Toward Standardized, Comparable Public Health Systems Data: A Taxonomic Description of Essential Public Health Work

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Objective. To identify taxonomy of task, knowledge, and resources for documenting the work performed in local health departments (LHDs).

Data Sources. Secondary data were collected from documents describing public health (PH) practice produced by organizations representing the PH community.

Study Design. A multistep consensus-based method was used that included literature review, data extraction, expert opinion, focus group review, and pilot testing.

Data Extraction Methods. Terms and concepts were manually extracted from documents, consolidated, and evaluated for scope and sufficiency by researchers. An expert panel determined suitability of terms and a hierarchy for classifying them. This work was validated by practitioners and results pilot tested in two LHDs.

Principal Findings. The finalized taxonomy was applied to compare a national sample of 11 LHDs. Data were obtained from 1,064 of 1,267 (84 percent) of employees. Frequencies of tasks, knowledge, and resources constitute a profile of PH work. About 70 percent of the correlations between LHD pairs on tasks and knowledge were high (>0.7), suggesting between-department commonalities. On resources only 16 percent of correlations between LHD pairs were high, suggesting a source of performance variability.

Conclusions. A taxonomy of PH work serves as a tool for comparative research and a framework for further development.

Key Words. Taxonomy, public health, work measurement, work characteristics, knowledge management

Over 2,500 local health departments (LHDs) in the United States share an overarching mission to ensure the conditions in which people can be healthy (Institute of Medicine 2002; National Association of County and City Health Officials 2006). There is a nationally acknowledged need for managing the performance of these organizations to provide consistent service to all constituents and to be adaptable in an increasingly complex environment

(Exploring Accreditation Planning Committee 2006; Salinsky and Gursky 2006). Yet there is little uniformity in how LHDs are organized and little understanding of how work within LHDs is accomplished (Mays 2007). Despite local differences between LHDs, mission-driven commonalities are likely to exist and LHDs are likely to share common features with other organizational forms in the public and private sector (Rainey 2000; Beitsch et al. 2007; Mays 2007).

To accurately specify how common organizational features may influence performance, it is necessary to understand the elements of work (Pulakos, Arad, and Donovan 2000). Systems theory is a familiar framework used for understanding organizational performance (Bertalanffy 1968; Donabedian 1980; Nadler and Tushman 1988; Lichiello 1999; Handler, Issel, and Turnock 2001; Public Health Foundation 2004a, b). An instance of systems theory applied to organizations is presented in the congruence model displayed in Figure 1 (Nadler and Tushman 1988). The model depicts an organization as a system of interrelationships and feedback loops. Inputs received from the external environment are transformed by work processes into outputs. Outputs influence outcomes (long-term results) related to the organization's mission and also produce feedback, which in turn influences the environment in which the organization operates. When management strategies optimize congruence or "fit" between the environment and the work, better performance in achieving outcomes is more likely (Woodward 1965; Nadler and Tushman 1988; Burton and Opel 1998). Researchers have operationalized the work processes represented in the congruence model as a set of connected networks representing the *employees*, the *tasks* to which they are assigned, the *knowledge* they possess, and the *resources* to which they have access (Thompson 1967; Krackhardt and Carley 1996; Carley 2007). Interactions between these elements can be studied with network analysis, a computational technique for understanding complex systems (Carley and Wallace 2001; Scott et al. 2005). The goal is to reveal common patterns and insights that support management decisions to improve organizational performance. Herein this general theoretical approach is applied to public health (PH) organizations.

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Figure 1:   A Congruence Model of an Organizational System Adapted from Nadler and Tushman (1988)
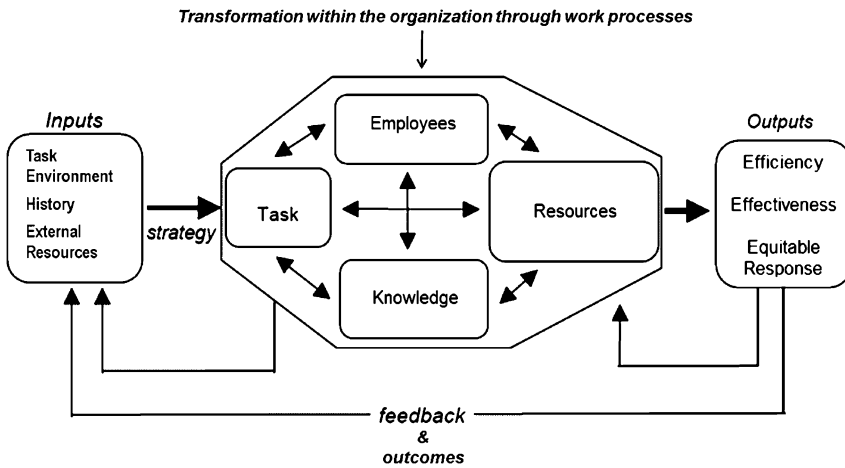
RESEARCH OBJECTIVE

The objective of the study presented here is to identify a taxonomy of tasks, knowledge, and resources that can serve as a standard for documenting the essentials of PH work. This was a foundational step in a larger research project that applied network analysis to study organizational performance in LHDs. Taxonomy is a classification framework that systematically arranges ideas, objects, or terms into categories according to specific criteria. Formulation of a well-defined theoretical or empirical classification is basic to conducting any form of scientific or systematic inquiry (McCarthy 1995; Bazzoli, Shortell, and Dubbs 2006). Taxonomies are among the models and tools needed by researchers and analysts in all fields to bridge language, integrate concepts, and enable complex analysis (Colwell 1999; Pulakos, Arad, and Donovan 2000; National Cancer Institute 2004; National Institutes of Health 2008). The Standard Occupational Classification system used by federal agencies to classify workers into occupational categories is an example of taxonomy with a broad scope (Bureau of Labor Statistics 2000). Many taxonomies of smaller scope exist to capture work processes, for example, taxonomy of cognitive work (Rasmussen, Pejtersen, and Schmidt 1990; Sanderson 2003) or how work is organized in relation to safety and health (Sauter et al. 2003).

METHODS

To build taxonomy of essential PH work a multistep rational methodology was applied: (1) identification of documents describing PH practice; (2) extraction of terms; (3) solicitation of expert opinion; (4) validation with practitioners; and (5) pilot testing of the taxonomy as part of an organizational network survey (Whittaker and Breininger 2008). This is a consensus-based, iterative method that relies on the opinions of experts and practitioners who are knowledgeable about a field that is appropriate to use in the absence of taxonomy development in this domain. The taxonomy is intended to represent a *minimum* set of tasks, knowledge, and resources. Minimum is defined as the least number of essential items required to document the components of work done in any LHD, not in a particular health department (Trevino 1988).

Identification of Established Practice Documentation

Database and World Wide Web searches were conducted to identify established documents describing PH practice using terms such as "practice," "process," and "work." Such documentation is not well represented in indexed sources (Turner et al. 2009); therefore, the document search relied on the research team's familiarity with the domain (Gebbie and Hwang 1998; Gebbie and Rice 1998; Gebbie 1999a, b; Gebbie and Garfield 2001; Gebbie and Merrill 2001, 2002; Gebbie et al. 2002a, 2003, 2007; Gebbie, Merrill, and Tilson 2002b; Merrill et al. 2003; Merrill 2004; J. Merrill and K. M. Gebbie, unpublished data) and previous taxonomy work (Gebbie and Merrill 2001). Most documents were retrieved from websites of professional associations and other organizations representing the practice community. Documents, sources, and the number of unique terms and concepts extracted from each document are listed in Table 1.

Extraction of Terms

The researchers manually extracted terms or concepts representing tasks, knowledge, and resources from the practice documents. Two researchers used manual color coding to extract 544 unique terms or phrases each representing a task, an item of knowledge, or a resource used in PH practice. Similar terms and phrases were grouped or consolidated. No terms were discarded. Criteria for this process were based on common understanding of a term and whether it could be considered a synonym or part of a larger category, bearing in mind the overall goal to identify a minimum set of terms. For example, a site visit and a facility survey were considered

Table 1:   Sources of Terms and Concepts Extracted from Documents Describing Public Health Practice

Title	Source	Unique Terms/Concepts		
		Task	*Resource*	*Knowledge*
Laboratory Information Management Systems Requirements Document	Association of Public Health Laboratories, 2003	25	14	4
2005 National Profile of Local Health Departments	National Association of County and City Health Officials, 2006	15	0	0
Taking Care of Business: A Collaboration to Define Local Health Department Business Processes	Public Health Informatics Institute & National Association of County and City Health Officials, 2006	28	16	18
Operational Definition of a Functioning Local Health Department	National Association of County and City Health Officials, 2006	21	15	7
Local Health Department Accreditation Self-Assessment Instrument	North Carolina Local Health Department Accreditation Board, 2006	11	114	5
Local Public Health System Assessment Instrument, Version 1	National Public Health Performance Standards Program, Centers for Disease Control & Prevention, 2002	6	37	16
Master's Degree in Public Health Core Competency Development Project, Version 2.3	Association of Schools of Public Health Education Committee, 2006	0	4	36
Core Competencies for Public Health Professionals	Council on Linkages Between Academia and Public Health Practice, 2001	0	4	36
Health People 2010, Chapter 23, Public Health Infrastructure	U.S. Department of Health and Human Services, 2000	14	57	11
Total of 544 Unique Terms and Concepts Extracted from Sources		120	267	157

subordinate to a more inclusive and common task: perform inspections. When there was disagreement the researchers engaged in discussion until they reached consensus on designation of the term. To ensure that terms and concepts adequately represented the range of essential PH work, they were evaluated for scope and sufficiency by mapping into a matrix of 10 essential services (Public Health Functions Steering Committee 1994) and 10 common activities performed in LHDs (National Association of County and City Health Officials 2006). The team iteratively reviewed this matrix to ensure there was adequate coverage in every cross-category. Consensus was reached on a draft list consisting of 77 tasks, 89 resource items, and 77 knowledge items.

Solicitation of Expert Opinion and Identification of a Schema

Expert panel meetings are frequently used to validate a method following the completion of initial development (Hora and Jensen 2002; Sherman et al. 2006). This technique employs a structured meeting to gather information from relevant experts about an issue. An expert panel was convened to determine the suitability of the draft list of tasks, knowledge, and resources. Eight PH practice experts were identified through literature review and the knowledge of the research team. They were recruited by e-mail, all of those selected agreed to participate, and no substitutions were made. A meeting of the panel was conducted via a web conference facilitated by the researchers. Detailed instructions and a worksheet containing the draft set of terms were distributed in advance. The twofold objective was to reach a consensus on the inclusion or exclusion of each term in the set compiled by the research team and to confirm a classification hierarchy, or schema.

The experts were instructed to apply professional and personal judgment to consider the relevance of each item in relation to the essential work done in any PH department. The experts eliminated or consolidated terms and separated others into more basic elements. For example, a string of terms "cost–benefit analysis; cost–utility analysis; cost-effectiveness analysis" was eliminated from the list of knowledge items because the experts agreed that these terms represented more specialized, nonessential, knowledge. Two resource concepts "current data files on health threats (screening, reportable conditions, environmental)" and "current data files on health status (vital records, mortality, and morbidity data for all population groups)" were reduced to a single concept "local surveillance data." The expert panel review resulted in a set of 44 tasks, 54 resource items, and 57 knowledge items.

An objective of taxonomies is to define overarching domains within which large numbers of specific instances can be understood in a simplified way (John and Srivastava 1968). An important goal for the expert panel was to determine a hierarchical schema for classifying tasks, knowledge, and resource items. Together with the research team, the experts considered how to categorize terms as each one was discussed. When the discussion reached a decision point on a hierarchical component of the schema, all members of the expert panel were queried. If there was lack of agreement, the discussion continued until consensus was reached. The experts determined that PH tasks, knowledge, and resources share a common dimension that is administrative in nature. From that starting point the experts categorized tasks into two subgroups: administrative or service. Knowledge items were categorized into four subgroups: administrative; analytic; policy and program; and PH science. Resources were also categorized into four subgroups: administrative; data and information; general; and outside partners. The schema is displayed in Figure 2.

Validation by Practitioners

A focus group was convened to assess whether the expert's results captured essential elements of work from the point of view of practitioners. Focus group research involves discussion with a group of individuals selected for their understanding of a topic (Krueger and Casey 2000). The hierarchy produced by the expert panel was reviewed by a group of 12 local practitioners recruited with the assistance of a county health director. These practitioners

Figure 2:   Hierarchical Schema for Taxonomy of Public Health Work
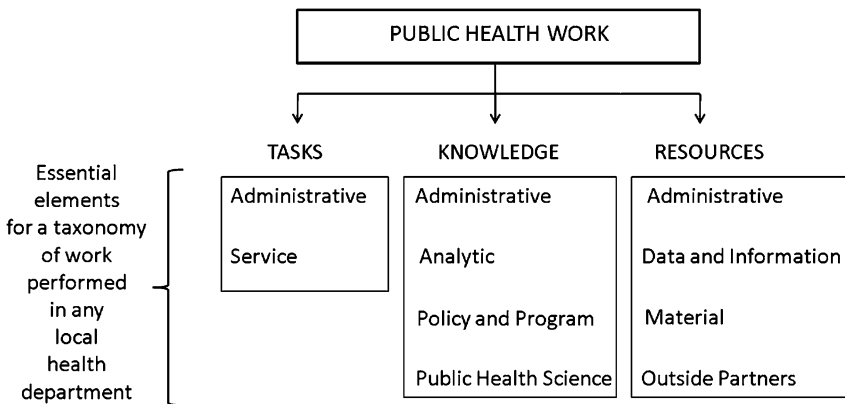
represented four levels of the workforce: three administrators, four professionals, two technicians, and three clerical support staff (U.S. Office of Personnel Management 2000). Participants were instructed to consider whether the lists reflected an essential set of tasks, knowledge, and resources items for any LHD. They were asked probing questions: Are there any items that you feel need to be expanded? Are there any items that you feel are too broad and need to be separated? Are the lists getting at the essence of what working in a local health department is like? Are any of the items worded in such a way that the meaning is ambiguous and could possibly be misinterpreted by local health department workers? Each item was discussed. Participants were instructed to comment if they were either unsure of the meaning or felt the term was unsuitable. They were encouraged to suggest items or to comment on wording, including labels used for the hierarchical schema. For example, the group suggested the hierarchical category "Material Resources" as a replacement for "General Resources." The proceedings were tape recorded and notes were taken by a researcher. Based on the focus group findings a draft was produced containing 43 tasks, 56 resource items, and 55 knowledge items.

Pilot Testing

The draft was used as the basis for a pilot organizational network survey. The survey was administered to a total of about 300 PH employees in a convenience sample of two LHDs that were recruited with the assistance of a state health department. Response rates of 90 and 77 percent were achieved from the two LHDs, respectively. An open text question requested feedback that resulted in changes to the survey format and content, such as more precise wording, consolidation of terms, and additions related to administrative support work. For example, two additional tasks were included: "phone communication with the public" and "use e-mail." Three tasks—"evaluate staff performance," "schedule staff," and "recruit staff"—were merged into a single item "manage staff." The finalized taxonomy of 44 tasks, 53 knowledge items, and 54 resources is displayed in Table 2.

RESULTS

Taxonomy Applied in a Study of LHD Networks

The taxonomy of PH work was used to study organizational networks in a national sample of LHDs. The study had two goals: the first goal, part of which is reported here, consisted of developing and administering a survey to compare LHD networks; the second goal, which will be reported elsewhere, was to ex-

Table 2:   Taxonomy for Documenting the Essential Elements of Public Health Work Done in Any Local Health Department

Tasks	Knowledge	Resources
1.1 Administrative Tasks	*2.1 Administrative Knowledge*	*3.1 Administrative Resources*
Manage files, prepare reports and/or correspondence	Workplace safety	E-mail access
	General office skills (filing, record keeping, writing reports, correspondence)	Internet access
Phone communication with the public		Personal computer workstation
Use the Internet to get information	Job descriptions (yours, those who work with you)	Desk space
Use e-mail	Chain of command in the health department	Mobile phone
Manage inventory		Mobile data collection device (PDA, laptop, tablet)
Manage personnel (e.g., recruit, schedule, train, and/or evaluate staff)	General operating policy and procedures	
	Mission of the health department	Reliable communication with management team
Supervise, plan, or distribute work to others	The health department's plan for emergency response	The health department group e-mail (list serve)
Postinformation for staff use		Trained coworkers
	Human relations/managing people	Epidemiology staff expert(s)
Process requests from the public (for services, information, or appointments)	Principles of team learning EEO guidelines	Information technology support (IT staff)
	Accounting and budget management	Presentation software (e.g., PowerPoint)
Schedule services and inspections	Contract requirements for the health department	Geographic information software (GIS)
Process billing, fees, and payments	Federal or state grant requirements	Transportation
Financial management (including manage budgets)	Quality improvement and performance measurement	Distance learning or other continuing education
Prepare applications for external funding	Strategic planning	Safe, secure working conditions
Manage contracts or service agreements	*2.2 Analytic Knowledge*	*3.2 Data and Information Resources*
Establish fees for public health services	Problem solving	Library of resources and scientific evidence (journals or publications)
Develop public policy and/or regulations	Assessment (community or individual)	Population health registries (e.g., immunization, lead, cancer, toxicology)
Enforce regulations	Data collection	
Develop community partnerships	Data analysis	Referrals from community providers
	Case investigation	State health alert network (HAN)
Plan public health programs	Program evaluation	
	2.3 Policy and Program Knowledge	State health information network (HIN)
Manage public health programs	Assets and resources in the community	Local surveillance data
	HIPPA regulations on confidentiality	National and state surveillance data

Table 2. *Continued*

Tasks	Knowledge	Resources
Evaluate program performance	Multicultural diversity and tolerance	Data sharing agreements
1.2 Service Tasks	Ethics, social justice, human rights principles	Public health websites (e.g., CDC, HRSA, EPA)
Serve on committees, boards, or task forces	Authority to operate (laws, regulations, and ordinances related to your work)	*3.3 Material Resources*
Register and enroll clients		The health code or local public health laws, regulations and ordinances
Deliver direct health services to clients	Health education and training methods	Health department's media communication plan
Meet with clients	Social marketing	Healthy People 2010
Review medical records	Health needs and health risks of the community	Community health assessment or improvement plan
Conduct site visits, home visits, or inspections	Distribution and determinants of disease in the population	Up-to-date directory of community groups and organizations
Perform health or environmental screenings	Community health improvement methods	Up-to-date directory of laboratories
Review facility operational plans	Community channels for communicating information	Up-to-date staff directory
Develop information and training materials	Ecological model of population health	Time and activity schedules for staff
Provide education to the public	Emerging public health issues (e.g., chronic diseases, bioterrorism)	Consumer satisfaction assessment
Conduct community assessments	Local policy makers and leaders	Consumer complaint log
Represent the department at community meetings	Utilization of health department services by the public	Staff development plan and training log
Interact with local or regional media	Evidence-based health promotion and disease prevention strategies	Staff performance evaluations
Develop surveillance procedures	Strategies for partnership and policy development	Lab kits for collection and testing
Investigate health problems, including environmental health	Benefits and costs of public health programs	Health information that is translated and/or culturally appropriate for your clients
Obtain information, specimens, or samples	Risk communication principles	Surveys, questionnaires, forms for data collection
Report data to the county or state	Principles of public health screening	Health department emergency response plan
Vector control	Participatory decision making	County emergency plan
Issue permits	Steps of program planning	*3.4 Outside Partner Resources*
Plan for emergencies	Definition of public health	State health department consultant
Respond to emergencies	Core functions and essential services of public health	Translator
Take part in public health research		Community health advocate

Table 2. *Continued*

Tasks	Knowledge	Resources
	Healthy People 2010 goals, objectives, indicators	State epidemiologist
		Public health veterinarian
	2.4 Public Health Science	State laboratory
	Knowledge	Other city, county, or state government agencies (private or public agencies)
	Biostatistics	
	Epidemiology	
	Basic human biology	Area health education
	Environmental health science	Center (AHEC)
		Medicaid and/or Medicare program staff
	Social or behavioral science	Local emergency planning committee
	Routine lab tests and diagnostic procedures	
	Genetics and genomics issues in public health	Researchers
		Legal counsel

amine how LHD networks correlate with system performance. Accordingly, the primary criterion for selecting study sites was recent completion of the National Public Health Performance Standards Assessment, Version 1 (National Public Health Performance Standards Program 2002). Another criterion was size of between 25 and 200 employees, which encompasses roughly 32 percent of LHDs nationally (National Association of County and City Health Officials 2006). This size was targeted for two reasons: to minimize response burden and to optimize the visualizations produced in network analysis by keeping the number of nodes representing employees in the network below 200. Sites were selected to represent a range of jurisdictional characteristics such as populations served (urban, rural, tribal) and type of governance (centralized, independent, home rule, and hybrid; Beitsch et al. 2006). A list of 17 eligible sites was identified by reviewing data from a national survey of LHDs (National Association of County and City Health Officials 2006) and the NPHPS V.1 assessment dataset. Eleven LHDs within six states (Arkansas, Arizona, Florida, Illinois, Montana, New Jersey, and New York) agreed to participate. Reasons LHDs gave for not participating included lack of either interest or capacity to participate in research. A total of 1,064 employees out of 1,267 possible completed the network survey, a mean response rate of 84 percent.

Profile of Essential Work

The organizational network survey asked employees to indicate (1) tasks (a) to which they were assigned as part of normal work, and (b) not assigned but they

could back up if needed; (2) items for which they possessed better than average knowledge; and (3) resources (a) readily available when needed for daily work, and (b) either completely unavailable or getting the resource delayed work. The ranking of task, knowledge, and resources documented by these 1,064 PH workers constitutes a profile of essential work performed in 11 LHDs. These results are displayed in Table 3.

Tasks. The tasks assigned to the greatest proportion of employees involve technology and communication: "use e-mail" (assigned to 90 percent of respondents) and "use Internet" (85 percent). Contact with the public, both administrative and service related, is well represented among top tasks: "phone communication with the public" (84 percent), "meet with clients" (65 percent), "process requests from the public" (62 percent), and "educate the public" (59 percent) all rank high among tasks assigned to the greatest proportion of employees. Tasks assigned to the lowest proportion of employees are specialized in nature, such as "develop public policy or regulations" (assigned to 16 percent of respondents), "develop surveillance procedures" (12 percent), and "prepare applications for funding" (13 percent). Task backup capability notably includes "respond to emergencies" (39 percent). Although not ranked in the top 10, another 35 percent of employees indicated that response is part of their assignment.

Knowledge. Top items for which employees possessed better than average knowledge fell into the administrative category. The greatest proportion of employees indicated above average knowledge of "general office skills, such as filing and record keeping, writing reports, and correspondence" (83 percent of respondents). About three quarters of employees indicated better than average knowledge of the health department's mission (76 percent). Knowledge of "HIPAA confidentiality regulations" was indicated by 67 percent of employees. Items for which the smallest proportion of employees indicated above average knowledge included "genetics and genomic issues in relation to practice" (15 percent) and "the ecological model of public health" (16 percent).

Resources. The top adequate resources (available when needed to do work) are also mostly administrative. "E-mail access" and "Internet access" were available to 92 and 90 percent of the respondents, respectively. "Computer workstation" and "desk space" were available when needed by 89 percent of

Table 3: Top and Bottom Ranked Tasks, Knowledge, and Resources as Reported by 1,074 Public Health Employees Who Completed a Survey Based on a Taxonomy of Essential Elements of Work Performed in Any Local Health Department

Tasks	%	Backup Tasks	%	Knowledge	%	Adequate Resources	%	Inadequate Resources	%
Top 10 ranked tasks, knowledge, and resources									
Use e-mail	90	Research	44	Office skills	83	E-mail access	92	Translator	27
Use Internet	85	Supervision	40	Job descriptions	83	Internet access	90	PDA	25
Phone communication	84	Respond to emergencies	39	Problem solving	77	Computer	89	Directory of community groups	23
Manage files	79	Manage personnel	38	Chain of command	77	Desk space	89	Consumer complaints	23
Meet w/clients	65	Postinformation	37	Mission	76	Department list serve	87	County emergency plan	23
Process requests	62	Manage inventory	37	Workplace safety	75	Trained coworkers	86	Library of resources	22
Educate public	59	Plan for emergencies	35	Policy and procedures	72	Safe work conditions	86	Health info translated	22
Postinformation for staff	48	Represent department	33	HIPAA regs	67	Management team	79	Staff development plan	21
Report data	43	Serve on committees	33	Data collection	65	Staff directory	78	Continuing education	21
Serve on committees	43	Register and enroll clients	31	Diversity	64	IT staff	76	Medicare program staff	20
Bottom 10 ranked tasks, knowledge, and resources									
Vector control	6	Use e-mail	5	Genetics	15	Veterinarian	17	E-mail access	3
Establish fees	8	Use Internet	10	Biostatistics	15	Researchers	18	List serve	6
Issue permits	10	Issue permits	13	Ecological model	16	GIS	25	Internet access	6
Develop surveillance	12	Manage files	13	Screening	23	AHEC	25	State laboratory	6
Prepare applications for funding	13	Phone communication	13	Contract requirements	25	Data-sharing agreements	27	Public health websites	7
Review plans	15	Vector control	14	Strategies for partnership	26	Mobile data collection device	29	Computer	7
Develop policy	16	Meet w/clients	17	Grant requirements	27	Directory labs	30	Lab kits	7
Interact w/media	16	Deliver health services	17	Risk communication	27	Community health advocate	30	Desk space	9
Research	17	Review records	19	Environmental health	27	Local surveillance	33	Other government agencies	9
Manage contracts	18	Conduct site visits	19	Epidemiology	28	State epidemiologist	33	Trained coworkers	10

respondents. "Safe working conditions" and "well-trained coworkers" are available to 86 percent of respondents and "IT support" available to 76 percent. About a quarter of employees indicated inadequate resources (i.e., unavailable or getting access created delays) for "translators" (27 percent) and "health information that is translated and/or culturally appropriate for clients" (22 percent).

Correlation of Tasks, Knowledge, and Resources

To confirm the utility of the taxonomy, we performed correlations across 11 sample sites using Kendall's τ, a nonparametric test of correspondence between two rankings (Kendall 1948). We correlated ranked lists of (a) tasks to which employees were assigned to as part of normal work; (b) items for which they possessed better than average knowledge; and (c) resources readily available when needed for daily work. Results demonstrated high correlation regarding tasks and knowledge, but limited correlation regarding resources. Correlation of tasks, ranked by the proportions of employees indicating assignment, yielded coefficients ranging between 0.59 and 0.85 with 69 percent of pairs highly correlated (at >0.70). Correlation of knowledge items, ranked by the proportions of employees indicating better than average knowledge, yielded coefficients ranging between 0.61 and 0.84, with 73 percent of pairs highly correlated (at >0.70). However, correlation coefficients for resources ranked by the proportions of employees indicating access was available when needed, ranged between 0.40 and 0.84, with only 16 percent of health department pairs highly correlated (at >0.70). These results are displayed in Table 4.

DISCUSSION

The taxonomy developed and tested here is a workable way of describing and comparing the essential work that goes on in health departments of different size and with different governance, information that is essential to conduct research about LHD performance. With a functional taxonomy we can raise a series of important questions about PH practice, as the profile in Table 3 and correlations in Table 4 begin to suggest. For example:

- PH work has a significant administrative component. Is this dominance related to the core communication aspect (written, oral, and electronic) of all PH activities? Can this profile be viewed in relation to other organizations with a significant administrative service com-

Table 4: Kendall's τ Correlation Coefficients* for Ranked Lists of Tasks Assigned (T), Knowledge Possessed (K), and Resources Available (R) in 11 Local Health Departments (LHDs) of Different Size and with Different Governance

Governance	Size		LHD 1	LHD 2	LHD 3	LHD 4	LHD 5	LHD 6	LHD 7	LHD 8	LHD 9	LHD 10
Centralized†	35	LHD 1	—									
	43	LHD 2		—								
		T	0.75									
		K	0.76									
		R	0.69									
Centralized hybrid‡	121	LHD 3			—							
		T	0.73	0.74								
		K	0.69	0.74								
		R	0.53	0.64								
	115	LHD 4				—						
		T	0.72	0.75	0.81							
		K	0.72	0.74	0.83							
		R	0.52	0.67	0.72							
	187	LHD 5					—					
		T	0.76	0.85	0.8	0.81						
		K	0.72	0.74	0.81	0.83						
		R	0.59	0.73	0.71	0.74						
Home rule§	139	LHD 6						—				
		T	0.68	0.64	0.7	0.73	0.69					
		K	0.64	0.7	0.74	0.74	0.76					
		R	0.57	0.69	0.65	0.59	0.61					
Independent¶	115	LHD 7							—			
		T	0.77	0.72	0.74	0.74	0.75	0.64				
		K	0.69	0.72	0.76	0.8	0.82	0.75				
		R	0.6	0.71	0.65	0.59	0.66	0.68				
	144	LHD 8								—		
		T	0.64	0.72	0.72	0.74	0.76	0.7	0.75			
		K	0.69	0.68	0.68	0.68	0.72	0.72	0.69			
		R	0.6	0.73	0.7	0.66	0.75	0.7	0.67			
	107	LHD 9									—	
		T	0.59	0.64	0.65	0.67	0.65	0.67	0.65	0.73		
		K	0.61	0.69	0.7	0.72	0.76	0.82	0.77	0.68		
		R	0.54	0.68	0.7	0.62	0.64	0.73	0.68	0.73		

118	LHD 10	T	0.72	0.68	0.69	0.75	0.75	0.73	0.79	0.78	0.7	—
		K	0.68	0.75	0.76	0.81	0.81	0.78	0.84	0.69	0.82	—
		R	0.52	0.63	0.54	0.58	0.61	0.62	0.61	0.6	0.64	—
122	LHD 11	T	0.72	0.72	0.75	0.75	0.77	0.77	0.77	0.81	0.73	0.84
		K	0.71	0.79	0.72	0.76	0.77	0.79	0.77	0.74	0.81	0.82
		R	0.4	0.58	0.65	0.65	0.63	0.66	0.59	0.63	0.69	0.66

*All correlations are significant at $p \leq .05$.

[†]LHDs are units of the state health agency.

[‡]LHDs are units of the state health agency with a degree of local autonomy.

[§]LHD that has jurisdiction over many local townships and municipalities.

[¶]LHDs are units of local government.

ponent? Could such comparisons inform system-wide management strategies for LHDs?

- Is the low ranking of more technical tasks related to the limited number of specialists available in a typical LHD, or is specialization less important in PH work than assumed?

- What does the low ranking of knowledge about the ecological model of population health (a prominent framework for education, training, and research; Institute of Medicine 2003) tell us about the model, or about the workforce?

- Do the nearly universal e-mail and Internet access, as well as highly ranked access to computers and IT support, reflect a decade of emergency preparedness funds, or something else?

- About 75 percent of employees indicate they either are assigned or have backup capability to respond in emergencies. Who are the 25 percent of employees that do not indicate capability for response? Are there implications for preparedness?

- Is inadequate access to translators and translated health materials a reflection of the nation's changing demographics, a different scope of PH services being provided, or something else?

- Limited correlations between LHDs on resources may not be surprising, given the range of funding for LHDs. Is lack of correlation related primarily to funding variance or to something else?

IMPLICATIONS

Beyond the exploratory questions suggested above, data collected using the taxonomy will enable exploratory analyses to examine the distribution of tasks and their association with resources and knowledge. This can contribute to a more precise picture of how work is accomplished in local PH, allow exploration of appropriate redundancies in PH work, and potentially suggest systemic strategies for management. In theory, with an expanded dataset such research might be extended to produce falsifiable predictions of performance in LHDs.

Taxonomy is the organization of a particular set of information for a particular purpose (Rappaport 2008). A classification of PH work can serve two main purposes: as a tool for research it provides a practical resource for documenting PH work; and it establishes a framework for further development.

Taxonomy is always a contentious issue because the world does not come to us arranged in tidy packages (Gould 1981), and the value of taxonomy at any stage of development is in its application. The survey developed with this taxonomy produced standardized comparable data that supported local management decisions and that potentially can inform system-wide infrastructure development (Merrill and Carley 2008). It is an expectation that this taxonomy will be revised and expanded by researchers and practitioners who use it (Bazzoli et al. 1999; Bazzoli, Shortell, and Dubbs 2006; Luke 2006). This taxonomy does have the advantage of being readily adapted to circumstances within real PH organizations because it is based on practice documentation and expert consensus.

The taxonomy is a first step toward developing a shared understanding of the work done in local PH. It lays a foundation for a controlled set of terms for representing information electronically in computer systems similar to the terminologies available in nursing and medicine (Werley et al. 1991; Kleinbeck 1996; McCloskey and Bulechek 2000; Pulakos, Arad, and Donovan 2000; Yeung, Chan, and Lee 2003; Chang et al. 2005; Cimino 2006; American Medical Association 2008; Lee et al. 2008). Future steps include establishing common definitions for all terms and evaluating these for consistency, completeness, and conciseness (Gomez-Perez 1995). Formal representation with Unified Modeling Language would allow visualization and further understanding of the concepts involved, which is a prerequisite for computational interoperability among heterogeneous systems such as those designed for finance, education, quality assurance, and research purposes (Object Management Group 2008).

The current state of knowledge about exactly how PH work is accomplished is insufficient to support modern analytic approaches in systems and policy research (Lenaway et al. 2006). Studies to inform both organizational management and policy development at all levels of government require data beyond what is currently available about PH organizations (Gebbie et al. 2007). Until common data elements and vocabulary are more widely available, this work will proceed slowly. As the discipline of Public Health Services and Systems Research emerges, it is incumbent upon members of this community to lay foundations for a sound and comparable body of knowledge with an array of data tools and resources.

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