002	37
	Preventing HIV	Wilson & Kahn; 2003	38
Injury Prevention			
	Air bags by seating position	Graham et al.; 1998	39
	Savings from four transport safety efforts	Zaloshnja et al.; 2000	40
	Hip protectors	Segui-Gomez; 2002	41
	Reducing injuries	Zaloshnja et al.; 2003	42
Blood Testing			
	Human immunodeficiency virus-testing protocols	Aubuchon et al.; 1994	43
	Value of alanine aminotransferase	Busch et al.; 1995	44

	Solvent-detergent-treated plasma	AuBuchon & Birkmeyer; 1999	45
Surveillance			
	Estimates of cancer risk	Provenzale et al.; 1999	46
	Latent tuberculosis infection	Khan et al.; 2002	47
Other – Health			
	Procuring organ donors	Mendeloff; 2004	48

Source: Tufts-NEMC CEA Registry, 2007

Table 3-3: Cost-Effectiveness of Public Health Interventions, 1976-2003

Intervention VERSUS Comparator IN Target Population	Ratio 2002 \$/QALY	Reference Number
Screening		
Cancer		
Mammogram every 2 years VERSUS no mammogram IN women age 75 and older with and without cognitive impairment, with or without prior screening	Not Reported	1
Onetime colonoscopic screening for colorectal cancer at 60-64 yrs old VERSUS No screening IN men over 40 years old	Cost Saving	2
Onetime colonoscopic screening for colorectal cancer at 55-59 yrs old VERSUS Onetime colonoscopic screening for colorectal cancer at 60-64 yrs old IN men over 40 years old	Cost Saving	2
Onetime colonoscopic screening for colorectal cancer at 60-64 yrs old VERSUS No screening IN women over 40 years old	Cost Saving	2
Onetime colonoscopic screening for colorectal cancer at 55-59 yrs old VERSUS Onetime colonoscopic screening for colorectal cancer at 60-64 yrs old IN women over 40 years old	700	2
Onetime colonoscopic screening for colorectal cancer at 50-54 yrs old VERSUS Onetime colonoscopic screening for colorectal cancer at 55-59 yrs old IN men over 40 years old	4,000	2
Onetime colonoscopic screening for colorectal cancer at 50-54 yrs old VERSUS Onetime colonoscopic screening for colorectal cancer at 55-59 yrs old IN women over 40 years old	9,700	2
Onetime colonoscopic screening for colorectal cancer at 45-49 yrs old VERSUS Onetime colonoscopic screening for colorectal cancer at 50-54 yrs old IN men over 40 years old	76,000	2
Pap test every 3 years until the age of 75 VERSUS Pap test every 3 years until the age of 65 IN Hypothetical cohort of U.S. women – age 20	12,000	3
Pap test every 2 years until the age of 75 VERSUS Pap test every 3 years until the age of 75 IN Hypothetical cohort of U.S. women – age 20	31,000	3
Pap test every 2 years until the age of 100 VERSUS Pap test every 2 years until the age of 75 IN Hypothetical cohort of U.S. women – age 20	59,000	3
Pap test and HPV test every 2 years until the age of 75 VERSUS Pap test every 2 years until the age of 100 IN Hypothetical cohort of U.S. women – age 20	73,000	3
Pap test and HPV test every 2 years until the age of 100 VERSUS Pap test and HPV test every 2 years until the age of 75 IN Hypothetical cohort of U.S. women - age 20	80,000	3
Diabetes		
Screening for Diabetes Mellitus VERSUS No systematic Diabetes Mellitus screening IN 25-34 year-old African Americans	970	4
Screening for Diabetes Mellitus VERSUS No systematic Diabetes Mellitus screening IN 35-44 year-old African Americans	2,300	4
Screening for Diabetes Mellitus VERSUS No systematic Diabetes Mellitus screening IN 45-54 year-old African Americans	15,000	4
Screening for Diabetes Mellitus VERSUS No systematic Diabetes Mellitus screening IN all individuals age 25-34yo	16,000	4
Screening for Diabetes Mellitus VERSUS No systematic Diabetes Mellitus screening IN all individuals age 25-34yo	22,000	4
Screening for Diabetes Mellitus VERSUS No systematic Diabetes Mellitus screening IN all individuals age 45-54yo	52,000	4
Screening for Diabetes Mellitus VERSUS No systematic Diabetes Mellitus screening IN all individuals age >=25yo	67,000	4
Screening for Diabetes Mellitus VERSUS No systematic Diabetes Mellitus screening IN African Americans 55-64yo	84,000	4
Screening for Diabetes Mellitus VERSUS No systematic Diabetes Mellitus screening IN all individuals age 55-64yo	140,000	4
Screening for Diabetes Mellitus VERSUS No systematic Diabetes Mellitus screening IN African Americans >=65yo	390,000	4
Screening for Diabetes Mellitus VERSUS No systematic Diabetes Mellitus screening (i.e., usual practice) IN all individuals >=65yo	680,000	4
Retinopathy screening every 5 years VERSUS No screening IN patients recently diagnosed (within past 5 years) with type 2 diabetes >40yo	19,000	5
Retinopathy screening every 3 years VERSUS Retinopathy screening every 5 years IN patients recently diagnosed (within past 5 years) with type 2 diabetes > 40yo	33,000	5

Retinopathy screening every 2 years VERSUS Retinopathy screening every 3 years IN patients recently diagnosed (within past 5 years) with type 2 diabetes > 40yo	55,000	5
Retinopathy screening every year VERSUS Retinopathy screening every 2 years IN patients recently diagnosed (within past 5 years) with type 2 diabetes > 40yo	120,000	5
Infection		
Genetic screening and monthly prophylaxis for genotype at high-risk for rheumatic fever VERSUS No genetic screening but standard prophylaxis for streptococcal pharyngitis and/or acute rheumatic fever for all subjects IN Newborns	8,500	6
Kidney		
Annual screening for proteinuria and subsequent treatment with ACE inhibitor or ARB therapy VERSUS Non-screening routine clinical practice IN U.S. adults with hypertension presenting to a primary care physician for an annual physical examination with previously undetected proteinuria - age 50	19,000	7
Annual screening for proteinuria and subsequent treatment with ACE inhibitor or ARB therapy VERSUS Routine clinical practice IN U.S. adults with neither hypertension nor diabetes presenting to a primary care physician for an annual physical examination with previously undetected proteinuria - age 50	280,000	7
Pre/Post-natal		
Free screening for carriers of the Cystic Fibrosis gene (CFTR) & free counseling of carriers VERSUS No screening offered IN families of female patients who are of reproductive age and >=18 yrs. old	9,500	8
Tandem mass spectrometry (MS/MS) for 14 fatty acid and organic acidemia disorders VERSUS No screening for 14 fatty acid and organic acidemia disorders IN Infants at birth	15,000	9
Tandem mass spectrometry (MS/MS) for medium-chain acyl-CoA dehydrogenase deficiency (MCAD) VERSUS No screening for medium-chain acyl-CoA dehydrogenase deficiency (MCAD) IN Infants at birth	43,000	9
Tandem mass spectrometry VERSUS No screening IN Newborn babies	6,100	10
Universal newborn screening by tandem mass spectrometry (MS/MS) for MCADD (simulated clinical course through age 70) VERSUS No universal screening IN Hypothetical cohort of neonates	140	11
Universal newborn screening by tandem mass spectrometry (MS/MS) for MCADD (simulated clinical course through age 20) VERSUS No universal screening IN Hypothetical cohort of neonates	5,700	11
Immunization		
Blood-borne Illnesses / STDs		
Targeted vaccination for individuals found to be negative for anti-HAV antibody after initial screening VERSUS No vaccination IN Patients in the USA with chronic hepatitis C viral infection - age 45+	55,000	12
Universal vaccination VERSUS Targeted vaccination for individuals found to be negative for anti-HAV antibody after initial screening IN Patients in the USA with chronic hepatitis C viral infection - age 45+	4,200,000	12
College-based vaccination against hepatitis B VERSUS No vaccination IN College students who have not been previously immunized against hepatitis A or B - age 18	Cost Saving	13
College-based vaccination against hepatitis A/B VERSUS No vaccination IN College students who have not been previously immunized against hepatitis A or B - age 18	Cost Saving	13
College-based vaccination against hepatitis A/B VERSUS College-based vaccination against hepatitis B IN College students who have not been previously immunized against hepatitis A or B - age 18	Cost Saving	13
Universal vaccination against high-risk human papillomavirus (HPV) infection VERSUS No vaccination IN Hypothetical cohort of 12 year old girls in the US	23,000	14
Joint hepatitis A and B vaccine VERSUS Hepatitis B vaccine only IN Young adult attendees of public sexually transmitted disease (STD) clinics	13,000	15
Respiratory Infections		
Hypothetical respiratory syncytial (RSV) vaccine VERSUS Medical management IN 65-year-olds in the United States	6,100	16
Supplementary immunization programs developed by CDC aims at reaching 90% local pre-school immunization rate VERSUS Pre-school immunization rate of 55% IN pre-school children in Milwaukee during local measles outbreak	52,000	17

Pneumococcal vaccine VERSUS No pneumococcal vaccine IN Healthy young American adults - age 35	24,000	18
Pneumococcal vaccine VERSUS No pneumococcal vaccine IN Healthy young American adults - age 22	56,000	18
Universal haemophilus influenzae Type b vaccination - at ages 2, 4, and 12-15 months VERSUS No vaccination IN Hypothetical U.S. birth cohort of newborns	Cost Saving	19
Use of pneumococcal polysaccharide vaccination (excluding future medical costs of survivors) VERSUS No vaccination IN Hypothetical cohort of black patients generally immunocompetent to invasive pneumococcal disease - age 50-64	Cost Saving	20
Use of pneumococcal polysaccharide vaccination (excluding future medical costs of survivors) VERSUS No vaccination IN Hypothetical cohort of black and non-black patients generally immunocompetent to invasive pneumococcal disease - age 50-64	4,100	20
Use of pneumococcal polysaccharide vaccination (excluding future medical costs of survivors) VERSUS No vaccination IN Hypothetical cohort of non-black patients generally immunocompetent to invasive pneumococcal disease - age 50-64	5,100	20
Use of pneumococcal polysaccharide vaccination (including future medical costs of survivors) VERSUS No vaccination IN Hypothetical cohort of black patients generally immunocompetent to invasive pneumococcal disease - age 50-64	7,600	20
Use of pneumococcal polysaccharide vaccination (including future medical costs of survivors) VERSUS No vaccination IN Hypothetical cohort of black and non-black patients generally immunocompetent to invasive pneumococcal disease - age 50-64	13,000	20
Use of pneumococcal polysaccharide vaccination (including future medical costs of survivors) VERSUS No vaccination IN Hypothetical cohort of non-black patients generally immunocompetent to invasive pneumococcal disease - age 50-64	15,000	20
Use of pneumococcal polysaccharide vaccination (including future medical costs of survivors) VERSUS No vaccination IN Hypothetical cohort of black patients at high risk for invasive pneumococcal disease - age 50-64	17,000	20
Use of pneumococcal polysaccharide vaccination (including future medical costs of survivors) VERSUS No vaccination IN Hypothetical cohort of black and non-black patients at high risk for invasive pneumococcal disease - age 50-64	21,000	20
Use of pneumococcal polysaccharide vaccination (including future medical costs of survivors) VERSUS No vaccination IN Hypothetical cohort of non-black patients at high risk for invasive pneumococcal disease - age 50-64	23,000	20
Regulatory / Education Policy		
National regulation against using a cellular telephone while driving VERSUS No regulation against using a cellular telephone while driving IN United States population	350,000	21
Intensive school-based tobacco prevention program - over 50 year period, assumes 56% smoking reduction, dissipates in 4 years VERSUS Status quo (Current average national tobacco educational practices) IN every 7th and 8th grade in the U.S.	5,300	23
Intensive school-based tobacco prevention program - over 50 year period, assumes 56% smoking reduction, dissipates in 1 year VERSUS Status quo (Current average national tobacco educational practices) IN every 7th and 8th grade in the U.S.	20,000	23
Intensive school-based tobacco prevention program - over 50 year period, assumes 30% smoking reduction, dissipates in 4 years VERSUS Status quo (Current average national tobacco educational practices) IN every 7th and 8th grade in the U.S.	22,000	23
Intensive school-based tobacco prevention program - over 25 year period, assumes 56% smoking reduction, dissipates in 4 years VERSUS Status quo (Current average national tobacco educational practices) IN every 7th and 8th grade in the U.S.	26,000	23
Intensive school-based tobacco prevention program - over 50 year period, assumes 30% smoking reduction, dissipates in 1 year VERSUS Status quo (Current average national tobacco educational practices) IN every 7th and 8th grade in the U.S.	49,000	23
Intensive school-based tobacco prevention program - over 25 year period, assumes 56% smoking reduction, dissipates in 1 year VERSUS Status quo (Current average national tobacco educational practices) IN every 7th and 8th grade in the U.S.	51,000	23
Intensive school-based tobacco prevention program - over 25 year period, assumes 30% smoking reduction, dissipates in 4 years VERSUS Status quo (Current average national tobacco educational practices) IN every 7th and 8th grade in the U.S.	55,000	23
Intensive school-based tobacco prevention program - over 25 year period, assumes 30% smoking reduction, dissipates in 1 year VERSUS Status quo (Current average national tobacco educational practices) IN every 7 th and 8th grade in the U.S.	100,000	23

Intensive school-based tobacco prevention program - over 50 year period, assumes 5% smoking reduction, dissipates in 4 years VERSUS Status quo (Current average national tobacco educational practices) IN every 7th and 8th grade in the U.S.	200,000	23
Intensive school-based tobacco prevention program - over 50 year period, assumes 5% smoking reduction, dissipates in 1 year VERSUS Status quo (Current average national tobacco educational practices) IN every 7th and 8th grade in the U.S.	360,000	23
Intensive school-based tobacco prevention program - over 25 year period, assumes 5% smoking reduction, dissipates in 4 years VERSUS Status quo (Current average national tobacco educational practices) IN every 7th and 8th grade in the U.S.	370,000	23
Intensive school-based tobacco prevention program - over 25 year period, assumes 5% smoking reduction, dissipates in 1 year VERSUS Status quo (Current average national tobacco educational practices) IN every 7th and 8th grade in the U.S.	650,000	23
A diet that includes enriched grain products projected to increase folic acid intake by 100mg/day including Cyanocobalamin supplementation VERSUS Same diet with folic acid fortification alone IN women aged 35-84 years (Secondary prevention)	1,000	24
Over-the-counter nicotine patches and gum VERSUS Prescription nicotine patches and gum IN Smokers	16,000	25
A new fleet of emission controlled diesel buses VERSUS A new fleet of conventional diesel buses IN Hypothetical US public transit district	270,000	26
Ban on the use of cell phones while driving (hands and hands free) VERSUS No restrictions on cell phone use while driving IN General population	75,000	27
Care Delivery		
External Defibrillators		
Emergency medical service system with public access defibrillation by police VERSUS Standard emergency medical services system IN persons experiencing out-of-hospital sudden cardiac arrest	32,000	28
Emergency medical services system with public access defibrillation by lay responders VERSUS Standard emergency medical services system IN persons experiencing out-of-hospital sudden cardiac arrest	46,000	28
Automated external defibrillators on large-capacity aircraft, selective training VERSUS No automated external defibrillators, attendants with basic life support training IN patients experiencing cardiac arrest onboard US commercial aircraft during a 12-month period	36,000	29
Automated external defibrillators on medium- & large-capacity aircraft, selective training VERSUS Automated external defibrillators on large-capacity aircraft, selective training IN patients experiencing cardiac arrest onboard US commercial aircraft during a 12-month period	41,000	29
Automated external defibrillators on all aircraft, full training VERSUS Automated external defibrillators on medium- & large-capacity aircraft, selective training IN patients experiencing cardiac arrest onboard US commercial aircraft during a 12-month period	98,000	29
Initial resuscitation automated external defibrillators (AED) provided through public access deployment VERSUS Treatment by emergency medical services equipped with automated external defibrillators (AED) IN Simulated cohort of cardiac arrest victims in the US	30,000	30
Standard EMS for cardiac arrest supplemented by defibrillation by trained lay responders VERSUS Standard EMS for cardiac arrest including first-responder defibrillation followed by advanced life support IN 140 patients with cardiac arrest in US casinos	55,000	31
HIV		
The current United States Public Health Services (USPHS) post-exposure prophylaxis guidelines VERSUS Monotherapy with zidovudine for all exposures IN health care workers exposed to known HIV+ blood	91,000	32
Triple therapy with zidovudine, lamivudine, and indinavir for all exposures VERSUS The current United States Public Health Services (USPHS) post-exposure prophylaxis guidelines	850,000	32
AIDS Drug Assistance Program (ADAP) Formulary policy for Nevada in 1997 VERSUS AIDS Drug Assistance Program (ADAP) Formulary policy for Arizona in 1997 and Oregon in 1997 IN Hypothetical cohort of HIV patients with CD4 250/uL (in antiretroviral drug strategy "low efficacy" scenario) - age 33, 80% male	7,600	33
AIDS Drug Assistance Program (ADAP) Formulary policy for Mississippi in 1997 VERSUS AIDS Drug Assistance Program (ADAP) Formulary policy for Arizona in 1997 and Oregon in 1997 IN Hypothetical cohort of HIV patients with CD4 350/uL (in antiretroviral drug strategy "high efficacy" scenario) - age 33, 80% male	8,400	33

AIDS Drug Assistance Program (ADAP) Formulary policy for South Dakota in 1997, 1998, and 1999 VERSUS AIDS Drug Assistance Program (ADAP) Formulary policy for Nevada in 1997 IN Hypothetical cohort of HIV patients with CD4 250/uL (in antiretroviral drug strategy "low efficacy" scenario) - age 33, 80% male	11,000	33
AIDS Drug Assistance Program (ADAP) Formulary policy for Oklahoma in 1999 VERSUS AIDS Drug Assistance Program (ADAP) Formulary policy for Mississippi in 1997 IN Hypothetical cohort of HIV patients with CD4 350/uL (in antiretroviral drug strategy "high efficacy" scenario) - age 33, 80% male	18,000	33
AIDS Drug Assistance Program (ADAP) Formulary policy for Oregon in 1999, Missouri in 1999, and Florida in 1998 and 1999 VERSUS AIDS Drug Assistance Program (ADAP) Formulary policy for Oklahoma in 1999 IN Hypothetical cohort of HIV patients with CD4 350/uL (in antiretroviral drug strategy "high efficacy" scenario) - age 33, 80% male	22,000	33
AIDS Drug Assistance Program (ADAP) Formulary policy for Florida in 1997 and Oklahoma in 1997, 1998, and 1999 VERSUS AIDS Drug Assistance Program (ADAP) Formulary policy for South Dakota in 1997, 1998, and 1999 IN Hypothetical cohort of HIV patients with CD4 250/uL (in antiretroviral drug strategy "low efficacy" scenario) - age 33, 80% male	30,000	33
Health Behavior – HIV / STDs		
Individual risk assessment and risk reduction counseling and education VERSUS No risk reduction intervention IN 13-21 yr. old men living in Minnesota who self-identified as gay or bisexual or who have had sex with men	7,500	34
Cognitive-behavioral HIV risk reduction intervention VERSUS No additional risk reduction intervention IN sexually active African-American male adolescents	32,000	35
Cognitive-behavioral HIV risk reduction intervention VERSUS No additional risk reduction intervention IN African-American male adolescents	64,000	35
Three-year statewide condom social marketing program VERSUS No condom social marketing program IN African Americans in Louisiana	Cost Saving	36
Three-year statewide condom social marketing program VERSUS No condom social marketing program IN African American men in Louisiana	Cost Saving	36
Three-year statewide condom social marketing program VERSUS No condom social marketing program IN African American women and men (combined) in Louisiana	Cost Saving	36
2 intervention sessions on condom use alone VERSUS 1 control session on nutrition IN Non-HIV-infected urban women at high risk for STDs/HIV	9,900	37
6 intervention sessions on sexual behavior and condom use VERSUS 1 control session on nutrition IN Non-HIV-infected urban women at high risk for STDs/HIV	37,000	37
6 intervention sessions on sexual behavior and condom use VERSUS 2 intervention sessions on condom use alone IN Non-HIV-infected urban women at high risk for STDs/HIV	140,000	37
Street outreach (provision of bleach and condoms plus risk reduction counseling) VERSUS No treatment IN Heterosexual male and female injection drug users (IDU) and heterosexual female non-IDU sex partners of male IDUs	1,300	38
Methadone maintenance therapy VERSUS No treatment IN Heterosexual male and female injection drug users (IDU) and heterosexual female non-IDU sex partners of male IDUs	97,000	38
Injury Prevention		
Driver air bags VERSUS No air bags IN the driving population*	24,000	39
Dual air bags VERSUS driver air bags IN the driving population*	61,000	39
Law requiring safety belt use by drivers and passengers VERSUS No safety belt law IN drivers and passengers in Navajo Nation	40 (both negative)	40
Installation of 28 streetlights along 1.1 mile cluster section of highway VERSUS No new streetlight installation IN pedestrians in Whiteriver, AZ	28,000 (both negative)	40
Livestock control project with authority to impound trespassing livestock VERSUS No livestock control program IN drivers in Fort Apache Indian reservation	170,000	40
Use of hip protectors VERSUS No use of hip protectors IN Men - age 65	Dominated	41
Use of hip protectors VERSUS No use of hip protectors IN Men - age 65-74	Dominated	41
Use of hip protectors VERSUS No use of hip protectors IN Men - age 75-84	Dominated	41
Use of hip protectors VERSUS No use of hip protectors IN Women - age 65	Cost Saving	41
Use of hip protectors VERSUS No use of hip protectors IN Women - age 65-74	Cost Saving	41
Use of hip protectors VERSUS No use of hip protectors IN Women - age 75-84	Cost Saving	41
Use of hip protectors VERSUS No use of hip protectors IN Women - age 85+	Cost Saving	41
Use of hip protectors VERSUS No use of hip protectors IN Men - age 85+	23,000	41
Safety-belt program (law passed permitting officers to stop vehicles for a safety-belt use violation alone) VERSUS No intervention IN The Navajo Nation (population of approximately 200,000) in Arizona, New Mexico, and Utah	Cost Saving	42

Streetlight project (installation of 28 streetlights along a 1.1- mile section of highway to reduce pedestrian injuries) VERSUS No intervention IN The White Mountain Apache tribe (population of approximately (10,000) in Whiteriver, Arizona	Cost Saving	42
Livestock control project (regulatory effort with authority to impound free-roaming livestock on reservation roads) VERSUS No intervention IN The White Mountain Apache tribe (population of approximately (10,000) in Whiteriver, Arizona	Cost Saving	42
Drowning prevention program (sale of "float coats", public education, and improved enforcement of boating laws) VERSUS No intervention IN Local residents using Alaska's Yukon and Kuskokwim rivers (population approximately 22,000)	Cost Saving	42
The suicide prevention and intervention program (screening, family outreach, hiring of social worker, peer support, etc.) VERSUS No intervention IN A Western Athabaskan tribe in rural New Mexico	460	42
Blood Testing		
ALT testing only VERSUS No non-A, non-B hepatitis testing IN patients undergoing blood transfusions	Cost Saving	43
Anti-HCV EIA-2 testing (added to ALT testing) VERSUS ALT testing only IN patients undergoing blood transfusions	Cost Saving	43
Anti-HCV EIA-2 testing only VERSUS No non-A, non-B hepatitis testing in patients undergoing blood transfusions	Cost Saving	43
ALT testing (added to anti-HCV EIA) VERSUS Anti-HCV EIA-2 testing only IN patients undergoing blood transfusions	9,600,000	43
HIV antibody testing VERSUS No Testing IN Blood donations to be screened for HIV infection*	3,600	44
HIV antibody testing VERSUS Theoretical test IN Blood donations to be screened for HIV infection*	61,000	44
RNA PCR testing VERSUS HIV antibody testing IN Blood donations to be screened for HIV infection*	1,966,000	44
p24 antigen test for HIV in blood donations VERSUS HIV antibody test for blood donations IN Blood donations to be screened for HIV infection*	2,281,000	44
Solvent-detergent-treated fresh-frozen plasma VERSUS Fresh-frozen plasma IN patients needing fresh-frozen plasma transfusion	289,000	45
Surveillance		
Surveillance every 1-5 years VERSUS No surveillance IN patients with Barrett's esophagus	120,000	46
Tuberculin skin testing and treatment with isoniazid and pyridoxine daily for 9 months for positive test results VERSUS No treatment IN Documented immigrants 18 years of age or older who entered the US from developing nations (China) n the year 2000	Cost Saving	47
Tuberculin skin testing and treatment with rifampin and pyrazinamide daily for 2 months for positive test results VERSUS Tuberculin skin testing and treatment with isoniazid and pyridoxine daily for 9 months for positive test results IN Documented immigrants 18 years of age or older who entered the US from developing nations (China) in the year 2000	1,300	47
Tuberculin skin testing and treatment with rifampin daily for 4 months for positive test results VERSUS Tuberculin skin testing and treatment with isoniazid and pyridoxine daily for 9 months for positive test results IN Documented immigrants 18 years of age or older who entered the US from developing nations (China) n the year 2000	15,000	47
Other - Health		
Cadaveric donor heart transplantation VERSUS Standard care based on condition IN Heart transplant candidates*	31,000	48
Cadaveric donor liver transplantation VERSUS Standard care IN End stage liver disease patients*	35,000	48

Source: Tufts-NEMC CEA Registry, 2007

Appendix A: Results of Review of Economic Literature

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Appendix B: US-Based Community-Level Cost-Utility Analyses

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Appendix D: Interview Protocols

1. Interview Protocol: State and Local Public Health Practitioners

1. Characterize the political and policy environment
 - a. Changes since 9/11
 - b. Role of state or local elected officials/chief health officer in allocating resources
 - c. Role of state or local elected officials/chief health officer in developing the public health infrastructure
2. Changes in service delivery mix over time
 - a. What services have been added in the past 5 years?
 - b. What services have been abandoned in the past 5 years?
 - c. Why?
 - (1) What was the basis for making the decisions?
 - (2) What are/were the factors/criteria used to guide the decisions?
 - (3) What was the process for making the decisions (i.e., a formal assessment/strategic planning process)?
 - (4) Shift of functions to a different governmental level?
 - (5) Changes in legal mandates/expectations?
 - d. To what extent did these changes reflect changes in valuing the added or dropped service? How was the value or lack of value determined/measured?
 - (1) What are the incentives/disincentives for measuring value?
 - (2) Role of Boards of Health in the process?
 - e. State vs. federal legal requirements to provide certain services (i.e., MCH, B/T)
 - f. Internal and external barriers to changing the mix of services offered or focusing on services providing the most value?
 - (1) Staff resistance
 - (2) Legal/political/fiscal/methodological barriers?
 - g. Role of private sector availability of services in making decisions
 - (1) Contracting?
 - (2) Monitoring the private sector?
 - (3) General trend toward privatization?
 - h. Role of community input into service delivery decisions
 - (1) How obtained?
 - (2) Administrative procedures (i.e., hearings/notice/comment)?
 - (3) Informal communications/meetings with community leaders/ reps?

3. Evaluation of service delivery

a. Do you evaluate services?

- (1) Routinely?
- (2) When deciding to make changes?
- (3) Data maintained?
- (4) Written reports?

b. Is there an established framework for the evaluation?

c. What are the standards for the evaluation?

- (1) Return on investment?
- (2) Political salience?
- (3) Intuition?
- (4) Community feedback?
- (5) Some determination of relative value added?
- (6) Specific outcome measures used?

d. How would you invest in the absence of legal/political constraints? Why?

e. Assessment of quality of services?

- (1) What are the metrics used?
- (2) Continuous QI?

4. How can the value of governmental public health services (GPHSs) be defined and measured?

a. Where do you invest and why?

b. Role of legal mandates

c. Role of political expectations

d. Role of formal evaluation techniques?

e. Role of community pressure?

f. Role of standard performance measures being developed? Which ones?

g. Do you rank services/social investments?

h. Tools/resources/knowledge needed to measure value?

i. What are the independent variables that need to be measured to understand value?

j. What specific outcome measures are used?

5. Which specific services (i.e., screening, vaccination) are likely to provide the greatest value to the public's health?

a. What is the appropriate unit of analysis?

b. Why?

6. Which specific domains (i.e. social value for reducing health disparities) are likely to provide the greatest value to the public's health?

- a. What is the appropriate unit of analysis?
 - b. Why?
7. How should the value be defined and measured? What should the metrics of value be?
- a. Tangible
 - b. Intangible
 - c. What should the criteria be for identifying the types of services that provide the most value to the population's health?
 - (1) Should public health systems be concerned with averting high-risk events (such as pandemic flu or bioterrorism), chronic disease prevention, screening, or alleviating health disparities for vulnerable populations?
 - (2) To determine which services to provide, should policymakers focus on total public health expenditures, lives saved, mortality costs avoided, staff time invested, health disparities reduced, or population affected?
 - (3) How do you factor how the public values the various services into these decisions?
8. Do you have any data to measure value?
- a. What specific measures/criteria do you use to measure value?
 - (1) Contingent valuation?
 - (2) CEA/CBA?
 - b. What data do you collect/use now for making decisions about which services to offer or eliminate?
 - c. What is the process you use to make these decisions?
 - d. Use of information markets (Hahn and Tetlock)
 - e. Pay for performance?
9. Role of performance standards as measuring value?
- a. 10 essential services
 - b. Healthy people 2010 objectives
 - c. Core public health functions
 - d. State-specific performance measures
 - e. National Public Health Performance Standards Program
 - f. HEDIS/clinical measurements
 - g. Federal performance frameworks (i.e., GPRA)
 - h. Baldrige Award criteria
 - i. Balanced scorecard
 - j. Link to public health accreditation project?
10. Capacity
- a. Relation of public health structure to measuring value

b. Staff to collect and analyze data

11. What previous or ongoing efforts to measure value or make resource allocation decisions have you undertaken?

12. How can the assessment of value be used to shape accountability measures?

a. Use of health impact assessments?

b. Use of performance indicators?

- (1) Service quality—continuity or intensity
- (2) Outcomes of internal or external evaluation of services
- (3) Accountability
- (4) Employee satisfaction
- (5) Customer satisfaction
- (6) Health outcomes—health status indicators
- (7) Efficiency—(costs and outputs)

13. What are the potential barriers to measuring value?

2. Interview Protocol: National Leaders

1. States/LHDs with active/innovative programs?
2. Criteria for selecting states/LHDs?
3. Ongoing national activity to measure value of public health services?
4. Role of performance standards as measuring value
 - a. 10 essential services
 - b. Healthy people objectives
 - c. Core public health functions
 - d. State-specific performance measures
 - e. National Public Health Performance Standards Program
 - f. HEDIS/clinical measurements
 - g. Federal performance frameworks (i.e., GPRA)
 - h. Baldrige Award criteria
 - i. Balanced scorecard
5. Accountability
 - a. Boards of Health
 - b. Political
 - c. As a function of measuring value
 - (1) Importance to Boards of Health
 - (2) Resources available to measure?
 - (3) Tools/resources/knowledge needed to measure value?
 - (4) What are the independent variables that need to be measured to understand value?
 - d. What are the incentives/disincentives for measuring value?
6. Other people/organizations to interview

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