EXAMINING THE RELATIONSHIP BETWEEN LOCAL PUBLIC HEALTH AGENCY INPUTS AND OUTPUTS

BY

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DISSERTATION

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Abstract

During the past decade, increasing attention has been focused on performance measurement in the delivery of medical care. Unfortunately, there has been no significant parallel movement to examine and measure performance in the public health system (Handler, Issel & Turnock, 2001). This study advances a model of performance measurement in public health based around logic model constructs (inputs, processes, outputs, impacts, outcomes) that focuses upon explanatory variables (inputs or resources) within the realm of control of the local public health agency (LPHA), and their subsequent effect on LPHA outputs (services or functions).

Forty-three of the 46 LPHAs selected participated in the study for a response rate of 93 percent. The investigation included measuring the Human, Informational, Organization and Fiscal Resources of the LPHAs to determine the effect upon LPHA outputs, namely the Assessment, Policy Development and Assurance functions of public health (commonly referred to as the Three Core Functions of Public Health).

Analysis to uncover the presence of any relationship between the explanatory variables (LPHA inputs or resources) and the dependent variables (LPHA outputs), was undertaken using canonical correlation analysis, with confirmatory analysis conducted through multiple regression. Results concluded that only modest relationships existed between the explanatory variables and the dependent variables noted, and such relationships were limited to the Organizational and Informational Resources of Public Health. As part of the investigation, a ranking process is elucidated, and implications for professionals and suggestions for further research are provided.

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Introduction

Multiple efforts continue to elucidate the need to define and measure public health, both in terms of a service industry and occupational field as well as a social good designed to improve the health status of a given populace. These efforts have culminated in two ongoing nationally focused projects: the development of a Voluntary National Accreditation Program for State and Local Public Health Departments (Association of State and Territorial Health Officials, National Association of County and City Health Officials, 2006), and the Operational Definition of a Functional Local Health Department project (National Association of County and City Health Officials, 2006). These projects, and multiple other similarly focused precursors including the early iterations of the Model Standards Project (American Public Health Association, Association of State and Territorial Health Officials, National Association of State and Territorial Health Officials, National Association of County Health Officials, U.S. Conference of Local Health Officers & Centers for Disease Control, 1985), the Assessment Protocol for Excellence in Public Health – Part One (APEX-PH) (National Association of County Health Officials, American Public Health Association, Association of Schools of Public Health, Association of State and Territorial Health Officials, Centers for Disease Control & U.S. Conference of Local Health Officers, 1990), Healthy Communities 2000 (American Public Health Association, Association of State and Territorial Health Officials, National Association of County Health Officials, U.S. Conference of Local Health Officers & Centers for Disease Control, 1991), Mobilizing for Action through Planning and Partnerships (MAPP) (National Association of County and City Health Officials, 2000) and the National Public Health Performance

Standards Program (National Association of County and City Health Officials, Centers for Disease Control and Prevention, 2005) all seem to focus around common themes central to the notion of performance measurement and the most ideal way to monitor performance within both the public health system (defined as all entities that contribute to the delivery of public health services within a community [National Association of County and City Health Officials, 2004]) and the local public health department (the governmental entity that has the primary statutory or legal responsibility for public health at the local level [Association of State and Territorial Health Officials & National Association of County and City Health Officials, 2006]).

During the past decade, increasing attention has been focused on performance measurement in the delivery of medical care. Unfortunately, there has been no significant parallel movement to examine and measure performance in the public health system (Handler, Issel & Turnock, 2001). Furthermore, a review of the field suggests that program evaluation is not practiced consistently within public health organizations, nor is it institutionalized in agencies as a day-to-day operation (Reedy, Luna, Olivas & Sujeer, 2005). To meet the demands of government regulations, to develop ongoing evaluation/monitoring systems and to satisfy the public health customer, public health also must develop and sustain a reputation for quality and continuous improvement by using the appropriate methods to effectively evaluate public health practice (Dever, 1997). These same goals were articulated by Turnock & Handler (1997) in a call for a comprehensive national surveillance system for public health practice that focuses on both measurement and examination of the relationships among typical logic model constructs: inputs (resources, capacity, etc.) core function-related processes, outputs

(services), as well as outcomes. Despite calls for a systems perspective of public health, the local public health agency was chosen as the focus of this study (rather than the public health system) because it has the primary responsibility for ensuring and improving the public's health, a fact reiterated by Mays, Halverson, Baker, Stevens & Vann (2004).

Performance measurement has been defined as the "selection and use of quantitative measures of capacities, processes, and outcomes to develop information about critical aspects of activities, including their effect on the public. It is the regular collection and reporting of data to track work produced and results achieved" (Lichiello, 1999, p. 82). Efforts thus far to advance the performance measurement mission, both in terms of academic research and in terms of guidance and recommendations for public health practice, have focused largely on what has been termed public health outputs (i.e., services, programs or functions) rather than upon linking the inputs (resources) of Local Public Health Agencies (LPHAs) to these outputs via the tenets of a typical logic model. A logic model presents an ideal way to depict the inputs, activities, outputs, and outcomes of a program, thus providing a clear framework of the workings and functions of the program (Torghele, Buyum, Dubruiel, Augustine, Houlihan, Alperin & Miner, 2007). The logic model describes the logical linkages that exist between a program's inputs and the outcomes expected for that program and how they interrelate (McLaughlin & Jordan, 1999).

The purpose of this study was to advance a model of performance measurement in public health based around logic model constructs (inputs, processes, outputs, impacts, outcomes) that focused upon explanatory variables (inputs) within the realm of control of

the LPHA, and their subsequent effect on LPHA outputs (services or functions) using canonical correlation analysis. Utilizing a benchmarking approach, this performance model identified those LPHAs who are superior performers on the basis of what Turnock (2001) has described as relatively recognizable inputs contributing to the public health system's capacity: the human, informational, financial, and organizational resources a public health organization has available to direct toward doing the work. The study then determined if there was a relationship between LPHA performance on the basis of these four inputs and the successful provision of outputs (the functions or services of the LPHA). LPHA success in providing outputs was determined through use of a 20-item instrument co-developed by Drs. Turnock and Handler at the University of Illinois at Chicago, and Dr. Miller at the University of North Carolina at Chapel Hill (1998). If a relationship is uncovered between any input variable and LPHA outputs (e.g., provision of services), the next logical step would suggest a subsequent effect on community health outcomes if the tenets of a typical logic model hold true. This study provides an important precursor to the eventual study of community health outcomes. As part of the investigation, LPHAs were stratified on the basis of performance, as described in the methodology section.

The logic model has been used frequently as an organizing framework for performance measurement in multiple organizations (United Way, 1996; W.K. Kellogg Foundation, 1998) including, to a lesser extent, public health agencies (Dykeman, Macintosh, Seaman & Davidson, 2003; Torghele, et al., 2007; Medeiros, Butkus, Chipman, Cox, Jones & Little, 2005). One of the virtues of a logic model is its ability to summarize the program's overall mechanism of change by linking processes to eventual

effects (Milstein & Wetterhall, 1999). To date, the major measurement efforts in public health have not attempted to link cause and effect. Logic models assist evaluation by linking program interventions with intended outcomes. By developing such a conceptual framework, it becomes easier to clearly delineate the links between the many desired outcomes, the processes leading to those outcomes, and the measurable indicators necessary to provide the rich data needed to evaluate the outcomes (Dykeman, et al., 2003). In recent years, many funders have begun to require that community-based initiatives develop logic models as part of their grant applications and for on-going monitoring and reporting. At the same time, program evaluators are increasingly using logic models to identify and measure expected results (Kaplan & Garrett, 2005). Central to this conceptual evaluation framework is the relationship of an organizations' inputs (which include the human, financial, organizational, and sometimes community resources a program has available to direct toward doing the work) to the intended results including its processes, outputs (i.e., the services to be delivered by the program) and outcomes (organizational, community, and/or system level changes expected to result from program activities, which might include improved conditions) (W.K. Kellogg Foundation, 2004).

Research Questions

This study answered the following questions:

1. Is there a relationship and, if so, how strong is the relationship between a local public health agency's inputs (e.g., funding per capita, qualifications of staff, number of full-time equivalent staff per capita) and the successful implementation of the practices of public health (outputs)?

2. What is the attributable share of a local public health agency's inputs to outputs (successful implementation of the practices of public health)?
3. If local public health agencies are stratified on the basis of performance according to the successful implementation of the practices of public health (outputs), what are the differences between low and high performing agencies in terms of their inputs?

Hypotheses

1. There is a relationship between a local public health agency's "inputs" and the successful implementation of the practices of public health (outputs).
2. There is a difference in outputs between low and high performing local public health agencies judged on the basis of their inputs.

Delimitations

1. The study did not investigate any other explanatory variable beyond local public health agency "inputs", the relationship between these inputs and the subsequent effect on "outputs". It did not investigate other components of a typical logic model due to the difficulty involved in explicating these variables.
2. The study was only intended to investigate local public health agency inputs and outputs of a number of local public health agencies in Illinois, and not intended for inferences across all local public health agencies.
3. The study was not intended to investigate or control for all possible variables that may moderate/mediate the relationship between the explanatory variable(s) and the dependent variable(s).

4. The research methodology proposed is quantitative in nature, and some benefits and barriers of public health practice and its effect on populations may be uncovered in a methodology that incorporates qualitative approaches.

Significance of Study

For over a decade, the scientific literature, governmental reports, and even popular media had been documenting numerous signs of weakness in our public health system (Baker, Potter, Jones, Mercer, Cioffi, Green, Halverson, Lichtveld & Fleming, 2005). Some of these criticisms have centered upon the lack of performance measurement and evaluation tools that have characterized quality improvement in other business sectors. Milstein and Wetterhall (1999), for example, note that program evaluation is an essential organizational practice in public health, yet is not practiced consistently across program areas or sufficiently well-integrated into the day-to-day management of most public health programs. In other words, those in public health need to show more concretely what we are doing and how we are doing it. Efforts toward quality improvement enable us to do this systematically (Libby, 2007).

While performance monitoring and evaluation of public health exists, often this evaluation extends only as far as evaluating the outputs (also referred to as "services" or "functions") of LPHAs rather than attempting to link LPHA inputs (resources) to their outputs (services) as suggested by a typical logic model. The ability to characterize and measure the operational aspects of the governmental presence in public health is important both from the perspective of capacity building, and for research into the impact of public health practice on health outcomes and community health status (Turnock, Handler, Hall, Potsic, Nalluri & Vaught, 1994). Health improvement is what public

health professionals strive to achieve. To reach this goal, public health professionals must devote their skill- and their will – to evaluating the effects of public health actions (Milstein & Wetterhall, 1999). The method proposed by this current study provides a precursor to eventual examination of the relationship between what a LPHA does, and what it hopes to achieve: improvement of community health status.

The significance of this research is that it provides a framework and methodological approach prescribing a fundamental structure by which health departments can link together the major evaluative components of a typical logic model while providing a means to more formally compare one LPHA to another (often referred to as "benchmarking") in terms of their inputs and outputs.

Definition of Terms

Logic Model – a picture of how an organization does its work – the theory and assumptions underlying the program. A program logic model links outcomes (both short- and long-term) with program activities/processes and the theoretical assumptions/principles of the program (W.K. Kellogg Foundation, 2004).

Inputs – For the purposes of this study we define inputs as the human, informational, financial, and organizational resources a public health organization has available to direct toward doing the work (Turnock, 2001).

Outputs – In public health, outputs are the "health programs and services intended to prevent death, disease, and disability, and to promote quality of life (Turnock, 2001, p. 335).

Outcome – referred to as an expected accomplishment involving benefits to end-users, expressed as a quantitative or qualitative standard, value or rate. Outcomes are the direct

consequence or effect of the generation of processes and lead to the fulfillment of a certain objective (Organizational Research Services, 1995). This term may also refer to organizational, community, and/or system level changes expected to result from program activities, which might include improved conditions (W.K. Kellogg Foundation, 2004).

Outcome-Based Evaluation – defined as a systematic way to assess the extent to which a program has achieved its intended results. This would involve measurement to determine if the desired goal had been accomplished.

Performance Measurement - the "selection and use of quantitative measures of capacities, processes, and outcomes to develop information about critical aspects of activities, including their effect on the public. It is the regular collection and reporting of data to track work produced and results achieved" (Lichiello, 1999, p. 82).

Processes – the things that are done by defined individuals or groups – or to, for, or with individuals or groups – as part of the provision of public health services. Processes refer to all the things we do in public health practice; for example, conducting educational classes, performing a test or procedure, investigating a complaint, crunching data, or meeting with community groups (Lichiello, 1999).

Public Health System – all entities that contribute to the delivery of public health services within a community. This system includes all public, private, and voluntary entities, as well as individuals and informal associations (National Association of County and City Health Officials, 2004).

Local Public Health Agency (LPHA) – the governmental entity that has the primary statutory or legal responsibility for public health at the local level (Association of State

and Territorial Health Officials et al., 2006). Often used interchangeably with Local Public Health Department or Local Health Department in the literature.

Assumptions

For the purposes of this study, we assume:

1. That the LPHA is an appropriate unit to investigate for the purposes of this study.
2. That LPHAs differ in their effect upon the performance of outputs (services) and the differences can be measured.
3. That the data used in this study is accurate and complete.
4. That the analytical methods used are appropriate and capable of addressing the research questions.
5. That the respondents to the survey did not misrepresent or alter their answers in any manner to try to jeopardize the results of this study.
6. That the survey questions to measure a local public health department's inputs and outputs were valid and appropriate.
7. That the four input variables of study, namely the human resources, informational resources, organizational resources, and fiscal resources, are equally important.
8. That the LPHA Administrator was an appropriate respondent for questions concerning the input variables of Organizational and Informational Resources, and the output variable of LPHA performance based on the core functions of public health noted in the literature review.
9. That the secondary data sources reviewed for the study provided adequate information for the evaluation of performance pertaining to the input variables of Human and Fiscal Resources.

Literature Review

Introduction

During the last century, public health in the United States made remarkable advances that led to dramatic increases in life expectancy. Today, an average American's life expectancy at birth is approaching 80 years, representing a 40-year increase over the average in 1900, when tuberculosis was the leading cause of death and diseases of infancy and childhood took a high toll. At the beginning of that century, infant and maternal mortality rates were such that pregnancy was a dangerous undertaking. Illness attributed to food and water were common. The nutrient content of foods was poor. We now associate these sorts of conditions with underdeveloped countries, but they were a fact of life in this country up through World War II. In large part, the accomplishments of public health initiatives did not stem from major scientific advances, but rather primarily to broad-based public health programs that involved epidemiology; public health education and communication; and policy interventions. These low-technology programs not only resulted in a huge saving of lives, they also improved the quality of life (Koplan, 2005). Despite these victories, however, the public health system, including those governmental units most responsible for the health of the Republic at the federal, state, and local level, has been resoundingly criticized.

Perhaps most notably, the Institute of Medicine Report on the Future of Public Health (1988) in describing the public health system of our nation identified the following important barriers inhibiting effective public health action:

- Lack of consensus on the content of the public health mission

- Inadequate capacity to carry out the essential public health functions of assessment, policy development, and assurance of services
- Disjointed decision making without necessary data and knowledge
- Inequities in the distribution of services and the benefits of public health
- Limits on effective leadership, including poor interaction among the technical and political aspects of decisions, rapid turnover of leaders, and inadequate relationships with the medical profession
- Organizational fragmentation or submersion
- Problems in relationships among the several levels of government
- Inadequate development of necessary knowledge across the full array of public health needs
- Poor public image of public health, inhibiting necessary support
- Special problems that unduly limit the financial resources available to public health (Turnock, 2001, p. 308).

These criticisms led the Institute of Medicine to conclude that the public health system was a "system in disarray". This conclusion was recapitulated in a subsequent Institute of Medicine Report (2003) in which the authors stated, "in many important ways, the public health system that was in disarray in 1988 remains in disarray today." The conclusions reached through the Institute of Medicine are perhaps both reflective and indicative of the perceptions of government involvement in health and the overall day-to-day concerns of the general public. For example, a 1994 survey conducted by the Healthcare Forum indicated that local, state, and federal governments were ranked very low by Americans for solving community problems (Dever, 1997). Public health is also

seen as a low priority issue for county governmental leaders, linked in part to the lack of recognition of important public health problems and low levels of community advocacy for public health issues (Marando & Melchior, 1995). In fact, for over a decade, the scientific literature, government reports, and even popular media had been documenting numerous signs of weakness in our public health system (Baker, et al., 2005). Some additional weaknesses cited include fragmented and precarious public funding, uneven and antiquated legal foundation; an inadequate workforce in terms of size, training, and advancing age; the inconsistent application of information technology, and organizational deficits (Baker, et al., 2005). In 1993, Turnock et al. studied the performance of local health departments and concluded that only a third of the U.S. population was being served effectively, using adequate performance of the 10 essential public health services as a standard (Turnock, et al., 1994). An additional study conducted in 1998 by researchers at the University of North Carolina found that the nation's largest health departments scored an average of only 64% in assessments of the quality of their 10 essential public health services, on the basis of 20 performance measures (Green & Mercer, 2001).

Other research has also indicated concern over the size, composition and distribution of the public health workforce with attracting and retaining competent public health workers and readiness taking center stage (Gebbie & Turnock, 2006). Collaboration across a broad range of stakeholders, the public health infrastructure, agreement on public health's essential services, preparedness, accountability and measurement, workforce, and a research agenda have also been noted as concomitant explanations of this "system in disarray" (Tilson & Berkowitz, 2006).

As Rowitz (2001) explained, "we are at a crossroads. Public health agencies appear to be under attack from multiple sources, including government entities, government superagencies, managed care organizations, the mass media, community groups, and disgruntled citizens." (p. 27). There is apparent difficulty in identifying what public health is and what it does by the public to which public health departments are accountable, and to the vast array of professionals working within it. "Public health agencies and professionals are experiencing an identity crisis because of the recent reconfiguring of their roles and responsibilities. Adding to the crisis is the public's lack of awareness of the nature of public health and the accomplishments of the public health system" (Rowitz, 2001, p. 3). The apparent lack of understanding and agreement concerning the content of organizational public health practice was one of the factors that led the public health community to reexamine altogether its mission and identity. The apparent "disarray" described by the Institute of Medicine (1988) was ascribed in part to a widespread lack of appreciation for the principles, practices, and services offered through the efforts of public health (Turnock, Handler, Dyal, Christenson, Vaughn, Rowitz, Munson, Balderson & Richards, 1994). The ability to characterize and measure the operational aspects of the governmental presence in public health is important both from the perspective of capacity building, and for research into the impact of public health practice on health outcomes and community health status (Turnock, et al. 1994).

Performance Measurement and Evaluation

While recognizing an honorable and momentous past for public health as a whole, it is clear that future gains will ultimately depend upon the system's ability to transform services and programs to effectively meet evolving population health needs. A

commitment to quality is one of the cornerstones of continued success in public health practice (Derose, Schuster, Fielding & Asch, 2002). It is this commitment that should serve as the means by which public health rises above the criticisms of the more recent past and forges a prominent place at the table of health policy, community engagement, and local public service. Doing "good works" and expecting to be supported are simply not enough. Those in public health need to show more concretely what we are doing and how we are doing it. Efforts toward quality improvement enable us to do this systematically (Libby, 2007). Health improvement is what public health professionals strive to achieve. To reach this goal, public health professionals must devote their skill—and their will—to evaluating the effects of public health actions (Milstein & Wetterhall, 1999). The 2005 National Profile of Local Health Departments conducted by the National Association of County and City Health Officials provides information about how local health departments (LHDs) are participating in performance improvement processes. Seventy-one percent of LHDs reported participating in some kind of performance improvement or quality improvement activities in the past three years. Participation was higher among LHDs serving larger jurisdictions, with percentages ranging from 63 percent of LHDs serving less than 25,000 people to 89 percent of LHDs serving 500,000 or more. Customer focus and satisfaction (79%) and health status (66%) are the two areas in which LHDs most frequently reported performance improvement efforts. LHDs were also asked about whether these performance management programs included four key elements: performance standards, performance measures, report progress, and a quality improvement process. Few LHDs have incorporated all of these elements into their performance improvement activities. In fact, this survey also shows

that when the numbers of health departments providing a specific program is cross referenced with the numbers of health departments evaluating or providing some quality improvement activity related to those programs, the percentages of LHD programs with quality improvement or evaluation activities range from a low of 14 percent to a high of 64 percent (Leep, 2007). Clearly, a commitment to the process and outputs of public health exists, but evaluation of such processes and outputs is lacking. Yet, evaluation is now typically required by most organizations that fund public health programs and is one of the 10 essential public health services (Tremain, Davis, Joly, Edgar, Kushion & Schmidt, 2007).

Perhaps part of the irrationality that exists between simultaneously valuing what performance monitoring and evaluation has to offer on one hand, and the relative dearth of evaluation research related to public health practice on the other hand is related to the fact that often the first step in evaluating any activity or intervention is understanding the context in which it takes place and the mechanisms that influence its outcome (Stem, Margoluis, Brown & Salafsky, 2004).

Practitioners and scholars across a variety of disciplines recognize good project management goes beyond implementation. They acknowledge that effective project management is integrally linked to well-designed monitoring and evaluation (M & E) systems. While specific approaches may vary, the underlying motivations behind M & E are the same. For project management, it can help demonstrate accountability and project impact, an increasingly important function in the current climate of fiscal constraints. M & E answers questions related to how well a project or strategy is working independently or in relation to other possible projects or strategies. M & E is also critical for improving

project management. It can help identify the conditions under which a project is likely to succeed or falter. Moreover, it can also serve as an early warning system for potential problems, and it can lead to ideas for potential remedial actions. As such, effectively delivered monitoring and evaluation results often provide the basis for improved decision making (Stem, et al., 2004).

Many industries and institutions, other than public health departments, have recognized the value of utilizing quality assessment tools and quality improvement methods, and comparable efforts are being implemented within the personal health care system. A model quality assurance process, the Baldrige National Quality Program, is a leader in performance monitoring processes currently ongoing in the United States. The Baldrige National Quality Award was created by Public Law 100-107 and signed into law in 1987. This award is given by the President of the United States to businesses – manufacturing and service, small and large – and to education, health care and non profit organizations that apply and are judged to be outstanding among their peers in seven component areas: leadership; strategic planning; customer and market focus; measurement, analysis, and knowledge management; human resource focus; process management; and results. Congress established the award program to recognize U.S. organizations for their achievements in quality and performance and to raise awareness about the importance of quality and performance excellence as a competitive edge (www.nist.gov/public_affairs/factsheet/baldfaqs.htm). "While the Baldrige Award and the Baldrige recipients are the very visible centerpiece of the U.S. quality movement, a broader national quality program has evolved around the award and its criteria. A report, *Building on Baldrige: American Quality for the 21st Century,* by the private Council on

Competitiveness, said "more than any other program, the Baldrige Quality Award is responsible for making quality a national priority and disseminating best practices across the United States" (www.nist.gov/public_affairs/factsheet/baldfaqs.htm).

Additionally, the Government Performance and Results Act has required federal agencies to set performance goals and to measure annual results. Nonprofit donor organizations (e.g., United Way) have integrated evaluation into their program activities and now require that grant recipients measure program outcomes. Public health oriented foundations (e.g., W.K. Kellogg Foundation) have also begun to emphasize the role of evaluation in their programming (Milstein & Wetterhall, 1999). Similarly, many public health departments have recognized the potential benefits of quality assessment and improvement and efforts are under way to institute measurement-based assessments to monitor practice performance (Derose, et al. 2002). Building evaluation capacity throughout the public health workforce is a goal also shared by the Public Health Functions Steering Committee. Chaired by the U.S. Surgeon General, this committee identified core competencies for evaluation as essential for the public health workforce of the twenty-first century (Milstein & Wetterhall, 1999). Although the public health system in the U.S. has started to utilize quantitative methods to measure the quality of its practices, many challenges remain for the implementation of a quality evaluation system. Currently, Local Health Department's (LHDs) lack measurement systems that fully address and evaluate the steps an LHD takes to achieve its health objectives (Derose, et al. 2002). In addition, many public health practitioners lack required background and skills to conduct useful, appropriate evaluations. In public health, health educators are often among the professionals most likely to conduct evaluations. Yet, a recent

competency training needs assessment of 7087 North Carolina public health workers identified that among 296 health educators, 44% indicated that evaluating programs to ensure that objectives and performance goals are met is important to their jobs and that they have a high level of need for training in this competency (Davis, 2006). A recent survey conducted by the Illinois Accreditation Development Project (2008) noted that among eight performance standards for local public health departments defined by 50 measures, the standard describing the 'evaluation' function of a local health department was the most problematic. In fact, of all health departments surveyed, the evaluation function received the lowest total score of the eight performance standards, noted by the researchers as a failing grade.

Both public and private sector organizations are increasingly being called upon to measure performance. "Performance measurement is valuable for public programs to undertake; indeed, in an era of increasing resource competition, performance differences may be one of the only ways to distinguish between equally valuable and potentially worthwhile public goods. In addition, performance measurement may help program managers and operators gauge how they are doing against both external and internal goals" (Kates, Marconi & Mannle, 2001). Despite these expressed benefits, a basic organizational framework for program evaluation in public health had not been developed prior to the CDC model entitled "Framework for Program Evaluation in Public Health" (1999).

"As the targets of public health actions have expanded beyond infectious diseases to include chronic diseases, violence, emerging pathogens, threats of bioterrorism, and the social contexts that influence health disparities, the task of evaluation has become

more complex" (Milstein & Wetterhall, 1999, p. 1). Incorporating quality measurement into public health can be challenging. Part of the difficulty is the scarcity of background theory, research, evidence-based standards, and practical experience upon which public health professionals can draw to develop quality indicators (or measures) for public health practice (Derose, et al., 2002). Program evaluation (a type of performance measurement) is noted as an essential organizational practice in public health. However, it is not practiced consistently across program areas, nor is it sufficiently well-integrated into the day-to-day management of most programs.

Structural Components of Performance Measurement & Evaluation

Performance measurement, which is often used interchangeably with the terms quality assessment and evaluation, is often broken into two component forms: formative evaluation and summative evaluation (Scriven, 2004). Formative evaluation is typically conducted during the development or improvement of a program or product (Scriven, 2004). Formative evaluation focuses on the process (Bhola, 1990). Formative evaluation occurs when data are being collected. This process provides information so that revisions and improvements can be made for the program (Rubinson, & Neutens, 1987). Summative evaluation is a method of judging the worth of a program at the end of the program activities and is focused on the outcome (Bhola, 1990). The purpose of this type of evaluation is to assess the overall effectiveness of a program and the extent to which the program is worthwhile in comparison to other, similar programs. Summative evaluation is concerned with the impact of a program (Rubinson & Neutens, 1987). As Rubinson and Neutens (1987) point out, there are multiple purposes of summative evaluation, 1) monitoring of the continuing needs for a program, 2) to assess the cost

effectiveness of the program, 3) to determine the global effectiveness of the program in meeting the goals and objectives of that program, and 4) to determine the possible side effects of a program.

Other authors have broken these two component forms down even further (MacDonald, Garcia, Zaza, Schooley, Compton, Bryant, Bagnol, Edgerly, & Haverkate, 2006) by focusing on process, impact, and outcome measures of program evaluation. Process measures, noted as a strategy utilized in formative evaluation, "help determine if a program has been implemented as planned. Process measures tend to count services and activities that result from the program. These measures cannot always be correlated with changes in the public's health, but, clearly if a program is not properly implemented, it cannot be expected to have the desired effect" (Stehr-Green, Gathany, Orisich, 2002). Impact measures, noted as a form of intermediate summative evaluation, are "concerned with more immediate results of a program such as changes in patient or physician knowledge or behavior. The use of impact measures assumes that changes in knowledge and behavior lead ultimately to changes in health status in the population" (Stehr-Green, et al. 2002). Outcome measures, in contrast, "help describe the results of the program. Outcome measures examine changes in the health status of the target population as the program is implemented, such as mortality, morbidity, disability, or the quality of life" (Stehr-Green, et al. 2002). Outcome evaluation is concerned with "documenting any change achieved as a result of an intervention. The terms impact and outcome are both used to refer to this change, and this can be the source of some confusion. Sentinella (2004) defines outcomes as 'the changes that result from the programme'. The UK Evaluation Society (2003) refers to impacts as 'a general term used to describe the effects

of a program on society. Impacts can be either positive or negative and foreseen or unforeseen'. However, 'impact' is generally used for more immediate effects, and 'outcome' for longer term effects" (Green & South, 2006, p.16). These measures are often inter-linked through the use of a logic model (theory of change) to describe the logical linkages among program resources (often referred to as inputs), activities, outputs, customers reached, and short-, intermediate-, and longer-term outcomes (Schalock, 2001).

The Logic Model as a Framework for Evaluation

The Logic Model has been used frequently as an organizing framework for performance measurement in multiple organizations (United Way, 1996; W.K. Kellogg Foundation, 1998) including, more recently, public health departments (Dykeman, et al., 2003; Torghele, et al., 2007; Medeiros, et al., 2005). According to Milstein & Wetterhall (1999):

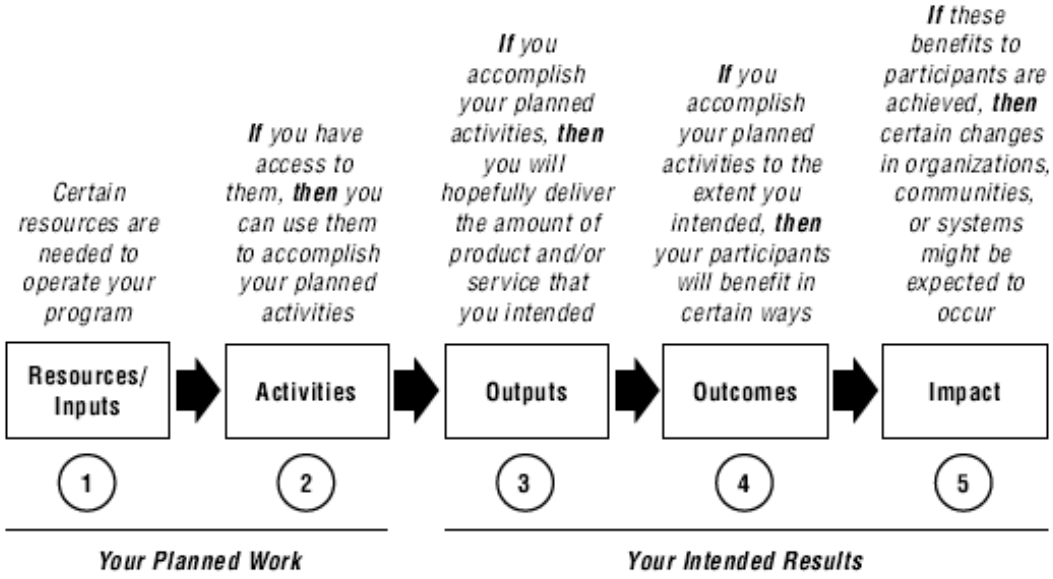
> A logic model describes the sequence of events for bringing about change by synthesizing the main program elements into a picture of how the program is supposed to work. Often this model is displayed in a flow chart, map, or table to portray the sequence of steps leading to program results. One of the virtues of a logic model is its ability to summarize the program's overall mechanism of change by linking processes to eventual effects. The logic model can also display the infrastructure needed to support program operations. Elements that are connected within a logic model might vary but generally include inputs (e.g., trained staff), activities (e.g., identification of cases of disease), outputs (e.g., persons completing

> treatment), and results ranging from immediate (e.g., curing affected persons) to intermediate (e.g., reduction in tuberculosis rate) to long-term effects (e.g., improvement of population health status). Creating a logic model allows stakeholders to clarify the program's strategies; therefore, the logic model improves and focuses program direction. It also reveals assumptions concerning conditions for program effectiveness and provides a frame of reference for one or more evaluations of the program. A detailed logic model can also strengthen claims of causality and be a basis for estimating the program's effect on endpoints that are not directly measured but are linked in a causal chain supported by prior research. (p. 11-12).

The logic model serves as a tool for incorporating theory in development and evaluation of programs (Savaya & Waysman, 2005). A logic model is an ideal way to depict the inputs, activities, outputs, and outcomes of a program, thus providing a clear framework of the workings and functions of the program. In planning a comprehensive evaluation, being able to view all the elements in a program and how they interrelate makes it easier to determine the areas that should be addressed (Torghele, et al. 2007). Evaluators have found the logic model process useful for at least twenty years. A logic model presents a plausible and sensible model of how the program will work under certain conditions to solve identified problems. A simple logic model includes two phases. The first phase would include planned work involving: 1) Resources or inputs: includes human, financial, organizational and community resources as well as other inputs required to support the program. Information on customer needs is an essential resource to the program, and 2) Activities: what the program does with the

resources/inputs. This would include the processes, tools, events, technology, and actions that are an intentional part of the program implementation and are used to bring about the intended program changes or results. The second phase of a simple logic model would include those things that reflect intended results, including 3) Outputs: the direct products of program activities including types, levels and targets of services to be delivered by the program, 4) Outcomes: the specific changes in program participants' behavior, knowledge, skills, status and level of functioning. Programs typically have multiple, sequential outcomes across the full program performance which would include short term outcomes (attainable within 1 – 3 years), intermediate outcomes and long term outcomes (achievable within a 4 to 6 year timeframe). If outcomes are achieved, it could be reasonably expected that an impact has been made (a change in an organization, community or system). (W.K. Kellogg Foundation, 2004).

FIGURE 1:



Logic Model (W.K. Kellogg Foundation, 2004)

Program managers across private and public sectors are being asked to describe and evaluate their programs in new ways. People want managers to present a logical argument for how and why the program is addressing a specific customer need and how measurement and evaluation will assess and improve program effectiveness. Managers often do not have clear and logically consistent methods to help them with this task. The logic model describes the logical linkages that exist between a program's inputs and the outcomes expected for that program and how they interrelate (McLaughlin & Jordan, 1999).

Notable Attempts to Define and Evaluate Local Public Health Practice

Much of the recent literature regarding public health practice has involved descriptive techniques centered upon answering questions related to what public health is and what it does rather than questions about effectiveness. The Institute of Medicine Report entitled *The Future of Public Health* (1988) identified the three core functions of public health as Assessment, Assurance, and Policy Development. Since that time, there has been considerable effort directed toward fleshing out in more suitable terms a clearer delineation of the roles and responsibilities of public health departments. In 1991, for example, the Public Health Practice Program Office of the Centers for Disease Control and Prevention set about defining these three core functions in a format that would lend itself well to surveillance and evaluation. The resulting 10 Organizational Practices of Public Health became the early framework for notable attempts to measure how effectively local health departments were carrying out the three core functions of public health. These 10 practices, as articulated by Turnock et al., (1994) included:

1. Assess the health needs of the community by establishing a systematic needs assessment process that periodically provides information on the health status and health needs of the community.
2. Investigate the occurrence of adverse health effects and health hazards in the community by conducting timely investigations that identify the magnitude of health problems, duration, trends, location, and populations at risk.
3. Analyze the determinants of identified health needs in order to identify etiologic and contributing factors that place certain segments of the population at risk for adverse health outcomes.
4. Advocate for public health, build constituencies, and identify resources in the community by generating supportive and collaborative relationships with public and private agencies and constituent groups for the effective planning, implementation, and management of public health activities.
5. Set priorities among health needs based on the size and seriousness of the problems, the acceptability, economic feasibility and effectiveness of interventions.
6. Develop plans and policies to address priority health needs by establishing goals and objectives to be achieved through a systematic course of action that focuses on local community needs and equitable distribution of resources, and involves the participation of constituents and other related governmental agencies.
7. Manage resources and develop organizational structure through the acquisition, allocation, and control of human, physical and fiscal resources;

and maximizing the operational functions of the local public health system through coordination of community agencies' efforts and avoidance of duplication of services.

8. Implement programs and other arrangements assuring or providing direct services for priority health needs identified in the community by taking actions which translate plans and policies into services.
9. Evaluate programs and provide quality assurance in accordance with applicable professional and regulatory standards to ensure that programs are consistent with plans and policies, and provide feedback on inadequacies and changes needed to redirect programs and resources.
10. Inform and educate the public on public health issues of concern in the community, promoting an awareness about public health services availability, and health education initiatives which contribute to individual and collective changes in health knowledge, attitudes and practices toward a healthier community (Turnock, et al., 1994, p. 654-655).

These Ten Organizational Practices of Public Health also formed the crux of future attempts to more clearly describe public health activities more understandably for external audiences and constituencies (Turnock & Handler, 1995). In 1994, for example, the Core Public Health Function Steering Committee developed the framework for what has been defined as the Ten Essential Services of Public Health, noted as:

1. Monitor health status to identify and solve community health problems,
2. Diagnose and investigate health problems and health hazards in the community.
3. Inform, educate and empower people about health issues.

4. Mobilize community partnerships and action to identify and solve health problems.
5. Develop policies and plans that support individual and community health efforts.
6. Enforce laws and regulations that protect health and ensure safety.
7. Link people to needed personal health services and assure the provision of health care when otherwise unavailable.
8. Assure competent public and personal health care workforce.
9. Evaluate effectiveness, accessibility, and quality of personal and population-based health services.
10. Research for new insights and innovative solutions to health problems.

Efforts to define public health practice also involved work to define the core business processes – those sets of related tasks designed to produce a specific programmatic (business) result – that cut across all local health departments (Public Health Informatics Institutes, 2006). Most recently, additional efforts to further delineate what health departments do and how they function have been directed toward the establishment of an "Operational Definition of a Functional Local Health Department" led by the National Association of County and City Health Officials (2005), and efforts are also ongoing in both Illinois and the U.S. to establish a certification/accreditation program for state and local public health departments (Association of State and Territorial Health Officials & National Association of County and City Health Officials, 2006; Illinois Accreditation Task Force, 2006). These ongoing efforts culminated from substantive examinations by Thielen (2004) of public health accreditation processes currently in progress in multiple states and from a review of accreditation processes from

other service industries (University of Arkansas for Medical Sciences, 2004). The Illinois Accreditation Task Force has developed 50 draft local public health performance measures relevant for all local health departments. The measures are organized by the eight practice standards that are currently in use in the Illinois Local Health Department Certification Program. The measures, like the current Certification standards, do not assess specific programs, but rather address the overall performance and capacities of the local health department as an organization (Illinois Accreditation Task Force, personal communication, 2007). Similar strategies are being explored for a national public health accreditation process (National Association of County and City Health Officials, et al., 2006). Concurrently, the Operational Definition of a Functional Local Health Department pursues a similar strategy of recommending certain standards by which every citizen should reasonably expect from their local health department (National Association of County and City Health Officials, 2005). The standards recommended through these processes are focused primarily around the commonalities of all health departments, particularly the activities or outputs of such departments, coordinated via the framework provided by the 10 essential services model. Much of these concurrent efforts seem to propose a framework that seeks to standardize a prescribed definition of what local health departments should be doing and how they should be functioning with particular attention directed toward conformity, rather than identification of superior performers. Measurement strategies discussed through these different modalities are seemingly directed toward an inclusive process which perhaps all health departments are capable of attaining if they want to put forth the effort at gathering the appropriate illustrative

evidence rather than establishing a vehicle of measurement and evaluation meant to identify unique and superior performance (ala a benchmarking process).

Another recent effort took a similar approach utilizing the three core functions of public health noted in the 1988 Institute of Medicine report, notably assessment, assurance and policy development, as an organizing framework. The National Longitudinal Study of Public Health Systems (2006) conducted through Dr. Glen Mays of the University of Arkansas and funded through the Robert Wood Johnson Foundation involved a random selection of local public health agency directors. This survey involved an instrument that was based on twenty indicators of public health performance developed by Drs. Arden Miller and Bernard Turnock (1998) structured around the three core functions of public health noted by the Institute of Medicine Report (1988). The survey instrument was designed and validated as a screening tool to assess the availability of 20 common public health activities with each of these activities reflecting one of the three core public health functions. The instrument asked respondents to think about various aspects of public health activities (outputs), the range of various community organizations playing a role in such activities, and how well the respondent believed such activities were being performed ranging from poor to excellent. Aggregate feedback was then shared with respondents with the data providing descriptive analysis comparing the respondent to a peer group, and to all US jurisdictions (G. Mays, personal communication, May 11, 2007).

Several reports initiated through the National Association of County and City Health Officials focused on the infrastructure of public health, the independent variable used in this study. Most notably, the report *The National Profile of Local Health*

Departments (2006), and its subsequent component iterations *The Local Health Department Workforce: Findings from the 2005 National Profile of Local Health Departments Study* (2007) and *Informatics at Local Health Departments: Findings from the 2005 National Profile of Local Health Departments Study* (2007) as well as the report *Local Public Health Agency Infrastructure: A Chartbook* (2001) have provided important resources framed around frequency and other descriptive data to help readers understand the practice of public health in terms of typical activities, but also in terms of those key infrastructure components (inputs) noted by Turnock (2001) as informational resources, human resources, organizational resources, financial resources, and physical resources.

One widely used assessment model, the Assessment Protocol for Excellence in Public Health (1991), funded through a Cooperative Agreement between the Centers for Disease Control and the National Association of County and City Health Officials was offered to local health departments as a means of enhancing their organizational capacity and strengthening their leadership role in their communities. This model was intended for voluntary use by a local health department under the assumption that a "strong local health department will better enable a community to achieve locally relevant goals." Part I of this model, the Organizational Capacity Assessment, was developed with the purpose of helping a health department director and an internal assessment team focus on improving organizational performance. Included were indicators focusing on authority to operate, community assessment, and policy development, as well as many major administrative areas including human relations and financial management thereby addressing infrastructure capacity

(www.wonder.cdc.gov/wonder/prevguid/p0000089/p0000089.asp accessed April 16, 2008). This model was widely used as a key vehicle for local health department certification throughout the state of Illinois.

An important landmark effort to assess public health performance occurred with the development of the National Public Health Performance Standards Project (NPHPSP) with the foci of performance standards based around the public health system rather than the local public health department. These performance standards included three instruments initially developed between 1997 and 2001 and updated in 2005-2007. The three instruments included the State Public Health System Performance Assessment Instrument (State Instrument), the Local Public Health System Performance Assessment Instrument (Local Instrument), and the Local Public Health Governance Performance Assessment Instrument (Governance Instrument). The NPHPSP was intended to improve the quality of pubic health practice and the performance of public health systems by: 1) providing performance standards for public health systems and encouraging their widespread use; 2) engaging and leveraging national, state, and local partnerships to build a stronger foundation for public health preparedness; 3) promoting continuous quality improvement of public health systems; and 4) strengthening the science base for public health practice improvement. This model of performance assessment was framed around the Ten Essential Public Health Services so there are 10 sections or "chapters" – one for each Essential Service. Each Essential Service section is further divided into several model standards, which represent major components, activities, or practice areas of the Essential Services

(www.cdc.gov/od/ocphp/nphpsp/documents/Complete%20scoring%methodology.pdf,

accessed July 23, 2006). The Ten Essential Services model has also served as the organizing framework for other evaluation strategies including the Capacity Assessment for State Title V (CAST-5) (Ruderman & Grason, 2002). Several of the model standards emphasized through these mechanisms also have relationships to the infrastructure components of human, informational, organizational, fiscal and physical resources noted by Turnock (2001) and cited earlier.

Other sources have also framed study of the public health system around these same infrastructure components. One critical assessment noted that, "Public health systems in the United States are built on an infrastructure of workforce, information systems, and organizational capacity; in each of these areas, however, serious deficits have been well documented….If government agencies are not strong, their ability to form strategic partnerships is jeopardized, thus further compromising a fragile public health system" (Baker, et al., 2005, p. 304). This article further criticized the public health infrastructure by stating that:

> When the components of public health infrastructure are strong, the system can carry out its core functions and essential services with uniform effectiveness. But when the components are weak, inconsistent, or deficient, the system's capacity to function is likewise at risk. Today's public health system will be able to withstand existing and potential threats to Americans' health only if its supporting infrastructure is strengthened. Unfortunately, major challenges confront those committed to assuring a strong infrastructure, and the research base needed for well-informed infrastructure development is sparse (p. 306).

Despite these noteworthy efforts, a gap in quality assessment remains in a review of the literature. Although valiant efforts have focused upon measuring local health department performance via the inputs (resources) or outputs (services) of local health departments, there has been very little attempt to relate performance of LPHA inputs to outputs, nor relate these evaluative constructs to outcomes. While community health status improvement remains the bottom line in public health, the tenets of a typical logic model dictate that there should be a relationship between inputs to outputs, and subsequently to outcomes. The research uncovering these relationships has been largely absent in the literature. This study will attempt to bridge that gap.

A New Framework and Model for the Evaluation of Local Public Health Practice

Using the logic model constructs mentioned earlier, the purpose of this study will be to determine the relationship between a local public health department's inputs (resources) and outputs (services). Very little research has attempted to link public health system outcomes to public health system processes such as assessment and planning, or to the structural capacity of the system (e.g., human resources or information resources) (Handler, et al., 2001). "Over the past decade, state and local public health improvement plans have struggled to consider how the effects of enhanced resources and relationships can be measured and linked to the performance of public health processes and, ultimately, outcomes. As a result, efforts in the practice community have promoted rebuilding the public health infrastructure (e.g., Health Alert Network funding), organizing state and local public health practice around the essential public health services framework (e.g., the National Public Health Performance Standards Initiative), and achieving common health objectives (e.g., Health People 2010). Although these

activities are often conducted simultaneously in the practice community, their links and interrelationships have never been explicitly acknowledged" (Handler, et al., 2001, p. 1238). Turnock (2001) notes that public health capacity includes a variety of relatively recognizable resources, which he terms as inputs, cited earlier.

Using the logic model constructs, the effect of these resources is manifested in the creation of outputs: the services provided by a local health department. As such, it seems rational that to effectively measure local health department performance we should incorporate study of the inputs and outputs of the local health department and attempt to relate performance along these constructs. Therefore, the resources (inputs) will serve as the independent variable of study. Since the outputs (services) of the local health department are dependent upon the resources (inputs), the outputs (services) will serve as the dependent variable in this study.

The Independent Variables: Local Public Health Department Resources (Inputs)

Human Resources in Public Health

The human resources involved in carrying out the core functions and essential services of public health constitute the public health workforce. Ironically, however, there has never been any specific academic bachelor-level degree or unique set of experiences that distinguish a public health professional from professionals in other fields. Many, if not most, of those who work in public health have a primary professional discipline, in addition to their attachment to public health. This multidisciplinary workforce, with often-divided loyalties to multiple professions, blurs the distinctiveness of public health as a profession. Yet, at the same time, it facilitates an interdisciplinary approach to community problem identification and problem solving (Turnock, 2001).

Governmental public health workers are often considered the primary public health workforce; their number, distribution, training and competencies are issues of public concern. Formal training in public health is more the exception than the rule in the public health workforce. Public health workers with graduate degrees from schools of public health or other graduate public health programs represent only a small fraction. The lack of formal public health training is prevalent throughout the public health workforce. Even more telling, only 22 percent of the top officials of local health departments in 1997 had graduate degrees in public health. In one notable study conducted in 1995 of 17,700 public health professionals in Texas, only 7 percent had formal public health education (Turnock, 2001).

Two general patterns of local health department staffing exist based around a core set of employees. One pattern focuses on clinical services, the other on more population-based programs. "The core employees consist of dietitians/nutritionists, sanitarians/environmental specialists, administrators, lab specialists, and health educators. The clinical pattern adds physicians, nurses, and dental health workers. The population-based pattern includes epidemiologists, public health nurses, social workers, and program specialists" (Turnock, 2001, p. 212).

The National Profile of Local Health Departments produced by the National Association of County and City Health Officials (NACCHO) collects data from local health departments throughout the U.S. at fairly routine intervals since 1990. This data provides some useful descriptive information about the human resources of local health departments across the United States. With regard to the top official, often referred to as

the Administrator, Health Officer, Director, Health Commissioner or another variation, the latest edition of this report (2005) indicates that:

- Eighty-six percent of local health departments have a full-time top agency executive. Most local health departments with a part-time executive serve relatively small populations.
- Fifty-five percent of local health department top executives are female. Local health departments serving smaller populations are more likely than those serving larger populations to have a female top executive.
- Ninety-two percent of local health department top executives are White.
- The mean and median age of local health department executives is 52 years. Nearly half of all local health department top executives are in their 50's.
- Fifty-eight percent of all local health department top agency executives have masters- or doctoral-level degrees. However, only 19 % of all local health department top executives have public health graduate degrees (MPH or DrPH).
- The mean time that local health department executives have served in their current positions is eight years (NACCHO, 2006).

The public health administrator functions as the executive manager of Illinois LPHA's and must meet specific educational and experiential statutory requirements for state certified LPHA's. Demographically, it has been noted that a majority (77 percent) of the Illinois public health administrator workforce is between the ages of 30 and 59. Correspondingly, 65 percent have 10 or more years of experience in public health. Roughly 56 percent have a master's degree and an additional 7 percent possess a doctoral degree. Registered nurses are the largest group (28%) of licensed professionals among

administrators. Licensed environmental health practitioners are the next most frequent group with 23 percent of LPHA administrators having this license. Only 2 percent of administrators were physicians while 23 percent held no professional licenses. These characteristics suggest that LPHA heads are a diverse group, coming from many different backgrounds and experiences. Few have formal training in public health or health administration (Turnock & Hutchinson, 2000).

Local health department employees are front-line workers in the nation's public health system and a major component of the local public health workforce. The National Association of County and City Health Officials National Profile of Local Health Departments (2006) makes a major contribution toward describing, and thus understanding the makeup of, the local health department workforce. With regard to the local health department workforce, this report notes that:

- Approximately 160,000 FTE (Full-Time Equivalent) workers are employed by local health departments. Twenty percent of local health departments employ fewer than five FTEs, and nearly 60% employ fewer than 25. Only 14% employ more than 100 FTEs.
- Occupations represented among local health department employees indicates that clerical personnel and nurses are each employed by over 90% of local health departments; managers/directors and environmental health specialists (sanitarians) each by over 80%. By contrast, information systems specialists, epidemiologists, and public information specialists are each employed by 30% of local health departments or fewer. Another notable finding is that only 43% of local health departments employ physicians.

- The occupations most often found at local health departments serving less than 50,000 are managers/directors, nurses, environmental health specialists, and clerical staff. Most local health departments serving 50,000 or more also employ nutritionists, health educators and emergency preparedness coordinators. Additional specialized occupations are represented among the employees of most local health departments serving between 100,000 and 500,000, including physicians, epidemiologists, environmental health scientists, and information systems specialists.
- Concern has been expressed about the possibility that a large percentage of public health workers will be eligible for retirement in the near future, resulting in a loss of valuable expertise and potential workforce shortages. Of those local health departments that had made this determination of pending retirements, the mean percentage of employees eligible for retirement within the next five years is 20%. In general, local health departments serving smaller populations reported larger percentages of staff eligible for retirement within the next five years than those serving larger populations (NACCHO, 2006).

Measuring Human Resources Capacity within LPHAs

The description provided by Turnock (2001) of the human resources of public health and the knowledge, skills, and abilities of the workforce is manifested in what has been defined as the competency of the local health department workforce. There has been considerable progress over the years to delineate and measure the core competencies and skills necessary for public health practitioners. Many of these initiatives have their roots in the Institute of Medicine report (1988) entitled *The Future of Public Health* cited earlier. A key development was the convening of public health practitioners and

academics through a Public Health Faculty/Agency Forum, which came to be known as the Council on Linkages between Academia and Practice Core Competencies Project. The purpose of this forum was to outline a set of core competencies that all public health professionals should have, regardless of training. These competencies address analytical, communication, policy development and program planning, cultural, basic public health sciences, and financial planning and management skills. The Public Health Functions Steering Committee refined these competencies for public health workforce development by linking them to the essential public health services (Turnock, 2001). These competency recommendations have culminated in self-assessment tools to enable practitioners to measure themselves against these competencies (Robbins, Bradley, & Spicer, 2001, http://www.phf.org/competencies.htm#tools). Other research relating to capacities of human resources have attempted to promote workforce assessment to identify training needs of public health staff (North Carolina Center for Public Health Preparedness, 2007; Northwest Center for Public Health Practice, 2002).

Within the state of Illinois, the local health department workforce has access to and participates in a system meant to assess workforce capacity, measure competencies, and identify training needs. The Illinois Department of Public Health's Learning Management System, or LMS, provides competency-driven assessments and course associations that are integrated in the system along with online quizzing and evaluation processes. The IDPH LMS was custom programmed to meet the specific needs of the state agency. To optimize the learning value of the system, Illinois wanted to identify workers in LPHAs who required training in particular competencies. Federal funding requirements stipulated that IDPH needed to ensure that 80% of its workforce had been

assessed for competencies associated with their professional roles by the end of the first year of implementation. Evidence provided by the LMS administrative reporting features indicated that over 85% of the 5500 LPHA workforce had been assessed by that benchmark. At the heart of the LMS are a set of practice-relevant focal competencies that serve as the basis for the assessment tools and processes included in the system. Each focal competency represents a complex aggregate of knowledge, attitudes and skills that are important for public health practice. The core and cross-cutting focal competencies are consistent with the national competency formulations advanced by the Council on Linkages between Academia and Practice (Robert Teel, personal communication, 7/10/2009).

Human Resources (HR) capacity can be measured by other means as well. While most measures used in public health settings have tended to focus on knowledge, skills and abilities (i.e., training and competency assessments), other more business (for profit sector) oriented approaches tended to focus on metric or scorecard approaches focused on more pragmatic objectives. For example, the most widely used HR metrics are typically concerned with employee attitudes, employee turnover, employee skill levels, as well as outsourcing costs, service center operations, the number of HR transactions processed, staffing process, training programs utilization and effectiveness, and promotions. These measurements are employed by 25 to 75% of all business organizations (www.Strategy2Act.com/solutions/hr_metrics.htm, accessed 1/16/2007).

Organizational Resources in Public Health

Organizational resources in public health include the network of federal, state, and local public health agencies, as well as mechanisms for linking public, private, and

voluntary organizations through collaborative relationships (Turnock, 2001). For the last several years, increasing importance has been placed on the network of public health stakeholders throughout a given community: those organizations having some influence on the health of residents. According to the Institute of Medicine (1997):

> The health of a community is a shared responsibility of all its members. Although the roles of many community members are not within the traditional domain of health activities, each has an effect on and a stake in a community's health. As communities try to address their health issues in a comprehensive manner, all parties – including individual health care providers, public health agencies, health care organizations, purchasers of health services, local governments, employers, schools, faith communities, community-based organizations, the media, policymakers, and the public – will need to sort out their roles and responsibilities, individually and collectively. These interdependent sectors must address issues of accountability and shared responsibility for various aspects of community health (p. 59).

The current emphasis on multiple interventions at multiple levels of the social ecology is a response to the severity and complexity of chronic health conditions that are rooted in a larger social, cultural, political and economic fabric. The current wisdom in health promotion holds that targeting the behavior of individuals, without also intervening at these other social levels that shape behavior, will not have as great an impact on health status (Butterfoss, Goodman & Wandersman, 1993). The development of coalitions of community agencies, institutions and concerned citizens to combat chronic health conditions is only gaining in popularity as an intervention aimed at

strengthening the social fabric. (Butterfoss, et al., 1993). Some widely used community assessment processes including PATCH (Planned Approach to Community Health), APEX-PH (Assessment Protocol for Excellence in Public Health) and MAPP (Mobilizing for Action through Planning and Partnerships) incorporate coalition building as a means of constituency development centered upon public health improvement. According to the Institute of Medicine's report, *The Future of the Public's Health in the 21st Century* (2002), local health departments are charged with promoting overall community health and well-being and addressing the causes of disease and disability. To achieve these goals in the 21st century, local health departments need to engage diverse communities in developing a broad spectrum of solutions to today's most pressing problems, including chronic diseases (the leading causes of death), health disparities, and other complex community health issues.

There are many benefits to working through collaborative partnerships. Collaborative efforts can function more efficiently than single organizations because work plans are shared among the partners rather than carried out by a single group. This serves to conserve limited resources and provides a pathway for reaching a larger part of the community. When organizations band together around specific goals (i.e., improving community health), their efforts carry greater credibility than when only one or a few organizations are involved. Collaborative efforts are also excellent mechanisms for ensuring a broad range of inputs and perspectives into the policy development process and for facilitating communication and information across agencies and organizations (Turnock, 2001). Certainly, coalitions and community partnerships provide a means of pooling the abilities, expertise and resources of numerous stakeholders to positively

affect community health (Granner & Sharpe, 2004). The development of collaborative partnerships within communities has been advanced as a primary mechanism to empower communities to implement effective prevention initiatives (Brown, Hawkins, Arthur, Abbott & Van Horn, 2008). In a summary of current research conducted by the Center for Prevention Research and Development (2006), it was found that coalition outcomes may be viewed as occurring at several levels, beginning with the collaborative process that brings existing resources together to work more effectively and efficiently. Coordination, collaboration, and resource exchange are often viewed as the true value-added benefit of a working and effective coalition. First-level outcomes found in research included systems change, changes in service delivery, system reform, cross-referral, and new community linkages. The evidence of long-term impact on behaviors is less well documented in the research literature.

Measuring Organizational Resources Capacity within LPHAs

The organizational resources of public health as described by Turnock (2001) are manifested through the collaborative nature of local health departments. Multiple authors have worked to develop and test survey instruments to measure the collaborative nature of organizations using self-assessment tools. Granner and Sharpe (2004) identified 146 measurement scales focused around partnership functioning and classified them under three categories: member characteristics and perceptions, organizational or group characteristics and measures for organizational or group processes/climate. However, "published measures often lacked information regarding validity and reliability, with internal consistency reliability being the most commonly reported statistic" (Granner & Sharpe, 2004, p. 514). Several instruments have been found in the literature focused

around collaboration specific to key elements of public health practice. Goldstein (1997), for example, described the development of an instrument initiated through the South Carolina Department of Health and Environmental Control that was based around key characteristics of an effective coalition found in research that included lead agency characteristics, planning group characteristics, membership, coalition structure, and institutionalization. In this project, a task-force was developed to draft a "Coalition Self-Assessment Tool" which was then pilot tested and revised and used by coalitions throughout South Carolina to provide a picture of their developmental stage and to determine areas needing technical assistance, training, or other support. Validity and reliability data was not provided for this instrument. Similarly, Greenbaum and Dedrick (2006) also worked toward the development of a self-report questionnaire used to measure interagency collaborative activities in four areas: financial and physical resources, program development and evaluation, client services, and collaborative policies. This instrument, titled the *Interagency Collaboration Activities Scale*, provided items that were generated from reviews of the literature, existing instruments, and from interviews with agency personnel operating in a mental health setting. Although evidence of reliability for this measure is comprehensive, evidence of validity is not provided.

A promising measure of community prevention collaboration has been developed more recently, building on previous research. Brown, et al. (2008) provided a thorough analysis of an instrument used to measure the degree of community-wide collaboration on prevention-specific activities that builds upon key aspects of public health practice. Using data from a sample of 599 community leaders across 41 communities, the authors

examined the measure with regard to its factor structure, associations with other concurrent community level measures, and prediction by individual- and community-level characteristics. Results of multilevel confirmatory factor analysis provided evidence for the construct validity of the measure and indicated significant associations with concurrent validity criteria, supporting the use of this measure in assessing the importance of collaboration in community-based prevention initiatives.

Additionally, the Assessment Protocol for Excellence in Public Health (APEX-PH) assessment model developed through the National Association of County and City Health Officials (1991) provides organizational capacity measurement items based around key indicators of community relations including intergovernmental relations, constituency development and constituency education. Similarly, the National Public Health Performance Standards Project provides a measurement tool that focuses on collaborative relationships as evidence of fulfillment of Essential Service #4: Mobilize community partnerships to identify and solve problems. Key indicators of performance provided here include constituency development and community partnerships (National Association of County and City Health Officials, 2005). The aforementioned National Profile of Local Health Departments has since 1990 routinely collected data from health departments related to partnerships and collaboration, reinforcing the importance of this variable to successful health department functioning.

Fiscal Resources in Public Health

For public health to meet its mission, 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 (Jacobson & Neumann, 2007). Practitioners become more entrepreneurial by focusing more attention on the fiscal resources of public health and the relationship of these resources to performance.

According to Turnock (2001):

> The fiscal resources available for public health activities can be viewed as both inputs and outputs of the system. They are clearly inputs, in that they represent an economic measure of the human, organizational, and informational resources described earlier, as well as the physical facilities, equipment, and other inputs that do not fit nicely into any of the other categories. However, the fiscal resources provided for public health programs also represent the perceived worthiness of these activities, in comparison with other public policy goals. In this light, fiscal resources are a product of public health activities and an expression of their value in the eyes of society.

Despite the relationship that exists between fiscal resources and a public health department's activities, the concept of public health finance as a field of study to support and encourage research has received little attention. This is an important shortcoming as the 2002 Institute of Medicine (IOM) report, *The Future of Public Health in the 21st Century*, noted some unresolved public health finance problems, including 1) the lack of a comprehensive investment plan with clear performance measures, 2) lack of knowledge on national funding requirements to sustain the public health infrastructure, and 3) lack of systems of accountability to ensure quality and availability of public health services

(Honore', Simoes, Jones, & Moonesinghe, 2004). Brown (1988) also acknowledged these shortcomings by noting that public administrators are often preoccupied with the budget process, and often neglect attention to financial analysis and management including aspects of accountability. The result, he concludes, gives the impression that public administrators are more concerned with getting and spending money and that public sector financial management systems are insufficient when designed to measure only financial resources (revenues and expenditures) and must be matched with performance information to facilitate informed management and policy decision making. Public health finance research is important because in spite of numerous reports that persistently label the public health infrastructure as underfunded, in disarray, and having haphazard and disorganized funding patterns, routine analysis on the different type of revenues and expenditures that fund the public health system is simply not routinely and systematically undertaken (Honore', et al. 2004).

Measuring Fiscal Resources Capacity within LPHAs

Several studies have attempted to link expenditures to core public health functions and essential public health services (CDC, 1995; Elbert, Barry, Bialek, & Garufi, 1996; Barry, Centra, Pratt, Brown, & Giordano, 1998). Predominately, these studies have been conducted using descriptive techniques to measure and define the amounts and proportions of public health expenditures (in per capita dollars) used to address each of the core functions or ten essential services of public health. As one study described, "it is critical to begin measuring investments in Essential Services in order to analyze, understand, and report to the nation what we do in public health…we then need to analyze what those investments are buying – i.e., what impact they are having on public

health goals and outcomes in the population – and to put these data in context with needs of the community" (Barry, et al. 1998, p.43). Limited efforts thus far have attempted to move the research agenda beyond the reporting of where the dollars go and how health departments spend funds to linking these expenditures to performance, either in terms of how well the health department produces outputs (services) or in terms of how well the local health department improves outcomes (community health status).

A study conducted by Honore, et al. (2004), however, attempted to correlate public health system performance (measured using the National Public Health Performance Standards Program instrument) of the 10 essential public health services with funding patterns of 50 local health departments in a large state. The study was intended to investigate if different levels and types of revenues, expenditures, and other demographic variables in a jurisdiction were correlated to performance. Although the study did not conclusively show strong associations, statistically significant positive associations were identified between higher levels of performance and jurisdiction taxes per capita. In addition, this study noted that of the 50 local public health systems studied, "the 24 high scoring systems had: 1) greater percentage of total revenues from taxes, 2) higher taxes per capita, 3) higher tax rates, 4) higher percentage of local health departments that deficit spend, 5) larger populations, and 6) higher age-adjusted mortality rates. The 26 lower scoring systems had: 1) a larger percentage of other revenues, 2) lower populations, and 3) lower age-adjusted mortality rates" (Honore', et al., 2004, p.449). Further analysis of the financial data revealed that, on average, high scoring systems had taxes per capita 38% greater than low scoring systems. However, of the 24 high scoring local public health systems, 12 (50%) had taxes per capita below the overall

mean, while 8 of the 26 low scoring systems had taxes per capita above the mean (Honore', et al., 2004). With research in this area so sparse, comparisons between the results of this study and others could not be conducted.

Still, other studies have also attempted to link health expenditures to health outcomes. Anyanwu & Erhijakpor (2007), for example, attempted to link African countries' per capita total as well as government health expenditures and per capita income to two health outcomes: infant mortality and under-five mortality. This study provided evidence that health expenditures have a statistically significant effect on infant mortality and under-five mortality. A similar study by Bokhari, Gai, and Gottret (2006) looked at global statistics of the developing world. This study provided econometric evidence linking a country's per capita government health expenditures and per capita income to two health outcomes: under-five mortality and maternal mortality, implying that while economic growth is certainly an important contributor to health outcomes, government spending on health is just as important a factor.

While these studies reflect evaluation techniques specifically oriented around the fiscal performance of health sector enterprises, other business sector environments measure fiscal performance differently. Although a firm's financial performance in other sectors is often measured strictly in terms of profit, several other criteria are also seen as important factors. For example, an article by Crane (2004) notes that in the agricultural industry, the Farm Financial Standards Council recommends standardized farm financial factors, measures and reporting formats farmers can use to better understand their farm business. The 16 recommended measures for financial analysis are grouped into five

broad categories that include: 1) Liquidity, 2) Solvency, 3) Profitability, 4) Repayment Capacity, and 5) Financial Efficiency.

Similarly, a study of the agri-food industry examined a number of most frequently appearing ratios in literature as useful indicators of financial performance and risk bearing ability. These 11 indicators could be grouped into three categories: 1) Profitability, 2) Solvency, and 3) Managerial Performance (Kalogeras, Baourakis, Zopounidis, & van Dijk, 2005).

Chakravarthy (1986) recommended a composite measure of fiscal performance as he described one of the better known multi-factor models of fiscal performance known as the bankruptcy model, first postulated by Altman and Argenti. "These researchers found, through careful study of several corporate bankruptcies, that a multiple discriminant function called the Z factor had very good predictive powers for determining corporate bankruptcies, especially close to the actual event…While the Z values were essentially constructed to predict bankruptcy, it can also be a valuable index of the company's overall well-being" (Chakravarthy, 1986, p. 446).

While these financial indicators are more often seen in evaluating the fiscal performance of for-profit sector businesses, they are now becoming more common in the not-for-profit sector as well. Trussel (2006), for example, recommended 10 analyses for financial evaluation of non-profits: 1) the statement of revenue/expense activities of the agency compared to several similar sized comparable agencies, 2) the balance sheet of the agency compared to several similar sized comparable agencies, to include various ratio analyses (an analytical technique that compares one financial statement item to another in meaningful ways); 3) liquidity: a measure of an organization's short-term debt

paying ability; 4) activity: which provides a measurement of the ability of the organization to utilize its assets to provide revenues; 5) Return on capital: used to measure the return per dollar of investment; 6) adequacy of resources: a summary of ratios to measure the sufficiency of resources available to the organization; 7) use of resources: measures how resources are utilized in operating the organization in terms of programmatic, administration and fundraising costs; 8) leverage/solvency: this category of financial ratios measures the long-term debt paying ability of the organization. The focus in this analysis is on the organization's ability to meet its long-term obligations and remain solvent; 9) combined analysis: ratios in this category come from ratios in other categories and are combined to provide a comprehensive measure of fiscal performance; 10) composite measures: in this analysis, two composite measures are used – the financial risk index and the accounting manipulation index. The financial risk index is a composite measure of the probability of financial problems. The index is based upon the combination of several key financial indicators, such as the ratios of net assets to revenues, revenue concentration, administrative to total expenses and surplus to revenues and it was developed using thousands of financially troubled and financially sound organizations. The accounting manipulation index is a composite measure of the probability of manipulating the program expenses, such as the ratios of surplus to revenues, deferred expenses, revenue growth, deferred revenues, and the change in program spending.

Multiple authors (Altman, 1968; Ohlsson 1980; Tuckman & Chang, 1991; Greenlee & Trussel, 2000; Keating, Fischer, Gordon, & Greenlee, 2005; Trussel, 2006; Crane, 2004; Kalogeras, et al., 2004) have consistently found the following categories of

indicators as important in evaluating the financial performance of both for-profit and not-for-profit sectors: 1) Financial Distress (a.k.a. Financial Vulnerability, Financial Risk), defined by Greenlee & Trussel (2000) as any non-profit that saw an overall decline in program expenses during a 3-year period, 2) Liquidity, defined as an organizations ability to pay their obligations (short-term debt) on time (Keating & Frumkin, 2001), 3) Profitability (revenues over expenses), and 4) Solvency, defined as an organization that has liabilities less than or equal to assets (Keating, et al. 2005). These important indicators are measured in the literature by use of various ratios, the numerators and denominators of which can be found in a typical health department's statement of fiscal activity or audit. In addition, another author (Keating, et al., 2005) has recommended various trend analyses of at least 3 years, measuring growth rates in total revenues and expenses. Several researchers (Greenlee & Trussel, 2004; Ohlsson, 1980; Keating, et al. 2005) in this area recommend the identification of comparison groups of similar organizations, noting that when the ratios differ substantially and adversely from peers, these organizations are likely to experience financial distress (Keating, et al., 2005). The models used by these authors to predict financial distress have been found to be robust (Keating, et al., 2005).

Informational Resources in Public Health

Information and access to information represent important elements of the public health infrastructure. "The information resources that support public health practice include both the scientific basis of public health and the network of data and information needed to assess and address health problems" (Turnock, 2001, p. 227). These resources also include the knowledge base and competency held by public health professionals to

assess and address health problems and the capacity of such professionals to use such information effectively (Turnock, 2001). Information is what drives the assessment function of public health in at least three important ways: 1) public health agencies commonly utilize surveillance data to monitor community health status and trends and to identify new health hazards effecting populations, 2) once health needs are identified, information is needed in order to inventory the community's resources available to address those needs and problems and the effectiveness of those resources, 3) information from assessments of health needs and current efforts must be tailored to the needs of decision and policy makers to facilitate more effective interventions (Turnock, 2001). The developing field of public health informatics as well as the competencies of health department professionals best describe the informational resources associated with public health. Public health informatics is the "systematic application of information and computer science and technology to public health practice, research and learning" (Yasnoff, O'Carroll, Koo, Linkins & Kilbourne, 2001, p. 45). As NACCHO (2007) describes, "The capacity to use information is fundamental to all public health activities. Consequently, informatics is a key part of the foundation, or infrastructure, on which the public health system is built." The scope of public health informatics includes conceptualization, design, development, deployment, refinement, maintenance, and evaluation of multiple systems relevant to public health including the communication, surveillance and information systems that are so important to the core functions of public health (Yasnoff, et al., 2001). As a key acknowledgement of the importance of informational resources to public health, Healthy People 2010 devotes much of Chapter 23 (Public Health Infrastructure) to information systems, data collection and data

management. The overall Healthy People 2010 initiative emphasizes data collection information systems, along with system communication and integration, at federal, tribal, state, and local levels. A general theme underlying the Healthy People 2010 initiative is that the collection, analysis, and dissemination of information drive public health effectiveness (Magruder, Burke, Hann & Ludovic, 2005). In addition, in its 2003 report *Who will Keep the Public Healthy*, the Institute of Medicine identifies eight areas of critical importance to public health education in the 21st Century. Informatics is the first area discussed. "Pointing to the work of the CDCs Public Health Informatics Competencies Working Group, the Institute of Medicine report highlights online information access as a competency defined as 'use of Information Technology tools to identify, locate, access, assess, and appropriately interpret and use online public health-related information and data'" (Allee, Alpi, Cogdill, Selden & Youngkin, 2004, p. A-4).

Rowitz (2003) has asserted, as well, that public health leadership is driven by an abundance of vital information. In order for public health leaders to "positively impact the communities that they serve" (p. 113), they must achieve informatics competence by:

- Taking training courses in informatics
- Learning techniques for the collection of health status indicators
- Learning how to interpret data and turn them into useful information
- Exploring different analytic tools for better understanding data
- Utilizing quantitative and qualitative information
- Becoming involved in the development of information systems
- Integrating conflicting data systems

A provocative article promoting improved information systems in public health reiterated the importance of public health informatics by noting that, "The health sector's most avoidable shortcomings can be linked to data, information, or knowledge that are inaccessible or demonstrate poor quality. Lost data, poor documentation, lack of access to available knowledge, and reliance on memory all impede the deliver of high quality health care services. Public health agencies lack the ability to share critical information quickly and encounter substantial difficulties when attempting to pool existing data for analysis" (Detmer, 2003, p. 2).

Despite the perceived importance of these informational resources, most local health departments, particularly those serving small populations, are currently providing limited informatics-related training to their staffs. Less than one-third of local health departments reported providing training on using and interpreting quantitative or qualitative data, using software analytical tools, designing and maintaining a public health Web site, or locating consumer health information on the Internet (National Association of County and City Health Officials, 2007). Staying abreast of developments in information access and management is clearly important for the practice of public health. These skills help public health practitioners confront daily challenges on multiple levels. Yet, there are significant challenges facing public health workers who seek to improve their skills in information access and management. One challenge is the continuous evolution of information technologies and resources, making ongoing training a necessity (Allee, et al., 2004).

Measuring Informational Resources Capacity within LPHAs

Magruder et al. (2005) surveyed local health departments in the United States to assess the utilization of information technology. The survey's intention was to assess if local public health agencies possessed the computer infrastructure to support the informatics competencies identified by O'Carroll and the Public Health Informatics Competency Workgroup (2002). The findings suggest that many local health departments still have basic information technology issues to address including hardware upgrades and broadband internet access. The researchers' concluded, "Overall, there is a need to focus health information technology dollars on the front line of the public health system by developing both the human and the technology capacities of local health departments" (p. 126). Additionally, Tanner, Pierce, and Pravikoff (2004) conducted a national survey of computer and information literacy skills among nurse educators, practicing nurses, and nurse administrators working in a variety of settings including public health departments to address the research question, "Are nurses ready for evidence-based practice?" (p. 937). The results of the survey indicated that most nurses are aware they need information to practice as 64% reported that their role required information on a regular basis, however, 42.9% stated the resources available in their workplace were completely inadequate. Seventy-three percent (73%) have had no formal informatics instruction, and many reported less than average computer skills. When asked how often they evaluate research reports, 66% reported never, and when asked if they utilize research findings in practice, 52% reported never. Translating research into practice via evidence-based methods are the key factors related to the importance of informatics in public health.

Informatics and informational resources of public health have been highlighted in multiple public health assessment instruments including the National Public Health Performance Standards Project (National Association of County and City Health Officials, 2005), the Operational Definition of a Functional Local Health Department Project (National Association of County and City Health Officials, 2005), the Assessment Protocol for Excellence in Public Health (National Association of County and City Health Officials, 1991) Organizational Capacity Assessment and both the National (American Public Health Association, et al., 2006) and Illinois (Illinois Accreditation Task Force, 2006) Local Health Department Accreditation Programs.

Several tools have also been developed to measure informatics competence in the local public health department workforce (Secco, Woodgate, Hodgson, Kowalski, Plouffe, Rothney, Dickson, & Suderman, 2006; Rosenfeld, Salazar-Riera & Vieira, 2002; Tanner, et al., 2004; O'Carroll, et al., 2002). Most notably, the work by O'Carroll and the Public Health Informatics Competencies Working Group (2002) attempted to define and develop consensus around specific informatics competencies that various public health professionals should have. Noting that, "Proficiency in these competencies would directly assist today's public health professionals to harness the power of modern information technology to the practice of public health" (p. 5), O'Carroll and colleagues (2002) suggested three general classes of public health informatics competencies: 1) competencies related to the use of information per se for public health practice; 2) competencies related to the use of information technology to increase one's individual effectiveness as a public health professional; and 3) competencies related to the development, deployment, and maintenance of information systems to improve the

effectiveness of the public health enterprise (e.g., the state or local health department). It is noteworthy that the competencies included in class 1 above were drawn verbatim from the "Core Competencies for Public Health Professionals" compendium developed by the Council on Linkages Between Academia and Public Health Practice.

The Dependent Variable: Health Department Outputs (Services)

"Local health department (LHD) performance measurement provides an opportunity to link inputs, outputs, and outcomes in a manner that should facilitate quality improvement. Since inputs flow from LHDs that vary substantially in size, organization, functioning and other characteristics, it is reasonable to assume that these variable inputs may affect LHD performance or outcomes" (Erwin, 2008, p. E9). The outputs of public health serve as both the dependent variable of study related to the resources noted above, but they also serve as the independent variable in relation to community health outcomes. Often, the public health community has used the term 'services' interchangeably with the terms 'processes' or 'functions'. Turnock (2001) defines health department outputs as the "health programs and services intended to prevent death, disease, and disability, and to promote quality of life" (p. 335). For many decades, public health was defined primarily on the basis of the services provided. More recently, considerable effort has been dedicated to defining public health on the basis of what it does, as evidenced by the Institute of Medicine Report (1988) describing the 3 core functions of public health, the work of the CDC Public Health Practice Program Office (1991) to operationalize these core functions into 10 organizational practices, the work of the Public Health Functions Steering Committee (1994) defining the 10 essential services of public health articulated in the document "Public Health in America", and the

efforts to develop the National Public Health Performance Standards Program. Even now, the current efforts pertaining to the work to develop an Operational Definition of a Functional Local Health Department (National Association of County and City Health Officials, 2005) and the National and State Public Health Accreditation Projects also seem to center upon what health departments do: the outputs of public health departments.

Congruently, evaluation strategies were naturally tied to determining how well a health department provided such services or core functions. Public health has been measuring itself in one way or another since 1914. The definitions and characterizations of the fundamental activities of public health naturally served as the principal framework for evaluative efforts. These characterizations and definitive efforts included most notably:

- The Basic Six Local Public Health Services (1945).
- Optimal Responsibilities of Local Health Departments (1950).
- The Eight Basic Services of Local Public Health (1963).
- Model Standards (1985).
- The Three Core Functions (1988).
- 332 National Health Objectives for the year 2000 (1990)
- Ten organizational practices (1991).
- Essential Public Health Services (1994) (Lichiello, 1999).

The guidance provided through the Core Functions of Public Health (Institute of Medicine, 1988), the Ten Organizational Practices of Public Health (CDC Public Health Practice Program Office, 1991), and the Ten Essential Services of Public Health (Public

Health Functions Steering Committee, 1994) essentially help us to structure our work – individually, by program or organization, or within or across groups, programs, or organizations – to best meet the needs of our constituents. This guidance can serve as a built-in way to think about and organize a performance measurement process. Public health practitioners can use these broad service categories (the focal point of these efforts) for developing performance measures of capacity (the capacity to conduct each service), process (the processes used to conduct each service), and outcomes (the results of the services) (Lichiello, 1999). In a test of the Core Functions of Public Health, a study conducted in 2005 determined that those state health agencies that most completely adopted a public health model focused around the three core functions of public health (assessment, policy development, and assurance) also experienced significant improvements in their population health measures (Ford, Duncan & Ginter, 2005).

Measuring Outputs in LPHAs

The American Public Health Association facilitated an early role in health department evaluation by developing two important measurement tools: the APHA Appraisal Form and subsequently the APHA Evaluation Schedule. Both tools focused primarily on the services that Local Health Departments and other agencies provided and were used to rate and compare Local Health Department performance. The Appraisal Form is a means of voluntary self-evaluation that was developed in 1925 to formally assess citywide public health practices. In 1943, the Evaluation Schedule was developed to replace the Appraisal Form. This self-evaluation tool, which was used into the 1950's, measured the immediate results (intermediate outcomes) as well as the activities of local public health systems (Derose, et al., 2002).

The driving force behind many of the more recent efforts to measure public health practice came from Objective 8.14 articulated in Healthy People 2000: the Health Objectives for the Nation (1990) which set forth a goal to "Increase to at least 90 percent the proportion of people who are served by a local health department that is effectively carrying out the core functions of public health" (Miller, Moore, Richards & McKaig, 1994, p. 659).

Numerous efforts have attempted to measure performance of both the local public health department and the local public health system utilizing the outputs of public health as the foci for evaluation. The work of Corso, Wiesner, Halverson & Brown (2000) provided rationale for the use of the Essential Services as a framework for identifying, analyzing, and evaluating public health activities, and these Essential Services now seem widely accepted as the backbone of evaluation tools utilized to measure public health practice. Scutchfield, Knight, Kelly, Bhandari & Vasilescu (2004), for example, noted after examining 28 capacity variables from the National Association of County and City Health Officials Profile of Health Departments and all 10 scores on the Essential Public Health Services, that public health agency capacities in the areas of funding, organizational leadership, and certain non-provider partnerships were found to be significantly related to public health system performance. Utilizing similar methodology, Mays, McHugh, Shim, Perry, Lenaway, Halverson & Moonesinghe (2006) evaluated associations between system characteristics and the performance of Essential Services. Their findings indicated that performance varied significantly with the size, financial resources, and organizational structure of local public health systems with some public health services appearing more sensitive to these characteristics than others. Staffing

levels and community characteristics also appeared to be related to the performance of selected services. In another example, Reedy et al. (2005) described a performance measurement process in which the framework for evaluation was based on the public health essential services that combined departmental indicators and specific program level outcomes for the Santa Clara County Department of Public Health (San Jose, California). The Essential Services framework has also been used as a tool to set benchmarks for improving capacity in areas of environmental health practice (Barron, Glad & Vukotich, 2007).

Several researchers (Handler, et al., 1995; Miller, et al., 1994; Miller, Richards, Christenson & Koch, 1995; Richards, Rogers, Christenson, Miller, Taylor & Cooper, 1995; Roher, Dominguez, Weaver, Atchinson & Merchant, 1997; Scutchfield, Hitabiddle, Rawding & Violante, 1997; Turnock, et al.,1998) have developed instruments to measure how well Local Health Departments provide the core functions of public health. Most often, these instruments incorporate either the 10 essential services of public health, the 10 organizational practices of public health first articulated in 1991, or the 3 core functions of public health articulated in 1988 by the Institute of Medicine. We center our review of the literature on discussion of several of these instruments due to their relevance to the current study. The instruments discussed are focused around the local public health department as the focus of evaluation rather than the local public health system.

Although it has been noted that public health has been measuring itself in one way or another since 1914, these efforts took on new meaning in 1988 when the Institute of Medicine identified the three core functions of public health as assessment, assurance and

policy development in their report entitled, *The Future of Public Health.* By 1990, these core functions had become largely accepted by practitioners and scholars alike, leading the US Public Health Service to acknowledge in Objective 8.14 of the national health promotion and disease prevention objectives entitled *Healthy People 2000* that 90% of the population should be "served by local health departments that are effectively addressing the three core functions of governmental public health" (p. 264). When this objective was established, neither baseline data nor adequate methods were available to measure progress toward fulfillment of this objective (Turnock, et al., 1994). By 1991, with funding through the CDC, work was on-going through the University of Illinois at Chicago School of Public Health, the University of North Carolina at Chapel Hill School of Public Health, and the University of South Florida School of Public Health to determine whether States had sufficient data and information available to measure the effectiveness of local health department (LHD) practice. In addition, this funding allowed researchers to develop and test measures to assess LHD practice, based on a framework of 10 organizational practices. These 10 organizational practices of public health were developed through the CDC and national public health practice organizations to operationalize the three core functions of public health cited in the IOM report (1988). As Turnock et al., noted (1994), "The potential importance of the 10-practice construct is based partly on its validity (does it correctly describe the organizational practice of public health?) and its utility (is it accepted as a way to describe and measure the organizational practice of public health?). To address validity, one must examine and critique the framework through the national practice organizations and ultimately to correlate the 10 practices with health department outputs and outcomes" (p. 481). By 1994, efforts of

Turnock et al. to develop such a measurement tool of public health practice were reported in the literature. Thirty-two draft indicators of performance were developed to correlate to the 10 practices identified. In addition, two other CDC sponsored surveillance projects had successfully incorporated aspects of the 10 organizational practices into their design. These three projects concluded that, "While the efforts of three schools of public health are insufficient to test the validity of the 10-practice construct, they demonstrate that it can provide a useful framework for measuring the activities of LHDs" (Turnock, et al., 1994, p. 484).

Directly following the publication of this research, Miller, et al., (1994) reported on progress using another assessment tool with 81 different practice measures utilizing 14 health departments that had been originally selected as exemplars for an earlier study. The results of this study allowed for distinctions to be made among the departments on levels of performance according to the 10 public health practices. In addition, in an effort to simplify the survey protocol so that it might be suitable for use with a large number of local public health jurisdictions, a subset of 26 indicators was selected for the previously developed 81 protocol indicators. Statistical tests were performed for correlations between the simplified instrument and its larger original design. Scatter plots showed close correlation between scores for the full survey and those of the 26 item design.

Most important of the conclusions from this study, the authors noted that this study suggests that evaluations of local public health performance are feasible through survey responses from directors of local health departments. Although the authors of this study expressed disappointment in the failure to identify a simplified method for separately assessing each of the 10 public health practices, they did conclude that

"additional experience and statistical analysis will help modify both the number and nature of the indicators for assessing public health practice. Initial analysis suggests that several questions have low predictive value and might be eliminated if findings are confirmed with a larger series of less highly selected respondents. Conversely, a few indicators show greater predictive value and suggest that a refined list of function- and practice-specific indicators might be developed, perhaps merging these findings with those of other investigators" (p. 663-664). More extensive analysis of this study design and 26-item survey tool appeared in a November 1994 issue of the American Journal of Public Health.

Concurrently, and released in the same journal (Public Health Reports, Vol. 109, No. 5) as the Miller et al. (1994) article cited above, Turnock, et al., (1994) released the results from a nationwide survey using a stratified random sample of local health departments. This study, with the expressed purposes of providing a benchmark of local health department effectiveness in addressing the core functions and measuring compliance in achieving the year 2000 target, concluded that on the basis of two different definitions developed by the investigators, only 19 and 31 percent of health departments surveyed were judged to be effective in addressing the core functions of public health. This study concluded, as well, that performance measures established for each of the 10 public health practices can be useful in assessing local health department effectiveness.

In September of 1995, in a printed response to the Miller, et al article (1994), Turnock and Handler voiced support for the work of Miller, et al. noting that, "Their use of 10 public health practices that operationally define the three core functions identified in the Institute of Medicine report provides additional evidence that this framework can

be successfully applied to both the measurement and improvement of public health practice by focusing on function rather than form" (p. 1295 – 1296). This response also provided clarification and acknowledged important distinctions between the 10 public health practices and the then newly developed 10 essential services of public health:

> Although many of the concepts embodied in the essential public health services are recognizable in the 10 public health practices, the two lists are dissimilar enough to raise important questions…The 10 practices were developed to specifically operationally define the IOM's three core functions at the local level so that local public health practice could be measured in terms consistent with Year 2000 National Health Objective 8.14 (90% of the population to be served by a local health department that is effectively addressing the core functions of public health). They reflect the organizational or collective processes through which public health inputs (workforce, information, organizational relationships) are applied to address the broad functions of public health. These processes result in outputs that are recognizable as programs and services intended to improve community health status, the ultimate outcome of the public health enterprise. The use of this framework, therefore, seems logical for activities that focus on local public health performance in comparison to a national target or optimal organizational performance. The essential public health services were developed for an entirely different application, namely, to describe public health activities more understandably for external audiences and constituencies…In sum, although these two formulations are generally compatible (embodying basically the same concepts), they were derived for quite different applications and should not be

> viewed as generic equivalents. In our view, if we are committed to an effective public health presence at the local level, it is essential that we not only clearly describe these activities to our constituencies but reliably measure these efforts as well. In this age of public accountability, building support for public health and building capacity for effective public health practice must go forward hand in hand (p. 1295-1296).

A further use and analysis involving the 10 public health practice standards and 29 associated practice performance indicators appeared later in the *Journal of Public Health Policy* (1996). In this study by Handler and Turnock, the raw data measuring local health department effectiveness from the Turnock et al. (1994) study was cross tabulated with data from the 1992-1993 National Association of County and City Health Officials nationwide profile survey of local health departments. The study noted several characteristics of effective local health departments including a full time top agency executive, higher total annual expenditures, a larger total staff as well as part-time staff, and a greater diversity of funding sources.

After completion of the studies noted above, the two primary CDC funded projects lead by Miller at UNC Chapel Hill School of Public Health, and Turnock and Handler at the University of Illinois at Chicago School of Public Health joined forces (1998) acknowledging that "both the measures used by Miller and by Turnock and Handler were based on 10 public health practices developed by a CDC-PHPPO workgroup commissioned in 1989. These practices incorporate many of the same concepts included in the more recent formulation known as the 10 essential public health services" (p. 27). The two projects then collaborated to develop a merged panel of 20

practice performance measures that would be useful for tracking local public health practice performance over time and that can be used as a screening tool for self-assessment and capacity building purposes. Of these 20 measures, 6 measures related to the core function of assessment defined by the Institute of Medicine (1988) report, 6 measures characterized the policy development function, and 8 measures were linked with the assurance function. "These measures, as was true for the original measures developed by Miller and for the majority of the measures developed by Turnock and Handler, assess the extent to which each practice is performed in the jurisdiction served by a local public health agency" (p. 27). These 20 measures were then applied to a national sample of local health departments using a stratified random sample of 503 local health department jurisdictions. Local health departments were sampled in 10 strata based on population size and type. To determine if the local health department effectively served their jurisdiction, at least 4 of 6 assessment-related measures, 4 of 6 policy development-related measures, and 6 of 8 assurance-related measures would need to be answered in the affirmative.

Local health departments were asked to rate the adequacy of the panel of the 20 measures as a tool for performance assessment using a five point Likert scale ranging from strongly agree to strongly disagree. The health departments were then also asked to report whether each of the 20 measures was performed in their jurisdiction. "Two-thirds (66 percent) of responding local health departments agreed or strongly agreed that these performance measures accurately characterize local health department effectiveness in addressing public health's 3 core functions. Fifteen percent either disagreed or strongly disagreed with this contention. "Local health department respondents reporting higher

levels of agreement with the adequacy of these measures also reported higher levels of performance" (p. 28). After weighting, mean performance scores for the 20 measures ranged from 23 to 94 percent, indicating that the measures were capable of identifying superior performance. The highest mean scores (79 to 94 percent) were for investigating adverse health events, maintaining necessary laboratory services, implementing mandated programs, maintaining a network of relationships, and regular provision of information to the public. The lowest mean scores (23 to 37 percent) were for assessing use of preventive and screening services in the community, conducting behavioral risk factor surveys, regularly evaluating the effect of services in the community, allocating resources consistent with community action plans, and deploying resources to meet identified needs. Altogether only 22 percent of the local health department jurisdictions in the weighted sample performed 4 or more of the assessment and policy development measures and 6 or more of the assurance-related measures. The study noted that "based on the proportion of the population served by local health departments in these strata, it is estimated that only 29 percent of the US population were effectively served in 1995 using this definition of core function-related effectiveness" (p. 28).

The adequacy and use of this 20-item measure as a means of self-evaluation of local health department effectiveness and performance continues. Mays, et al., (2004), for example, recently used this instrument to measure perceived effectiveness of US local health departments serving at least 100,000 residents. Kanarak, et al. (2006) also utilized this 20-item instrument as a measure to analyze the relationship between local public health department performance and health outcomes. Because of its utility and validity,

this 20-item instrument has been used in this study as our measure of public health department effectiveness.

Summary

In order to acknowledge and respond to much of the criticism of public health practice levied over the years, a structured measurement and evaluation approach is needed. This structure isn't needed for the sake of self discovery, but for the purpose of quality improvement: public health needs to constantly adapt to meet the growing needs of an ever-changing population and an ever-expanding agenda. In order to improve public health practice, the union between academia and practice is even more critical where the discovery of what works, and what makes up an effective and efficient public health department, as well as public health system, can be shared with all and modeled in practice.

The logic model, used now for decades in evaluative practices to show the relationship between resources and the meeting of ultimate goals and everything in between, provides a basic framework for such a measurement and evaluation approach. An organization's resources or inputs, should relate to its processes and outputs, and ultimately to the desired outcomes it hopes to achieve.

This study attempts to unite these logic model constructs, focusing on the inputs of public health departments (those things under the control of the department), and their relationship to the outputs of such departments (their functions or services). The study provides an important precursor to eventual study of relating what a health department does to what it hopes to achieve: improvements in community health status. By focusing on those areas noted as public health department inputs and cited in the literature, we can

measure how successful these health departments are in fulfilling their infrastructure capacities: the Human Resources, Fiscal Resources, Organizational Resources, and Informational Resources. As noted in this literature review, appropriate instruments currently exist that would help us measure the success of the health department in each of these capacity areas. In this way, the inputs of the health department serve as the independent variable of study.

Also described in the literature is an appropriate and widely used assessment instrument to measure how successful the health department is in developing and providing outputs, the services or practices of the department. In this way, the outputs serve as a dependent variable of study. By attempting to elucidate a relationship between health department inputs to outputs, we provide a test of a typical logic model. If the tenets of a typical logic model are correct, those health departments that are most successful in developing their inputs should have a subsequent effect in the provision of highly successful outputs. These outputs, then, could eventually serve as the independent variable for the dependent variable of community health outcomes in future study.

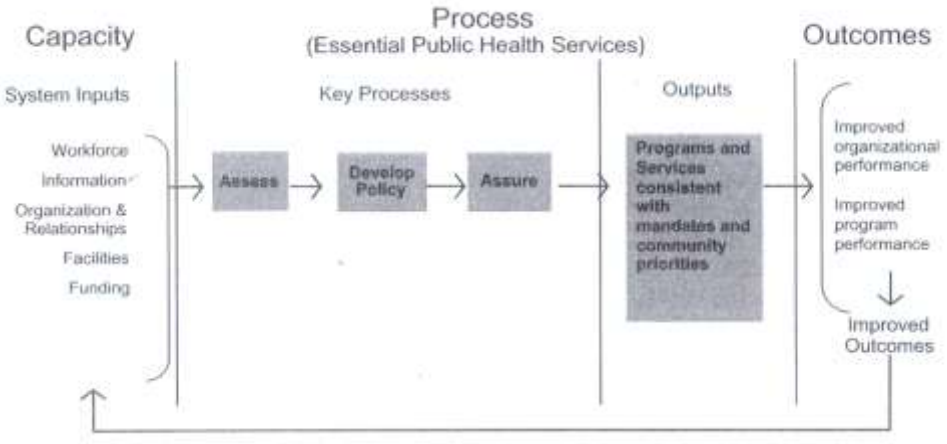
The methodology section will elucidate the approach used in studying these issues.

Methodology

Introduction

During the past decade, increasing attention has focused on performance measurement in the delivery of medical care. Unfortunately, there has been no parallel movement, conceptual framework, or research agenda to allow for an examination of the performance of the public health delivery system and the relationships between the practice of public health and population outcomes (Handler, et al., 2001). The measurement of public health activities has been ongoing for largely the last 85 years. Along the way, the emphasis of these evaluations and assessment tools has shifted from examining whether public health was doing things right towards examining whether the right things were being done. All the while, performance measurement in the public health sector has been inching ever closer toward measuring outcomes rather than just counting inputs and outputs (Lichiello, 1999). This study furthers these efforts by developing a methodology to assess relationships between typical logic model constructs of LPHA inputs (resources) and LPHA outputs (services). Figure 2 summarizes the structural framework emphasized throughout this study:

FIGURE 2:



Framework for Measuring Public Health System Performance (Turnock, 2001, p. 201)

The purpose of this study was to advance a model of performance measurement in public health based around logic model constructs that focused upon explanatory variables within the realm of control of the Local Public Health Agency (LPHA) and their subsequent effect on LPHA outputs using canonical correlation analysis. As part of this measurement analysis, a benchmarking process was elucidated, identifying superior performers across various strata representing jurisdiction size served, and across the state of Illinois as a whole. Through the noted methodology, the study sought to answer the following questions:

1. Is there a relationship and, if so, how strong is the relationship between a local public health agency's inputs (e.g., funding per capita, qualifications of staff, number of full-time equivalent staff per capita) and the successful implementation of the practices of public health (outputs)?
4. What is the attributable share of a local public health agency's inputs to outputs (successful implementation of the practices of public health)?
5. If local public health agencies are stratified on the basis of performance according to the successful implementation of the practices of public health (outputs), what are the differences between low and high performing agencies in terms of their inputs?

Key steps necessary to address the issues raised in the previous chapter include the following: (1) The development of a survey instrument from a review of literature to measure performance with regard to certain Local Public Health Agency (LPHA) inputs (the explanatory variable), and LPHA outputs (the dependent variable), (2) review of secondary data sources to measure performance with regard to other LPHA inputs, and

(3) an analysis of the relationship between LPHA inputs to LPHA outputs using canonical correlation analysis.

Measurement Frame of the Study

The measurement frame of this study is a sample of 46 certified Local Public Health Agencies (LPHA) operating within the State of Illinois. Currently 100 of the 102 counties within the state of Illinois receive some level of public health services through one of 95 LPHA's. Of these 95 LPHA's, six operate as multi-county jurisdictional agencies including four bi-county LPHA's, one three-county LPHA, and one seven-county LPHA (Illinois Department of Public Health, 2007). Seven LPHA's operate as municipal or district-level jurisdictional agencies. With the exception of the City of Chicago Health Department, all municipal or district-level jurisdictional agencies have been excluded from the study because of the difficulty finding supporting data for jurisdictions smaller than a county aggregation. Roughly sixty percent of the 88 certified county or multi-county LPHA's in Illinois serve a jurisdiction of less than 50,000 residents, approximately 28% of the certified health departments serve jurisdictions between 50,000 and 149,999 residents, and approximately12% of the certified health departments in Illinois serve jurisdictions of 150,000 residents or greater (Illinois Department of Public Health, 2007). Excluding municipal or district-level jurisdictional agencies, this study will examine 15 randomly selected LPHAs serving jurisdictions less than 50,000 residents, all 18 LPHAs serving jurisdictions between 50,000 and 149,999 residents, and all 13 LPHAs serving jurisdictions of 150,000 residents or greater (including the City of Chicago Health Department).

Selection of Survey Respondents

Survey respondents included the lead health official, termed "public health administrator" by Illinois State Statute, throughout the 46 selected certified LPHA's. A directory of Illinois' public health administrators is maintained by the Illinois Department of Public Health and provided the means of contact for implementation of the study.

Research Procedure

The study investigated the effect of LPHA inputs (resources) on LPHA outputs (services). A review of the literature was completed in order to specifically operationalize the explanatory variables (LPHA inputs) of interest to this study. Turnock (2001) provides extensive review of the human, informational, financial, and organizational resources which contribute to the public health system's capacity. Each of these resources or inputs were examined as part of this study. A survey instrument for LPHA administrators was developed based on a review of literature. The survey was used to capture data pertaining to LPHA capacity with regard to informational resources and organizational resources. Two additional survey items were added to this survey to complete the data necessary to finalize the human resources variable. The investigator examined data collected by the Illinois Department of Public Health to capture data pertaining to LPHA capacity with regard to human resources, and also examined other publicly accessible sources collected by each LPHA to capture data pertaining to LPHA capacity with regard to financial resources. A copy of the survey instrument for LPHA administrators is found in Appendix A. Similarly, a review of the literature was also completed in order to specifically operationalize the dependent variable (LPHA outputs) of interest to this study. Survey items were included in the LPHA administrator survey to

evaluate LPHA performance of outputs by measuring performance against what the Institute of Medicine (1988) described as the three core functions of public health, namely assessment, policy development, and assurance functions. Table 1 provides detail about the data collected or reviewed as part of this study.

TABLE 1: Data Description

	Content	Type/Source of Data	# of Items	Scale of Responses	Range of Scores Possible
Human Resources	Core Competencies	Secondary/IDPH	61	1 – 5	61 – 305
	% of staff with formal training	Primary	1	0-100%	
	% Turnover	Primary	1	0-100%	
Informational Resources	*General Information Systems	Primary	6	1 – 5	6 – 30
	*Data Collection/Processing/ Maintenance	Primary	5	1 – 5	5 – 25
	*Integration of data/data sharing	Primary	2	1 – 5	2 – 10
	*Data Analysis	Primary	5	1 – 5	5 – 25
Organizational Resources	Collaborativeness	Primary	9	1 – 4	9 – 36
Fiscal Resources	Per Capita LPHA Expenditures	Secondary/Audit	1	Variable	1.0 or proportion thereof
	Indicators of Financial Distress	Secondary/Audit	1	Variable	1.0 or proportion thereof
	Indicators of Liquidity/Solvency	Secondary/Audit	2	Variable	1.0 or proportion thereof
	Indicators of Profitability	Secondary/Audit	2	Variable	1.0 or proportion thereof
Public Health Output	*Assessment	Primary	6	1 – 5	6 – 30
	*Policy Development	Primary	6	1 – 5	6 – 30
	*Assurance	Primary	8	1 – 5	8 – 40

Note: Those content areas marked with * denote areas in which an affirmative response is followed up with an additional question. For these additional questions, responses are scaled using a 5-point Likert Scale ranging from 1=meets no agency need to 5=meets all needs.

The research procedure followed multiple steps leading to statistical analysis, as follows:

Step one - data collection for the explanatory variables (LPHA inputs).

A survey instrument was designed to measure completely 2 of the 4 categories of the input variable noted by Turnock (2001). The additional input variables were measured through review of available secondary data sources. Performance against the input variables of organizational and informational resources were measured through use of an electronic survey instrument provided to the public health administrator. Specific instructions were provided to the administrator for completion of the survey, along with a cover letter explaining the purpose of the study. The cover letter and accompanying instructions are included as part of Appendix A. To ease respondent burden, the investigator chose not to add survey items where data could be readily accessed from alternate sources, e.g., LPHA annual reports or audits. Thus, just one survey instrument for LPHA administrators was developed to measure the input variables of interest.

To measure performance of the input variables pertaining to human and financial resources capacity of LPHAs, secondary data sources were examined. Data allowing for measurement of performance pertaining to the human resources capacity of LPHA was provided through recent surveys conducted of LPHA staff throughout the state of Illinois via the Learning Management System (LMS), a training needs system developed through the Illinois Department of Public Health. As part of this system, all LPHA staff were required to participate in a self-assessment pertaining to the Core Competencies of Local Public Health Agency staff. To finalize this variable, two additional survey items were added to the administrator survey.

Data allowing for the measurement of performance pertaining to the financial resources capacity of LPHAs was provided via a review by the investigator of publicly

accessible financial audits of each LPHA. This review provided data necessary for the calculation of various ratios as indicated in the literature meant to assess the financial health of the LPHA, ala a "stress test" of the financial resources capacity of the agency. All data were categorical or continuous in nature, and entered into SPSS Version 18 as appropriate

Significant effort was exerted to ensure an adequate response rate. To encourage compliance, a presentation was made to a statewide Illinois public health administrators professional association, followed by an email. Surveys were then sent electronically to the LPHA administrator. A follow-up survey was sent electronically to non-respondents approximately two weeks after initial contact, followed by a hard copy survey with an enclosed self-addressed stamped return envelope two weeks later. A final follow-up phone call was initiated two weeks after the hard copy survey was sent. To urge compliance and improve survey response, the cover letter for each instrument was signed by individuals considered meaningful to the recipient, including the President of the Illinois Association of Public Health Administrators, the Executive Director of the Illinois Public Health Association, and a former director of the Illinois Department of Public Health currently serving as Clinical Professor and Director of the Division of Community Health Sciences and Director of the Illinois Public Health Preparedness Center at the School of Public Health, University of Illinois at Chicago.

The survey instrument

A survey instrument was designed for use by the LPHA administrator to gather information pertaining to the input and output variables of interest. The instrument designed for LPHA administrator respondents is found in Appendix A and combines

multiple tools found in the literature. These measurement tools assess: 1) Organizational resources capacity using the Brown et al., (2008) measure of community prevention collaboration, 2) Informational resources capacity by combining several tools found in the literature specific to public health organizations that focus on general information systems; data collection, processing, and maintenance; integration of data/data sharing with community partners; and data analysis, and 3) LPHA performance in providing services (outputs) described later. Two items were also added to the survey to complete and finalize the human resources input variable

Organizational resources are described by Turnock (2001) as including the network of federal, state, and local public health agencies as well as mechanisms for linking public, private, and voluntary organizations through collaborative relationships. The survey instrument developed by Brown, et al., (2008) to measure community prevention collaboration was used to measure this input variable. Brown, et al., (2008) worked to establish a survey instrument that would measure community-wide collaboration on prevention-specific activities (i.e., prevention collaboration), much the same types of activities found common in LPHAs. This instrument measures prevention collaboration through use of nine items based on a review of the community coalition literature as indicators of successful coalition collaboration. Response items were based on a 4-point Likert scale format to include strongly agree, somewhat agree, somewhat disagree, and strongly disagree. In a test of this survey instrument, Brown, et al., (2008) surveyed 599 community leaders across 41 different communities examining the instrument in terms of its factor structure, associations with other concurrent community-level measures and prediction by individual- and community-level characteristics,

thereby testing face, content, and construct validity. Results of multilevel confirmatory factor analysis provided evidence for the construct validity of the measure and indicated significant ($p<.05$) associations with concurrent validity criteria.

To measure information resources of LPHAs, an assessment tool for LPHA administrators was developed that combined survey items found in multiple other public health self-assessment processes. This tool was developed around several categories of information capacity that, when combined, appropriately measure LPHA performance against this input variable. Items were grouped into constructs pertaining to general information systems; data collection, processing, and maintenance; integration of data/data sharing with community partners; and data analysis. Survey items were developed from information included as part of the National Association of County and City Health Officials National Profile of Local Health Departments (2008) assessment, Healthy People 2010 Objectives for the Nation (2000), the Assessment for Protocol for Excellence in Public Health Organizational Capacity assessment (1990) and the Operational Definition of a Functional Local Health Department (2005) assessment. Eighteen items, not including follow-up items, were included in this survey. Response items varied by question, with most items scaled using a 3-point scale of Yes/No/Don't Know, with a follow-up item provided for each affirmative response. Each follow-up item was scaled using a 5-point Likert scale ranging from 1 = meets no agency need to 5 = meets all needs. Face validity of the items was established by a panel of experts.

Secondary data sources

The study incorporated review of available secondary data sources to fulfill examination of all LPHA inputs noted. Secondary sources were examined to measure

LPHA performance with regard to human and fiscal resources. To evaluate performance of the human resources capacity of LPHAs, the investigator reviewed data collected by the Illinois Department of Public Health as part of their Learning Management System (LMS). As part of the Bioterrorism Preparedness Grant implemented through the Illinois Department of Public Health Office of Preparedness and Response, all LPHA staff were urged to complete a self-evaluation of a public health core competencies assessment to fulfill grant deliverables. Each focal competency represents a complex aggregate of knowledge, attitudes and skills that are important for public health practice and are consistent with the national competency formulations advanced by the Council on Linkages between Academia and Practice (Robert Teel, personal communication, 7/10/2009). Permission to review LPHA specific responses was granted through a request made of each LPHA administrator as part of the survey questionnaire.

To evaluate performance of the fiscal resources capacity of the LPHA the investigator reviewed secondary data collected from readily available LPHA audits. As required by Illinois State Statute Chapter 55: Section 5: Division 6-31, all counties are to conduct annual financial audits for submission to the Comptroller of the State of Illinois. To enable this review, a request was made of each LPHA administrator for their last three completed annual fiscal audits. Upon receipt, the investigator reviewed each audit to enable the calculation of appropriate ratios as noted in the previous chapter. Based on a comprehensive literature review of fiscal performance of LPHAs and other non-profit organizations, the 3-year averages of the following fiscal indicators were utilized: 1) per capita LPHA expenditures, 2) an indicator of financial distress referred to in the literature as “Profit Margin” (defined as total revenue minus total expenses divided by total

revenue). 3) An indicator of liquidity/solvency, referred to in the literature as "Days Cash on Hand" (defined as cash and cash equivalents divided by monthly expenses). For this particular ratio, the higher quotient represents better liquidity/solvency of the agency. 4) An indicator of profitability defined as the growth in revenue as a proportion of total operating budget.

Step two - data collection for the dependent variable (LPHA outputs)

The study investigated the effect of LPHA inputs on LPHA outputs. The survey instrument to measure LPHA outputs was combined into a single form with the instrument used to measure the input variables of organizational and informational resources noted previously. A copy of this instrument is located in Appendix A.

The survey instrument – LPHA outputs (services).

To evaluate the performance of LPHAs in the provision of services, the 20-item instrument co-developed by Drs. Turnock and Handler at the University of Illinois at Chicago, and Dr. Miller at the University of North Carolina at Chapel Hill (1998) was used. The 20-item survey was based around a measurement of performance incorporating the three core functions of public health noted by the Institute of Medicine (1988). In this survey, 6 items measure performance of the assessment function of public health, 6 items measure performance of the policy development function of public health, and 8 items measure performance of the assurance function of public health. These 20 measures were identified through expert panel meetings, literature reviews, and local health department case studies and surveys. LPHA activities selected for measurement were selected on the basis of expert opinions of their importance in improving public health and their statistical association with other summary measures of public health

performance. Each activity was measured with a simple yes/no question asked of the LPHA administrator concerning whether or not a specific public health activity was performed in the LPHAs jurisdiction. To establish face and content validity, researchers who developed the 20 measure survey tested the usefulness of the instrument through a nationally representative sample of 298 local health department directors in 1995 and found agreement with the 20 activities as indicators of local public health performance. All of the performance measures based on these activities were self-reported by the LPHA administrator and therefore reflected the perceptions and perspectives of the respondents (Mays et al., 2004). This 20-item instrument was adapted slightly by asking a secondary question for each affirmative response to the 20 items. This secondary question asked LPHA administrator respondents how well they perceived their LPHA effectiveness in addressing these 20 activities. Responses for these items were scaled in a 5-point Likert format to represent a continuum ranging from 1 = Not Effective to 5 = Very Effective, with only the endpoints labeled.

Step three - evaluating the variables

Evaluating the explanatory variable (LPHA inputs).

In order to determine if a relationship exists between LPHA inputs and the dependent variable of LPHA outputs, it was necessary to determine if those LPHAs who were more successful at meeting such inputs had a better effect at influencing the dependent variable of interest to the study. For example, an assertion could be made that those LPHAs having higher per capita expenditures had better success in providing services overall. To evaluate LPHA success against the 4 input categories noted by Turnock (2001): Human resources, organizational resources, informational resources,

and fiscal resources, techniques were employed similar to those used by Notaro (2000) in ranking doctoral level health education programs. Such techniques allow for independent analysis of each input variable's effect upon the outcome variable of interest. Evaluation of LPHA success against the 4 input variables was conducted by using the following steps:

1) Human Resources input variable: a raw score was calculated for each of three critical data elements comprising this input variable. Since each critical data element was scaled uniquely, a ratio was developed to standardize each raw score to allow for comparison. For these items, the highest raw score was assigned a value of 1.0 and each of the remaining scores were a proportion of 1.0 or the highest score. The proportion was determined by dividing the raw score by the raw score of the highest value to obtain the proportion. For example, if a 98.2% employee retention rate was the highest of all LPHAs studied, that LPHA would receive a value of 1.0. A second LPHA having an employee retention rate of 90.4% would receive a value of .920 (90.4 divided by 98.2). The ratios of the three critical data elements comprising the human resources input variable were then summed and averaged by dividing by three.
2) Organizational Resources input variable: data to complete this variable of interest was comprised of the first 9 items in the administrator survey, all of which were scaled similarly utilizing a four-point Likert scale format. The scores for each of these 9 items were summed to calculate a raw score and then averaged by dividing by 9 (the number of items). A ratio was then calculated similar to above where the highest raw score was assigned a value

of 1.0 and each of the remaining scores were a proportion of 1.0 or the highest score. The proportion was determined by dividing the raw score by the raw score of the highest value to obtain the proportion.

3) Informational Resources input variable: data to complete this variable of interest was comprised of 18 items in the administrator survey all of which were scaled similarly utilizing a five-point Likert scale format. These survey items were oriented around four different constructs that when combined would comprise this input variable. The raw scores for each of these items were summed and averaged by dividing by the number of items making up that construct. These averages were then used to calculate a ratio where the highest average was assigned a value of 1.0 and each of the remaining scores were a proportion of 1.0 or the highest score. The four construct ratios were added together and then averaged to compute a final score.
4) Fiscal Resources input variable: data to complete this variable of interest was provided through secondary review of LPHA annual fiscal audits. Specific data from these audits were used to calculate a raw score for each of four critical data elements that when combined would comprise this input variable. The raw scores for each of these critical data elements were then used to calculate a ratio where the highest score was assigned a value of 1.0 and each of the remaining scores were a proportion of 1.0 or the highest score. The four ratios were then summed and averaged to calculate a final score for this input variable

In calculation of the various ratios, the LPHA strata (small, medium, or large) was used to compare similar sized agencies to one another and then ranked accordingly. Similarly, ratios were also calculated on the basis of performance statewide to determine if higher performers, regardless of size, had similar and meaningful characteristics.

Thus, for every input variable noted (human resources, organizational resource, informational resources, and fiscal resources) a standardized ratio was calculated using the same methodology to summarize LPHA performance against that input variable. The ratios for each of the four input variables were then summed for a total summary score for each LPHA, measuring the overall performance of LPHA inputs.

Evaluating the dependent variable (LPHA outputs).

Similarly, in order to determine if a relationship exists between LPHA inputs and LPHA outputs, it was also necessary to determine which LPHAs performed better in providing the outputs of public health. As such, a method was necessary to collectively evaluate the indicators of LPHA outputs. To do so, techniques were employed similar to those used above for evaluating the input variable using the following steps:

1) Successful performance in the provision of the outputs of public health was measured using the adapted 20-item Likert survey developed by Drs. Turnock and Handler at the University of Illinois at Chicago, and Dr. Miller at the University of North Carolina at Chapel Hill (1998). Any items that were negatively worded were reverse scored.
2) The individual responses to each of the three constructs representing the 3 core functions of public health were summed to arrive at a total raw score for each construct of assessment, policy development, and assurance. Such a

strategy allowed for independent analysis of the input variable's effect on each dependent variable.

3) The individual responses to the 20-item survey were summed to arrive at a total raw score for each health department surveyed. The highest raw score was assigned a value of 1.0 and each of the remaining scores were calculated as a proportion of 1.0 or the highest score. The proportion was determined by dividing the raw score by the raw score of the highest value to obtain the proportion.

Analysis to uncover the presence of any relationship between the dependent variables (LPHA outputs) and the explanatory variables (LPHA inputs), if any, was then undertaken using canonical correlation analysis and confirmed using multiple regression analysis. Thus, the input variables (human resources, organizational resources, informational resources and fiscal resources) both independently and collectively were compared to the output variables (Assessment, Assurance and Policy Development). For the purposes of analysis and discussion, the data were stratified on the basis of LPHA size (either small, medium, or large) and by LPHA performance and analyzed for relationships. For the purpose of analysis for this study, data sets with large amounts of missing data were deemed unusable. For other cases in which smaller amounts of data were missing, the particular variable was checked for normality using the Shapiro-Wilk test and the strata mean or median was substituted for the missing data.

Step four - statistical treatment

The data were summarized using descriptive statistics, both in the aggregate and by the strata indicated previously. The standardized score of each input variable, as well

as the overall cumulative score of all input variables combined, was analyzed for correlation to the dependent variable of LPHA outputs. In order to determine the size and nature of the relationship between variables, it was necessary to use canonical correlation analysis. The general purpose of canonical correlation analysis is to facilitate the study of interrelationships among sets of multiple dependent variables (i.e., the three core functions of public health) and multiple independent variables (i.e., a LPHAs inputs) (Hair, Anderson, Tatham & Black, 1998). Canonical correlation is considered to be the general model on which many other multivariate techniques are based because it can use both metric and non-metric data for either the dependent or independent variables. Similar to regression, canonical correlation's goal is to quantify the strength of the relationship between two sets of variables (independent and dependent). Canonical correlation represents the only technique available for examining the relationship with multiple dependent variables (Hair, et al., 1998). Canonical correlation analysis deals with the association between composites of sets of multiple dependent and independent variables. In doing so, it develops a number of independent canonical functions that maximize the correlation between the linear composites, also known as canonical variates (Hair, et al., 1998). Results were then confirmed using multiple regression analysis.

In this study, we conducted surveys, and reviewed accessible secondary data sources, to understand the relationship between the inputs of a local public health agency (the capacities such an agency has available to direct toward doing the work: human resources, fiscal resources, organizational resources and informational resources) as predictors of the outputs of that local public health agency (the three core functions of public health). Thus, this study involves examining the relationship between four

independent variables (inputs) and three dependent variables (the three core functions of public health). The research problem involves predicting these 3 dependent variables simultaneously. The study is illustrated in Table 2. By using canonical correlation analysis, a composite measure is created of LPHA outputs rather than having to compute a separate regression equation for each of the dependent variables. The result of applying canonical correlation is a measure of the strength of the relationship between two sets of multiple variables (canonical variates).

The analysis will result in canonical variates representing the optimal linear combinations of dependent and independent variables, and a canonical correlation representing the relationship between them.

TABLE 2: Canonical Correlation of LPHA Outputs (the three core functions of public health) with LPHA Inputs (the Agency Human, Fiscal, Organizational and Informational Resources)

Survey Variables

LPHA Outputs	LPHA Inputs
- Assessment (6 items) - Policy Development (6 items) - Assurance (8 items)	- Human Resources - Fiscal Resources - Organizational Resources - Informational Resources

Canonical Analysis Elements

Composite of Dependent Variables	**Canonical Correlation**	**Composite of Independent Variables**
Dependent Canonical Variate	R_c	*Independent Canonical Variate*

Summary

The study as proposed will provide a new methodology for measuring performance with a focus on Illinois Local Public Health Agencies. This approach seeks

to measure performance along four key variables defined by Turnock (2001) as the structural capacity or inputs of public health: Informational Resources, Organizational Resources, Human Resources and Fiscal Resources. These LPHA inputs are each measured in this study through the use of various instruments found in the literature designed for the expressed purposes of measuring performance related to these variables, or through analysis of readily accessible secondary sources of data. The approach toward measuring inputs of these LPHAs allows for comparison with other LPHAs throughout the state of Illinois in a type of benchmarking process.

The study also extends quality assurance activities in the public health sector currently ongoing throughout the state of Illinois and the U.S. by determining the relationship between the inputs or structural capacity of LPHAs and the subsequent outputs (services or functions) of those LPHAs. In a test of a typical logic model, the inputs of LPHAs would have a relationship to the outputs (services or functions) of that agency. These outputs are measured through the use of a 20-item instrument (Turnock, et al. 1998) focused around the three core functions of public health first articulated by the Institute of Medicine in 1988. Subsequently, the dictates of a typical logic model would also indicate that outputs have an effect on outcomes. The methodology as proposed would provide precursory steps for eventual study of the relationship between LPHA outputs and what LPHAs hope to achieve: community health status improvement.

If the tenets of a typical logic model hold true, one might expect the presence of a relationship between a LPHAs inputs, their outputs, and a subsequent effect on community health status. This study addresses the gaps in the literature focused upon evaluation of public health agencies by linking together the basic tenets of such a logic

model with the desired outcomes LPHAs hope to achieve. The study provides a framework for further investigation of quality assurance activities in local public health agencies that would link what a health department does to community health status improvement.

Results and Discussion

Introduction

The purpose of this study was to advance a model of performance measurement in public health based around logic model constructs that focused upon explanatory variables within the realm of control of the Local Public Health Agency (LPHA) and their subsequent effect on LPHA outputs using canonical correlation analysis. As part of this measurement analysis, a benchmarking process is elucidated, identifying superior performers across various strata representing jurisdiction size served, and across the state of Illinois as a whole. Turnock (2001) has described that LPHAs are made up of relatively recognizable inputs contributing to the public health system's capacity: the human, informational, financial, and organizational resources a public health organization has available to direct toward doing the work. The logic model served as the organizing framework for the study due to the value it provides in summarizing a program's overall mechanism of change by linking processes to eventual effects. Detailed analysis of each of the critical data elements completing the input and output variables of investigation including descriptive information, summary data and rankings is found in Appendix B.

The Administrator Survey

Primary data was collected through the use of a survey to LPHA administrators, located in Appendix A. This survey was sent electronically to 46 administrators within the state of Illinois, including 15 randomly selected administrators representing small strata LPHAs, all administrators representing the 18 medium strata LPHAs, and all administrators representing the 13 large strata LPHAs. Forty-three of the 46 LPHA

administrators (93.5%) responded to the survey providing usable data to complete the analysis. Of these, 12 of the 15 small strata LPHAs (80%) were represented, as well as all 18 medium strata LPHAs (100%), and all 13 large strata LPHAs (100%). Two cases in the small strata were removed from analysis due to large amounts of missing data. One other small strata LPHA did not respond to the survey. Multiple attempts were made to acquire complete data for these cases, but these attempts were unsuccessful.

Strata Descriptives

The strata are described in Table 3. In order to compare similar sized agencies to one another, the LPHA strata were set using 3-year average service area population. Small strata LPHAs represented a jurisdiction size of less than 50,000 population, medium strata LPHAs represented a jurisdiction size equal to or greater that 50,000 but less than 150,000 population, and large strata LPHAs represented a jurisdiction size equal to or greater than 150,000 population.

TABLE 3: LPHA Strata Descriptives

Strata	**3-Yr. Avg Population Size Served Mean/Median**	**3-Yr. Avg. # FTE Staff Mean/Median**	**3-Yr. Avg Expenditures Mean/Median**	**3-Yr. Avg Revenues Mean/Median**
Small Strata (12)	28,608	*19	*$1,230,465	*$1,296,528
Medium Strata (18)	*72,440	55	$3,624,182	$3,763,215
Large Strata (13)	*305,617	*135	*$8,982,539	*$9,571,126

*Note: * Median is used if the data for the variable are not normally distributed.*

Among small strata LPHAs, the service area three-year population averaged 28,608 persons and ranged from a low of 7,551 persons to a high of 46,728 persons. The median number of full-time equivalent staff was 19 and ranged from a low of 12 to a high of 130. The LPHA with 130 staff serves a multi-county area with 3 offices, and provides mental health as well as public health services. Median expenditures for small strata LPHAs were $1,230,465 and ranged from $639,422 to $6,390,095 and median revenues were $1,296,528 and ranged from $672,700 to $6,782,107. Five of the 12 small strata LPHAs had 3-year average expenditures greater than revenues.

Among medium strata LPHAs, the service area three-year population median was 72,440 persons and ranged from a low of 52,043 persons to a high of 146,800 persons. The average number of full-time equivalent staff was 55 and ranged from a low of 12 to a high of 140. The LPHA with 140 staff operates 3 offices within their service area and also operates as a Federally Qualified Health Center. Expenditures of medium strata LPHAs averaged $3,624,182 and ranged from $977,779 to $9,169,890. Revenues averaged $3,763,215 and ranged from $887,075 to $9,047,096. Within this strata, 10 of the 18 LPHAs had 3-year average expenditures greater than revenue.

Among large strata LPHAs, the service area 3-year population median was 305,617 and ranged from a low of 163,540 persons to a high of 5,278,738 persons. The average number of full-time equivalent was 135 and ranged from a low of 35 to a high of 1200. Median expenditures of large strata LPHAs were $8,982,539 and ranged from $2,719,274 to $62,985,757, while median revenues were $9,571,126 and ranged from $2,800,487 to $64,023,523. Among the large strata LPHAs, 2 of the 13 had 3-year average expenditures greater than revenue.

Discussion

Interestingly, beyond obvious differences across strata with regard to service area population size, there were other noteworthy differences within each strata with regard to financial indicators and numbers of staff. In those strata where it appeared that there was large range in numbers of staff, typically those LPHAs having the larger staff numbers had assumed greater responsibilities in terms of the range of services provided. For example, most LPHAs within the state of Illinois do not provide mental health services in addition to public health services. Typically mental health services are provided through another community service entity. In addition, few LPHAs within the state of Illinois have assumed responsibilities as a Federally Qualified Health Center, requiring them to offer a full range of primary medical (clinical) services in addition to public health services.

Perhaps most noteworthy however are the differences between strata with regard to the financial indices described. Five of the 12 (41.7%) small strata LPHAs, 10 of the 18 (55.6%) medium strata LPHAs, and 2 of the 13 (15.4%) large strata LPHAs had 3-year average expenditures exceeding 3-year average revenues. Among small strata LPHAs operating with a deficit, the average deficit was $54,548 or 4.4% of the median budget for this strata. Among medium strata LPHAs operating with a deficit, the average deficit was $147,022 or 4.1% of the median budget for this strata. Among large strata LPHAs operating with a deficit, the average deficit was $149,917, or 1.7% of the median budget for this strata. Fewer large agencies had deficits, and those deficits tended to be much smaller than both the small and medium sized agencies. This could be related to the possibility that larger agencies rely less on soft money sources such as grants in favor

of funding that is more predictable. It could also be related to the possibility that perhaps in LPHAs with larger budgets, deficits in one programmatic area within the LPHA can often be recovered in other areas. In many cases, for example, larger LPHAs provide a broader range of services, e.g., clinical and dental services, which capture more fee-for-service revenue that could be used to better offset deficits. Smaller agencies may conclude that such services are not in their best interest to provide after cost-benefit analyses show that volume of patients are essential to reaching a break even point.

These indices have become increasingly important as the fiscal position of the state of Illinois has deteriorated further since this data was collected. As the economic climate of the recent past (2008 – 2010) continues to struggle towards recovery, it becomes more noteworthy, for instance, when a LPHA has operated with an average deficit over the last three years. With many LPHAs experiencing exactly this scenario, it is indicative that their cash position has weakened over time and the agency has become more financially vulnerable.

Public Health Inputs (Resources) Final Summary Scores

As noted in the last chapter, each of the independent variables is constructed of multiple critical data elements which, when combined, complete each variable under study. Detailed analysis of each of these critical data elements including descriptive information, summary data and rankings is found in Appendix B.

The following is a summary of the independent variables overall: the Human, Organizational, Informational, and Fiscal Resources which when combined contribute to public health capacity to improve community health. The rankings reflect the combined

average strata ratio for all of the independent variables (inputs or resources) under investigation. Utilizing this method, we are able to identify the best performing LPHAs for each strata in terms of the inputs necessary for carrying out the mission and goals of the agency. These final summary scores set the stage for comparing the independent variables to the dependent variables through canonical correlation analysis. Through this process, we can also determine which of these four input variables might contribute to or explain higher performance in terms of the infrastructure capacity and resources under the control of the LPHA overall. Independent variable performance for small strata LPHAs is presented in Table 4.

TABLE 4: Independent Variable Final Score: Public Health Resources, Small LPHAs

Public Health Agency	Informational Resources Strata Score (Rank)	Organizational Resources Strata Score (Rank)	Human Resources Strata Score (Rank)	Fiscal Resources Strata Score (Rank)	FINAL Strata Ratio Avg.	Rank
1	.594(7)	.817(7)	.813(3)	.157(7)	.595	5
2	.360(9)	.908(4)	.724(6)	-.136(11)	.464	12
3	.727(4)	.757(9)	.769(5)	.093(8)	.587	6
4	.346(10)	.939(3)	.870(2)	-.110(10)	.511	10
5	.457(8)	.787(8)	.650(10)	.378(6)	.568	7
6	1.00(1)	.848(6)	.936(1)	.423(4)	.802	1
7	.201(12)	.696(11)	.529(12)	.471(3)	.474	11
8	.619(6)	.969(2)	.652(9)	.407(5)	.662	4
9	.739(3)	.878(5)	.596(11)	-.080(9)	.533	8
10	.811(2)	.727(10)	.779(4)	.657(2)	.744	3
11	.307(11)	.666(12)	.685(7)	.407(5)	.516	9
12	.652(5)	1.00(1)	.653(8)	.726(1)	.758	2

Interestingly, the top three ranked small strata LPHAs combined had 3-year average expenditures totaling less than the small strata LPHA with the highest total expenditures. In terms of these four variables measuring implementation of public health resources, perhaps this indicates that while money matters, how that money is used is

equally important, meaning that it may be less important in terms of overall LPHA performance. However, from another perspective it is noteworthy that review of rankings overall seems to indicate that performance in Fiscal Resources seemed to explain performance overall more fully, with four of the top 5 performing LPHAs in Fiscal Resources also found in the top 5 performances overall. Organizational Resources seemed less predictive of performance overall.

Independent variable performance for medium strata LPHAs is summarized as part of Table 5.

TABLE 5: Independent Variable Final Score: Public Health Resources, Medium LPHAs

Public Health Agency	Informational Resources Strata Score (Rank)	Organizational Resources Strata Score (Rank)	Human Resources Strata Score (Rank)	Fiscal Resources Strata Score (Rank)	FINAL Strata Ratio Avg.	Rank
13	.707(2)	.750(7)	.738(6)	.043(16)	.560	7
14	.495(4)	.972(2)	.703(7)	.517(3)	.672	2
15	.490(5)	.694(9)	.597(18)	.150(11)	.483	10
16	.170(16)	.778(6)	.623(15)	.232(10)	.451	13
17	.091(18)	.667(10)	.600(17)	.252(9)	.403	17
18	.378(7)	.694(9)	.668(10)	.071(15)	.453	12
19	.283(13)	.667(10)	.770(3)	-.085(18)	.409	16
20	.418(6)	.861(5)	.643(13)	.318(6)	.560	7
21	.553(3)	.639(11)	.691(9)	.389(4)	.568	5
22	.362(8)	.722(8)	.943(1)	.127(12)	.539	8
23	.351(9)	.694(9)	.666(11)	.350(5)	.515	9
24	.349(10)	1.00(1)	.764(4)	.309(7)	.606	4
25	.216(15)	.917(4)	.615(16)	.518(2)	.567	6
26	.150(17)	.778(6)	.642(14)	.258(8)	.457	11
27	.316(12)	.722(8)	.753(5)	-.066(17)	.431	15
28	.278(14)	.722(8)	.657(12)	.091(13)	.437	14
29	.337(11)	.944(3)	.700(8)	.777(1)	.690	1
30	1.00(1)	.722(8)	.878(2)	.085(14)	.671	3

In terms of medium strata LPHAs, a similar trend emerges with regard to the top performance overall. The top performing medium strata LPHA received the top score in only one of the four variables under investigation: Fiscal resources. In fact, top scoring LPHA #29 performed far below superior level in two of the four variables overall, rating only 11th in performance of the Informational Resources variable and just 8th in performance of the Human Resources variable. In this case, performing well in the Fiscal Resource variable seemed to equate to performance overall. Here, under closer examination, it seems that Human Resources was less predictive of performance overall.

Independent variable performance of the inputs or resources of public health for large strata LPHAs is presented in Table 6.

TABLE 6: Independent Variable Final Score: Public Health Resources, Large LPHAs

Public Health Agency	Informational Resources Strata Score (Rank)	Organizational Resources Strata Score (Rank)	Human Resources Strata Score (Rank)	Fiscal Resources Strata Score (Rank)	FINAL Strata Ratio Avg.	Rank
31	.342(11)	.969(2)	.590(10)	.173(13)	.519	11
32	.488(5)	.939(3)	.755(3)	.236(10)	.605	7
33	.381(8)	.848(5)	.693(5)	.284(7)	.552	9
34	.388(7)	.727(9)	.960(1)	.188(12)	.663	3
35	.356(9)	.757(8)	.641(7)	.314(5)	.606	6
36	.688(3)	.908(4)	.602(9)	.344(4)	.636	4
37	.708(2)	.908(4)	.644(6)	.205(11)	.616	5
38	.238(13)	.848(5)	.700(4)	.293(6)	.520	10
39	.346(10)	.454(10)	.583(11)	.447(2)	.458	12
40	.421(6)	.969(2)	.755(3)	.263(9)	.602	8
41	1.00(1)	.817(6)	.620(8)	.367(3)	.701	2
42	.565(4)	1.00(1)	.765(2)	.621(1)	.738	1
43	.246(12)	.787(7)	.534(12)	*.280(8)	.462	13

*Included substituted strata mean/median for missing data.

In review of large strata distributions and ranks, under closer examination it appears that Informational Resources does a better job of explaining performance overall,

with four of the top 5 performers in this variable among the top 5 performances overall. Within this strata, Organizational Resources and Human Resources performance seem less important in performance overall.

A bivariate Pearson correlation coefficient was calculated using the strata ratios to determine the strength of the relationship between each of these input variables to performance of the complete set of Public Health Resources overall. Results for each of these input variables reflected Pearson Correlation Coefficients of .352 for Human Resources ($p < .05$ level); .491 for Organizational Resources ($p < .01$ level); .751 for Informational Resources ($p < .01$ level); and .622 for Fiscal Resources ($p < .01$ level). These results suggest the appropriateness of each input variable in the performance of Public Health Resources overall.

Table 7 provides a statewide ranking utilizing the same methodology of creating ratios to standardize the data and provide a means for comparison between LPHAs across the entire state of Illinois. The statewide data allows for stratification on the basis of performance rather than size of jurisdiction, allowing for further analysis of top performers. This way, review can be undertaken to determine what similarities and differences might exist between top performers overall. The strata of each LPHA is represented in the table by the notation of S = small strata LPHAs, M = medium strata LPHAs, and L = large strata LPHAs.

Again, a bivariate Pearson correlation coefficient was calculated using the statewide ratios to determine the strength of the relationship between each of these input variables to performance of the complete set of Public Health Resources overall. Results

for each of these input variables reflected Pearson Correlation Coefficients of .413 for Human Resources; .565 for Organizational Resources; .751 for Informational Resources; and .525 for Fiscal Resources, all of which were found to be significant $p < .01$ level.

TABLE 7: Independent Variable Final Score: Public Health Resources, Statewide

Public Health Agency	Strata (S,M,L)	Informational Resources Statewide Score FINAL	Organizational Resources Statewide Score FINAL	Human Resources Statewide Score FINAL	Fiscal Resources Statewide Score FINAL	FINAL Statewide Ratio Avg.	Rank
1	S	.434	.750	.726	.133	.513	20
2	S	.262	.833	.676	.043	.455	32
3	S	.536	.694	.704	.093	.508	22
4	S	.254	.861	.746	.064	.482	26
5	S	.337	.722	.642	.230	.484	25
6	S	.736	.778	.780	.327	.658	2
7	S	.147	.639	.497	.307	.398	41
8	S	.451	.889	.633	.298	.570	10
9	S	.541	.806	.589	.111	.514	19
10	S	.597	.667	.694	.313	.569	11
11	S	.226	.611	.619	.272	.433	34
12	S	.480	.917	.634	.456	.623	5
13	M	.696	.750	.679	.024	.540	15
14	M	.488	.972	.682	.275	.606	6
15	M	.482	.694	.574	.103	.465	31
16	M	.166	.778	.611	.137	.424	37
17	M	.089	.667	.592	.143	.373	43
18	M	.372	.694	.637	.031	.435	33
19	M	.279	.667	.714	-.043	.405	40
20	M	.413	.861	.627	.185	.523	17
21	M	.545	.639	.653	.175	.505	23
22	M	.355	.722	.836	.064	.496	24
23	M	.346	.694	.630	.239	.479	27
24	M	.345	1.000	.710	.187	.561	12
25	M	.212	.917	.600	.347	.520	18
26	M	.148	.778	.617	.179	.431	35
27	M	.307	.722	.694	-.050	.421	38
28	M	.273	.722	.625	.090	.429	36
29	M	.329	.944	.656	.480	.604	7
30	M	.990	.722	.760	.068	.638	4
31	L	.337	.889	.582	.092	.476	29
32	L	.479	.861	.746	.143	.559	14
33	L	.377	.778	.683	.195	.509	21
34	L	.378	.667	.950	.109	.528	16
35	L	.347	.694	.632	.203	.471	30
36	L	.676	.833	.594	.226	.585	8
37	L	.696	.833	.634	.137	.578	9
38	L	.234	.778	.690	.209	.479	27
39	L	.342	.417	.574	.251	.397	42
40	L	.414	.889	.746	.192	.561	12
41	L	.988	.750	.611	.216	.643	3
42	L	.553	.917	.756	.586	.705	1
43	L	.241	.722	.525	*.187	.419	39

Discussion

In review of the independent variables, the Human, Organizational, Informational and Fiscal Resources or inputs that a LPHA has available to do the work of public health, several noteworthy things stand out.

Overall, these variables offer good face validity as a whole and lend themselves well to measurement of the critical infrastructure that makes up public health practice altogether. While the value of the evaluative indicators chosen to fulfill measurement of each variable is indeed debatable, the variables themselves appear to round out and define public health practice.

With regard to **Human Resources**, in a service industry, such as public health, the knowledge, skills and abilities that the employees bring to doing the actual work are considered extremely important. While concern has been expressed in the literature over the size, composition and distribution of the public health workforce, attracting and retaining competent public health workers and their readiness has taken center stage (Gebbie & Turnock, 2006). Since there has never been any specific academic bachelor-level degree or unique set of experiences that distinguish a public health professional from professionals in other fields (Turnock, 2001), focus has shifted to establishing core public health competencies to unite the multiple disciplines making up the workforce. These competencies address analytical, communication, policy development and program planning, cultural, basic public health sciences, and financial planning and management skills. There has been considerable progress over the years to delineate and measure the core competencies and skills necessary for public health professionals (Turnock, 2001;

Robbins, et al. 2001, North Carolina Center for Public Health, 2007). In fact, a NACCHO report (2005) noted that 72% of LPHAs were familiar with the Core Competencies for Public Health Workers project.

Within the state of Illinois, these efforts culminated in the Learning Management System (LMS), an IDPH tool providing competency-driven assessments to identify how well LPHA staff measure themselves against a core set of competencies that all public health professionals should have, regardless of training. Secondary data was collected for each LPHA studied to measure the core competence of LPHA professional staff. The mean competency score was very similar across strata, varying just .111. As such, it doesn't appear that this particular data element matters much in terms of differentiating performance overall across strata. This may reflect that the competency measure used in the Learning Management System wasn't specific enough to identify meaningful differences, or it could mean that regardless of field of expertise, LPHA staff are very similar in terms of these core competencies as they relate to public health practice. While the importance of workforce competence has been highlighted in the literature as critical, the value of this element in terms of performance overall may be expressed in only modest terms in the current study. Although Pearson correlation coefficients indicated that LMS scores were significant to performance of the Human Resources variable overall, these correlations were just .381 across strata and .435 statewide, indicating modest relationships overall. While the competence of LPHA staff matter to performance of this variable overall, they don't matter as much as what might be suspected.

Another interesting result was noted by the strength of retention rates overall. Retention of public health staff, and the relationship of retention to competence, has been the subject of multiple reports (Tilson & Gebbie, 2004; Institute of Medicine, 2002; NACCHO, 2007), all of which highlighted the importance of reducing turnover of competent staff within LPHAs. With mean 3-year average retention rates ranging from a low of 88% to 91%, it appears that LPHAs within the state of Illinois have been very successful at reducing turnover overall. While this may be reflective of the overall economy at the time of the survey, it is nonetheless a noteworthy finding. The low turnover rate is important to the practice of public health in Illinois as a whole in that it allows the critical knowledge base of personnel to be maintained over time. As noted above, with the only unifying force defining the multi-disciplined workforce of public health being the setting those staff practice in rather than professional preparation, perhaps it becomes more critical to train employees to recognize the value of public health as a whole and expand beyond simple loyalty to a specific profession. As such, retaining staff is perhaps even more critical in public health than in other fields that are united by a professional discipline. Despite these calls for better retention of staff, a NACCHO report (2007) noted the LPHAs are experiencing problems hiring competent staff, with a majority of respondents blaming uncompetitive pay and benefits as reasons why.

While the literature provides credence to the arguments for better retention of staff, Pearson correlation coefficients using strata indicated that retention of staff was not significant in the performance of the Human Resources variable overall. Pearson correlation coefficients, however, were found to be significant statewide, showing a

modest correlation of .336. The contribution of retention rates to the total independent variable of the inputs or resources of public health was even less pronounced and not deemed significant in statewide Pearson correlations.

Review of the Human Resources variable data also noted that one critical data element, the Proportion of Master's Prepared Staff in a Public Health Field, rated surprisingly high in importance in the performance of the variable overall. While it has been noted in the literature that formal training in public health is more the exception than the rule in the public health workforce, it appears that this is a critical shortcoming noted in this study in terms of performance of the Human Resources capacity of LPHAs overall. This study substantiates earlier research that only about 7% of the public health professional workforce has received formal training in the field. Review of data across different strata appeared to reflect that performance on this one key data element seemed to ensure performance overall for the variable as a whole. This assertion was noted with a Pearson correlation coefficient indicating a statistically significant correlation of .878 across strata, .892 statewide. This data element's contribution to performance of the complete independent variable of public health inputs or resources was noted as statistically significant in statewide Pearson correlations.

A bivariate Pearson correlation coefficient using the strata ratios was calculated to determine the strength of the relationship between the Human Resources variable to performance of the complete set of Public Health Resources overall. Results reflected a significant Pearson correlation coefficients of .352 ($p<.05$ level), and .413 when using statewide data ($p<.01$ level). These results provide some evidence to the validity of

Human Resources capacity of LPHAs in explaining performance of public health resource capacity overall.

With regard to the **Organizational Resources** variable, a few important points stand out upon review. This variable was noted by Turnock (2001) to include the network of federal, state, and local public health agencies, as well as mechanisms for linking public, private, and voluntary organizations through collaborative relationships. In other words, the variable is meant to explain the collaborativeness of LPHAs in fulfilling the key capacities of public health practice. The first 9 items included in the administrator survey provided a measure of prevention-oriented collaboration typically found in LPHAs. This measure by Brown et al., (2008) was used in a study of 599 community leaders across 41 communities including several human service organizations. While other collaborativeness measures existed, the evidence of validity and reliability weren't as strong as those provided through this measurement vehicle.

The development of collaborative partnerships within communities has been advanced as a primary mechanism to empower communities to implement effective prevention initiatives (Brown, et al., 2008). The survey items included in the LPHA administrator survey, identified through a review of community psychology literature, were designed to measure how collaborative a particular agency is in performing prevention-specific activities.

For the last several years, increasing importance has been placed on the network of public health stakeholders throughout a given community. As noted by the Institute of Medicine (1997), the health of a community is a shared responsibility of all of its residents. The current emphasis on multiple interventions at multiple levels of the social

ecology is a response to the severity and complexity of chronic health conditions that are rooted in a larger social, cultural, political and economic fabric (Butterfoss, et al. 1993). It has become clear that as local health departments are charged with promoting overall community health and well-being and addressing the causes of disease and disability, they need to engage diverse communities in developing a broad spectrum of solutions to today's most pressing problems, including chronic diseases, health disparities, and other complex community health issues (Institute of Medicine, 2002). Being collaborative in approach to addressing community health problems is a critical function of LPHAs.

To compare these results with other organizations operating within a community, a study was conducted to test these same survey items among 599 community leaders from a range of community sectors. In that study, Brown, et al., (2008) noted an overall mean score of 1.97 out of 4.0. The 78 human service agencies included as part of the Brown et al., (2008) study reported a mean of 2.25 out of 4.0, compared to an average mean of 3.08 across the three strata represented in this study, and an average median of 3.02. In reference to the Brown, et al. (2008) research, it appears that the LPHAs studied using this same instrument were more collaborative in their approach to community-based prevention specific activities than other community sector agencies, reflecting the emphasis often found within the public health sector that improving the health of the community is a system-wide responsibility.

The literature provides ample evidence that there is an increasing interest and investment in such partnerships as a way of addressing challenging public health issues. Partnerships are now more often the norm than the exception in health education and disease prevention work (Ansari & Weiss, 2006). Based on this evidence, the capacity of

the LPHA to collaborate with other organizations seems an integral function of public health practice. This study noted that LPHAs studied seemed to be equally collaborative with very little difference between mean scores across strata. Within strata variations existed however and seemed to differentiate high performers from lesser performers overall.

Of the nine items included in this survey, one item seemed to serve as a tipping point distinguishing performance as a whole: "Organizations in this community share money and personnel when addressing prevention issues". Responses noting agreement with this key item were low across all strata, ranging from 55% to 64%. Surprisingly though, in comparison to the evidence found in Brown et al., (2008), LPHAs across the state of Illinois were more collaborative, reflecting the emphasis in the public health sector for a systems perspective to confronting public health challenges. Such evidence provides an indication just how collaborative public health practice is in Illinois overall. This may be indicative of budget constraints found recently in the Illinois public health system, whereby LPHAs and other community groups are forced to share resources in more inventive ways than previously demanded.

While the literature is clear what value there exists in collaboration, there is limited evidence of the effectiveness of partnerships in achieving desired outcomes as noted in Ansari & Weiss (2006). While not evidentiary in correlating to outcomes, the current research does provide some evidence to the effect of this variable in performance of the complete set of public health resources (the independent variables) overall, with Pearson correlation coefficients noting a statistically significant relationship of .491 across strata, and .565 across the state of Illinois as a whole.

The contribution of the **Informational Resources** to overall performance of the independent variable of public health inputs or resources also was investigated. Much has been written about the potential of information technology to vastly improve the capabilities of the public health workforce. Individual systems are being used in LPHAs for surveillance, immunization registries, vital statistics, emergency preparedness functions, and the development of electronic medical records is now an emerging application as well. Yet there is little quantitative data regarding the extent of informatics proficiency in the public health workforce. LPHAs need staff ready and proficient to perform in an information society-able to effectively use information and information technology, and to manage information technology projects (Cunningham, Ascher, Viola & Visintainer, 2007). These critical capacities were noted by O'Carrol (2002) in the development of informatics competencies to measure proficiencies of LPHA staff by job level. Despite these clarion calls of the importance of information to public health practice, even as late as 2003 it was reported that public health continues to be "plagued by an underuse of information and technology, and the literature regarding public health information needs and information-seeking behavior is still in its infancy." (Cunningham, et al., 2007, pg. 303).

Measurement of the Informational Resources variable was provided through the inclusion of 18 items in the administrator survey. These items were chosen from items found in multiple public health infrastructure resources noted earlier, forming constructs focused on key capacities including: General Information Systems; Data Collection, Processing and Maintenance; Integration of Data/Data Sharing with Community Partners; and Data Analysis.

Review of the data pertaining to this variable identified several noteworthy findings. Perhaps most noteworthy was the apparent disconnect that exists between what the literature deems as critically important in terms of the developing infrastructure of public health and perceived effectiveness noted by the administrators in our survey. For example, administrators across strata rated perceived effectiveness of General Information Systems related activities at just 26.7% on average of the maximum possible score that would be obtained if all activities were performed at levels fully meeting community needs. Similarly, administrators across strata rated perceived effectiveness of Data Collection, Processing and Maintenance activities at just 42.7% on average of the maximum possible score; Integration of Data/Data Sharing activities at just 8% on average of the maximum possible score; and Data Analysis activities at just 37.3% of the maximum possible score. This may be reflective that administrators simply don't believe that their LPHAs perform these functions well, but it may also indicate that the LPHAs don't feel these activities are relevant to their functions overall, a fact consistent with findings noted in Cunningham et al., (2007). This level of disconnect may reach critical mass as the nation moves toward the widespread development and implementation of electronic medical records, a vision communicated by both President George W. Bush and President Barack Obama.

Most surprisingly though is the fact identified through the research regarding how important this variable was in overall performance of the independent variable of public health inputs or resources overall. Pearson correlations rated each of these critical data elements extremely high in strata and statewide performance of the overall Informational Resources variable as a whole, but also in terms of how important this overall variable

was in terms of performance of the entire independent variable of public health inputs or resources, with Pearson correlations across strata and statewide, rating .751, the highest correlation coefficient of all variables of analysis. Similarly, all critical data elements were found to be significant in the performance of the overall independent variable when analyzed using statewide data.

Clearly, successful performance of the informational resources variable seemed to provide an important explanation of performance of the independent variable overall. Yet, analysis seems to indicate that many administrators underestimate this importance and the relevance to overall public health practice as a whole.

The importance of the **Financial Resources** variable was noted by Jacobson & Neumann (2007): "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 outcome measures, improved data collection and analysis, and communications. Public health practitioners must also become more entrepreneurial without losing core public health values." (p. 4).

The critical data elements making up this variable were developed after careful consideration of public health and accounting literature. The most widely used measure of financial resources found in public health literature was that referred to as "Per Capita Public Health Expenditures". Several studies (Eilbert et al., 1996; Centers for Disease Control and Prevention, 1995; Gordon, Gerzoff & Richards, 1997) attempted to link this data element with the performance of other related LPHA inputs or agency outputs

(services), while fewer others attempted to link the data element to population-based health outcomes (Bokhari, et al., 2006; Anyanwu & Erhijakpor, 2007).

In addition, in an attempt to become more entrepreneurial, investigation was undertaken to identify and implement some of the more frequently cited domains of other indicators found in accounting and business sector literature pertaining to the fiscal health of organizations. Among these domains were indicators pertaining to fiscal distress, liquidity, solvency, and profitability. The list of specific indicators investigated as part of this study was shortened due to limitations in available data found in review of the fiscal audits of LPHAs. Retained from the list to fulfill domains noted, were Profit Margin, cited as an indicator of financial distress; Days Cash on Hand, cited in the literature as an indicator of liquidity/solvency; and Growth in Revenue as a Percent of Total Budget, cited as an indicator of Profitability. The purpose of the inclusion of these multiple indicators was to create a more robust measure pertaining to the overall fiscal health of LPHAs, thereby creating a so-called "stress test" similar to that undertaken in early 2009 of the US banking industry.

The investigation elicited several noteworthy findings. For practical purposes, Days Cash on Hand has proven to be an important measure in the current fiscal climate within the state of Illinois. With Illinois regarded in a Pew Report (2009) as having one of the 10 worst fiscal positions of all the 50 states, LPHAs and other local government agencies often wait for very long periods of time before receiving reimbursements owed to them by the state for providing state-sponsored services to clients. Some LPHAs have chosen to end state contracts simply because they do not have enough cash on hand to pay expenses and then wait several months for reimbursements. This measure provides

an indicator of how long a LPHA could hold out waiting for reimbursements to be provided by the state and other funding sources. With mean data indicating that LPHAs in Illinois only have enough cash on hand to pay bills for between 2.5 and 3.8 months, this indicator should prove meaningful as LPHAs struggle to weather the fiscal crisis looming large in that state.

Similarly, the Profit Margin indicator also provided a strong related measure to determine the fiscal health of LPHAs. While LPHAs operate as units of local government, they nevertheless are similarly interested in some degree of profit simply because that profit is used to generate cash on hand to help weather those difficult fiscal crises that arise from time to time when dealing with soft money sources frequently found in public sector organizations. As results have indicated, profit margins of LPHAs ranged from .6 percent to 3.2% over the 3-year study period as indicated by the LPHA fiscal audits. Overall, these statistics reflect the acquisition of very little additional funds on hand to assist with financial crises affecting many states, but also speak to the poor ability of LPHAs to find emergency funding for public health crises that sometimes occur due to disease outbreaks, or having necessary funds available for the deployment of resources to create critical public health programs to ward off other threats to the populations they serve, or have enough cash on hand to simply maintain existing facilities. One related very surprising finding of this research was that fully 40% of LPHAs studied had 3-year average expenditures exceeding average revenues, indicative of pending fiscal crises as public funding atrophies within the state of Illinois. The results here can be used to develop a predictive model of which agencies may be confronting financial catastrophe in the fairly near future.

Interestingly, there were obvious disparities existing in Per Capita Public Health Expenditures. These disparities seemed to range more broadly as the LPHA jurisdictions decreased in size, becoming much less pronounced as the jurisdiction size increased. Also noteworthy was the fact that these expenditures on average decreased as jurisdiction size increased, indicating that population size is important in terms of having more people shoulder the burden of providing public health services overall. From a purely fiscal perspective, this seems to indicate that bigger is better when it comes to the amount of money needed to ensure population health, but in no way is indicative of how well an LPHA does in providing services. What an LPHA does with the funding they receive seems to be equally important as how much funding they receive, noted by the fact that several lesser funded LPHAs performed better in terms of the measures investigated.

The Dependent Variables by Strata: The Three Core Functions of Public Health

Small Strata LPHAs

Descriptive Information

The dependent variable for small strata LPHAs is presented by the data provided in Table 8. The data used to complete the dependent variable came from the merged panel of 20 practice measures developed by Turnock et al., (1998) meant to assess performance of what has been termed the Three Core Functions of Public Health. These items were included as part of the administrator survey located in the Appendix A. In raw score terms the Three Core Functions, noted as Assessment, Policy Development, and Assurance, were scored separately and analyzed. The raw score mean takes into account all items in the survey, including the items where the administrator responded that his/her LPHA did not perform the activity noted, in which case a score of 0 was

indicated for that follow-up item. The follow-up question reflected perceived effectiveness of the LPHAs performance of the activity noted.

The 20-items reflected 20 different activities deemed important to public health practice. These 20-items were based on a Yes/No/Don't Know response scale, followed by a follow-up question provided after each affirmative response. This follow-up question was scaled using a 5-point Likert scale representing perceived effectiveness with 1=meets no agency need, 2=meets some needs, 3=meets half of the needs, 4=meets most needs, and 5=meets all needs. A "no" response was scored=0. For small strata LPHAs, each of these three dependent variables was found to be normally distributed.

TABLE 8: Three Core Functions, Small LPHAs

Critical Data Elements	**Maximum Possible Score/Item**	**Obtained Item Score Low-High**	**Mean Item Score**	**Median Item Score**	**% of Max Possible Score**
Based on 20-items included in the Administrator Survey (5-point Likert Scale format)					
Assessment Function (6 items)	6.0	0 - 3.50	2.36	2.33	39%
Policy Development Function (6 items)	6.0	0 – 4.17	2.63	2.67	44%
Assurance Function (8 items)	6.0	0 – 3.63	2.15	2.31	36%

Of the 20 activities deemed important to public health practice, performance by small strata LPHAs ranged from 55% to 95% as measured by the administrator survey. On average, however, 74.6% of these activities were fulfilled by small strata LPHAs, much higher than the 56% reported in a national sample of LPHAs conducted in 1995

using the same survey (Turnock, et al., 1998) and the 66% reported in a national survey of larger service area LPHAs reported later (Mays, et al., 2004), also using the same survey. These numbers included 76.4% of small strata LPHAs fulfilling performance of the Assessment activities, 84.7% of LPHAs fulfilling performance of Policy Development activities, and 65.6% of LPHAs fulfilling performance of the Assurance activities of Public Health overall. The activity types most likely to be available in these jurisdictions included the availability of a community needs assessment process describing the health status in the community (100%), investigation of adverse health events (100%), the presence of support and communication relationships (100%), a prioritization of community health needs (100%), and never having failed to implement a mandated program or service (100%). In contrast, the activities least likely to be performed include having regular evaluations of the effects of public health services on community health status (8.3%), and having conducted an analysis of age-specific participation in preventive and screening services (33.3%).

Summary Scores and Rankings

Table 9 presents the dependent variable of study findings for small strata LPHAs, setting up the investigation of possible relationships between successfully performing LPHA in terms of their structural capacity (inputs or resources) and their intended results (outputs). Thus far, very little research has attempted to link these structural components to one another. If the basic tenets of a typical logic model are correct, those health departments that are most successful in developing and implementing their inputs/resources (the human, organizational, informational, and fiscal resources of the LPHA), should have a subsequent effect in the provision of highly successful outputs (the

three core functions of public health). As noted by Erwin (2008), "Local health department performance measurement provides an opportunity to link inputs, outputs, and outcomes in a manner that should facilitate quality improvement. Since inputs flow from LPHAs that vary substantially in size, organization, functioning and other characteristics, it is reasonable to assume that these variable inputs may affect LPHA performance or outcomes" (p. E9).

TABLE 9: Three Core Functions Summary Scores and Rank, Small LPHAs

Public Health Agency	Assessment (Avg. of 6 items)	Policy Dev. (Avg. of 6 items)	Assurance (Avg. of 8 items)	Overall	Rank
	Avg/Strata Ratio	*Avg/Strata Ratio*	*Avg/Strata Ratio*		
1	3.00/.857(2)	3.67/.879(3)	3.63/1.00(1)	3.45/.945	2
2	2.50/.714(4)	4.17/1.00(1)	1.00/.275(9)	2.40/.658	7
3	3.00/.857(2)	2.67/.639(5)	2.38/.654(5)	2.65/.726	4
4	2.00/.571(6)	2.00/.480(7)	1.00/.275(9)	1.60/.438	9
5	2.33/.667(5)	2.67/.639(5)	2.25/.620(6)	2.40/.658	7
6	2.00/.571(6)	1.67/.400(8)	1.75/.482(7)	1.80/.493	8
7	2.33/.667(5)	.67/.160(9)	.75/.207(10)	1.20/.329	11
8	2.33/.667(5)	2.67/.639(5)	2.75/.758(4)	2.60/.712	5
9	1.67/.476(7)	3.33/.799(4)	3.00/.826(3)	2.70/.740	3
10	3.50/1.00(1)	4.00/.959(2)	3.50/.964(2)	3.65/1.00	1
11	1.00/.286(8)	1.67/.400(8)	1.38/.379(8)	1.35/.370	10
12	2.67/.762(3)	2.33/.560(6)	2.38/.654(5)	2.45/.671	6

Upon examination of small strata LPHAs and comparing these summary rankings with those measuring LPHA inputs, it appears that 3 of the top 5 performing LPHAs in terms of inputs also appear in the top 5 performing LPHAs in performance of outputs, providing some support to the theory that the inputs are at least moderately correlated to outputs.

With small LPHAs, the within strata rankings for each output or core function provide other noteworthy findings. Here, the top two performers overall were very

consistent in performance across each of the three core function, but their 3rd highest ranking LPHA overall (LPHA #9), ranked just 7th in the Assessment function. This LPHA ranked highest in performance of the Assurance function, indicating that perhaps performance of this function has more to do with performance of the overall variable.

Also of important note is that there appears to be quite a range of performance for each of these dependent variables. In the items in which the administrator was asked to rate the perceived effectiveness of their agency in performing these functions, the Assessment function of public health, for example, ranges from an average score per item of 1.0 to 3.5 on a scale ranging from 0 to 5. For the Policy Development function of public health, scores range from .67 to 4.17 per item. For the Assurance function of public health, scores seemed to again vary widely across communities, ranging from .75 to 3.63 per item. Altogether, average scores appeared to cluster at lower ranges of the distribution, similar to what was noted by Mays et al. (2004).

Medium Strata LPHAs

Descriptive Information

The dependent variable for medium strata LPHAs is presented by the data in Table 10. For medium strata LPHAs, each of these three dependent variables was found to be normally distributed. As before, the raw score mean takes into account all items in the survey, including the items where the administrator responded that his/her LPHA did not perform the activity noted, in which case a score of 0 was indicated for that follow-up item. The follow-up question reflected perceived effectiveness of the LPHAs performance of the activity noted.

TABLE 10: Three Core Functions, Medium LPHAs

Critical Data Elements	Maximum Possible Score/Item	Obtained Item Score Low-High	Mean Item Score	Median Item Score	% of Max Possible Score
Based on 20-items included in the Administrator Survey (5-point Likert Scale format)					
Assessment Function (6 items)	6.0	0 – 4.00	2.25	2.17	38%
Policy Development Function (6 items)	6.0	0 – 3.33	2.24	2.08	37%
Assurance Function (8 items)	6.0	0 – 3.50	2.07	2.25	35%

Of the 20 activities deemed important to public health practice, performance by medium strata LPHAs ranged from 30% to 95%. On average, however, 70.0% of these activities were fulfilled by medium strata LPHAs. These numbers included 73.1% of medium strata LPHAs fulfilling performance of the Assessment activities, 83.3% of LPHAs fulfilling performance of Policy Development activities, and just 57.6% of LPHAs fulfilling performance of the Assurance activities of Public Health overall. The activity types most likely to be available in these jurisdictions included the availability of a community needs assessment process describing the health status in the community (100%), investigation of adverse health events (100%), the presence of support and communication relationships (100%), and a prioritization of community health needs (100%). In contrast, the activities least likely to be performed in medium strata LPHAs include having regular evaluations of the effects of public health services on community health status (11.1%), having conducted an analysis of age-specific participation in

preventive and screening services (22.2%), providing the public with information about current health status, health care needs, positive health behaviors, and health care policy issues (27.8%), and using professionally recognized process and outcome measures to monitor programs (33.3%).

Summary Scores and Rankings

Table 11 presents the dependent variable of study findings for medium strata LPHAs.

TABLE 11: Three Core Functions Summary Scores and Rank, Medium LPHAs

Public Health Agency	Assessment (Avg. of 6 items)	Policy Dev. (Avg. of 6 items)	Assurance (Avg. of 8 items)	Overall	Rank
	Avg/Strata Ratio	*Avg/Strata Ratio*	*Avg/Strata Ratio*		
13	1.67/.417(9)	3.00/.901(2)	2.13/.607(8)	2.25/.625	7
14	2.33/.583(5)	2.00/.601(8)	2.25/.643(7)	2.20/.611	8
15	2.50/.625(4)	2.83/.851(3)	2.25/.643(7)	2.50/.694	4
16	1.83/.458(8)	2.17/.651(7)	1.13/.321(12)	1.65/.458	12
17	.67/.167(10)	1.00/.300(11)	.75/.214(14)	.80/.222	15
18	2.17/.542(6)	2.50/.751(5)	3.13/.893(2)	2.65/.736	3
19	2.33/.583(5)	2.00/.601(8)	.88/.250(13)	1.65/.458	12
20	2.33/.583(5)	1.83/.551(9)	2.88/.821(3)	2.40/.667	6
21	2.17/.542(6)	2.00/.601(8)	2.50/.714(6)	2.25/.625	7
22	2.67/.667(3)	2.67/.801(4)	2.25/.643(7)	2.50/.694	4
23	1.83/.458(8)	1.67/.501(10)	2.63/.750(5)	2.10/.583	10
24	2.67/.667(3)	2.33/.701(6)	1.63/.464(9)	2.15/.597	9
25	2.00/.500(7)	1.83/.551(9)	.75/.214(14)	1.45/.403	14
26	1.67/.417(9)	2.00/.601(8)	1.50/.429(10)	1.70/.472	11
27	2.00/.500(7)	1.67/.501(10)	1.25/.357(11)	1.60/.444	13
28	3.67/.917(2)	3.00/.901(2)	3.13/.893(2)	3.25/.903	2
29	4.00/1.00(1)	3.33/1.00(1)	3.50/1.00(1)	3.60/1.00	1
30	2.00/.500(7)	2.50/.751(5)	2.75/.786(4)	2.45/.681	5

Amongst medium strata LPHAs, the association between performance of the outputs or three core functions of public health and LPHA inputs appears much less pronounced: only two of the top 5 performers in terms of inputs appear amongst the top

5 performers in performance of outputs. This trend may be indicative of a less than meaningful relationship between inputs and outputs overall.

Again, with medium LPHAs, the within strata rankings for each output or core function provide other noteworthy findings. Here, similar to small strata LPHAs, the top two performers overall were very consistent in performance across each of the three core function, but the 3rd highest ranking LPHA overall (LPHA #18), ranked just 6th in the Assessment function and 5th in the Policy Development function. Just as with the small strata LPHAs, this LPHA ranked highest in performance of the Assurance function, indicating that perhaps performance of this function has more to do with performance of the overall variable.

Again, review of medium strata LPHAs shows the development of a similar trend to that noted with the small strata LPHAs: a seemingly broader range of raw scores in performance of the core functions of public health. The range for performance of the Assessment function per item spans from .67 to 4.00; for the Policy Development function it ranges from 1.00 to 3.33 per item; and for the Assurance function, it ranges from .80 to 3.60 per item. The trend again confirms the finding by Mays et al. (2004) that administrator perceptions regarding the effectiveness of public health activities vary widely across communities, but appear to cluster at lower ends of the distribution.

Large Strata LPHAs

Descriptive Information

The dependent variable for large strata LPHAs is described by the data provided in Table 12. For large strata LPHAs, the Policy Development and Assurance variables

were not normally distributed, indicating a skew in the data for these variables. As noted earlier, the raw score mean takes into account all items in the survey, including the items where the administrator responded that his/her LPHA did not perform the activity noted, in which case a score of 0 was indicated for that follow-up item. The follow-up question reflected the administrators opinion regarding perceived effectiveness of the LPHAs performance of the activity noted.

TABLE 12: Three Core Functions, Large LPHAs

Critical Data Elements	Maximum Possible Score/Item	Obtained Item Score Low-High	Mean Item Score	Median Item Score	% of Max Possible Score
Based on 20-items included in the Administrator Survey (5-point Likert Scale format)					
Assessment Function (6 items)	6.0	0 – 4.17	2.58	2.67	43%
Policy Development Function (6 items)	6.0	0 – 4.00	2.65	2.33	*39%
Assurance Function (8 items)	6.0	0 – 4.00	2.28	1.75	*29%

*Policy Development and Assurance elements were not normally distributed therefore the median was used in calculating the % of maximum possible score.

Of the 20 activities deemed important to public health practice, performance by large strata LPHAs ranged from 70% to 95%. On average, however, 80.8% of these activities were fulfilled by large strata LPHAs. These numbers included 80.8% of large strata LPHAs fulfilling performance of the Assessment activities, 93.6% of LPHAs fulfilling performance of Policy Development activities, and 71.2% of LPHAs fulfilling performance of the Assurance activities of Public Health overall. The activity types most likely to be available in these jurisdictions included the availability of a community needs

assessment process describing the health status in the community (100%), investigation of adverse health events (100%), informing elected officials about the potential public health impact of decisions under their consideration (100%), prioritization of community health needs (100%), implementation of community health initiatives consistent with established priorities (100%), the development of a community health action plan with community participation (100%), and the deployment of resources to address priority health needs identified (100%). In contrast, the activities least likely to be performed in large strata LPHAs include having regular evaluations of the effects of public health services on community health status (7.7%), having conducted an analysis of age-specific participation in preventive and screening services (46.2%), and using professionally recognized process and outcome measures to monitor programs (53.9%).

Summary Scores and Rankings

Table 13 presents the dependent variable of study findings for large strata LPHAs.

TABLE 13: Three Core Functions Summary Scores and Rank, Large LPHAs

Public Health Agency	Assessment (Avg. of 6 items)	Policy Dev. (Avg. of 6 items)	Assurance (Avg. of 8 items)	Overall	Rank
	Avg/Strata Ratio	*Avg/Strata Ratio*	*Avg/Strata Ratio*		
31	4.17/1.00(1)	1.83/.458(6)	2.13/.531(5)	2.65/.697	6
32	3.67/.879(2)	3.17/.458(6)	1.75/.438(6)	2.75/.724	5
33	2.83/.679(5)	2.33/.583(4)	1.50/.375(8)	2.15/.566	9
34	1.33/.320(11)	1.67/.417(7)	1.75/.438(6)	1.60/.421	13
35	2.50/.600(7)	2.33/.583(4)	1.38/.344(9)	2.00/.526	10
36	2.00/.480(9)	2.33/.583(4)	2.25/.563(4)	2.20/.579	8
37	2.67/.639(6)	4.00/1.00(1)	4.00/1.00(1)	3.60/.947	2
38	1.00/.240(12)	2.00/.500(5)	1.63/.406(7)	1.55/.408	14
39	1.67/.400(10)	2.00/.500(5)	1.75/.438(6)	1.80/.474	11
40	2.67/.639(6)	3.83/.958(2)	2.63/.656(3)	3.00/.789	4
41	3.33/.799(4)	4.00/1.00(1)	4.00/1.00(1)	3.80/1.00	1
42	3.50/.839(3)	3.33/.833(3)	3.50/.875(2)	3.45/.908	3
43	2.17/.520(8)	1.67/.417(7)	1.38/.344(9)	1.70/.447	12

Among large strata LPHAs, the rankings reflect that three of the top 5 performers with regard to the outputs of public health also appear amongst the top 5 performers with regard to the inputs or resources of public health. Again, while indicating that some relationship may exists, perhaps that relationship is not as strong as what might be perceived. While there still appears to be some range in scores between high and low performers amongst large strata LPHAs, that range of performance seems to be closing somewhat. This fact may indicate that as LPHAs become larger, they become more similar in terms of performance.

With large LPHAs, the within strata rankings for each output or core function provide other noteworthy findings. Similar to the small and medium strata LPHAs, the top performing large LPHAs overall were consistent performers across all three functions measured, with performance of the Assessment function less pronounced. As was the case with small and medium strata performance, again performance of the Assurance function seemed to solidify higher ranking for overall performance of the dependent variable as a whole.

Relating Critical Data Elements to Dependent Variable Performance

Given the speculative trend appearing in much of the data, bivariate Pearson correlation coefficients were calculated using strata ratios to determine the strength of the relationship between each data element and overall performance of dependent variable. In this manner, these statistics reflect the contribution of each element to performance of the variable overall.

Results for each of these output variables reflected Pearson Correlation Coefficients of .760 for the Assessment function of public health; .848 for the Policy Development function of public health, and .890 for the Assurance function of public health, all of which were found to be significant ($p<.01$ level). Using these measures, performance of the Assurance function has more to do with performance of this dependent variable overall.

Statewide Dependent Variable Performance and Ranking

A statewide ranking process was also undertaken utilizing the same methodology of creating ratios to standardize the data and provide a mean for comparison between LPHAs across the entire state of Illinois. The statewide data permits stratification on the basis of performance rather than size of jurisdiction, allowing for further analysis of top performers. This allows a review to be undertaken to determine what similarities and differences might exist between top performers overall and sets the stage for comparison of top performers with regard to both the independent and dependent variables via canonical correlation analysis. Data for the dependent variable of public health outputs (the Three Core Functions of Public Health) is provided as part of Table 14.

TABLE 14: Three Core Functions Summary Scores and Rank, Statewide

Public Health Agency	Strata (S,M,L)	Assessment	Policy Dev.	Assurance	Statewide Ratio Avg. (20 items)	Rank
		Statewide Ratio	*Statewide Ratio*	*Statewide Ratio*		
1	S	.719	.879	.906	.908	5
2	S	.600	1.000	.250	.632	19
3	S	.719	.639	.594	.697	11
4	S	.480	.480	.250	.421	36
5	S	.560	.639	.563	.632	19
6	S	.480	.400	.438	.474	30
7	S	.560	.160	.188	.316	42
8	S	.560	.639	.688	.684	14
9	S	.400	.799	.750	.711	10
10	S	.839	.959	.875	.961	2
11	S	.240	.400	.344	.355	41
12	S	.639	.560	.594	.645	17
13	M	.400	.719	.531	.592	22
14	M	.560	.480	.563	.579	24
15	M	.600	.679	.563	.658	15
16	M	.440	.520	.281	.434	34
17	M	.160	.240	.188	.211	43
18	M	.520	.600	.781	.697	11
19	M	.560	.480	.219	.434	34
20	M	.560	.440	.719	.632	19
21	M	.520	.480	.625	.592	22
22	M	.639	.639	.563	.658	15
23	M	.440	.400	.656	.553	28
24	M	.639	.560	.406	.566	26
25	M	.480	.440	.188	.382	40
26	M	.400	.480	.375	.447	32
27	M	.480	.400	.313	.421	36
28	M	.879	.719	.781	.855	7
29	M	.959	.799	.875	.947	3
30	M	.480	.600	.688	.645	17
31	L	1.000	.440	.531	.697	11
32	L	.879	.759	.438	.724	9
33	L	.679	.560	.375	.566	26
34	L	.320	.400	.438	.421	36
35	L	.600	.560	.344	.526	29
36	L	.480	.560	.563	.579	24
37	L	.639	.959	1.000	.947	3
38	L	.240	.480	.406	.408	39
39	L	.400	.480	.438	.474	30
40	L	.639	.919	.656	.789	8
41	L	.799	.959	1.000	1.000	1
42	L	.839	.799	.875	.908	5
43	L	.520	.400	.344	.447	32

A bivariate Pearson correlation coefficient was again calculated to determine the strength of the relationship between each of these 3 output variables (the Three Core Functions of Public Health: Assessment, Policy Development, and Assurance) and overall performance of the dependent variable altogether using statewide data rather than strata data. Results indicated a correlation of .766 for the Assessment function of public health and performance of the complete dependent variable, .858 for the contribution of the Policy Development function to overall performance, and.900 for the contribution of the Assurance function to overall performance.

Closer examination of statewide performance of the dependent variable notes that just 2 of the top 10 performers fall amongst the small strata LPHAs, three of the top 10 performers fall amongst the medium strata LPHAs, and 5 of the top 10 performers fall amongst the large strata LPHAs. In both raw numbers and overall proportion of top 10 performers, large strata LPHAs seem to perform much better with regard to the dependent variable. Altogether, 13 of the 20 best performers of the independent variable (the inputs of public health) are in the top 20 best performers of the dependent variable (the outputs of public health), lending some support to the theory of at least a modest correlation between the variables overall.

Discussion

Review of the data collected to evaluate performance in the provision of the outputs of public health has elicited several important considerations. While it was reported earlier that 74.6% of small strata LPHAs, 70% of medium strata LPHAs, and 80.8% of large strata LPHA fulfilled the activities noted by the 20 performance measures identified, fewer were deemed "effective" as defined in the literature. As noted earlier, Healthy People 2000 set forth a goal to "increase to at least 90 percent the proportion of people who are served by a local health department that is effectively carrying out the core functions of public health" (Miller, et al., 1994, p. 659). To operationally define the word "effective", Turnock et al. (1998) noted that at least 4 of 6 assessment-related measures, 4 of 6 policy development-related measures, and 6 of 8 assurance-related measures would need to be answered in the affirmative.

Using this definition, just 42% of small strata LPHAs, 28% of medium strata LPHAs, and 62% of large strata LPHAs would be deemed as "effective". Closer examination notes that among small strata LPHAs, while 83.3% reached the appropriate threshold for Assessment function related activities and 91.7% reached the threshold for Policy Development related activities, only 41.7% reached the appropriate threshold for Assurance activities. Among medium strata LPHAs, while 77.8% reached the appropriate threshold for Assessment function related activities and 88.9% reached the appropriate threshold for Policy Development function related activities, only 27.8% reached the appropriate threshold for Assurance function related activities. Among large strata LPHAs, while 92.3% of LPHAs reached the appropriate threshold for Assessment function related activities and 100% of large strata LPHAs reached the appropriate

threshold for Policy Development function related activities, only 69.2% of LPHAs in this strata reached the appropriate threshold for Assurance function related activities. It appears that many of Illinois' LPHAs are failing at providing assurance functions of public health: which would include such activities as conducting self-assessment functions, deploying resources to address priority needs, use of process and outcome evaluation measures, conducting behavioral risk factor surveillance of their populations, engaging in community action planning, planning for the allocation of resources, evaluating the effects of public health services, and conducting analysis of the use of preventive services. This differs from the results found by Mays, et al. (2004) where performance of policy development function related activities rated poorest of the Three Core Functions. This is a critical finding in that the Assurance function of public health relates directly to the provision of services where client interaction takes place.

Another important note after consideration of the data is that administrator's ratings pertaining to perceived effectiveness were surprisingly low. Similar to findings by Mays, et al., (2004), these ratings appeared to cluster at lower ranges of the distribution. For Assessment function related activities, small strata LPHA administrators perceived their agency's effectiveness at just 39% of the maximum possible score; among medium strata LPHAs, this perceived effectiveness was rated at 38%, and among large strata LPHAs, just 43%. For Policy Development function related activities, small strata LPHA administrators perceived their agency's effectiveness at just 44% of the maximum possible score; among medium strata LPHAs, this perceived effectiveness was rated at 37%, and among large strata LPHAs, just 39%. Similarly, for Assurance function related activities, small strata LPHA administrators perceived their

agency's effectiveness at just 36% of the maximum possible score; among medium strata LPHAs, this perceived effectiveness was rated at 35%, and among large strata LPHAs, just 22%. Clearly this is a critical shortcoming evidenced by the data.

The perceived effectiveness score provides an opportunity for speculation as to why agency administrators would rate their agency effectiveness so low. Several explanations are possible. Perhaps the data are clustered negatively because they take into account that a "no" response to an item would score a 0, pulling the mean scores downward altogether thus skewing the data. Also, perhaps administrator perceptions are based on the level of participation they receive from other community partners making up the public health system in their jurisdictions, indicating that while their effectiveness at performing such activities might be low, it's because such activities are performed elsewhere in the system by another community partner, a finding substantiated in the Mays et al. (2004) research. Another plausible explanation is that while the administrator might affirm that such activities are provided, they rate their effectiveness at providing such activities low simply because they do not deem such activities as priorities of their agency and choose to dedicate resources to other, perhaps more locally critical, functions of their agency.

The availability and perceived effectiveness of public health activities appear far from ideal within the communities in which Illinoisans reside. Many of 20 activities considered to be basic elements of local public health practice were not performed in the jurisdictions surveyed. Of the activities that were performed, most were rated only partially effective in meeting the existing community need. Among the activities least likely to be available in local jurisdictions were those that have been argued as essential

features of a responsive and effective public health system (Mays, et al., 2004). Together, these findings suggest that many of the LPHAs practicing in Illinois have relatively limited capacities for ensuring that available public health resources are being used most effectively and efficiently to improve public health.

Correlation Findings

Multiple Regression Analysis

With several modest correlations between the independent and dependent variables noted, the data were then subjected to additional confirmatory analysis utilizing stepwise multiple regression to assess the order of the combined importance of the four independent variables with each of the dependent variables. In each analysis, the same result was noted: only one independent variable was found to be statistically significant and none of the other independent variables could be entered into the model. In effect, after taking into consideration the results of the first and most significant variable, other independent variables were excluded from the model due to the lack of significant enough correlation with the dependent variable. In each instance, even the significant variable entered failed to explain very much variance with the dependent variable as measured by the R^2 test of significance. Results of the stepwise multiple regression analyses are shown in Table 15.

TABLE 15: Stepwise Multiple Regression Results (figures represent % of variance explained)

Variables Entered	Assessment	Policy Development	Assurance	3 Core Functions – Combined
	R^2 Strata/State	*R^2 Strata/State*	*R^2 Strata/State*	*R^2 Strata/State*
Informational Res.	*/*	.152/.219	.332/.388	.288/.311
Organizational Res.	.134/.112	*/*	*/*	*/*
Fiscal Res.	*/*	*/*	*/*	*/*
Human Res.	*/*	*/*	*/*	*/*
Inputs/Resources -Combined	.160/.132	*/.173	.267/.330	.253/.305

*Denotes R^2 results that are non-significant and excluded from the regression model

Several other variables approached significance when analyzing the relationship between the dependent and independent variables. In analyzing data by strata, the correlation between the Fiscal Resources of public health and performance of the Assessment function were near significant ($p<.10$), as was the correlation between the Fiscal Resources of public health and performance of the Assurance function ($p<.10$). In addition, there was near significant correlation between the Organizational Resources of public health and performance of the total dependent variable, the Three Core Functions ($p<.10$).

Similarly, in review of statewide analyses, several variables approached significance including the correlation between the Informational Resources of public health and performance of the Assessment function ($p<.10$), the correlation between the Fiscal Resources of public health and performance of the Assessment function ($p<.10$), and correlation between the Fiscal Resources of public health and the Assurance function

(p<.10). In addition, there was near significant correlation between the Organizational Resources of public health and performance of the total dependent variable, the Three Core Functions (p<.10).

Interestingly, and substantiated through the canonical correlation analysis discussed later, is the finding that the linear combination of independent variables with the dependent variables, both individually and collectively, provided the best explanation of performance overall. That is, those LPHAs that perform all of the input or resource functions well were consistently better in performing the Three Core Functions of Public Health. These results are depicted in Figures 3 – 4.

FIGURE 3:

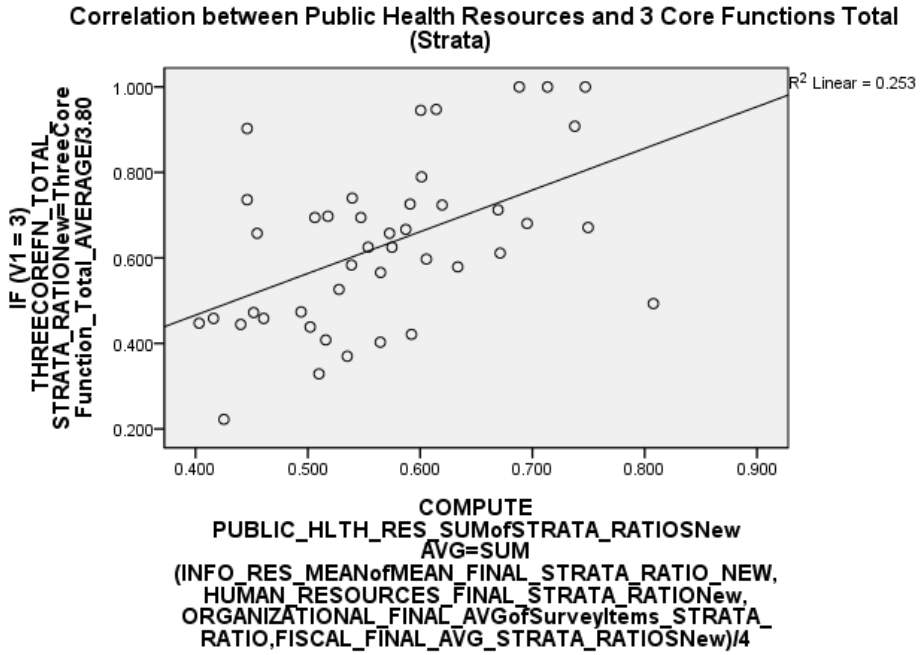
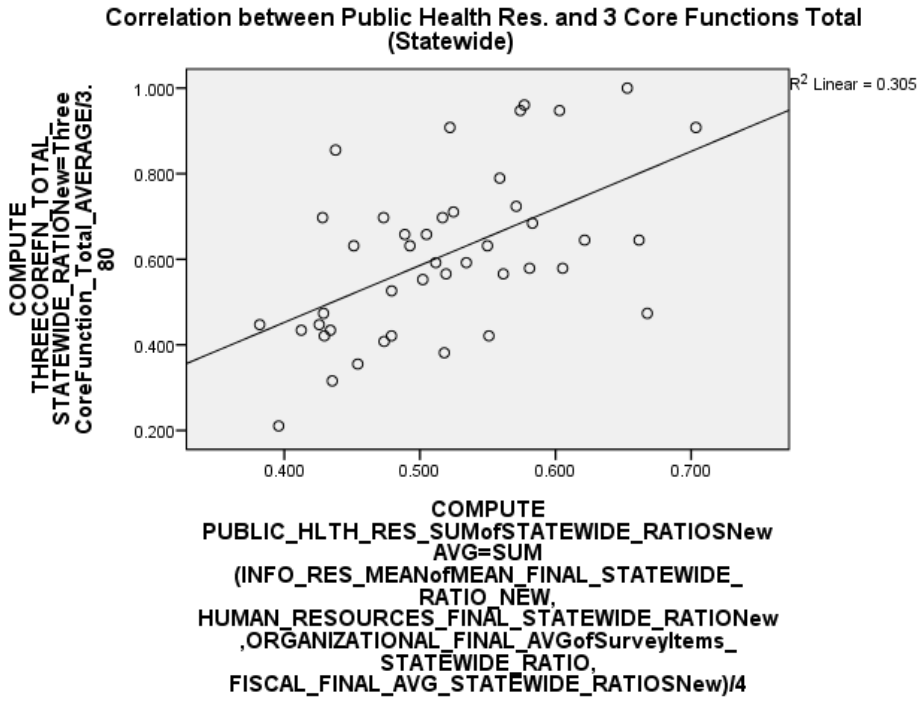


FIGURE 4:



Canonical Correlation

The next stage in the research problem involved analyzing the relationship between the four independent variables (the Human, Organizational, Information, and Financial Resources of public health) comprising the inputs of public health, and the three dependent variables (the three core functions of public health: assessment, policy development and assurance functions) comprising the outputs of public health, through canonical correlation analysis. If the tenets of a typical logic model hold true, the inputs should relate to outputs and subsequently to outcomes, setting the stage for future analysis of the impact of LPHA performance on community health outcomes. Statistical analysis involved performing canonical correlations.

Canonical correlation is designed for assessing the relationship between two sets of variables. The data set is split into two groups, for example X and Y, based on some

common characteristics. The purpose of canonical analysis is to find the relationship between groups X and Y, i.e., can some form of X represent Y. It works by finding the linear combination of X variables, i.e., X_1, X_2 etc., and linear combination of Y variables, i.e., Y_1, Y_2 etc., which are most highly correlated. This combination is known as the "first canonical variate" which are usually denoted U_1 and V_1, with the pair of U_1 and V_1 being called a "canonical function". The next canonical function, U_2 and V_2 are then restricted so that they are uncorrelated with U_1 and V_1 (http://en.wikipedia.org/wiki/Canonical_analysis, accessed 12/10/2010). The possible number of such pairs is limited to the number of variables in the smallest group. In this study, there are four independent variables and three dependent variables. Thus, a canonical correlation analysis on these sets of variables will generate three pairs of canonical variates.

Strata Analysis

When using strata data, the analysis yielded three canonical functions or variates. The first pair of variates, a linear combination of the inputs of LPHAs and a linear combination of the outputs of LPHAs had a correlation coefficient of .619. The second pair had a correlation coefficient of .419, and the third pair .353. Each subsequent pair of canonical variates is less correlated. These can be interpreted as any other Pearson correlations. That is, the square of the correlation (.383, .176, and .125 respectively) represents the proportion of the variance in one group's variate explained by the other group's variate. In this respect, the largest of all possible correlations explains just 38% of the variance between the variates.

Collectively, only the full model (a linear combination of the independent and dependent variables) across all functions was statistically significant using the Wilks's Λ=.445 criterion $F(12, 92.89) = 2.769$, $p<.01$. Because Wilks's Λ represents the variance unexplained by the model, 1-Λ yields the full model effect size in an r^2 metric. Thus, for the set of three canonical functions, the r^2 type effect size was .555, which indicates that the full model explained a substantial portion, about 56%, of the variance shared between the variable sets.

The dimension reduction analysis allows the researcher to test the hierarchal arrangement of functions for statistical significance. As noted, the full model (Functions 1 to 3) was statistically significant. Function 1 to 3 represents a linear combination of the independent variables and a linear combination of the dependent variables. Functions 2 to 3 and 3 to 3 were not significant at the .05 level.

Table 16 presents the standardized canonical coefficients for the statistically significant dimension across both sets of variables.

Table 16: Standardized Canonical Coefficients

Data Element	**Dimension 1**
	Dependent Variables
Assessment	.183
Policy Development	-.302
Assurance	1.081
	Independent Variables
Fiscal Resources	.376
Organizational Resources	.033
Human Resources	-.143
Informational Resources	.904

The standardized canonical coefficients mean that, if all of the variables in the analysis are rescaled to have a mean of zero and a standard deviation of 1, the coefficients generating the canonical variates would indicate how a one standard deviation increase in the variable would change the variate. For example, an increase of one standard deviation in the Assessment function would lead to a .183 unit increase in the first variate of the dependent variable, the Three Core Functions of public health.

For the dependent variables, the dimension is most strongly influenced by Assurance (1.081). For the independent variables, the dimension was most influenced by Informational Resources (.904) and then Fiscal Resources (.376). As noted earlier, this means that, if all of the variables in the analysis are rescaled to have a mean of zero and a standard deviation of 1, the coefficients generating the canonical variates would indicate how a one standard deviation increase in the variable would change the variate. For example, an increase of one standard deviation in the Fiscal Resources variable would lead to a .376 unit increase in the first variate of the independent variable, Public Health Inputs (Resources).

Table 17 represents the correlations between each variable making up the dependent variable of the Three Core Functions of Public Health and the dependent variable canonical variates.

Table 17: Correlations between DEPENDENT and Canonical Variables

Variable	Function 1
Assessment	.552
Policy Development	.500
Assurance	.972

Here, it is noted that Assessment has a Pearson correlation of .552 with the first Three Core Function variate, that Policy Development has a Pearson correlation of .500 with the first Three Core Function variate, and most notably, Assurance has a Pearson correlation of .972 with the first Three Core Function variate.

Table 18 represents the correlations between each variable making up the independent variable of Public Health Inputs, and the independent variable canonical variates.

Table 18: Correlations between COVARIATES and Canonical Variables

Variable	Function 1
Fiscal Resources	.489
Organizational Resources	.243
Human Resources	.031
Informational Resources	.900

As indicated, Fiscal Resources has a Pearson correlation of .489 with the first Public Health Inputs variate, Organizational Resources has a Pearson Correlation of .243 with the first Public Health Inputs variate, Human Resources has a Pearson Correlation of .031 with the first Public Health Inputs variate, and most notably, Information Resources has a Pearson Correlation of .900 with the first Public Health Inputs variate. What this indicates is that of the independent variables (LPHA Inputs), Informational Resourcs (.900) and Fiscal Resources (.489) seem to have more to do with performance of the linear combination of independent and dependent variables used in this study.

The analysis indicates the linear combination of dependent variables represents about 50% of the total variance in the dependent variables. Also noted is that the linear

combination of the covariate or independent variables explains about 19% of the total variance in the dependent variables. Similarly, the linear combination of the dependent variables explains about 10.6% of the total variance in the covariates. Also the linear combination of the covariate or independent variables explains about 27.7% of the total variance in the covariate. Again, only canonical variate 1 was deemed statistically significant.

What the strata specific canonical correlation analyses indicate overall, and confirmed through multiple regression analysis discussed earlier, is that the independent and dependent variables are only modestly correlated, explaining a relatively small amount of the variance overall.

Statewide Analysis

When using statewide data, the analysis yielded three functions with squared canonical correlations of .433, .140, and .087 for each successive function. Collectively, the full model (a linear combination of the independent and dependent variables) across all functions was statistically significant using the Wilks's Λ=.445 criterion $F(12, 92.89) = 2.775$, $p<.01$. Because Wilks's Λ represents the variance unexplained by the model, 1-Λ yields the full model effect size in an r^2 metric. Thus, for the set of three canonical functions, the r^2 type effect size was .555, which indicates that the full model explained a substantial portion, about 56%, of the variance shared between the variable sets.

The dimension reduction analysis allows the researcher to test the hierarchal arrangement of functions for statistical significance. As noted, the full model (Functions 1 to 3) was statistically significant. Function 1 to 3 represents a linear combination of the

independent and dependent variables. Functions 2 to 3 and 3 to 3 were not significant at the .05 level.

Table 19 presents the standardized canonical coefficients for the statistically significant dimension across both sets of variables.

Table 19: Standardized Canonical Coefficients, Statewide

Data Element	Dimension 1
	Dependent Variables
Assessment	-.059
Policy Development	.097
Assurance	.963
	Independent Variables
Fiscal Resources	.230
Organizational Resources	.091
Human Resources	-.077
Informational Resources	.953

The standardized canonical coefficients mean that, if all of the variables in the analysis are rescaled to have a mean of zero and a standard deviation of 1, the coefficients generating the canonical variates would indicate how a one standard deviation increase in the variable would change the variate. For example, an increase of one standard deviation in the Policy Development function would lead to a .097 unit increase in the first variate of the dependent variable, the Three Core Functions of public health.

For the dependent variables, the dimension is most strongly influenced by Assurance (.963). For the independent variables, the dimension was most influenced by Informational Resources (.953) and then Fiscal Resources (.230). As noted earlier, this means that, if all of the variables in the analysis are rescaled to have a mean of zero and a standard deviation of 1, the coefficients generating the canonical variates would indicate

how a one standard deviation increase in the variable would change the variate. For example, an increase of one standard deviation in the Fiscal Resources variable would lead to a .230 unit increase in the first variate of the independent variable, Public Health Inputs (Resources).

Table 20 represents the correlations between each variable making up the dependent variable of the Three Core Functions of Public Health and the dependent variable canonical variates.

Table 20: Correlations between DEPENDENT and Canonical Variables, Statewide

Variable	Function 1
Assessment	.478
Policy Development	.700
Assurance	.997

Assessment has a Pearson correlation of .478 with the first Three Core Function variate, Policy Development has a Pearson correlation of .700 with the first Three Core Function variate, and most notably, Assurance has a Pearson correlation of .997 with the first Three Core Function variate.

Similarly, Table 21 represents the correlations between each variable making up the independent variable of Public Health Inputs, and the independent variable canonical variates.

Table 21: Correlations between COVARIATES and Canonical Variables, Statewide

Variable	Function 1
Fiscal Resources	.321
Organizational Resources	.229
Human Resources	.098
Informational Resources	.957

Fiscal Resources has a Pearson correlation of .321 with the first Public Health Inputs variate, Organizational Resources has a Pearson Correlation of .229 with the first Public Health Inputs variate, Human Resources has a Pearson Correlation of .098 with the first Public Health Inputs variate, and most notably, Information Resources has a Pearson Correlation of .957 with the first Public Health Inputs variate. What this indicates is that of the independent variables (LPHA Inputs), Informational Resources (.957) and Fiscal Resources (.321) seem to have more to do with performance of the linear combination of independent and dependent variables used in this study.

Also noted in the analysis was that the linear combination of dependent variables represents about 57% of the total variance in the dependent variables, and the linear combination of the covariate or independent variables explains about 19% of the total variance in the dependent variables. Similarly, the linear combination of the dependent variables explains about 11.7% of the total variance in the covariates. The output also reflect that the linear combination of the covariate or independent variables explains about 27% of the total variance in the covariate. Again, only canonical variate 1 was deemed statistically significant.

What the statewide specific canonical correlation analyses indicate overall, and confirmed through multiple regression analysis discussed earlier, is that the independent

and dependent variables are only modestly correlated, explaining a relatively small amount of the variance overall.

While canonical correlation analysis provides useful feedback, such tests are meant to provide analysis on the linear combination of independent and dependent variables together, not to elicit which independent variables might be more meaningful in their effect on each of the dependent variables. As noted in Jaccard & Ramos (2002), univariate analysis of the independent and dependent variables can provide just as useful information.

Based on these results, it is concluded that performance of the independent variables is of limited usefulness in predicting performance in either the Assessment, Policy Development, or Assurance functions of LPHAs.

Analysis of Results after Stratification by Performance

All LPHAs were divided first into 3 groups based on their statewide performance ratio calculated from the total sum of the dependent variable (Three Core Functions of public health). Similarly and independently, all LPHAs were then divided up into 3 groups based on their statewide performance ratio from the total independent variable (Public Health Resources or Inputs). Comparisons were then made of the performance groups to determine the potential relationships between independent and dependent variables based on overall performance. The top performing group had 14 LPHAs, the middle performing group had 14 LPHAs, and the poor performing group had 15 LPHAs. Final statistical evidence of relationships by performance was conducted using stepwise multiple regression analysis.

Cursory examination of the placement of LPHAs into both the independent variable performance groups and the dependent variable performance groups noted several interesting findings. A list of LPHAs and their placement in each group was created to assist with this examination. In the top performers group, 8 of the 14 best performers of the independent variable were also amongst the top performers of the dependent variable. Among the middle performers group, 7 of the 14 best performers of the independent variable were also amongst the middle performing group for the dependent variable. Finally, among poor performers, 11 of the 15 poor performers of the independent variable were also amongst the poor performing group for the dependent variable overall.

Additional cursory examination was undertaken to see how many misplaced LPHAs there were within the extreme groups (the top and poor performing groups). A LPHA was defined as misplaced if it was noted as a top performer of the independent variable but a poor performer of the dependent variable; or a poor performer of the independent variable but a top performer of the dependent variable. Only one of the LPHAs noted as a top performing agency based on the independent variable was among the poorest performing LPHAs based on the dependent variable. Similarly, only three of the poorest performing LPHAs based on the independent variable were among the top performing LPHAs based on the dependent variable. The ratios were set at three decimal places making the degree of separation between groups very small. While these results provide cursory evidence of a modest relationship between inputs and outputs of local public health agencies overall, more evidence is needed.

Summary, Conclusions, and Suggestions for Further Research

Summary

The purpose of this study was to advance a model of performance measurement in public health based around logic model constructs that focused upon explanatory variables within the realm of control of the Local Public Health Agency (LPHA) and their subsequent effect on LPHA outputs using canonical correlation analysis. As part of this measurement analysis, a benchmarking and ranking process was elucidated, identifying superior performers across various strata representing jurisdiction size served, and across the state of Illinois as a whole.

Forty-three of 46 selected LPHA administrators participated in this study for a response rate of 93.5 percent. The study investigated the effect of performance of LPHA inputs (resources) on the performance of LPHA outputs (services). LPHA inputs performance was based on four independent variables: LPHA performance of the Human Resources function of the agency (as measured by three critical data elements), performance of the Organizational Resources function of the agency, performance of the Informational Resources function of the agency (as measured by four critical data elements), and performance of the Fiscal Resources function of the agency (as measured by four critical data elements). Performance results of each variable, both individually and in the aggregate, were used to rank LPHAs by strata and statewide. Similarly, LPHA outputs performance was based on three dependent variables: LPHA performance of the Assessment function of the agency, performance of the Policy Development function of the agency, and performance of the Assurance function of the agency. These dependent

variables are known commonly in the literature as the Three Core Functions of Public Health. Performance results of each dependent variable, both individually and in the aggregate, were used to rank LPHAs by strata and statewide independently of the LPHAs performance of the input variable. Analysis was then performed to determine the presence, and strength of, a relationship between the independent and dependent variables using canonical correlation analysis: Does performance of the inputs of public health correlate to performance of the outputs of public health?

Hypotheses Findings

The research findings in relation to the hypotheses are summarized as noted below:

1. There is a relationship between a local public health agency's "inputs" and the successful implementation of the practices of public health (outputs).

A statistically significant relationship was found between a local public health agency's inputs or resources and the successful implementation of the practices of public health (outputs). This relationship however, noted through canonical correlation analysis and confirmed through multiple regression analysis, is best described as modest.

2. There is a difference in outputs between low and high performing local public health agencies judged on the basis of their inputs.

When statistical analysis was performed on the basis of high, medium and low performers, similarly only modest differences were found between the input variables of local public health agencies and the successful implementation of the practices of public health (outputs).

Implications of this Study

The determination of whether a LPHAs inputs correlate to outputs provides meaningful feedback to academia and practice. This study has noted, that at least in terms of these measures, inputs are only modestly correlated to outputs. In questioning why this correlation is not stronger, suggestions for future research become evident. The modest correlation could be indicative of the presence of other yet to be uncovered variables which intervene between these logic model constructs. As an old English proverb has stated, "there is many a slip between the cup and the lip".

Beyond that though, the study provides a new ideal of measurement and evaluation for local public health practice that extends beyond merely the checklist approach found in accreditation and operational definition models. By attempting to link process to effect, public health evaluation rises above just the measurement of inputs or outputs independently of one another. As Tremain, et al., (2007) remarked in summary comments provided from a Multi-State Learning Collaborative Conference on accreditation, "unless you can demonstrate fidelity of the program and process quality, you have no business talking about outcomes..." and "unless our process leads to an improvement in the public's health, then we are missing the boat." This study, despite the modest findings between inputs and outcomes, moves the discussion into the proper arena.

As noted previously, ranking studies are abundant in other fields and popular press and have been used for a variety of purposes. The ranking of LPHAs yields similar benefits as those identified for other fields of study, but also yields benefits specific to

local public health practice. These benefits can be yielded from both a ranked list of LPHAs and from the systematic development of criteria to rank such agencies. The literature from both private and public sectors and a variety of fields was consulted in arriving at the criteria used in this study.

The study also yields a process that can serve as a benchmarking methodology in which superior performers in any one of these input or output variables can serve as a model for other similar sized LPHAs to improve public health practice. This research formalizes a process that often went on informally at various meetings and discussions with colleagues and friends in the field: learning what other's in the field are doing and how; discussion of what works in practice and what doesn't. The literature also was consulted in this regard with what many consider to be the most notable benchmarking process in practice in the US: the Baldrige National Quality Award. This award focuses on sectors of business, education, health care, and nonprofit organizations. Seven key criteria are established by the Baldrige process, including an examination of how the organization performs relative to competitors (http://www.nist.gov/public_affairs/factsheet/baldfaqs.htm, accessed 4/19/2008).

The study provides sufficient detail within the critical data elements making up each of the variables to establish other implications. For example, the critical data elements combining to create the fiscal resources variable could be used independently as a LPHA "stress test" to identify agencies that may be headed for severe fiscal crises as has become evident in recent years with the economic recession.

Finally, the ratio scores for each of the independent and dependent variables and the composite scores sets the stage for the development of recognition awards in which superior performers can be acknowledged for their contributions to the practice of public health and thus serve as role models for other LPHAs to strive to achieve. By setting the standard, the superior performers provide the compass by which other LPHAs are able to focus on the goal of continual improvement.

Conclusions

The methodology and findings of this study yielded the following conclusions:

- As noted previously, the logic model has been used frequently as an organizing framework for performance measurement in multiple organizations (United Way, 1996; W.K. Kellogg Foundation, 1998) including, more recently, public health agencies (Dykeman, et al., 2003; Toghele, et al., 2007; Medeiros, et al., 2005). The logic model describes the logical linkages that exist between a program's inputs and the outcomes expected for that program and how they interrelate (McLaughlin & Jordan, 1999). This research has noted however, at least in terms of LPHAs, the logic model provides only modest accuracy in linking an agency's inputs (the human, informational, fiscal, and organizational resources of an LPHA) to their outputs (assessment, policy development and assurance functions of LPHAs). Certainly, the logic model in this research provides a logical evaluative framework, providing face validity for the underpinnings that gird what public health is and what it does. Similarly, the dependent variable of study, the outputs of public health as measured in terms of their core functions, also

provide proper face validity in terms of measuring what matters in public health practice. The logic model would dictate that there is a relationship between these inputs and outputs, and while this research confirms that indeed inputs do relate to outputs, that relationship, at least in these terms, is just modestly correlated. Importantly, this research is significant from the perspective that very few studies in public health have attempted to link the resources of public health to the effects they hope to achieve. The literature is replete with studies attempting to measure and evaluate either the resources (inputs) of LPHAs, OR the outputs of LPHAs, but very few attempt to identify and measure the linkage between the two.

- Turnock (2001) notes that local public health practice is framed by key infrastructure components which form the resources or inputs of public health practice. These inputs include informational resources, human resources, organizational resources, and financial resources and provided the focus for measurement of the independent variable of this study. While other policy initiatives focusing on public health practice, (e.g., NACCHO, 2005; Illinois Accreditation Task Force, 2006; Thielen, 2004; NACCHO, 1997) have provided detailed foci for evaluative study, the inputs noted by Turnock (2001) seem to adequately and accurately serve as appropriate constructs for these more detailed accounts: virtually every evaluative indicator in these policy initiatives could be grouped into one of these primary inputs. While the effect of such inputs on the dependent variable is critical to this research and relatively novel in the literature, the measurement of inputs provides a study in itself, and serves as an indicator of superior performance in the local public health system. This research is the first

to attempt to measure successful performance of LPHAs on the basis of these inputs. Similarly, the dependent variable of study, cited as the three core functions of public health, serves as a valid focus for the evaluation of effect. For more than two decades, these three core functions have been substantiated in countless journal articles and government planning documents pertaining to public health practice across local, state, and federal jurisdictions. In fact, a Google search for these terms elicited 424,000 results. Substantial effort noted in earlier research has also yielded a valid performance measure of these core functions, used in this study to measure success in performance of the dependent variable. Again, measurement of these core functions provides a meaningful study in itself, and the literature provides several accounts undertaken for exactly that purpose. Both the independent (the inputs of public health) and the dependent variables (the outputs of public health) independently provide meaningful measures of evaluation and also provide the basis for the methodology enabling ranking of LPHAs by performance. Whether such LPHAs are ranked on the basis of their performance of inputs, or on the basis of their performance of outputs, or a combination of both, such measurement and evaluation strategies provide a novel approach to evaluation of LPHAs, as well as evaluation of government agencies as a whole.

- This study provides a ranking of LPHAs where none currently exists. Rankings have become common in numerous fields and disciplines. Rankings are readily available in newsstand type publications such US News and World Report, which now provides rankings for best colleges, best graduate schools, best high schools,

best vacations, best cars and trucks, best hospitals and the like. Other publications rank best places to work, college sports teams, and places to retire. Rankings provide a means of evaluation and measurement that have been successful at garnering attention of academic professionals, and the general population as a whole. This research ranking LPHAs advances ranking studies by following academic research principles which included the following: 1) the use of scholarly accepted survey instruments, 2) a literature review to derive widely accepted criterion for measurement of what constitutes public health practice, 3) vigorous follow-up to obtain the highest possible response rate, 4) academia accepted sampling strategies and stratification techniques, and 5) the data for the variables were tabulated and analyzed using valid statistical processes.

- Executive Directors of LPHAs (referred to as "Administrators" in Illinois) need meaningful information to assist them with decisions related to the allocation of resources, fiscal management, staffing issues, and the like. This research provides useful information about what matters most in terms of the services provided by such agencies. As noted in the research, through both canonical correlation and regression tests, the Information Resources of public health have more to do with successful performance in the provision of the three core functions of public health, followed by the Fiscal Resources of public health. While the Organizational Resources and Human Resources of public health matter, the evidence provided by this study note that these variables are of lesser importance to superior performance overall. The detailed critical data elements found within each of the 4 input variables provides additional meaningful and useful

information to LPHA administrators as well. Knowing, for example, where a particular LPHA ranks in Days Cash on Hand may solidify that LPHAs confidence in the throes of a recession; or knowing that his/her agency is ranked number one in their strata on the basis of the assessment function of public health, might assist that particular administrator in securing planning grants for various pilot projects or public support for the agency.

- Review of the ratio scores and rankings also served to elucidate superior performers in each of the independent and dependent variables independently and in the aggregate for each strata and across the state as a whole. The ratio scores were used to group LPHAs by performance into either the top, middle, or poor performing groups for both the independent and dependent variables. Eight of the 14 best performers of the independent variable were also in the top performers of the dependent variable. Among the middle performers group, 7 of the 14 best performers of the independent variable were also in the middle performing group for the dependent variable. Finally, among the poor performers, 11 of the 15 poor performers of the independent variable were also in the poor performing group of the dependent variable overall.
- Review of the canonical correlation analysis noted that the full model of both independent and dependent variables explained nearly three-fifths of the variance in the model, and noted the presence of a statistically significant relationship between the independent and dependent variables in what has been ordinarily defined as a modest correlation, confirmed by univariate analyses. Such analyses also noted that performance of the Informational Resources variable was most

meaningful to the dependent variable, followed by performance of the Fiscal Resources variable.

Suggestions for Further Research

Based on the results of this study, the following suggestions for further research are offered.

- Much of the information provided to complete the variables relied on self-reported data found in the administrator survey and secondary data sources (such as the Illinois Department of Public Health Learning Management System). The methodology could be improved by developing valid measures of variables that are not so dependent upon self-reported data.
- The research could benefit by being repeated with greater participation from multiple states. Such broader participation may lessen the effect of outliers on the overall data set and thus reduce bias.
- Further development of the variables could increase validity and reliability of the data, which may increase the relationship between the independent and dependent variables. The Organizational Resources variable, for example, did not include as wide a variety of measures of performance as the other input variables, utilizing just nine questions in the administrator survey to fulfill in whole the performance measure for this variable. Other variables had multiple critical data elements and a wider depth of survey questions or data sources available to measure LPHA performance.
- While the input variables were suggested in the literature, the measures chosen to evaluate LPHA performance may not be the best measures available for this

purpose. While the measures used were substantiated by the literature, questions of validity are at times elusive. Casting a wider net may yield more and better measures to answer the questions posed by the study.

- The methodology could be adapted slightly to allow for comparison of different divisions within local public health agencies. Such an adaptation would allow Divisions of Environmental Health, for instance, to compare themselves to one another along multiple input and output variables.
- The study would benefit by being able to better discern low, medium, and high performance. Often the difference between these different performance levels involved a separation of less than a tenth of a point in the ratios used to measure performance. The methodology could be adapted to generate more discrete differences, for example.
- Realizing that there exists a multitude of variables influencing the role of LPHAs within their communities, the study should advance beyond the LPHA and focus on the systems approach and attempt to account for the multitude of organizations responsible for providing public health services across the spectrum of providers. By taking into account the larger context within which LPHAs operate and function, a higher likelihood exists for linking inputs and outputs to eventual outcomes: improvement in public health status overall.

An investigation of the before mentioned points, among others, related to measurement and evaluation of public health practice appear to be necessary prior to concluding that these measures and this methodology are better than all others. This study does suggest a new methodology for evaluation and measurement of public health

practice that utilizes logic model constructs and ranking procedures where none currently exists. In the end, it is the programs and readers of this study that must judge the utility of the findings for their own purposes.

APPENDIX A

Administrator Cover Letter and Survey

910 Route 54 East
POB 518
Clinton, IL 61727
Phone: 217.935.3427
Fax: 217.935.4037

DeWitt-Piatt
Bi-County Health Department

1020 S. Market Street
Monticello, IL 61856
Phone: 217.762.7911
Fax: 217.762.3422

Dear Fellow Public Health Administrator:

Serving as the Public Health Administrator for the DeWitt/Piatt Bi-County Health Department, I understand and empathize with the challenges of working in this environment: how to survive on predominately soft money sources, worries about staffing issues, policies and procedures, and whether or not what we do makes a difference.

To answer some of these questions, I've been working with colleagues toward defining a way in which we might be able to measure exactly that: if what health departments do makes a difference in the services they provide, and ultimately in the health outcomes of their populations. This survey is the first step in that process. If the tenets of a typical logic model hold true, an organizations inputs relate to outputs, and subsequently to outcomes. Your feedback is essential to the success of this study.

Dr. Bernard Turnock, former director of the Illinois Department of Public Health, has defined a local public health department's inputs as the human, informational, organizational, fiscal and physical resources dedicated toward doing the work of public health. This survey attempts to measure these inputs and determine if there is a relationship between these inputs and the outputs of the agency. We are surveying multiple small, medium, and large size county-wide departments of public health throughout Illinois. As part of the process, the study allows us to compare one agency to other similar-sized agencies on the basis of these inputs so that we can better understand how public health departments survive and thrive in their communities. Even more, the reports generated from this study might prove useful in helping you to satisfy the IPLAN requirement of completing an Organizational Capacity Assessment. As such, if you'd like a copy of your survey results, simply check the box at the end of the survey and I'll make sure you receive a copy.

The individuals noted below strongly support the study and encourage your participation. The survey is in electronic format and easy to complete. Your results will be kept strictly confidential and your participation is voluntary. By completing the electronic questionnaire and returning it to me within two weeks you acknowledge your consent to participate in this important research project. Your feedback is greatly appreciated. If you have any questions, please feel free to contact me at (217) 519-3380 or dremmert@dewittpiatthealth.com.

Sincerely,

David M. Remmert, M.P.H.
Principal Investigator
DeWitt/Piatt Bi-County Health Department

Dr. Bernard Turnock, M.P.H, M.D.
Director
Div. of Community Health Sciences
University of Illinois at Chicago

Steve Laker
President
Illinois Assoc. of Public Health Administrators

Jim Nelson
Executive Director
Illinois Public Health Association

Under the direction of Dr. Thomas O'Rourke, Principal Investigator from the Department of Kinesiology and Community Health of the University of Illinois at Urbana-Champaign, you are invited to participate in a research study on the relationship between Local Public Health Agency inputs (resources) and the outputs of that agency. This study will take approximately 20 minutes of your time. You will be asked to complete an online survey about key characteristics of local public health agency capacity. Your decision to participate or decline participation in this study is completely voluntary and you have the right to terminate your participation at any time without penalty. If you do not wish to complete this survey just close your browser. Your participation will be completely confidential and data will be averaged and reported in aggregate. Possible outlets of dissemination may include providing data to you for your purposes, and aggregate reporting for dissemination through research articles found in scholarly journals. Your individual responses and the name of your agency will not be disseminated as part of these articles. This research may benefit you by providing feedback as part of an organizational capacity assessment, and will help us understand the relationship between local agency inputs and outputs. If the tenets of a typical logic model hold true, this study may provide an important precursor to the eventual link between what a local public health agency does, and what it hopes to achieve: improvement of population health outcomes. There is no more risk to individuals participating in this survey than what is encountered in everyday life.

If you have questions about this project, you may contact Dr. Thomas O'Rourke, University of Illinois, at (217) 333-3163 or torourke@illinois.edu or Dave Remmert, Investigator, at (217) 762-7911 or dremmert@dewittpiatthealth.com. If you have any questions about your rights as a research participant in the study, please contact the University of Illinois Institutional Review Board at (217) 333-3670 (collect calls accepted if you identify yourself as a research participant) or via email at irb@illinois.edu.

Please print a copy of this consent form for your records, if you so desire.

I have read and understand the above consent form. I certify that I am 18 years old or older and, by clicking the Yes button to enter the survey, I indicate my willingness to voluntarily take part in the study.

- Yes, I wish to take part in the survey
- No, I do not wish to participate in the survey

Section I: The following questions address the collaborativeness of your agency. Collaborativeness refers to a set of activities that relate to the shared efforts of organizations, agencies, or groups and individuals within a community. Please select one response for each question.

1. There is a network of people concerned about prevention issues who stay in touch with each other.
    - Strongly Disagree
    - Somewhat Disagree
    - Somewhat Agree
    - Strongly Agree

2. Community agencies and organizations rarely coordinate prevention activities.

- Strongly Disagree
- Somewhat Disagree
- Somewhat Agree
- Strongly Agree

3. Community agencies and organizations work together to address problems with prevention strategies.

- Strongly Disagree
- Somewhat Disagree
- Somewhat Agree
- Strongly Agree

4. Organizations in this community participate in joint meetings to address prevention issues.

- Strongly Disagree
- Somewhat Disagree
- Somewhat Agree
- Strongly Agree

5. Organizations in this community share information with each other about prevention issues.

- Strongly Disagree
- Somewhat Disagree
- Somewhat Agree
- Strongly Agree

6. Organizations in this community coordinate prevention strategies.

- Strongly Disagree
- Somewhat Disagree
- Somewhat Agree
- Strongly Agree

7. Organizations in this community participate in joint planning and decision making about prevention issues.

- Strongly Disagree
- Somewhat Disagree
- Somewhat Agree
- Strongly Agree

8. Organizations in this community share money and personnel when addressing prevention issues.

- Strongly Disagree
- Somewhat Disagree
- Somewhat Agree
- Strongly Agree

9. In this community, each organization has a clearly defined role in carrying out the community's prevention plan.

- Strongly Disagree
- Somewhat Disagree
- Somewhat Agree
- Strongly Agree

Section II: The following questions address if your agency performs multiple public health oriented functions. Please select one response to each question. Then, for each "Yes" response, a second question is asked to determine how well you perceive your agency's effectiveness in performing the function noted.

10. For the jurisdiction served by your local public health department, is there a community needs assessment process that systematically describes the prevailing health status and needs of the community?

- Yes
- No
- Don't Know

10.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

11. In the past three (3) years in your jurisdiction, has the local public health department surveyed the population for behavioral risk factors?

- Yes
- No
- Don't Know

11.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

12. For the jurisdiction served by your local public health department, are timely investigations of adverse health events, including communicable disease outbreaks and environmental health hazards conducted on an ongoing basis?

- Yes
- No
- Don't Know

12.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

13. Are the necessary laboratory services available to the local public health department to support investigations of adverse health events and meet routine diagnostic and surveillance needs?

- Yes
- No
- Don't Know

13.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

14. For the jurisdiction served by your local public health department, has an analysis been completed of the determinants and contributing factors of priority health needs, adequacy of existing health resources, and the population groups most impacted?

- Yes
- No
- Don't Know

14.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

15. In the past three (3) years in your jurisdiction, has the local public health department conducted an analysis of age-specific participation in preventive and screening services?

- Yes
- No
- Don't Know

15.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

16. For the jurisdiction served by your local public health department, is there a network of support and communication relationships, which includes health-related organizations, the media and the general public?

- Yes
- No
- Don't Know

16.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

17. In the past year in your jurisdiction, has there been a formal attempt by the local public health department at informing elected officials about the potential impact of actions under their consideration?

- Yes
- No
- Don't Know

17.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

18. For the jurisdiction served by your local public health department, has there been a prioritization of the community health needs which have been identified from a community needs assessment?

- Yes
- No
- Don't Know

18.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

19. In the past three (3) years in your jurisdiction, has the local public health department implemented community health initiatives consistent with established priorities?

- Yes
- No
- Don't Know

19.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

20. For the jurisdiction served by your local public health department, has a community health action plan been developed with community participation to address community health needs?

- Yes
- No
- Don't Know

20.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

21. During the past three (3) years in your jurisdiction, has the local public health department developed plans to allocate resources in a manner consistent with the community health action plan?

- Yes
- No
- Don't Know

21.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

22. For the jurisdiction served by your local public health department, have resources been deployed, as necessary to address the priority health needs identified in the community health needs assessment?

- Yes
- No
- Don't Know

22.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

23. In the past three (3) years in your jurisdiction, has the local public health department conducted an organizational self-assessment?

- Yes
- No
- Don't Know

23.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

24. For the jurisdiction served by your local public health department, are age-specific priority health needs effectively addressed through the provision of/or linkages to appropriate services?

- Yes
- No
- Don't Know

24.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

25. In the past three (3) years in your jurisdiction, has there been an instance in which the local public health department has failed to implement a mandated program or service?

- Yes
- No
- Don't Know

25.a. If No, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

26. For the jurisdiction served by your local public health department, have there been regular evaluations of the effect that public health services have on community health status?

- Yes
- No
- Don't Know

26.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

27. In the past three (3) years in your jurisdiction, has the local public health department used professionally recognized process and outcome measures to monitor programs and to redirect resources as appropriate?

- Yes
- No
- Don't Know

27.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

28. For the jurisdiction served by your local public health department, is the public regularly provided with information about current health status, health care needs, positive health behaviors, and health care policy issues?

- Yes
- No
- Don't Know

28.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

29. In the past year in your jurisdiction, has the local public health department provided reports to the media on a regular basis?

- Yes
- No
- Don't Know

29.a. If yes, how effective is this activity in meeting community needs within your jurisdiction?

- Meets no community needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

Section III: Part One: The following questions address informational resources capacity of your agency. Indicate your Local Public Health Department's level of awareness or activity for each of the following information technology areas. (select one response).

30. Website

Not Aware	Aware	Investigating or have investigated	Planning to implement	Have implemented

31. Electronic Health Records

Not Aware	Aware	Investigating or have investigated	Planning to implement	Have implemented

32. (Regional) Health Information Exchanges (HIE's or RHIOs)

Not Aware	Aware	Investigating or have investigated	Planning to implement	Have implemented

33. Use of Information Technology (IT) in the field (e.g., handhelds, laptops, tablet notebook

Not Aware	Aware	Investigating or have investigated	Planning to implement	Have implemented
○	○	○	○	○

34. Wireless access to Local Public Health Department network

Not Aware	Aware	Investigating or have investigated	Planning to implement	Have implemented
○	○	○	○	○

35. IT disaster recovery planning

Not Aware	Aware	Investigating or have investigated	Planning to implement	Have implemented
○	○	○	○	○

36. Geographic Information Systems

Not Aware	Aware	Investigating or have investigated	Planning to implement	Have Implemented
○	○	○	○	○

37. National Health IT data standards initiatives

Not Aware	Aware	Investigating or have investigated	Planning to implement	Have implemented
○	○	○	○	○

38. To what proportion of your staff do you provide Internet and email access?

- ○ We do not provide access
- ○ 1 - 24%
- ○ 25 - 50%
- ○ 51 - 75%
- ○ 76 - 99%
- ○ 100%

39. To what proportion of your staff do you provide training on how to use the internet and other electronic information systems to apply data and information to public health practice?

- ○ We do not provide training
- ○ 1 - 24%
- ○ 25 - 50%
- ○ 51 - 75%
- ○ 76 - 99%
- ○ 100%

Part Two: General Information Systems: Please select one response to each question. Then, for each "Yes" response, a second question is asked to determine how well you perceive your agency's effectiveness in performing the function noted.

40. The health department has a management information system that allows the analysis of administrative, demographic, epidemiologic, and utilization data to provide information for planning, administration, and evaluation.

- Yes
- No
- Don't Know

40.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

41. The local public health department has a plan for the introduction and/or expansion of computer-based systems

- Yes
- No
- Don't Know

41.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

42. The local public health department has a technical library of books and other publications relevant to its public health activities for immediate reference by its staff, and a method for keeping materials current.

- Yes
- No
- Don't Know

42.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

43. The local public health department annually compiles or updates a listing of health-related information systems and data bases maintained by units of government within its jurisdiction.

- Yes
- No
- Don't Know

43.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

44. The local public health department subscribes to an on-line, computer-based data system that provides direct access to health-related data or that has direct access to public health and population data compiled by state agencies.

- Yes
- No
- Don't Know

44.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

45. The local public health department maintains current information on federal data bases and information systems relevant to its programs

- Yes
- No
- Don't Know

45.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

Part Three: Data Collection, Processing and Maintenance: Please select one response to each question. Then, for each "Yes" response, a second question is asked to determine how well you perceive your agency's effectiveness in performing the function noted.

46. The local public health department staff has expertise and training to collect, manage, integrate, analyze, interpret, and display health-related data.

- Yes
- No
- Don't Know

46.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

47. The local public health department demonstrates an electronic linkage with local and statewide databases.

- Yes
- No
- Don't Know

47.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

48. The local public health department has a process and protocols in place to maintain a comprehensive collection, review, and analysis of data from a variety of reliable sources.

- Yes
- No
- Don't Know

48.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

49. The local public health department collects and reviews primary data (e.g., community surveys; disease reporting) and secondary data (e.g., state health department data, census data; hospital discharge data) from a variety of reliable sources.

- Yes
- No
- Don't Know

49.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

50. The local public health department contributes to and/or maintains a registry (e.g., log of all known events of certain types in the community—immunization; violence; communicable disease).

- Yes
- No
- Don't Know

50.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

Part Four: Integration of Data/Data Sharing with Community Partners: Please select one response to each question. Then, for each "Yes" response, a second question is asked to determine how well you perceive your agency's effectiveness in performing the function noted.

51. A written protocol to integrate data exists.

- Yes
- No
- Don't Know

51.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

52. The local public health department uses an electronic system to integrate assessment data from a variety of sources (e.g. database software).

- Yes
- No
- Don't Know

52.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

Part Five: Data Analysis: Please select one response to each question. Then, for each "Yes" response, a second question is asked to determine how well you perceive your agency's effectiveness in performing the function noted.

53. The local public health department has a process in place to analyze and identify patterns in data.

- Yes
- No
- Don't Know

53.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

54. The local public health department draws inferences from data to identify trends over time, health problems, environmental, health hazards, and social and economic conditions that adversely affect the public's health.

- Yes
- No
- Don't Know

54.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

55. The local public health department compares local data to other jurisdictions and/or the state or nation.

- Yes
- No
- Don't Know

55.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

56. The local public health department conducts gap analysis of the needs of populations who may encounter barriers to services.

- Yes
- No
- Don't Know

56.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

57. The local public health department makes data analysis usable to others.

- Yes
- No
- Don't Know

57.a. If yes, how effective is this activity in meeting agency needs?

- Meets no agency needs
- Meets some needs
- Meets half of the needs
- Meets most needs
- Meets all needs

Section IV: The following questions address specific infrastructure capacity issues of YOUR agency and cover your last THREE fiscal years.

58. Over your last THREE agency fiscal years, what was the AVERAGE number of Full-time Equivalent staff members (including yourself) working for your local public health department? (Please enter a number in the space below).

59. Of these, how many (including yourself) have formal (Master's degree level) training in a Public Health field (defined as a Master's level degree in Public Health, Public Health Nursing, Environmental Health Science, Health Education, or similarly related field)? (Please enter a number in the space below).

60. Over your last three agency fiscal years, how many employees separated from service in total (adding together each of the last three fiscal years)?

Access to Information

Some baseline information pertaining to your local public health department was collected as part of the IDPH Learning Management System (LMS). To save you time and to complete this assessment, this data will need to be reviewed. The data will be combined with other local public health department data and will remain confidential.

Will you allow access to this LMS data?

- Yes
- No

Would you like to receive a copy of the findings from this study?

- Yes
- No

To enable analysis of the financial resources capacity of local public health agencies, some fiscal information is needed. To save you time, a request will be made within the next two weeks for financial audit information. This data will allow for the completion of various ratios to determine the financial health of agencies in relation to other similar-sized agencies. This data is critical to making the case for the need for additional funding. All data is completely confidential and will not be shared with anyone. Your assistance and cooperation is most appreciated.

APPENDIX B

The Independent Variables by Strata, Descriptive Information and Summary Data and Rankings

The Independent Variables by Strata: LPHA Inputs (Resources)

Small Strata LPHAs

Human Resources

Descriptive Information

The Human Resources variable is described by the data provided in Table 1. This variable was comprised of three critical data elements: 1) the Core Competencies LPHA mean score provided through the IDPH Learning Management System. LPHA staff of each agency were required to conduct a self-assessment of confidence levels pertaining to multiple constructs noted as key public health competencies. This assessment was based on a five-point Likert scale ranging from 1=Not Confident to 5=Very Confident, 2) the LPHA 3-year average Retention Rate of staff (the reverse of the staff turnover rate) collected as part of the LPHA administrator survey, located in the Appendix, and 3) the proportion of LPHA staff having Master's degree level preparation in a public health field, also collected as part of the LPHA administrator survey. Shapiro-Wilk tests were conducted to determine if data were normally distributed.

TABLE B1: Human Resources, Small LPHAs

Critical Data Elements	**Mean**	**Median**	**Min – Max (Range)**
Public Health Core Competencies via IDPH Learning Mgmt System (5-point Likert Scale format)	3.53	3.62	2.76 – 4.01 (1.25)
LPHA Retention Rate (Turnover Rate)	90.10%	93.73%	60.0 - 96.7% (36.7)
LPHA % Master's Prepared Staff	7.52%	7.11%	0 – 21.4% (21.4)

Overall, retention rates as a whole appear to be high, perhaps reflective of the general economy at the time of data collection.

Summary Data and Rankings

For each of the independent variables, ratios were calculated to standardize the data and allow for comparisons across variables. The ratios were calculated by using the raw score for each critical data element and dividing by the highest raw score for that element in the strata. The best raw score in the strata would receive a 1.0, and every other LPHA in the strata would then receive a proportion of 1.0. Using this methodology, summary tables were produced for each of the 4 independent variables of analysis.

The Human Resources variable for small strata LPHAs is analyzed by the data provided as part of Table B2. This data includes ratios for each LPHA in relation to other LPHAs within the same strata, utilizing all critical data elements comprising that variable. These critical data elements were then summed together and divided by 3 to arrive at a total strata ratio average for the Human Resources variable. This ratio average was then used to rank all LPHAs in each strata and across the state overall. In review of the small strata Human Resources variable, there are several noteworthy items.

TABLE B2: Independent Variable Summary Table: Human Resources, Small LPHAs

Public Health Agency	Learning Management System	Proportion of Staff with Master's Trng.	Retention (Turnover) Rate	Total Strata Ratio Avg.	Rank
	Raw Avg/ Strata Ratio(rank)	*Raw Avg/ Strata Ratio(rank)*	*Raw Avg/ Strata Ratio(rank)*		
1	3.81/.950(3)	11.43/.533(3)	92.38/.956(6)	.813	3
2	3.71/.925(4)	5.88/.274(6)	94.10/.973(4)	.724	6
3	4.01/1.00(1)	8.33/.389(5)	88.89/.920(8)	.769	5
4	3.58/.893(7)	16.67/.778(2)	90.74/.939(7)	.870	2
5	3.88/.967(2)	.00/.000(9)	95.00/.983(2)	.650	10
6	3.67/.922(5)	21.43/1.00(1)	85.71/.887(9)	.936	1
7	3.13/.781(11)	4.00/.187(7)	60.00/.621(10)	.529	12
8	3.54/.884(8)	1.54/.072(8)	96.67/1.00(1)	.652	9
9	3.23/.807(10)	.00/.000(9)	95.00/.983(2)	.596	11
10	3.37/.841(9)	11.11/.518(4)	94.44/.977(3)	.779	4
11	2.76/.688(12)	8.33/.389(5)	94.44/.977(3)	.685	7
12	3.67/.915(6)	1.54/.072(8)	93.85/.971(5)	.653	8

For example, ranking the three critical data elements making up the Human Resources variable construct indicate the LPHA that may be the best performer on one data element may not necessarily rank well over the total variable. For example, the LPHA having the highest competency score via the Learning Management System, ranked just 5th in the proportion of staff with Master's level training in a public health field, and 8th overall in their ability to retain staff. Of important note, however, is that high performance on one key element, the proportion of staff with Master's level training in a public health field, ensured high rank overall. Although there were a few ties in this key element, the top six ranking LPHAs were the same order six overall in the variable as a whole. Although this could be indicative of a higher order correlation, it may also reflect a broader skew in this critical data element. Since our ratios are calculated based on a proportion of the top score, if one LPHA is not close to the top score, the ratio could be only a fraction. For example, just under 6% of LPHA #2 staff are Master's prepared

compared to over 21% of the top performing LPHA. The ratio for LPHA #2 then is calculated at .27, only a small fraction of the 1.00 of the top performer, a meaningful difference. The other two critical data elements making up this variable had LPHA raw scores that were grouped closer to the top performer, indicating that there wasn't much difference between the top performer and other LPHAs within the strata.

Organizational Resources

Descriptive Information

The small strata Organizational Resources variable is summarized by the data provided in Table B3. This variable was measured utilizing the Brown, et al., (2008) instrument included as part of the LPHA administrator survey located in Appendix A. This 9-item instrument was designed to measure how collaborative community organizations are with regard to prevention-specific activities commonly found in LPHAs. The instrument is based on a 4-point Likert scale format with a range of possibilities that includes strongly disagree, somewhat disagree, somewhat agree, and strongly agree. Eight of the 9 survey items were worded positively, with one item requiring reverse scoring. Survey items addressed varying degrees of collaborativeness ranging from participating in "a network of people concerned about prevention issues who stay in touch with each other" to "organizations in my community share money or personnel when addressing prevention issues". Shapiro-Wilk normality tests indicated that the data for small strata LPHAs were normally distributed.

TABLE B3: Organizational Resources, Small LPHAs

Critical Data Elements	Mean	Median	Min – Max (Range)
9 Items included as part of Administrator Survey (4-point Likert Scale format)	3.06	3.06	2.44 – 3.67 (1.22)

Among small strata LPHAs, the mean score was 3.06 per item, indicating near somewhat agreement that small strata LPHAs are collaborative in their approach to prevention. Small strata LPHA totals for the 9 items ranged in raw score from 22.0 to 33.0 with a mean of 27.5 (or 3.06 per item), indicating that, on average, small strata LPHA administrators rated their effectiveness in performing collaboration related activities at 76% of the maximum possible score that would be obtained if all activities were performed at levels fully meeting community needs. Responses were used to summarize the data by strata. The mean scores for each item were divided by the maximum possible to calculate percentages.

Of the 9 collaborative activities noted by these measures, performance by small strata LPHAs, ranged from 61% to 92%, with an average of 76% of these activities being fulfilled by small strata LPHAs. Of the nine items, among small strata LPHAs, the collaborative activities with the highest scores included agreement that organizations in the community participate in joint meetings to address prevention issues (84%), that there is a network of people concerned about prevention issues who stay in touch with each other (82%), that community agencies work together to address problems with prevention strategies (80%), and that organizations in the community share information with each other about prevention issues (80%). In contrast, the collaborative activities with the

lowest scores indicated disagreement that organizations in the community share money and personnel when addressing prevention issues (55%), and that each organization in the community has a clearly defined role in carrying out the community's prevention plan (68%).

Summary Data and Rankings

The small strata Organizational Resources variable is analyzed by the data provided as part of Table B4. This data includes strata ratios for each LPHA in relation to other LPHAs within the same strata. In this case, LPHA administrator responses to 9 survey items were summed and then averaged. Strata ratios were developed using the same methodology as previously noted. This strata ratio average was then used to rank all LPHAs in each strata.

TABLE B4: Independent Variable Summary Table: Organizational Resources, Small LPHAs

Public Health Agency	Raw Score Avg.	Strata Ratio	Rank
1	3.00	.817	7
2	3.33	.908	4
3	2.78	.757	9
4	3.44	.939	3
5	2.89	.787	8
6	3.11	.848	6
7	2.56	.696	11
8	3.56	.969	2
9	3.22	.878	5
10	2.67	.727	10
11	2.44	.666	12
12	3.67	1.000	1

Informational Resources

Descriptive Information

The Informational Resources variable is summarized by the data provided as part of Table B5. This variable was comprised of 4 critical data elements as follows: 1) General Information Systems; 2) Data Collection, Processing, and Maintenance; 3) Integration of Data/Data Sharing with Community Partners; and 4) Data Analysis. Altogether, 18 items were included in the LPHA administrator survey to measure performance of information capacity. Each item included a Yes/No/Don't Know response scale, followed by a follow-up question provided after each affirmative response to measure perceived effectiveness. This follow-up question was scaled using a 5-point Likert scale with 1=meets no agency need, 2= meets some needs, 3= meets half of the needs, 4=meets most needs, and 5=meets all needs. A "no" response was scored as=0. Only the follow-up question responses were scored and analyzed. Shapiro-Wilk tests of the data elements in the small strata indicated that all elements were normally distributed with the exception of Integration of Data/Data Sharing.

TABLE B5: Informational Resources, Small LPHAs

Critical Data Elements	Maximum Possible Score/item	Obtained Item Score Low – High	Mean Item Score	Median Item Score	% of Max Possible Score
Based on 18 items included In the Administrator Survey (5-point Likert Scale format)					
General Information Systems (6 items)	6.0	0 – 3.17	1.76	1.75	29%
Data Collection, Processing, & Maintenance (5 items)	6.0	0 – 4.00	2.62	2.60	44%
Integration of Data/Data Sharing (2 items)	6.0	0 – 2.00	.29	0.00	5%
Data Analysis (5 items)	6.0	0 – 4.00	2.12	2.40	35%

For the purposes of analyses, the Yes responses were used to summarize the data by strata. A Yes response would indicate fulfillment of the resource activity noted by the survey item. Of the 18 informational resources activities noted by these measures, performance by small strata LPHAs ranged from 33% to 83%, with an average of 62% of these activities being fulfilled by small strata LPHAs. These numbers included just 8.3% of small strata LPHAs fulfilling performance of the Integration of Data/Data Sharing with Community Partners activities, 61.7% of small strata LPHAs fulfilling performance of the Data Analysis activities, 66.7% of small strata LPHAs fulfilling performance of the General Information Systems activities, and 85% of small strata LPHAs fulfilling performance of the Data Collection, Processing, and Maintenance activities, The activity types most likely to be available in these jurisdictions included LPHA review of primary and secondary data from reliable sources (100%), the LPHA contributing to and/or

maintaining a registry of important public health events (100%), and the LPHA comparing local data to other jurisdictions and/or the state or nation. In contrast, the activities least likely to be performed include having a written protocol to integrate data (0%), the LPHA annually compiling a listing of health-related information systems and data bases maintained by units of government within its jurisdiction (8.3%), the LPHA using an electronic system to integrate assessment data from various sources (16.7%), and the LPHA having a process in place to analyze and identify patterns in data (33.3%).

Summary Data and Rankings

This variable is analyzed by the data located in Table B6. This data includes ratios for each LPHA in relation to other LPHAs within the same strata utilizing all four critical data elements comprising this variable. In this case, each of the survey item raw score responses making up the four data elements were summed and then divided by the total number of survey items measuring that data element to produce an average raw score for each of the four data elements. The average raw scores for each data element were then summed together, and averaged by dividing by 4, the number of data elements making up the variable. This mean of means was then used to produce a final strata ratio for the variable. This ratio average was then used to rank all LPHAs in each strata overall. Strata ratios were also produced for each data element for review purposes, but these ratios did not figure into the total strata ratio for the variable overall.

TABLE B6: Independent Variable Summary Table: Informational Resources, Small LPHAs

Public Health Agency	Gen. Info. Systems	Data Collect., Process., Main.	Integration of Data/ Data Sharing	Data Analysis	Total Strata Ratio	Rank
	Raw Avg/ Strata Ratio (Rank)	*Raw Avg/ Strata Ratio (Rank)*	*Raw Avg/ Strata Ratio (Rank)*	*Raw Avg/ Strata Ratio (Rank)*		
1	1.50/.473(7)	3.20/.800(3)	.00/.000(3)	2.40/.600(5)	.594	7
2	1.50/.473(7)	2.40/.600(5)	.00/.000(3)	.40/.100(10)	.360	9
3	2.00/.631(4)	2.80/.700(4)	1.50/.750(2)	2.40/.600(6)	.727	4
4	1.33/.421(8)	1.60/.400(7)	.00/.000(3)	1.20/.300(8)	.346	10
5	.67/.210(9)	1.80/.450(6)	.00/.000(3)	3.00/.750(3)	.457	8
6	3.17/1.00(1)	4.00/1.00(1)	2.00/1.00(1)	2.80/.700(4)	1.00	1
7	.00/.000(10)	1.20/.300(8)	.00/.000(3)	1.20/.300(8)	.201	12
8	2.00/.631(4)	3.80/.950(2)	.00/.000(3)	1.60/.400(7)	.619	6
9	1.83/.578(5)	3.80/.950(2)	.00/.000(3)	3.20/.800(2)	.739	3
10	2.50/.789(3)	3.20/.800(3)	.00/.000(3)	4.00/1.00(1)	.811	2
11	1.67/.526(6)	1.20/.300(8)	.00/.000(3)	.80/.200(9)	.307	11
12	3.00/.946(2)	2.40/.600(5)	.00/.000(3)	2.40/.600(6)	.652	5

While only raw score averages were used to calculate the final strata ratio for this variable, the four critical data element ratios provide additional information for review purposes. Within small strata LPHAs, the distribution of data shows a broader range of scores separating top performers from lesser performers for each of the critical data elements making up this variable. In review of rankings for small strata LPHAs, it appears that the top performers overall were very consistent in performance across all critical data elements forming the variable.

Fiscal Resources

Descriptive Information

The Fiscal Resources variable is summarized by the data provided as part of Tables B7. This variable was comprised of 4 critical data elements as follows: 1) Per capita public health expenditures. This indicator was computed by taking the 3-year

average LPHA expenditures and dividing by the 3-year average population, 2) Growth in revenue as a percent of total budget. This data element is noted in the literature as an indicator of profitability, providing feedback as to whether the LPHA has improved their ability to expand revenue over time, 3) Profit margin. This indicator is provided as an indicator of financial distress and defined as total revenue minus total expenses divided by total revenue, and 4) Days cash on hand. This data element is provided as an indication of the LPHAs liquidity/solvency and is expressed in terms of how many months the LPHA could pay expenses with the amount of short-term cash and cash equivalents they have available. Shapiro-Wilk tests for normality indicated that of these critical data elements, the indicator for Per Capita Public Health Expenditures was not normally distributed and positively skewed due to several agencies experiencing high expenditures. This is noted in that the range for this data element went from a low of $18.50 per capita, to a high of $240.05 per capita while the median was $43.09.

TABLE B7: Fiscal Resources, Small LPHAs

Critical Data Elements	**Mean**	**Median**	**Min – Max (Range)**
Per Capita Public Health Expenditures	$77.19	$43.09	$18.50- 240.05 (221.55)
Growth in Revenue as a Percent of Total Budget	5.98%	7.43%	-23.20% - 35.92 (59.12)
Profit Margin	2.58%	5.31%	-8.26% - 13.41 (21.67)
Days Cash on Hand	3.83 (months)	3.51	.76 – 8.50 (7.74)

Both Growth in Revenue and Profit Margin, expressed as percents, were positive showing that although modest, LPHAs within this strata were able to expand revenue over time and remain profitable.

Perhaps one of the more noteworthy findings for small strata LPHAs is the disparate differences that exist in the Per Capita Public Health Expenditures data element. This disparity is greatest among the small strata LPHAs, and creates clear distinction between top performers and lesser performers in calculation of the strata ratio. Such a wide skew in raw scores contributes to this data element being non-normally distributed.

Summary Data and Rankings

The Fiscal Resources variable is analyzed by the data provided as part of Table B8. This data includes strata ratios for each LPHA in relation to other LPHAs within the same strata utilizing the 4 critical data elements comprising this variable.

TABLE B8: Independent Variable Summary Table: Fiscal Resources, Small LPHAs

Public Health Agency	Per Capita Public Hlth Expenditures	Growth in Revenue as % of total budget	Profit Margin	Days Cash on Hand (months)	Total Strata Ratio Avg.	Rank
	Raw Score/ Strata Ratio (Rank)	*Raw Score/ Strata Ratio (Rank)*	*Raw Score/ Strata Ratio (Rank)*	*Raw Score/ Strata Ratio (Rank)*		
1	$49.37/.206(5)	12.25%/.341(5)	-2.12%/-.158(9)	2.02/.238(10)	.157	7
2	$37.36/.156(9)	-14.59%/-.406(10)	-8.26%/-.616(12)	2.76/.324(9)	-.136	11
3	$63.95/.266(4)	3.59%/.100(9)	-1.12%/-.083(8)	.76/.089(12)	.093	8
4	$42.54/.177(7)	-14.72%/-.410(11)	-7.89%/-.588(11)	3.24/.381(7)	-.110	10
5	$26.14/.109(11)	8.30%/.231(6)	8.00%/.597(3)	4.88/.573(4)	.378	6
6	$38.21/.159(8)	3.94%/.110(8)	5.67%/.423(6)	8.50/1.00(1)	.423	4
7	$195.69/.815(2)	14.77%/.411(4)	7.12%/.531(4)	1.07/.126(11)	.471	3
8	$136.75/.570(3)	6.55%/.182(7)	5.78%/.431(5)	3.78/.444(6)	.407	5
9	$43.63/.182(6)	-23.20%/-.646(12)	-6.43%/-.480(10)	5.30/.623(3)	-.080	9
10	$34.09/.142(10)	35.92%/1.00(1)	13.41%/1.00(1)	4.12/.485(5)	.657	2
11	$18.50/.077(12)	15.08%/.420(3)	4.95%/.369(7)	6.49/.763(2)	.407	5
12	$240.05/1.00(1)	23.90%/.665(2)	11.85%/.883(2)	3.01/.354(8)	.726	1

One obvious difference in strata ratios for the critical data elements making up this variable is that for the first time ratios are observed as negative proportions. With some data elements in the fiscal variable expressed as percents (such as Growth in Revenue as a Percent of Total Budget and Profit Margin), a negative value would indicate that the LPHA had a loss in revenue over time or had a negative profit margin indicative of total expenses greater than total revenues.

While the three highest performing small strata LPHAs in Per Capita Public Health Expenditures rank amongst the top 5 LPHAs in this variable overall, the 4th best performing LPHA in this data element ranks just 8th overall, indicating that other fiscal factors play an influential role as well. For example, the top 4 small strata performers in Growth in Revenue as a Percent of Total Budget are represented in the top five performers in the variable overall, and the top 5 small strata performers in Profit Margin

are represented in the top six performers in the variable overall, indicative of how important these data elements are in explaining performance of this variable overall.

Medium Strata LPHAs

Human Resources

Descriptive Information

The Human Resources variable for Medium Strata LPHAs is described in Table B9. Shapiro-Wilk tests were conducted to determine if data were normally distributed. Competency scores and Retention Rate data are normally distributed in this distribution, but the data pertaining to the proportion of staff being Master's prepared is not normally distributed.

TABLE B9: Human Resources, Medium LPHAs

Critical Data Elements	**Mean**	**Median**	**Min – Max (Range)**
Public Health Core Competencies via IDPH Learning Mgmt System (5-point Likert Scale format)	3.46	3.49	2.98 – 3.90 (.92)
LPHA Retention Rate (Turnover Rate)	90.51%	89.82%	80.4 – 99.0% (18.6)
LPHA % Master's Prepared Staff	7.98%	6.11%	0 – 26.0% (26.0)

Descriptive information pertaining to the Human Resources variable for medium strata LPHAs are similar to those for smaller strata LPHAs.

Summary Data and Rankings

The Human Resources variable for medium strata LPHAs is analyzed by the data provided as part of Table B10. Upon examination of this variable for medium strata LPHAs, a different trend emerges.

TABLE B10: Independent Variable Summary Table: Human Resources, Medium LPHAs

Public Health Agency	Learning Management System	Proportion of Staff with Master's Trng.	Retention (Turnover) Rate	Total Strata Ratio Avg.	Rank
	Raw Score/ Strata Ratio(rank)	*Raw Score/ Strata Ratio(rank)*	*Raw Score/ Strata Ratio(rank)*		
13	3.70/.948(4)	11.76/.453(4)	80.40/.812(18)	.738	6
14	3.90/1.00(1)	2.86/.110(14)	99.00/1.00(1)	.703	7
15	2.98/.763(18)	3.85/.148(13)	87.18/.881(13)	.597	18
16	3.28/.842(14)	1.11/.043(17)	97.41/.984(3)	.623	15
17	3.65/.936(5)	.00/.000(18)	85.50/.864(14)	.600	17
18	3.23/.828(15)	5.48/.211(11)	95.43/.964(5)	.668	10
19	3.76/.965(2)	11.11/.428(5)	90.74/.917(9)	.770	3
20	3.42/.876(11)	2.00/.077(15)	96.67/.976(4)	.643	13
21	3.55/.909(9)	7.14/.275(8)	88.10/.890(11)	.691	9
22	3.70/.950(3)	23.08/.889(2)	98.08/.991(2)	.943	1
23	3.29/.844(13)	6.67/.257(9)	88.89/.898(10)	.666	11
24	3.56/.912(8)	10.91/.420(6)	95.15/.961(6)	.764	4
25	3.20/.820(16)	1.79/.069(16)	94.60/.956(7)	.615	16
26	3.44/.883(10)	4.00/.154(12)	88.00/.889(12)	.642	14
27	3.39/.868(12)	12.00/.462(3)	92.00/.929(8)	.753	5
28	3.64/.934(6)	5.56/.214(10)	81.50/.823(17)	.657	12
29	3.57/.916(7)	8.33/.321(7)	85.42/.863(15)	.700	8
30	3.02/.774(17)	25.97/1.00(1)	85.10/.860(16)	.878	2

In this example, the top performer overall for the complete variable did not receive the top ratio for any of the 3 critical data elements making up the variable, yet was consistently high in all of the elements, ranking 3rd among the Learning Management System Competency Scores, 2nd among the Proportion of Staff Master's Prepared, and 2nd among the Staff Retention (turnover) Rate. Again, the top six performers with regard to the Proportion of Staff with Master's Training data element retained varying positions

amongst the top 6 performers overall for the complete variable. Reliability and consistency across all data elements weighs favorably in review of medium strata LPHAs. In many cases, it isn't enough to do just one thing well within these variables, consistent performance is necessary to rank highly among their peer group, a trend that becomes even more noticeable as we review statewide data.

Organizational Resources

Descriptive Information

The medium strata Organizational Resources variable is summarized by the data provided in Table B11. Shapiro-Wilk normality tests indicated that the data for medium strata LPHAs were not normally distributed. Much like the small strata LPHAs, the medium strata LPHAs also seem equally collaborative, with a mean score of 3.10 per item (out of 4.0) and a median of 2.89 across the 18 medium-sized agencies.

TABLE B11: Organizational Resources, Medium LPHAs

Critical Data Elements	**Mean**	**Median**	**Min – Max (Range)**
9 Items included as part of Administrator Survey (4-point Likert Scale format)	3.10	2.89	2.56 – 4.00 (1.44)

Medium strata LPHA totals for the 9 items ranged in raw score from 23.0 to 36.0 with a mean of 27.9, indicating that, on average, small strata LPHA administrators rated their effectiveness in performing collaboration related activities at 78% of the maximum possible score that would be obtained if all activities were performed at levels fully meeting community needs.

Of the 9 collaborative activities noted by these measures, performance by medium strata LPHAs, ranged from 64% to 100%, with an average of 77% of these activities being fulfilled by medium strata LPHAs. Of the nine items, among medium strata LPHAs, the collaborative activities with the highest scores included agreement that organizations in the community participate in joint meetings to address prevention issues (86%), that organizations in the community share information with each other about prevention issues (86%), that there is a network of people concerned about prevention issues who stay in touch with each other (82%), and that community agencies work together to address problems with prevention strategies (82%). In contrast, the collaborative activities with the lowest scores indicated disagreement that organizations in the community share money and personnel when addressing prevention issues (58%), and that each organization in the community has a clearly defined role in carrying out the community's prevention plan (67%).

Summary Data and Rankings

The medium strata Organizational Resources variable is analyzed by the data provided as part of Table B12.

TABLE B12: Independent Variable Summary Table: Organizational Resources, Medium LPHAs

Public Health Agency	Raw Score Avg.	Strata Ratio	Rank
13	3.00	.750	7
14	3.89	.972	2
15	2.78	.694	9
16	3.11	.778	6
17	2.67	.667	10
18	2.78	.694	9
19	2.67	.667	10
20	3.44	.861	5
21	2.56	.639	11
22	2.89	.722	8
23	2.78	.694	9
24	4.00	1.000	1
25	3.68	.917	4
26	3.11	.778	6
27	2.89	.722	8
28	2.89	.722	8
29	3.78	.944	3
30	2.89	.722	8

Informational Resources

Descriptive Information

The medium strata Informational Resources variable is summarized by the data provided as part of Table B13. For the purposes of analyses, the Yes responses were used to summarize the data by strata. Shapiro-Wilk tests of the data elements in the medium strata indicated that the General Information Systems and Integration of Data/Data Sharing distributions were not normally distributed.

TABLE B13: Informational Resources, Medium LPHAs

Critical Data Elements	Maximum Possible Score/item	Obtained Item Score Low – High	Mean Item Score	Median Item Score	% of Max Possible Score
Based on 18 items included In the Administrator Survey (5-point Likert Scale format)					
General Information Systems (6 items)	6.0	0 – 3.83	1.32	.83	22%
Data Collection, Processing, & Maintenance (5 items)	6.0	0 – 4.20	2.38	2.30	40%
Integration of Data/Data Sharing (2 items)	6.0	0 – 4.00	.47	0.00	8%
Data Analysis (5 items)	6.0	0 – 4.00	2.02	1.80	34%

Of the 18 informational resources activities noted by the measures included in the administrator survey, performance by medium strata LPHAs ranged from 11% to 100%, with an average of 57% of these activities being fulfilled by medium strata LPHAs. These numbers included just 13.9% of LPHAs fulfilling performance of the Integration of Data/Data Sharing with Community Partners activities, 42.6% of LPHAs fulfilling performance of the General Information Systems activities, 73.3% fulfilling performance of the Data Analysis activities, and 75.6% of LPHAs fulfilling performance of the Data Collection, Processing, and Maintenance activities. The activity types most likely to be available in these medium strata jurisdictions included LPHA review of primary and secondary data from reliable sources (100%), LPHA staff having the expertise and training to collect, manage, integrate, analyze, interpret and display health-related data

(94.4%), the LPHA drawing inferences from data to identify trends that adversely affect the public's health (94.4%), and the LPHA comparing local data to other jurisdictions and/or the state or nation (94.4%). In contrast, the activities least likely to be performed include the LPHA annually compiling a listing of health-related information systems and data bases maintained by units of government within its jurisdiction (5.6%), having a written protocol to integrate data (5.6%), the LPSA having a process and protocols in place to maintain a comprehensive collection, review, and analysis of data from a variety of sources (22.2%), and the LPHA using an electronic system to integrate assessment data from various sources (22.2%).

Summary Data and Rankings

The medium strata Informational Resources variable is summarized by the data located in Table B14.

TABLE B14: Independent Variable Summary Table: Informational Resources, Medium LPHAs

Public Health Agency	Gen. Info. Systems	Data Collect., Process., Main.	Integration of Data/ Data Sharing	Data Analysis	Total Strata Ratio	Rank
	RawAvg/ Strata Ratio (Rank)	*Raw Avg/ Strata Ratio (Rank)*	*Raw Avg/ Strata Ratio (Rank)*	*Raw Avg/ Strata Ratio (Rank)*		
13	3.33/.870(2)	4.00/.952(2)	.00/.000(5)	4.00/1.00(1)	.707	2
14	2.33/.609(4)	2.80/.667(5)	.00/.000(5)	2.80/.700(3)	.495	4
15	.67/.174(10)	3.20/.762(3)	2.00/.500(2)	2.00/.500(6)	.490	5
16	.33/.087(11)	1.60/.381(10)	.00/.000(5)	.80/.200(10)	.170	16
17	.67/.174(10)	.80/.190(11)	.00/.000(5)	.00/.000(11)	.091	18
18	.67/.174(10)	2.60/.619(6)	.00/.000(5)	2.80/.700(3)	.378	7
19	1.33/.348(7)	1.60/.381(10)	.00/.000(5)	1.60/.400(7)	.283	13
20	2.50/.653(3)	2.00/.476(9)	.00/.000(5)	2.20/.550(5)	.418	6
21	1.17/.305(8)	3.00/.714(4)	1.50/.375(3)	3.20/.800(2)	.553	3
22	2.00/.522(5)	2.40/.571(7)	.00/.000(5)	1.40/.350(8)	.362	8
23	1.83/.479(6)	2.20/.524(8)	.00/.000(5)	1.60/.400(7)	.351	9
24	1.00/.261(9)	1.60/.381(10)	1.00/.250(4)	2.00/.500(6)	.349	10
25	.67/.174(10)	1.60/.381(10)	.00/.000(5)	1.20/.300(9)	.216	15
26	.00/.000(11)	.80/.190(11)	.00/.000(5)	1.60/.400(7)	.150	17
27	.67/.174(10)	3.20/.762(3)	.00/.000(5)	1.20/.300(9)	.316	12
28	.67/.174(10)	2.20/.524(8)	.00/.000(5)	1.60/.400(7)	.278	14
29	.00/.000(11)	3.00/.714(4)	.00/.000(5)	2.40/.600(4)	.337	11
30	3.83/1.00(1)	4.20/1.00(1)	4.00/1.00(1)	4.00/1.00(1)	1.00	1

Among medium strata LPHA, excluding the top performer (who received the top scores in each of the four critical data elements), there seemed to be a range of performance for each data element amongst the other top performers in the strata. For example, the 3rd best performer overall, LPHA #21, ranked just 8th in the General Information Systems data element, and the 5th best performer overall ranked just 10th on this same data element. Also, under closer scrutiny, it appears that the Data Collection, Processing, and Maintenance data element seemed to ensure performance overall with the top 5 performers in this data element ranking as the top 5 performers across the overall

variable. This may be indicative of a higher order collaboration between this data element and variable performance.

Fiscal Resources

Descriptive Information

The medium strata Fiscal Resources variable is summarized by the data provided as part of Table B15. Shapiro-Wilk tests for normality indicated that all of the critical data elements amongst the medium strata LPHAs, except the indicator for Per Capita Public Health Expenditures were normally distributed.

TABLE B15: Fiscal Resources, Medium LPHAs

Critical Data Elements	**Mean**	**Median**	**Min – Max (Range)**
Per Capita Public Health Expenditures	$44.78	$38.35	$17.59 - 130.53 (112.94)
Growth in Revenue as a Percent of Total Budget	8.43%	5.30%	-9.58% - 34.64 (44.22)
Profit Margin	.61%	-.46%	-28.21% - 36.95 (65.16)
Days Cash on Hand	2.55 (months)	2.34	.006 – 7.07 (7.06)

The values for the Per Capita Public Health Expenditures statistic range from $17.59 per capita to $130.53. Although LPHAs in this strata were able to grow revenue over time greater than the smaller agencies, their profitability (an indicator taking into account the agency expenses as well as revenue) was less. The medium strata LPHAs also had less cash on hand, having only enough cash to pay expenses for roughly 2.5 months on average.

Summary Data and Rankings

The medium strata Fiscal Resources variable is analyzed by the data provided as part of Table B16.

TABLE B16: Independent Variable Summary Table: Fiscal Resources, Medium LPHAs

Public Health Agency	Per Capita Public Hlth Expenditures	Growth in Revenue as % of total budget	Profit Margin	Days Cash on Hand (months)	Total Strata Ratio Avg.	Rank
	Raw Score/ Strata Ratio (Rank)	*Raw Score/ Strata Ratio (Rank)*	*Raw Score/ Strata Ratio (Rank)*	*Raw Score/ Strata Ratio (Rank)*		
13	$24.66/.189(15)	.38%/.011(14)	-3.56%/-.096(14)	.49/.069(15)	.043	16
14	$87.03/.667(2)	28.48%/.822(3)	11.54%/.312(3)	1.90/.269(11)	.517	3
15	$37.88/.290(10)	.47%/.014(13)	-1.15%/-.031(10)	2.30/.326(10)	.150	11
16	$38.83/.297(9)	9.94%/.287(7)	.23%/.006(9)	2.37/.335(9)	.232	10
17	$130.53/1.00(1)	-1.13%/-.033(15)	-1.36%/-.037(11)	.55/.078(14)	.252	9
18	$31.69/.243(11)	3.84%/.111(10)	-2.56%/-.069(13)	.01/.001(18)	.071	15
19	$20.73/.159(16)	-4.11%/-.119(17)	-28.21%/-.764(18)	2.71/.383(8)	-.085	18
20	$51.20/.392(6)	14.48%/.418(5)	2.33%/.063(7)	2.83/.400(6)	.318	6
21	$41.58/.319(8)	34.64%/1.00(1)	8.35%/.226(5)	.08/.012(17)	.389	4
22	$46.66/.357(7)	6.76%/.195(9)	-8.54%-.231(15)	1.32/.186(13)	.127	12
23	$28.42/.218(13)	10.17%/.294(6)	2.10%/.057(8)	5.89/.833(2)	.350	5
24	$64.20/.492(3)	9.13%/.264(8)	3.54%/.096(6)	2.72/.384(7)	.309	7
25	$31.74/.243(12)	15.96%/.461(4)	13.64%/.369(2)	7.07/1.00(1)	.518	2
26	$54.79/.420(4)	1.94%/.056(11)	-1.57%/-.042(12)	4.23/.598(4)	.258	8
27	$27.77/.213(14)	-1.28%/-.037(16)	-18.11%/-.490(17)	.37/.052(16)	-.066	17
28	$18.46/.141(17)	-9.58%/-.276(18)	9.11%/.246(4)	1.78/.252(12)	.091	13
29	$52.22/.400(5)	30.78%/.889(2)	36.95%/1.00(1)	5.80/.821(3)	.777	1
30	$17.59/.135(18)	.92%/.027(12)	-11.69%/-.316(16)	3.51/.497(5)	.085	14

While there remains disparity amongst lowest to highest performing LPHAs in terms of Per Capita Public Health Expenditures, these disparities are not as broad amongst medium strata LPHAs when compared to small strata LPHAs. Perhaps not surprisingly of this particular data element is that it becomes more noticeable that as population grows, the median Per Capita Expenditure goes down. It appears as well that, when reviewing medium strata LPHAs, this data element's effect on the variable as a

whole has decreased, with the top performing Per Capita Expenditure LPHA ranking just 9th in the overall variable and only two of the top 5 performing Per Capita Expenditure LPHAs ranking in the top five for the Fiscal Resources variable overall.

Four of the top 5 performing medium strata LPHAs in terms of Profit Margin rank amongst the top 5 performing LPHAs for the Fiscal Resources variable overall, making this data element a very influential part in performance overall. Just 3 of the top 5 performing medium strata LPHAs in terms of Days Cash on Hand rank amongst the top 5 performing LPHAs for the Fiscal Resources variable overall.

Large Strata LPHAs

Human Resources

Descriptive Information

The large strata Human Resources variable is described located in Table B17.

TABLE B17: Human Resources, Large LPHAs

Critical Data Elements	**Mean**	**Median**	**Min – Max (Range)**
Public Health Core Competencies via IDPH Learning Mgmt System (5-point Likert Scale format)	3.42	3.46	2.40 – 3.97 (1.57)
LPHA Retention Rate (Turnover Rate)	88.18%	86.50%	77.5 - 96.8% (19.3)
LPHA % Master's Prepared Staff	10.45%	7.05%	.83 – 38.9% (38.1)

Similar to the medium LPHA strata, the large strata LPHA Competency scores and Retention Rate data are normally distributed. The proportion of Master's prepared staff indicator, however, represents a negatively skewed distribution.

Summary Data and Rankings

The large strata Human Resources variable is presented in Table B18.

TABLE B18: Independent Variable Summary Table: Human Resources, Large LPHAs

Public Health Agency	Learning Management System	Proportion of Staff with Master's Trng.	Retention (Turnover) Rate	Total Strata Ratio Avg.	Rank
	Raw Score/ Strata Ratio(rank)	*Raw Score/ Strata Ratio(rank)*	*Raw Score/ Strata Ratio(rank)*		
31	2.82/.710(12)	7.05/.181(7)	85.20/.880(10)	.590	10
32	3.43/.864(9)	18.46/.475(3)	89.74/.927(5)	.755	3
33	3.46/.872(7)	8.11/.208(6)	96.85/1.00(1)	.693	5
34	3.52/.886(6)	38.89/1.00(1)	96.30/.994(2)	.960	1
35	3.44/.867(8)	6.36/.164(9)	86.36/.892(8)	.641	7
36	3.30/.831(11)	6.76/.174(8)	77.50/.800(13)	.602	9
37	3.97/1.00(1)	2.88/.074(10)	83.00/.857(11)	.644	6
38	3.56/.897(5)	8.57/.220(5)	95.24/.983(3)	.700	4
39	3.31/.833(10)	.93/.024(12)	86.50/.893(7)	.583	11
40	3.85/.969(2)	15.38/.396(4)	87.18/.900(6)	.755	3
41	3.84/.967(3)	1.65/.043(11)	82.40/.851(12)	.620	8
42	3.56/.897(4)	20.00/.514(2)	85.71/.885(9)	.765	2
43	2.40/.604(13)	.83/.021(13)	94.40/.975(4)	.534	12

In review of the Human Resource variable data pertaining to large LPHAs, we note that performance pertaining to the Proportion of Staff with Master's Training data element seems to relate well to performance over the complete variable. In this case, the top 6 performers in the Proportion of Staff with Master's Training were the same top 6 performers overall. Across all strata, some important considerations have emerged. For example, retention rates are considerably higher than expected, possibly as a result of the weakening economy overall. Also, the percent of LPHA staff with Master's degrees in a

public health field is considerably low, yet consistent with findings reported in Turnock (2001).

Organizational Resources

Descriptive Information

The large strata Organizational Resources variable is described in Table B19. Shapiro-Wilk normality tests indicated that the data for large strata LPHAs were not normally distributed and negatively skewed. Much like the small and medium strata LPHAs, the large strata LPHAs also seem equally collaborative based on the activities noted in the administrator survey, with a mean score of 3.09 and a median of 3.11 across the 13 large-sized agencies.

TABLE B19: Organizational Resources, Large LPHAs

Critical Data Elements	Mean	Median	Min – Max (Range)
9 Items included as part of Administrator Survey (4-point Likert Scale format)	3.09	3.11	1.67 – 3.67 (2.00)

Large strata LPHA totals for the 9 items ranged in raw score from 15.0 to 33.0 with a mean of 27.8, indicating that on average, small strata LPHA administrators rated their effectiveness in performing collaboration related activities at 77% of the maximum possible score that would be obtained if all activities were performed at levels fully meeting community needs.

Of the 9 collaborative activities noted by these measures, performance by large strata LPHAs, ranged from 42% to 92%, with an average of 77% of these activities being fulfilled by large strata LPHAs. Of the nine items, among large strata LPHAs, the

collaborative activities with the highest scores included agreement that organizations in the community participate in joint meetings to address prevention issues (91%), that organizations in the community coordinate prevention activities (81%), that community agencies work together to address problems with prevention strategies (81%), that organizations in the community share information with each other about prevention issues (81%), and that organizations in the community participate in joint planning and decision making about prevention issues (81%). In contrast, the collaborative activities with the lowest scores indicated disagreement that organizations in the community share money and personnel when addressing prevention issues (64%), and that each organization in the community has a clearly defined role in carrying out the community's prevention plan (64%).

Summary Data and Rankings

The large strata Organizational Resources variable is presented in Table B20.

TABLE B20: Independent Variable Summary Table: Organizational Resources, Large LPHAs

Public Health Agency	Raw Score Avg.	Strata Ratio	Rank
31	3.56	.969	2
32	3.44	.939	3
33	3.11	.848	5
34	2.67	.727	9
35	2.78	.757	8
36	3.33	.908	4
37	3.33	.908	4
38	3.11	.848	5
39	1.68	.454	10
40	3.56	.969	2
41	3.00	.817	6
42	3.67	1.000	1
43	2.89	.787	7

Most noteworthy perhaps of this variable is that all three strata (small, medium, and large) means are within .04 of each other. Since all three strata perform equally well in their approach to prevention-specific collaboration, it appears unlikely that this variable will have much influence on the dependent variable. While there may be some intra-strata variation, regardless of the size of their service area, regardless of the number of staff, regardless of budget, regardless of other factors under investigation, all LPHAs perform equally well across strata in organizational resource performance.

Informational Resources

Descriptive Information

The large strata Informational Resources variable is described in Table B21. Normality tests using the Shapiro-Wilk statistic noted that among large strata LPHAs only the construct for General Information Systems was normally distributed. Data for the Data Collection, Processing & Maintenance construct was negatively skewed, while the data for the Integration of Data/Data Sharing construct was positively skewed, as was the data for the Data Analysis construct.

TABLE B21: Informational Resources, Large LPHAs

Critical Data Elements	Maximum Possible Score/item	Obtained Item Score Low – High	Mean Item Score	Median Item Score	% of Max Possible Score
Based on 18 items included In the Administrator Survey (5-point Likert Scale format)					
General Information Systems (6 items)	6.0	0 – 4.00	1.72	1.50	29%
Data Collection, Processing, & Maintenance (5 items)	6.0	0 – 4.00	2.66	2.80	44%
Integration of Data/Data Sharing (2 items)	6.0	0 – 4.00	.65	0.00	11%
Data Analysis (5 items)	6.0	0 – 4.00	2.55	2.00	43%

Of the 18 informational resources activities noted by the measures in the administrator survey, performance by large strata LPHAs ranged from 44% to 100%, with an average of 69% of these activities being fulfilled by large strata LPHAs. These numbers included 19.2% of LPHAs fulfilling performance of the Integration of Data/Data Sharing with Community Partners activities, 56.4% of large strata LPHAs fulfilling performance of the General Information Systems activities, 84.6% of LPHAs fulfilling performance of the Data Collection, Processing, and Maintenance activities, and 87.7% fulfilling performance of the Data Analysis activities. The activity types most likely to be available in these large strata jurisdictions included LPHA review of primary and secondary data from reliable sources (100%), and the LPHA comparing local data to other jurisdictions and/or the state or nation (100%). In contrast, the activities least likely to be performed include the LPHA having a written protocol to integrate data (7.7%), the

LPHA annually compiling or updating a list of health-related information systems and data bases maintained by units of government within its jurisdiction (23.1%), and the LPHA using an electronic system to integrate assessment data from various sources (30.8%).

Summary Data and Rankings

The large strata Informational Resources variable data are presented in Table B22. Again, strata ratios were produced for each data element for review purposes, but these ratios did not figure into the total strata ratio for the variable overall.

TABLE B22: Independent Variable Summary Table: Informational Resources, Large LPHAs

Public Health Agency	Gen. Info. Systems	Data Collect., Process., Main.	Integration of Data/ Data Sharing	Data Analysis	Total Strata Ratio	Rank
	Raw Avg/ Strata Ratio (Rank)	*Raw Avg/ Strata Ratio (Rank)*	*Raw Avg/ Strata Ratio (Rank)*	*Raw Avg/ Strata Ratio (Rank)*		
31	1.67/.417(6)	1.60/.400(6)	.00/.000(5)	2.20/.550(4)	.342	11
32	1.00/.250(9)	2.80/.700(4)	2.00/.500(2)	2.00/.500(5)	.488	5
33	1.00/.250(9)	1.60/.400(6)	1.50/.375(3)	2.00/.500(5)	.381	8
34	.00/.000(11)	3.20/.800(2)	.00/.000(5)	3.00/.750(3)	.388	7
35	1.50/.375(7)	3.00/.750(3)	.00/.000(5)	1.20/.300(7)	.356	9
36	3.00/.750(3)	4.00/1.00(1)	.00/.000(5)	4.00/1.00(1)	.688	3
37	3.33/.833(2)	4.00/1.00(1)	.00/.000(5)	4.00/1.00(1)	.708	2
38	1.00/.250(9)	1.20/.300(7)	.00/.000(5)	1.60/.400(6)	.238	13
39	1.33/.333(8)	1.20/.300(8)	1.00/.250(4)	2.00/.500(5)	.346	10
40	2.33/.583(4)	2.40/.600(5)	.00/.000(5)	2.00/.500(5)	.421	6
41	4.00/1.00(1)	4.00/1.00(1)	4.00/1.00(1)	4.00/1.00(1)	1.00	1
42	1.83/.458(5)	4.00/1.00(1)	.00/.000(5)	3.20/.800(2)	.565	4
43	.33/.083(10)	1.60/.400(6)	.00/.000(5)	2.00/.500(5)	.246	12

Across strata the small differences between mean raw scores of each of these critical data elements may not provide enough distinction between strata to warrant more attention since each element is made up of just 2 – 6 survey items. Differences between data elements across strata are noted as follows: .449 separates the General Information

Systems raw score averages between the best performing strata and the poorest performing strata, .284 separates the Data Collection, Processing and Maintenance raw score averages, .362 separates the Integration of Data/Data Sharing raw score averages, and .532 separates the Data Analysis raw score averages.

Fiscal Resources

Descriptive Information

The large strata Fiscal Resources variable is presented in Table B23. Shapiro-Wilk tests for normality of large strata data indicated that of these critical data elements, the indicators for Growth in Revenue and Profit Margin were not normally distributed, both of which were positively skewed.

TABLE B23: Fiscal Resources, Large LPHAs

Critical Data Elements	**Mean**	**Median**	**Min – Max (Range)**
Per Capita Public Health Expenditures	$35.71	$39.47	$3.64 – 89.11 (85.47)
Growth in Revenue as a Percent of Total Budget	17.22%	11.35%	-4.94% - 97.09 (102.03)
Profit Margin	6.74%	3.20%	-4.96% - 52.65 (57.61)
Days Cash on Hand	3.39(months)	3.54	0 – 6.29 (6.29)

The mean for the per capita public health expenditures indicator has gone down in comparison to the other two strata, reflecting that as population size grows the burden of cost for public health services has been shared across more people, possibly reflecting an economy of scale. Both the Growth in Revenue and Profit Margin medians are the

highest of all strata indicating less financial distress and better profitability of larger strata LPHAs overall. On average, large strata LPHAs have enough cash on hand to pay expenses for just under 3.5 months.

Summary Data and Rankings

The large strata Fiscal Resources variable is presented in Table B24.

TABLE B24: Independent Variable Summary Table: Fiscal Resources, Large LPHAs

Public Health Agency	Per Capita Public Hlth Expenditures	Growth in Revenue as % of total budget	Profit Margin	Days Cash on Hand (months)	Total Strata Ratio Avg.	Rank
	Raw Score/ Strata Ratio (Rank)	*Raw Score/ Strata Ratio (Rank)*	*Raw Score/ Strata Ratio (Rank)*	*Raw Score/ Strata Ratio (Rank)*		
31	$45.49/.510(4)	9.53%/.098(8)	3.43%/.065(6)	.11/.017(12)	.173	13
32	$38.44/.431(7)	7.22%/.074(10)	2.97%/.056(8)	2.39/.380(11)	.236	10
33	$20.95/.235(9)	2.93%/.030(11)	3.59%/.068(5)	5.05/.803(3)	.284	7
34	$44.82/.503(5)	24.17%/.249(2)	.05%/.001(11)	.00/.000(13)	.188	12
35	$47.37/.532(3)	17.18%/.177(3)	6.24%/.119(3)	2.70/.429(10)	.314	5
36	$40.50/.454(6)	8.17%/.084(9)	6.06%/.115(4)	4.55/.724(4)	.344	4
37	$18.60/.209(10)	16.10%/.166(4)	-4.96%/-.094(13)	3.40/.540(7)	.205	11
38	$10.18/.114(11)	.13%/.001(12)	2.90%/.055(9)	6.29/1.00(1)	.293	6
39	$89.11/1.00(1)	15.89%/.164(5)	1.62%/.031(10)	3.73/.593(5)	.447	2
40	$18.62/.209(10)	13.18%/.136(6)	6.32%/.120(2)	3.68/.585(6)	.263	9
41	$50.83/.570(2)	-4.94%/-.051(13)	-.05%/-.001(12)	5.97/.950(2)	.367	3
42	$3.64/.041(12)	97.09%/1.00(1)	52.65%/1.00(1)	2.78/.442(9)	.621	1
*43	^$35.71/.401(8)	**11.35%/.117(7)	**3.20%/.061(7)	^3.39/.539(8)	.280	8

*LPHA #43 did not submit fiscal data. In this case, the strata mean (^) or median (**) was substituted based on whether the data were normally distributed.

In review of the large strata LPHA fiscal data, one agency failed to submit fiscal data but managed to submit all other data under study. In this one case, the strata mean or median was used as a substitute for missing data. With large strata LPHAs, it becomes more noticeable that Per Capita Public Health Expenditures has become more normally distributed and there is less disparity between agencies as a whole. Again, the mean of

this critical data element reflects the higher population size and thus the lowest average expenditure amongst all strata overall.

Other noteworthy elements in the large strata data for this variable are that both the Growth in Revenue as a Percent of Total Budget and Profit Margin show fewer LPHAs with negative proportions, indicating that these larger LPHAs may fare better as a whole with regard to fiscal matters. In addition, larger LPHAs have a higher average Days Cash on Hand than their smaller LPHA counterparts.

It appears with the large strata LPHAs that in both the Growth in Revenue as a Percent of Total Budget and Profit Margin statistics that there exists the presence of an outlier which skews the data into a non-normal distribution. In reviewing the ranks of each large strata LPHA across each data element, 3 of the top 5 performers among the Per Capita Public Health Expenditures data element rank in the top 5 for the overall variable. It appears that this particular data element increases in importance to performance overall as strata size increases. In addition, 3 of the top 5 performers in the Growth in Revenue as a Percent of Total Budget data element rank in the top 5 for the overall variable; 3 of the top 5 performers in the Profit Margin data element rank in the top 5 for the overall variable; and 3 of the top 5 performers in the Days Cash on Hand data element rank in the top 5 for the overall variable.

Relating Critical Data Elements to Independent Variable Performance

Given the speculative trend appearing in much of the data reflecting the critical data elements making up each of these independent variables, bivariate Pearson correlation coefficients were calculated using strata ratios to determine the strength of the relationship between each element and overall performance of each respective independent variable. In this manner, these statistics reflect the contribution of each element to performance of the variable overall. These correlation coefficients are provided in Table B25.

TABLE B25: Relating Critical Data Elements to Variable Performance, Strata

Variable **Critical Data Element**	**Pearson R**
Human Resources	
% of Master's Prepared Staff	.88*
LMS Competency Score	.38*
LPHA Retention (Turnover) Rate	.27
Organizational Resources	N/A
Informational Resources	
Data Collection, Processing, Maintenance	.82*
General Information Systems	.81*
Data Analysis	.79*
Integration of Data/Data Sharing	.58*
Fiscal Resources	
Profit Margin	.79*
Growth in Revenue as % of Total Budget	.69*
Per Capita Public Health Expenditures	.37*
Days Cash on Hand	.37*

Although some critical data elements show a greater contribution to performance of the independent variables overall, it should be noted that the collective contribution of all elements together provides the most meaningful approach to overall performance of public health inputs.

Statewide Independent Variable Performance and Ranking

A statewide ranking process was also undertaken utilizing the same methodology of creating ratios to standardize the data and provide a means for comparison between LPHAs across the entire state of Illinois. The statewide data permits stratification on the basis of performance rather than size of jurisdiction, allowing for further analysis of top performers. This allows a review to be undertaken to determine what similarities and differences might exist between top performers overall. Data for the Human Resources variable is provided as part of Table B26. The strata of each LPHA is represented in the table by the notation of S = small strata LPHAs, M = medium strata LPHAs, and L = large strata LPHAs.

TABLE B26: Independent Variable Summary Table, Human Resources, Statewide

Public Health Agency	Strata (S,M,L)	Learning Management System	Proportion of Staff with Master's Trng.	Retention (Turnover) Rate	Total Statewide Ratio Avg.	Rank
		Statewide Ratio	*Statewide Ratio*	*Statewide Ratio*		
1	S	.950	.294	.933	.726	9
2	S	.925	.151	.951	.676	19
3	S	1.000	.214	.898	.704	12
4	S	.893	.429	.917	.746	6
5	S	.967	.000	.960	.642	22
6	S	.922	.551	.866	.780	3
7	S	.781	.103	.606	.497	43
8	S	.884	.040	.976	.633	26
9	S	.807	.000	.960	.589	38
10	S	.841	.286	.954	.694	14
11	S	.688	.214	.954	.619	31
12	S	.915	.040	.948	.634	24
13	M	.922	.303	.812	.679	18
14	M	.973	.073	1.000	.682	17
15	M	.743	.099	.881	.574	40
16	M	.819	.029	.984	.611	34
17	M	.911	.000	.864	.592	37
18	M	.806	.141	.964	.637	23
19	M	.939	.286	.917	.714	10
20	M	.853	.051	.976	.627	29
21	M	.884	.184	.890	.653	21
22	M	.924	.593	.991	.836	2
23	M	.821	.171	.898	.630	28
24	M	.887	.281	.961	.710	11
25	M	.798	.046	.956	.600	35
26	M	.859	.103	.889	.617	32
27	M	.845	.309	.929	.694	13
28	M	.909	.143	.823	.625	30
29	M	.891	.214	.863	.656	20
30	M	.753	.668	.860	.760	4
31	L	.703	.181	.861	.582	39
32	L	.856	.475	.907	.746	7
33	L	.864	.208	.978	.683	16
34	L	.878	1.000	.973	.950	1
35	L	.859	.164	.872	.632	27
36	L	.824	.174	.783	.594	36
37	L	.991	.074	.838	.634	24
38	L	.888	.220	.962	.690	15
39	L	.825	.024	.874	.574	40
40	L	.960	.396	.881	.746	8
41	L	.958	.043	.832	.611	33
42	L	.889	.514	.866	.756	5
43	L	.599	.021	.954	.525	42

Review of statewide data, while not providing ranking data for each data element within the Human Resources variable, seems to support the theory that consistent performance across all key data elements weighs heavily upon performance overall as competition grows. Whereas, in review of strata performance, it appeared that in many cases a LPHA could do well in one key data element but not others and still perform well overall.

A bivariate Pearson correlation coefficient was calculated to determine the strength of the relationship between Proportion of Staff with Master's Training and the Human Resources variable across all data statewide. Results indicated a correlation of .892, stronger than that seen across strata. Pearson correlation coefficients were again also calculated to determine the strength of the relationship between the LMS Competency Score and the Human Resources variable overall across all data statewide. Results showed a correlation of .435, also stronger than what was shown across strata. Finally, Pearson correlation coefficients were also calculated across all data statewide to determine the strength of the relationship between the LPHA Retention (turnover) Rate and the Human Resources variable overall. Results for this correlation were noted as .336. All correlation coefficients when performed using all LPHA data statewide were found to be significant at the .01 level.

Closer examination of statewide Human Resources results notes that three of the top 10 performers fall amongst the small strata LPHAs, three of the top 10 performers fall amongst the medium strata LPHAs, and 4 of the top 10 performers fall amongst the large strata LPHAs. In both raw numbers and overall proportion of top 10 performers, large strata LPHAs seem to perform better with regard to the Human Resources variable. This

could be related to these LPHAs having larger budgets and therefore more resources available to them. Related to these greater resources, it is possible that perhaps large LPHAs have better ability at attracting and retaining highly qualified staff.

Similarly, a statewide ranking process was also undertaken for the Organizational Resources variable. Table B27 provides a statewide score and ranking for the Organizational Resources variable utilizing the same methodology as noted earlier.

TABLE B27: Independent Variable Summary Table, Organizational Resources, Statewide

Public Health Agency	Strata (S,M,L)	Statewide Ratio	Rank
1	S	.750	22
2	S	.833	13
3	S	.694	31
4	S	.861	10
5	S	.722	25
6	S	.778	17
7	S	.639	40
8	S	.889	7
9	S	.806	16
10	S	.667	36
11	S	.611	42
12	S	.917	4
13	M	.750	22
14	M	.972	2
15	M	.694	31
16	M	.778	17
17	M	.667	36
18	M	.694	31
19	M	.667	36
20	M	.861	10
21	M	.639	40
22	M	.722	25
23	M	.694	31
24	M	1.000	1
25	M	.917	4
26	M	.778	17
27	M	.722	25
28	M	.722	25
29	M	.944	3
30	M	.722	25
31	L	.889	7
32	L	.861	10
33	L	.778	17
34	L	.667	36
35	L	.694	31
36	L	.833	13
37	L	.833	13
38	L	.778	17
39	L	.417	43
40	L	.889	7
41	L	.750	22
42	L	.917	4
43	L	.722	25

With regard to Organizational Resources, statewide results note that while there are several ties present, 3 of the top 10 performers appear among the small strata LPHAs, 5 of the top 10 performers appear among the medium strata LPHAs, and 4 of the top 10 performers appear among the large strata LPHAs. As a proportion of the total number of LPHAs in that strata, again large LPHAs appear to be outperforming their smaller agency counterparts overall, indicating that perhaps larger agencies are more collaborative in their approach to prevention related activities in their communities. On the other hand, this may also be indicative of a broader range of prevention-oriented community organizations existent in larger communities, leading to speculation that perhaps it is easier to be collaborative in communities where there are more prevention-oriented organizations overall.

Similarly, Table B28 provides a statewide score and ranking for the Informational Resources variable utilizing the same methodology as noted earlier.

TABLE B28: Independent Variable Summary Table, Informational Resources, Statewide

Public Health Agency	Strata (S,M,L)	General Information Systems	Data Collect., Processing, Maintenance	Integration of Data/ Data Sharing	Data Analysis	Total Statewide Ratio Avg.	Rank
		Statewide Ratio	*Statewide Ratio*	*Statewide Ratio*	*Statewide Ratio*		
1	S	.375	.762	.000	.600	.434	17
2	S	.375	.571	.000	.100	.262	34
3	S	.500	.667	.375	.600	.536	11
4	S	.333	.381	.000	.300	.254	35
5	S	.167	.429	.000	.750	.337	29
6	S	.792	.952	.500	.700	.736	3
7	S	.000	.286	.000	.300	.147	42
8	S	.500	.905	.000	.400	.451	16
9	S	.458	.905	.000	.800	.541	10
10	S	.625	.762	.000	1.000	.597	7
11	S	.417	.286	.000	.200	.226	38
12	S	.750	.571	.000	.600	.480	14
13	M	.833	.952	.000	1.000	.696	4
14	M	.583	.667	.000	.700	.488	12
15	M	.167	.762	.500	.500	.482	13
16	M	.083	.381	.000	.200	.166	40
17	M	.167	.190	.000	.000	.089	43
18	M	.167	.619	.000	.700	.372	22
19	M	.333	.381	.000	.400	.279	32
20	M	.625	.476	.000	.550	.413	19
21	M	.292	.714	.375	.800	.545	9
22	M	.500	.571	.000	.350	.355	23
23	M	.458	.524	.000	.400	.346	25
24	M	.250	.381	.250	.500	.345	26
25	M	.167	.381	.000	.300	.212	39
26	M	.000	.190	.000	.400	.148	41
27	M	.167	.762	.000	.300	.307	31
28	M	.167	.524	.000	.400	.273	33
29	M	.000	.714	.000	.600	.329	30
30	M	.958	1.000	1.000	1.000	.990	1
31	L	.417	.381	.000	.550	.337	28
32	L	.250	.667	.500	.500	.479	15
33	L	.250	.381	.375	.500	.377	21
34	L	.000	.762	.000	.750	.378	20
35	L	.375	.714	.000	.300	.347	24
36	L	.750	.952	.000	1.000	.676	6
37	L	.833	.952	.000	1.000	.696	4
38	L	.250	.286	.000	.400	.234	37
39	L	.333	.286	.250	.500	.342	27
40	L	.583	.571	.000	.500	.414	18
41	L	1.000	.952	1.000	1.000	.988	2
42	L	.458	.952	.000	.800	.553	8
43	L	.083	.381	.000	.500	.241	36

A bivariate Pearson correlation coefficient was also calculated to determine the strength of the relationship between each of these critical data elements to performance of the Information Resources variable overall statewide. Results for each of these elements reflected Pearson Correlation Coefficients of .84 for Data Collection, Processing, and Maintenance; .84 for Data Analysis, .82 for General Information Systems; and .66 for Integration of Data/Data Sharing with Community Partners; and all of which were found to be statistically significant at the .01 level. Collectively, these correlation coefficients are, on average, much higher than for any of the other critical data elements represented in all the other variables of study, leading to speculation that Informational Resources have more to do with success of LPHAs overall in terms of the inputs of public health.

With regard to Informational Resources, statewide results note that three of the top 10 performers appear among the small strata LPHAs, three of the top 10 performers appear among the medium strata LPHAs, and 4 of the top 10 performers appear among the large strata LPHAs. In raw numbers and as a proportion of the total number of LPHAs in that strata, again large LPHAs appear to be outperforming their smaller agency counterparts overall with regard to information resources. As was noted earlier, this could be due to the larger budget size of these agencies as a whole and how those dollars may translate into an improved ability to attract and retain staff expertise as it relates to information resources and analysis

Using the same methodology as noted above, a statewide ranking process was also undertaken for the Fiscal Resources variable. Table B29 provides results that include a statewide score and ranking for each data element comprising the Fiscal Resources variable.

TABLE B29: Independent Variable Summary Table, Fiscal Resources, Statewide

Public Health Agency	Strata (S,M,L)	Per Capita Public Hlth Expenditures	Growth in Revenue as % of total budget	Profit Margin	Days Cash On Hand (months)	Total Statewide Ratio Avg.	Rank
		Statewide Ratio	*Statewide Ratio*	*Statewide Ratio*	*Statewide Ratio*		
1	S	.206	.126	-.040	.238	.133	29
2	S	.156	-.150	-.157	.324	.043	39
3	S	.266	.037	-.021	.089	.093	33
4	S	.177	-.152	-.150	.381	.064	38
5	S	.109	.086	.152	.573	.230	13
6	S	.159	.041	.108	1.000	.327	5
7	S	.815	.152	.135	.126	.307	7
8	S	.570	.067	.110	.444	.298	8
9	S	.182	-.239	-.122	.623	.111	30
10	S	.142	.370	.255	.485	.313	6
11	S	.077	.155	.094	.763	.272	10
12	S	1.000	.246	.225	.354	.456	3
13	M	.103	.004	-.068	.057	.024	41
14	M	.363	.293	.219	.224	.275	9
15	M	.158	.005	-.022	.271	.103	32
16	M	.162	.102	.004	.279	.137	28
17	M	.544	-.012	-.026	.065	.143	25
18	M	.132	.039	-.049	.001	.031	40
19	M	.086	-.042	-.536	.319	-.043	42
20	M	.213	.149	.044	.333	.185	22
21	M	.173	.357	.159	.010	.175	24
22	M	.194	.070	-.162	.155	.064	37
23	M	.118	.105	.040	.693	.239	12
24	M	.267	.094	.067	.320	.187	20
25	M	.132	.164	.259	.832	.347	4
26	M	.228	.020	-.030	.497	.179	23
27	M	.116	-.013	-.344	.043	-.050	43
28	M	.077	-.099	.173	.209	.090	35
29	M	.218	.317	.702	.682	.480	2
30	M	.073	.009	-.222	.413	.068	36
31	L	.190	.098	.065	.013	.092	34
32	L	.160	.074	.056	.281	.143	25
33	L	.087	.030	.068	.594	.195	18
34	L	.187	.249	.001	.000	.109	31
35	L	.197	.177	.119	.317	.203	17
36	L	.169	.084	.115	.536	.226	14
37	L	.077	.166	-.094	.399	.137	27
38	L	.042	.001	.055	.739	.209	16
39	L	.371	.164	.031	.438	.251	11
40	L	.078	.136	.120	.433	.192	19
41	L	.212	-.051	-.001	.702	.216	15
42	L	.015	1.000	1.000	.327	.586	1
43	L	*.214	*.106	*.056	*.371	*.187	20

In review of the statewide ratios, it should be noted that LPHA #43 did not submit fiscal data for their agency. In this case the mean statewide ratio for each data element was used as a substitute.

A bivariate Pearson correlation coefficient was again calculated to determine the strength of the relationship between each of these critical data elements to performance of the Fiscal Resources variable overall statewide. Results for each of these elements reflected Pearson Correlation Coefficients of .87 for Profit Margin, significant at the .01 level; .70 for Growth in Revenue as a Percent of Total Budget, significant at the .01 level; .48 for Days Cash on Hand, also significant at the .01 level, and .33 for Per Capita Public Health Expenditures, significant at the .05 level. These results suggest the appropriateness of each critical data element in the performance of the Information Resources variable.

Here, we see a different trend emerge. With regard to the Fiscal Resources variable, statewide results note that 6 of the top 10 performers appear among the small strata LPHAs, 3 of the top 10 performers appear among the medium strata LPHAs, and only 1 of the top 10 performers appear among the large strata LPHAs. As a proportion of the total number of LPHAs in that strata, small LPHAs appear to be well outperforming their larger agency counterparts overall. This may indicate that even though the smaller agencies have smaller budgets, perhaps they are better able to live within their means, or it could simply be a reflection that per capita expenditures are greater in smaller communities since the burden of support is spread to a smaller population overall. In review of the correlation coefficients though it appears that given the contribution of each data element to performance of this variable overall, profit margin and growth in revenue

as a percent of total budget would appear greater in smaller agencies than their larger counterparts.

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David M. Remmert

EDUCATION

Bachelor of Science with a double major in Community Health and School Health including a minor in Business Administration: May, 1989. Eastern Illinois University, Charleston, IL.

Master in Public Health: December, 1995. University of Illinois, Springfield, IL. Thesis: Job Satisfaction in Local Public Health Agency Staff in Illinois.

PhD in Community Health: May 2011. University of Illinois; Urbana, IL. Dissertation: Examining the Relationship Between Local Public Health Agency Inputs and Outputs.

EXPERIENCE

Public Health Administrator – DeWitt/Piatt Bi-County Health Department. Responsible for the overall operation of a certified local health department providing services to a population of approximately 35,000 people. Duties include overall fiscal, personnel and operations management. 2005 – present.

Adjunct Lecturer - University of Illinois. Responsible for the instruction of undergraduate students in a lecture hall environment. Courses taught: CHLH 100: Contemporary Health; CHLH 101: Introduction to Public Health. 1996 - present.

Research Consultant – Center for Prevention Research and Development, University of Illinois. Responsible for providing direction and oversight in partnership with research team for Robert Wood Johnson funded research project focused around the impact of public health laws on community health status.

Director of Community Health Surveillance, Planning and Education - Champaign-Urbana Public Health District. Responsible for the community health planning, health education and disease surveillance functions of the agency. Duties include conducting community needs assessment, data analysis, data system development, agency quality assurance monitoring, etc. Duties also include the development, implementation, promotion and evaluation of a wide variety of grant programs serving a population of 173,025 including public speaking, supervision of employees, grantwriting, technical support, community networking, public relations, etc. 1991 - 2005.

David M. Remmert
Resume'

Health Educator - Champaign-Urbana Public Health District. Responsible for the implementation of various grant programs requiring extensive public speaking. 1991

Health Educator - Mahomet-Seymour Jr. High School and High School, Unit #3 school district. Student Teaching practicum. 1990

Special Projects Coordinator - American Heart Association. Worked as assigned on development projects in 17 county area utilizing resources of volunteer sector in recreational and corporate setting. 1988-89.

ACTIVITIES & HONORS

Fellow, Illinois Public Health Leadership Institute - 1997.

Outstanding Student in Public Health, University of Illinois at Springfield.

Certified Health Education Specialist.

Eta Sigma Gamma - Health Sciences Honorary.

Shirley O'Reilly Award - Illinois Society for Public Health Education Graduate Studies Scholarship Recipient.

Illinois Society for Public Health Education. Offices held:
-Trustee
-Secretary/Treasurer

Champaign County SAFE KIDS Coalition. National recipient: Award for Coalition Excellence. Awarded, December, 1998.

Illinois Public Health Association. Offices held:
-Chair, Health Education/Health Promotion Section
-Nominating Committee
-President-elect

David M. Remmert
Resume'

Illinois Association of Public Health Administrators. Offices held:
-Secretary: 2009

Eastern Illinois University. Department of Health Studies
Advisory Board: 2004 - Present

Champaign County SAFE KIDS Coalition. Founding Member:
-Chairman of the Board: 2004-2005

Champaign County Christian Health Clinic:
-Board Member: 2004 - 2007

IFLOSS: (Illinois coalition focused on the issues of Oral Health for underserved)
-Board Member: 2005 – 2007
-President: 2007 - 2008

State of Illinois Maternal and Child Health Advisory Board:
Governor Rod Blagojevich: Appointed October, 2007 - Present.

Recipient of the Outstanding Community Service Award, Piatt County Rotary. Awarded November, 2008.

PUBLICATIONS

Reis, J., Trockel, M., King, T., Remmert, D. (2004). Computerized training in breast self-examination: A test in a community health center. Cancer Nursing, Vol. 27: 2.

Ruiz, M., Remmert, D. (2004). A local department of public health and the geospatial data infrastructure. Journal of Medical Systems, Vol. 28: 4

REFERENCES & TRANSCRIPTS

Available upon request