Characterizing Informatics Roles and Needs of Public Health Workers: Results from the Public Health Workforce Interests and Needs Survey

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Abstract

Objective: To characterize public health workers who specialize in informatics, and to assess informatics-related aspects of the work performed by the public health workforce.

Methods (Design, Setting, Participants): Using the nationally representative Public Health Workforce Information Needs Survey (PH WINS), we characterized and compared responses from informatics; information technology (IT); clinical and laboratory; and other public health science specialists working in state health agencies.

Main Outcome Measures: Demographics, income, education, and agency size were analyzed using descriptive statistics. Weighted medians and interquartile ranges (IQR) were calculated for responses pertaining to job satisfaction, workplace environment, training needs, and informatics-related competencies.

Results: Out of 10 246 state health workers, we identified 137 (1.3%) informatics specialists and 419 (4.1%) IT specialists. Overall, informatics specialists are younger but share many common traits with other public health science roles, including positive attitudes towards their contributions to the mission of public health as well as job satisfaction. Informatics specialists differ demographically from IT specialists, and the two groups also differ with respect to salary and their distribution across agencies of varying size. All groups identified unmet public health and informatics competency needs, particularly limited training necessary to fully utilize technology for their work. Moreover, all groups indicated a need for greater future emphasis on leveraging electronic health information for public health functions.

Conclusions: Findings from the PH WINS establish a framework and baseline measurements that can be leveraged to routinely monitor and evaluate the ineludible expansion and maturation of the public health informatics workforce, and can also support assessment of the growth and evolution of informatics training needs for the broader field. Ultimately, such routine evaluations have the potential to guide local and national informatics workforce development policy.

Keywords: Public Health Informatics; workforce; information systems; survey research; state health agency; information needs

Introduction

Public health informatics (PHI) is the systematic application of information and computer science as well as information systems to public health practice, research, and learning.[1] Although public health practitioners have long utilized information technologies to perform their jobs, the rise of PHI as a discipline within both public health and the broader field of informatics began at the start of the twenty-first century. During the first decade, PHI activities were characterized by a primary focus on automating surveillance.[2] Today PHI contributes to many areas of public health, including but not limited to the following activities: 1) implementation of electronic health record (EHR) systems and health information exchange (HIE) to enable successful achievement of "meaningful use" criteria such as electronic reporting of notifiable diseases[3-5]; 2) measurement of a wider array of health indicators, including social determinants through "big data" analysis of multiple community data sources[6,7]; and 3) development, implementation, and assessment of patient-centered technologies aimed at supporting health and well-being in the changing landscape of health care delivery.[8-10] To receive data from EHR systems and HIE networks; interact 'bi-directionally' with providers and patients; and, monitor population health using increasingly 'Big' and complex multi-source data streams, public health agencies need to invest in PHI systems as well as workers.

Given the need for and accelerating initiatives in the field, PHI is viewed as an important core to modern public health practice by the U.S. Centers for Disease Control and Prevention (CDC)[11], Council for State and Territorial Epidemiologists (CSTE)[12] and the Association of Schools & Programs in Public Health (ASPPH)[13]. Despite the increasing perceived value of PHI, it is believed that there are few PHI educational programs[14] and trained individuals working in public health agencies.[15] However, the actual size and characteristics of the PHI workforce are largely unknown given a dearth of studies and data from the field.

In a 2009 survey of American Public Health Association (APHA) members that assessed PHI core competencies in the public health workforce[16], only 8 of the 56 total respondents reported working in a health department. Since that study, the CDC started an official, registered apprenticeship program in PHI.[17,18] Each year the CDC sponsors approximately 10 fellows who are placed in state and local health departments. While the CDC publicly reports on the activities of its trainees during their fellowship, the agency does not publish data on the jobs held by these individuals after fellowship completion. In a recent analysis of the 2013 profile survey by the National Association of City and County Health Officials (NACCHO), Mac McCullough and Goodin[19] found that health departments classified as 'high capacity' with respect to PHI employed "information systems" personnel at a higher rate than departments deemed to be 'low capacity.' However, this most recent study did not assess the number or characteristics of PHI related roles within local health departments.

The recently-fielded Public Health Workforce Interests and Needs Survey (PH WINS) presents an opportunity to characterize PHI workers in state health agencies (SHAs). The survey results further provide an opportunity to compare PHI workers with other groups, such as Information Technology (IT) workers, and analyze informatics-related aspects of the work performed by the broader public health workforce. In this paper we present an analysis of the PH WINS workforce data, focusing on respondents who self-reported they are in PHI or IT roles which may lead, support, or participate in informatics related work activities (e.g., implementation of a information system). Understanding the roles of informatics-related workers and needs of the broader public health workforce can inform curriculum development at schools of public health; training needs for existing public health workers; and PHI competencies that underlay the CDC apprenticeship program.

Methods

Using data from the 2014 PH WINS, we sought to characterize PHI workers, compare PHI to other roles, and identify informatics-related needs of the broader public health workforce. As a secondary analysis

of PH WINS, the study was deemed non-human subjects research by the Indiana University Institutional Review Board.

Survey instrument

The PH WINS was developed by the Association for State and Territorial Health Officials (ASTHO) in partnership with the de Beaumont Foundation to "collect perspectives from the field on workforce issues, to validate responses from leaders on workforce development priorities, and to collect data to monitor over time." The survey utilizes a number of previously tested workforce items from prior instruments, and the survey underwent cognitive testing prior to distribution. For additional details on the design and pre-testing of PH WINS, refer to Leider et al.[20]; a copy of the full instrument can be found on the ASTHO web site.[21]

Data collection

The web-based survey targeted three frames: 1) state health agencies[22]; 2) members of the Big City Health Coalition; and 3) local health departments (LHDs). A total of 40 091 invitations were distributed across the three frames via email between September and December 2014, with reminder emails every 2-3 weeks. A total of 19 171 (47.8%) respondents from 37 state health agencies, 14 of the nation's largest metropolitan health departments and over 50 local health departments completed the survey. Of the total respondents, 10 246 (53.4%) were permanently employed at a SHA central office. The remaining permanent employees from LHDs and all non-permanent employees were excluded from this study, because they could be used only to generate estimates at agency or state levels.

Response weighting

In our analyses, responses were weighted to account for the complex sampling frame and to match the national distributions of state public health agency employees among paired U.S. Department of Health

and Human Services (HHS) geographic regions (5 levels), governance type (4 levels), and population size served (3 levels), and central office versus non-central office location, as measured by the 2012 ASTHO Profile Survey. A more detailed description of the weighting methodology is available in Leider et al.[20]

Data set preparation

The data set was prepared by ASTHO and delivered using secure file transfer for analysis. Prior to delivery, new variables were created by collapsing multiple survey items or calculating new variables. For example, respondents' job classifications were grouped into four segments: Administrative, which included "Information Technology Specialist"; Public Health Science (PHS), which included "Public Health Informatics Specialist"; Clinical and Laboratory (CL); and Social Services. A single, collapsed race/ethnicity variable was generated from separate self-reported race and ethnicity questions. Additional details regarding data set preparation are available in Leider et al.[20]

Data analysis

To characterize PHI workers, we calculated descriptive statistics for demographics as well as selected job satisfaction, workplace environment and training questions using the weighted sample proportions and 95% confidence intervals. We further calculated similar descriptive statistics for the IT, CL, and other PHS groups. These groups were chosen for comparison because PHI workers often serve as key connectors between a division (e.g., epidemiology, public health laboratory) and the IT group, working on projects that design, implement, or enhance an information system in use within the division. Therefore PHI workers may share common traits and needs with the employees they most often interact with during day-to-day functions. The Rao-Scott chi-square test, a design-adjusted version of the Pearson chi-square test, was employed to determine if differences in job satisfaction, workplace environment and training existed between groups.

Summary statistics and measures of dispersion for ordinal-level data were compared using weighted medians and interquartile ranges (IQR), respectively, due to extremely left skewed distributions. The median response by group to questions regarding core public health competencies were compared in terms of perceived importance to day-to-day work and current skill level. Respondents indicating "N/A" for current skill level were excluded from median calculations in order to preserve the ordinal interpretation of the scale. Finally, we quantified median values and IQR to summarize respondents' exposure to the trend of leveraging electronic health information as well as how they perceive the importance, impact on their work, and need for future emphasis in public health. All analyses were performed with SAS 9.4 (Carey, NC) using the PROC SURVEYMEANS and PROC SURVEYFREQ procedures.

Results

Characteristics of the PHI vs. IT vs. Other Public Health Workforce Segments

Out of the total SHA central office respondents, 137 (1.3%) indicated they serve in a "Public Health Informatics Specialist" role; 419 (4.1%) indicated they serve in an "Information Technology Specialist" role; 3 861 (37.7%) indicated they serve in a "Public Health Science" role; and 1 487 (14.5%) indicated they serve in a "Clinical and Laboratory" role. Table-1 summarizes the demographics, education, annual salary, geographic location, and size of population served by workers in these roles.

Although the PHI segment is in many ways similar to other segments of the workforce, several notable distinctions stand out in Table-1. More than a third (36.3%) of PHI workers are 40 or under, which is higher than the proportions reported in the IT (16.4%), other PHS (29.6%), and CL (23.6%) segments for this age range. IT workers were more likely to be 40 to 60 years old (70.8%), which is more than 10% higher than any other group. However, a quarter of the PHI workforce reports working in public health for more than 21 years; which is twice that of the IT segment (12.9%) and almost equal to those in the PHS and CL segments. Whereas IT workers tend to be male (59.1%) and similar in gender distribution

with CL workers (78.1% male), PHI workers tend to be female (61.3%) and similar to PHS workers (67.6% female). With respect to race, IT workers are more likely to be Asian (13.1%) when compared to PHI workers (5.7% Asian); overall PHI racial demographics are again similar to other PHS workers as opposed to IT or CL workers. With respect to income, PHI workers tend to earn less with more than half of PHI respondents (54.3%) reporting an annual salary up to $55,000. The PHI segment also exhibits a unique mix of educational degrees held by workers. Like the IT segment, nearly a third (28.8%) of PHI workers do not have a Bachelors, yet like other PHS roles PHI employees predominantly (38.2%) hold a Masters. Finally, unlike the other segments, PHI workers appear to be more evenly distributed among SHAs that serve small (34.1%), medium (30.5%) and large (35.4%) populations; whereas the other groups, especially IT workers, appear to be concentrated in large jurisdictions (IT=63.6%; PHS=45.7%; CL=45.0%).

<Insert Table-1 approximately here>

Job satisfaction, training needs and workplace environment

In Table-2 we summarize weighted job satisfaction, training needs, and workplace environment responses. When asked if they were satisfied with their job, PHI workers tended to respond either somewhat (34.8%) or very (52.4%) satisfied. This is contrasted with lower proportions in the other three segments ($p=0.046$). Similarly, PHI respondents were generally satisfied with their pay; with nearly two-thirds (64.9%) indicating they were either somewhat or very satisfied, as opposed to the IT (49%), PHS (51.1%) and CL (44.5%) segments ($p<0.0001$). The PHI segment reported similarly favorable feelings towards their organization ($p=0.72$) and job security ($p=0.10$).

Respondents were further asked about their work environment. With respect to whether respondents felt the work they do is important, PHI workers were more likely to agree or strongly agree than IT, CL, or other PHS ($p<0.0001$). PHI workers also responded more favorably regarding the relative contribution of their work to the agency's mission ($p=0.0006$) as well as the availability of opportunities to apply their

expertise (p=0.0052). Among all four groups, respondents were more neutral when asked about job training. When asked whether employees training needs are assessed, PHI responses were marginally higher than CL workers but more than 10% higher than IT and other PHS workers (p<0.0001). PHI respondents answered more favorably (>10% when compared to CL and other PHS; >20% when compared to IT; p<0.0001) when asked if they received sufficient technical training. Yet for all four groups, at least 20% of respondents disagreed that employees' training needs were assessed and they received sufficient technical training.

<Insert Table-2 approximately here>

Informatics needs and trends

In Figure-1 we summarize selected workforce training priorities identified by the PHI, IT, PHS and CL segments. The survey asked respondents to assess both the importance of and their current skill level in a number of core public health competencies. We selected the subset of core public health competencies that overlap the greatest with previously defined PHI competencies.[2,23,24]

<Insert Figure-1 approximately here>

Of the selected knowledge areas, "gathering reliable information" and "applying quality improvement concepts in my work" are perceived similarly (Medians range between 3.1 and 3.4 which are "somewhat important" values) across the 4 segments with respect to importance in day-to-day work. Furthermore, there are similar ratings with respect to current skill level in these areas across the four segments (Medians range 2.4 to 2.8 representing responses between beginner and proficient). There is divergence in the three questions pertaining to interpreting data and evidence-based practice. Like the PHS and CL segments, PHI workers rate data interpretation, finding evidence and applying evidence as somewhat important (Medians range from 2.6 to 3.3). Conversely, the IT segment rated these competencies as somewhat unimportant (Medians range 1.6 – 2.4) to their day-to-day work. With respect to their

current skill level in these three areas, median response in each of the four segments similarly was between Beginner (2.0) and Proficient (4.0) with several medians leaning towards the Beginner level.

The survey further asked respondents a series of questions about several trends in public health. Respondents were asked about how much they had heard about the trends as well as the importance of the trends to the field, their impact on the respondents' daily work, and how much emphasis should be given to them in the future. The trends included concepts such as Public Health Services and Systems Research (PHSSR)[25], Health in All Policies, and implementation of the Affordable Care Act.[26] In Figure-2, we summarize respondents' answers to the questions about leveraging electronic health information – a core concept in PHI.

<Insert Figure-2 approximately here>

While PHI, IT and PHS workers reported hearing about the trend "A little," CL responses trended towards "Not much." All four groups generally felt that electronic health information would impact their day-to-day work. Yet only PHI and IT workers feel that electronic health information is somewhat important with PHS and CL responses trending towards "somewhat unimportant." All groups agreed that in the future "more emphasis" should be placed on leveraging electronic health information for public health functions.

Discussion

Using the PH WINS dataset, we analyzed the characteristics, perceptions, and information needs of PHI workers in SHA central offices in relation to other workforce segments. The data from PH WINS establish a large, representative baseline for an increasingly important segment of the broader public health workforce – public health informatics. Respondents' answers help characterize existing, self-identified PHI workers while distinguishing them from other segments of the public health workforce. Furthermore, because PHI is increasingly recognized as a core competency for all public health workers

and not just specialists, responses to several questions on the PH WINS help benchmark where the field is with respect to supporting broader PHI training and needs among the public health workforce.

A key finding is that PHI is a very small segment of the public health workforce. Just 1.4% of respondents identified themselves as a PHI specialist, whereas 4.1% of respondents identified themselves as IT specialists. Combined this is just 5.5% of the overall public health workforce. At first glance, the small number may seem inadequate given the growth in information system adoption and use within public health. However, these numbers are on par with similar measurements of the IT workforce within the health care sector from several years ago when IT systems were just beginning to proliferate medicine. Estimates from the United Kingdom and Australia suggest there are roughly 1 in 50 health care workers who specialize in IT; in U.S. hospitals it was estimated that 1 in 60 workers specialized in IT.[15] Over time we expect that the PHI workforce will expand, yet we do not anticipate that it would grow much beyond 1 in 40 PH workers since it is a highly specialized role.

The survey further characterizes PHI workers as younger, earning less, and more diffuse among health departments of various sizes. These findings are not surprising given that the PHI specialization is a recent addition to the field, so health departments may have just one or two PHI specialists rather than an entire division such as the Minnesota Department of Health has an Office of Health Information Technology.[27] Public health agencies use and continue to adopt a wide range of sophisticated information systems as the practice of public health, like medicine, has shifted away from paper-based towards electronic processes for conducting routine business functions like surveillance, food inspections, and environmental monitoring. PHI specialists increasingly play key roles in supporting not just the installation of systems but the design, selection, integration, adoption and use of these systems in support of public health practice. As information systems continue to proliferate public health agencies, there is likely to be an increased need for specialists, and maybe divisions, who not only understand information architectures but also core public health business processes. Such insight

enables PHI specialists to ensure that information systems in public health agencies meet core business objectives and the needs of end users. The characterization of this segment via the PH WINS establishes a baseline that will allow for monitoring of PHI specialists over time as agencies continue to adopt and evolve information systems and their uses.

Another key observation from this analysis is that the PHI segment is distinct from the IT segment of the public health workforce. In fact, the PH WINS classification of PHI as "Public Health Science" in contrast to "Administration" appears to be appropriate given responses on several sections of the survey. Often PHI and IT workers are lumped together because they both support modernization of public health practice through the use of computers and information systems. Yet their roles and functions within a health department are distinct; and the PH WINS data show they are also distinct with respect to demographics, education, income, distribution among health departments, and core competencies they deem important to their roles within health departments. For example, whereas PHI workers rate data interpretation, finding evidence and applying evidence as important to their day-to-day job, these functions may be less central to the responsibilities of IT workers. This may be because PHI workers not only support public health practice but also contribute to the science of public health. For example, whereas an IT specialist may provide support for general systems and software (e.g., desktop computers, keeping a server running), a PHI specialist may contribute to syndrome definitions or integrated visualizations of multi-source data feeds which enhances epidemiology. Therefore future studies as well as training should consider these differences before lumping them into a single job classification.

The PH WINS survey also highlights interesting but confusing characterizations of the PHI workforce. For example, PHI workers tend to earn less than IT workers, yet the PHI segment tends to have higher educational attainment than the IT segment. This disparity could be due to several factors including age, region, supervisory status, and population served. Furthermore, PHI workers were evenly distributed

across jurisdictions whereas IT workers were concentrated in larger SHAs. It is unclear from these data whether smaller SHAs contract out IT workers or cooperatively share IT support with other, neighboring SHAs.

In addition to helping classify PHI workers, the PH WINS survey supports identifying and benchmarking PHI training needs for the broader public health workforce. Our analysis examined PHI-related trends and information needs, most notably the trend towards the use of electronic health information. While the responses to these questions further reveal distinctions between the PHI, IT and CL segments of the workforce, they also highlight similar needs across groups of workers. All groups indicated that more emphasis needs to be placed on the use of electronic health data; and three of the four groups indicated that finding, interpreting and applying data to practice is both important and a key training need. Furthermore, we observed mixed responses to the technology training questions with roughly 1-in-5 respondents indicating that health departments may not provide sufficient technology training for the current workforce. As public health agencies continue to adopt electronic systems to manage larger volumes of data, we believe these results indicate a gap with respect to workers' capacity to access, locate, interpret and apply electronic data in the course of their job function.

Responses related to computer and informatics training suggest a continued need to both enhance the curricula in schools of public health (SPH) and training programs that target the existing workforce. Currently informatics is considered a key component[13] of a twenty-first century MPH degree by ASPPH and has been proposed as foundational content for the MPH and DrPH degrees by the Council on Education for Public Health. Yet there are currently few PHI programs.[14] These recommendations will help informatics find its way into curricula at accredited SPH, but the adoption process will likely take several years to be fully realized. For example, although widely recognized as important to clinical practice for many years, adoption of informatics as foundational content in medical schools has been slow.[28,29] In addition, it will take many years for trained graduates to become established throughout

public health agencies. Therefore practice-based training programs will be necessary to support existing workers as well as new public health professionals who do not receive such training in their academic program. There have been existing efforts by the Public Health Informatics Institute, American Medical Informatics Association, and CDC. While beneficial, these or similar programs will need to increase in capacity to meet the needs of the larger workforce. Future work and research must continue to design, implement, and assess training programs that address the broad needs.

Limitations

All studies have limitations that warrant caution when interpreting the results. Despite a rigorous methodology and representative participation from all geographic regions and jurisdiction sizes, 13 states did not participate in the PH WINS. This may limit is generalizability to all SHAs, although this weakness is mitigated somewhat by the data cleaning and weighting scheme. Furthermore, our analyses did not correct or adjust for differences based on age, education, population size, or years in public health. Additional analyses may be necessary to confirm patterns and trends, including which differences between groups are both statistically and meaningfully different.

More germane to this analysis is the lack of clear definitions around the self-identified job role within the health department. Since the PH WINS did not ask respondents to provide exact titles or describe example job responsibilities or functions, there is no way to independently validate that a self-identified PHI respondent actually performs typical PHI job functions. It is feasible that some IT specialists may have selected PHI as their role, and equally plausible is that PHI specialists may have indicated they serve in an IT role. Furthermore, respondents' selection of their job type may vary by state based on similar roles being given different titles or job classifications. Given overlap between PHI and other PHS roles, it may also be the case that some information management workers, such as epidemiologists, self-identified as PHI workers, while others did not.

There is also the potential for non-IT or non-informatics roles to perform PHI functions, further confounding the results. For example, since some existing PHI specialists likely were trained originally as epidemiologists or another job duty before specializing in PHI, they may have reported their role as something other than PHI or IT. It is also possible that epidemiologists may perform PHI functions as part of their regular duties. For example, configuration of a syndromic surveillance system could just as easily be performed by a savvy epidemiologist as a PHI specialist. Electronic laboratory reporting interfaces and system maintenance might also be performed by epidemiologists in areas where there isn't funding for PHI specialists.

Future analyses of the PHI role should therefore seek to explore the range of job classifications used in health departments, the informatics functions performed by non-PHI specialists, and the functions that informatics specialists play within a health department, including the variety of functional areas (e.g., communicable disease, environmental health) they serve. This will not only help further define the specialty of PHI but also further clarify the informatics competencies needed by the broader public health workforce.

Conclusion

Information systems and technologies are revolutionizing the delivery of health care as well as the practice of public health. Just as we've observed a growing demand for informatics capacity in health care organizations, a similar process is unfolding in the public health sector. Sufficient capacity requires both informatics specialists as well as general informatics competencies among the broader public health workforce. Results from the PH WINS establish a baseline against which future growth and maturation of the PHI workforce as well as expanding and evolving informatics training needs for the broader workforce can be measured.

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FIGURE LEGENDS

Figure 1: Median responses to importance and skill level of selected core public health competencies for public health informatics, information technology, public health science, and clinical and laboratory specialists.

Figure 2: Median responses to questions about awareness, importance, impact, and emphasis to be placed on leveraging electronic health information for public health informatics, information technology, public health science, and clinical and laboratory specialists.

Table 1. Weighted proportions, standard error and raw counts for demographic, education, salary, geographic location, and population size characteristics for selected state health agency worker sub-groups.

	Public Health Informatics * (n=137) †			**Information Technology * (n=419)** †			**Other Public Health Science * (n=3 861)** †			**Clinical and Lab * (n=1 487)** †		
	Weighted %	*(se %)*	*[n]**	*Weighted %*	*(se%)*	*[n]**	*Weighted %*	*(se%)*	*[n]**	*Weighted %*	*(se%)*	*[n]**
Sex												
Female	61.3	(6.5)	47	40.9	(2.7)	250	67.6	(0.8)	1252	21.9	(1.2)	313
Male	38.7	(6.5)	87	59.1	(2.7)	163	32.4	(0.8)	2560	78.1	(1.2)	1160
Race / Ethnicity												
American Indian or Alaska Native	0	(0)	0	1.0	(0.7)	2	0.4	(0.1)	15	0.5	(0.2)	7
Asian	5.7	(2.0)	10	13.2	(3.2)	39	4.9	(0.4)	181	5.6	(0.8)	81
Black or African American	11.5	(4.5)	18	8.7	(1.7)	36	10.2	(0.5)	337	9.3	(1.1)	111
Hispanic or Latino	6.6	(2.9)	5	3.3	(0.7)	12	5.6	(0.4)	199	4.9	(0.5)	68
Native Hawaiian or Pacific Islander	0.4	(0.4)	1	0.7	(0.6)	1	0.1	(0.1)	3	0.2	(0.1)	3
White	71.7	(3.5)	96	67.9	(3.4)	297	74.6	(0.8)	2883	76.0	(1.7)	1144
Two or more Races	4.1	(2.6)	6	5.2	(1.2)	23	4.2	(0.5)	170	3.5	(0.9)	50
Age												
≤ 30	12.9	(5.7)	12	2.3	(0.7)	11	8.3	(0.6)	325	6.7	(0.7)	104
31 to 40	23.4	(4.1)	31	14.1	(2.6)	65	21.3	(0.9)	782	16.9	(1.1)	255
41 to 50	18.2	(3.4)	34	32.8	(2.8)	134	26.3	(1.3)	989	22.5	(1.9)	325
51 to 60	31.6	(3.3)	40	38.0	(2.1)	152	30.0	(0.9)	1164	37.5	(1.9)	548
> 60	13.9	(5.3)	17	12.8	(1.5)	50	14.1	(0.9)	533	16.4	(0.9)	231
Years in Public Health												
0-5 years	23.3	(6.3)	32	25.3	(2.3)	104	20.5	(0.8)	760	22.3	(0.8)	353
6-10 years	24.6	(3.2)	28	29.1	(3.1)	106	18.1	(1.0)	670	20.6	(1.2)	298
11-15 years	17.7	(3.3)	24	19.2	(3.5)	74	17.8	(0.8)	689	15.3	(0.9)	244
16-20 years	8.7	(2.5)	15	13.5	(2.4)	51	13.0	(0.7)	518	14.0	(1.1)	189
21 or above	25.7	(6.2)	35	12.9	(1.5)	56	30.6	(1.0)	1155	27.8	(1.6)	369
Supervisory Status												
Non-supervisor	69.0	(3.8)	89	61.4	(2.7)	254	35.5	(0.9)	1439	54.9	(1.2)	827
Team leader	17.9	(3.4)	26	18.9	(2.2)	67	14.4	(0.7)	533	18.5	(1.2)	274
Supervisor	11.4	(3.1)	17	12.8	(1.9)	58	20.3	(0.8)	800	15.9	(1.0)	233
Manager	1.7	(1.1)	4	5.5	(1.0)	32	23.1	(0.9)	837	8.5	(1.3)	119
Executive	0	(0)	0	1.4	(0.8)	5	6.7	(0.4)	241	2.2	(0.5)	29
Highest Educational Attainment												
Doctoral	5.5	(2.1)	10	0.6	(0.4)	3	14.2	(0.9)	532	11.1	(1.3)	141
Masters	38.2	(7.9)	48	23.2	(2.5)	89	47.7	(0.9)	1835	28.4	(1.2)	392
Bachelors	27.5	(6.2)	38	47.5	(2.4)	200	29.5	(1.1)	1147	45.4	(1.3)	706
No Bachelor or Higher	28.8	(5.8)	41	28.7	(2.8)	127	8.6	(0.5)	345	15.1	(1.2)	247
Annual Salary												
≤ $35,000	9.9	(3.4)	17	2.9	(0.9)	14	3.5	(0.4)	119	5.9	(0.7)	76
$35,000.01 - $45,000	20.6	(5.7)	26	8.2	(1.7)	37	8.8	(0.7)	342	12.3	(1.0)	185
$45,000.01 - $55,000	23.8	(6.6)	23	19.3	(1.7)	69	16.0	(0.8)	627	22.5	(1.4)	315
$55,000.01 - $65,000	10.6	(2.8)	19	19.3	(2.3)	78	19.5	(1.0)	650	18.2	(1.3)	251
$65,000.01 - $75,000	15.7	(5.1)	17	15.5	(2.0)	62	17.4	(0.8)	604	15.5	(1.1)	200
$75,000.01 - $85,000	6.0	(2.2)	9	13.9	(2.4)	47	13.5	(0.7)	470	11.7	(1.4)	136
$85,000.01 - $95,000	8.1	(3.2)	10	12.5	(1.9)	42	8.3	(0.7)	300	4.7	(0.5)	74
> $95,000	5.3	(2.5)	6	8.4	(1.7)	39	12.9	(0.7)	475	9.0	(1.1)	124
Region												
New England & Atlantic (HHS 1 &2)	13.5	(2.9)	20	15.4	(2.0)	67	18.4	(0.5)	751	20.8	(0.8)	306

Mid-Atlantic & Great Lakes (HHS 3 &5)	17.0	(3.5)	29	17.7	(1.8)	107	17.6	(0.5)	961	20.0	(1.0)	380
South (HHS 4 &6)	38.2	(6.6)	47	31.3	(1.8)	123	35.9	(0.7)	1086	35.7	(1.5)	472
Mountain/Midwest (HHS 7 & 8)	18.7	(2.7)	27	5.5	(2.0)	24	12.5	(0.6)	568	10.8	(1.1)	198
West (HHS 9 & 10)	12.6	(3.8)	14	30.0	(2.1)	98	15.5	(1.0)	495	12.7	(0.6)	131
Size of Population Served												
Small (Population ≤ 2,750,000)	34.1	(5.2)	18	12.9	(2.8)	25	19.5	(0.6)	410	19.7	(1.5)	146
Medium (Population 2,750,001 to 6,250,000)	30.5	(5.8)	54	23.5	(2.7)	70	34.8	(0.8)	1304	35.3	(1.4)	539
Large (Population > 6,250,000)	35.4	(8.1)	39	63.6	(3.3)	252	45.7	(0.8)	1557	45.0	(1.8)	576

* Respondents' job roles, such as Public Health Informatics Specialist, were self-reported.

† Number of survey respondents.

HHS = U.S. Department of Health and Human Services

Table 2. Sparkline summary of satisfaction, workplace factors and training need responses by selected state health agency worker sub-groups.*

How satisfied are you with your …[†]	**Job**	**Job Security**	**Organization**	**Pay**
Public Health Informatics[‡]				
Information Technology[‡]				
Other Public Health Science[‡]				
Clinical and Lab[‡]				

Rate your level of agreement with the following statements [§]	**Work is important**	**Work is relevant**	**I apply my expertise**	**Sufficient technology training exists**	**My training needs are assessed**
Public Health Informatics[‡]					
Information Technology[‡]					
Other Public Health Science[‡]					
Clinical and Lab[‡]					

* Sparkline Minimum = 0%, Maximum=65%

† The five sparkline points, left to right, are: very dissatisfied, dissatisfied, neither dissatisfied nor satisfied, somewhat satisfied, very satisfied

‡ Respondents' job roles, such as Public Health Informatics Specialist, were self-reported

§ The five sparkline points, left to right, are: Strongly disagree, disagree , neither agree nor disagree, agree , strongly agree

Figure 1: Median responses to importance and skill level of selected core public health competencies for public health informatics, information technology, public health science, and clinical and laboratory specialists.

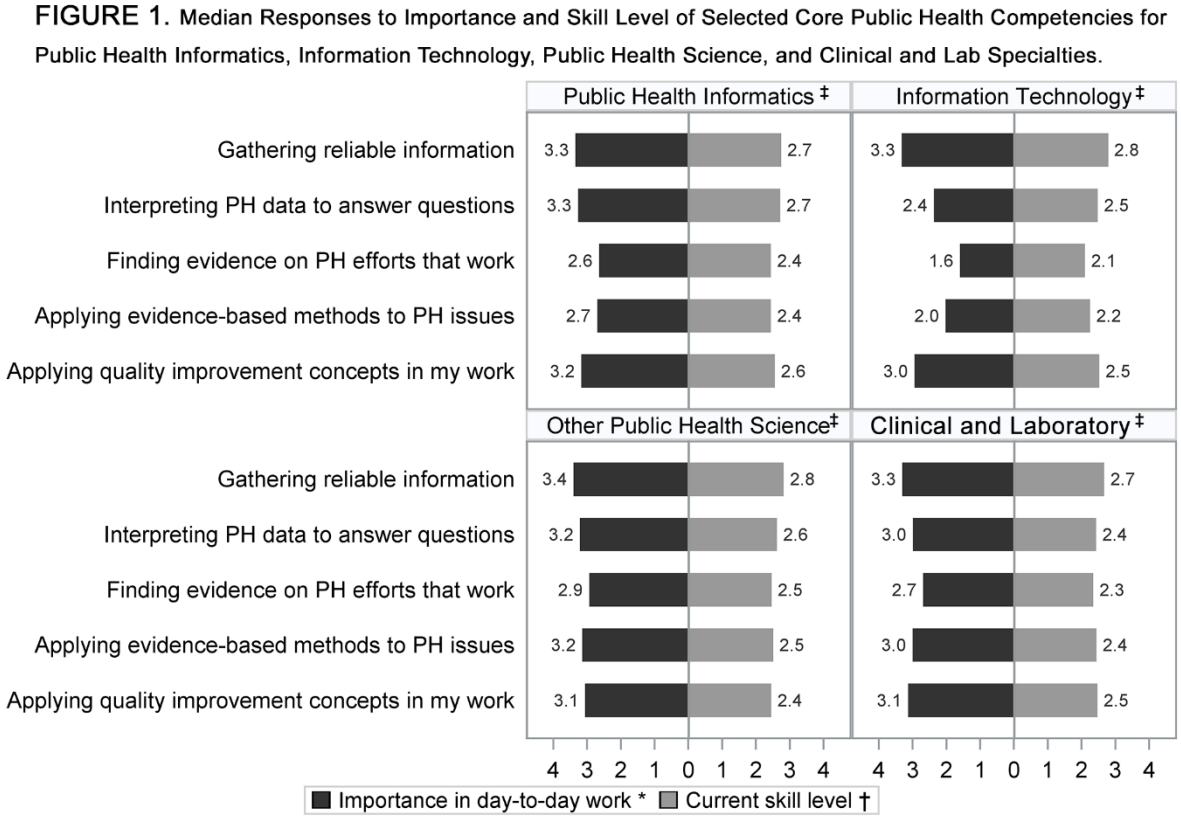
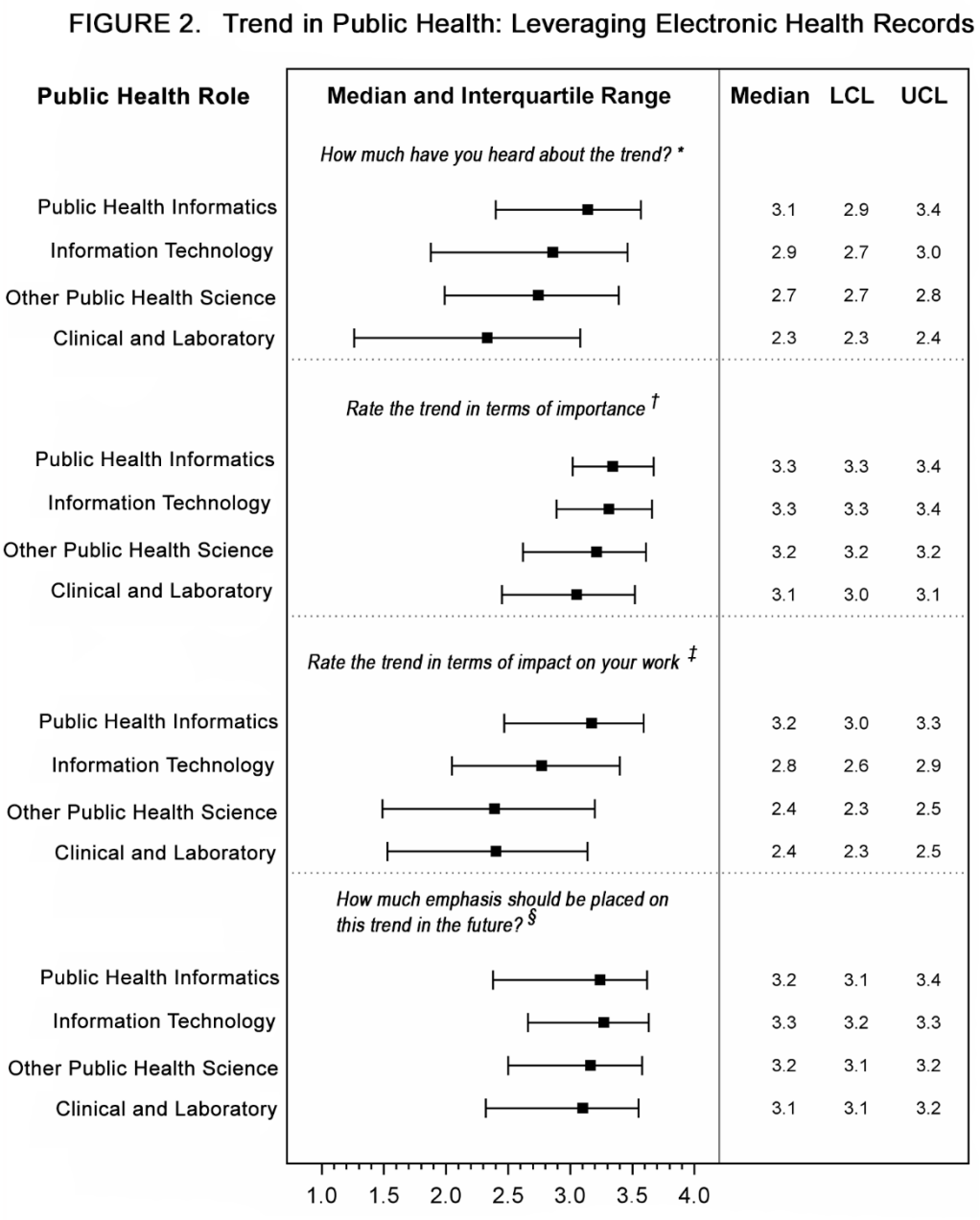


Figure 2: Median responses to questions about awareness, importance, impact, and emphasis to be placed on leveraging electronic health information for public health informatics, information technology, public health science, and clinical and laboratory specialists.



Note: Self-reported public health roles.
* 1 = Nothing at all; 2 = Not much; 3 = A little; 4 = A lot
† 1 = Not Important; 2 = Somewhat unimportant; 3 = Somewhat important; 4 = Very important
‡ 1 = Not at all; 2 = Not too much; 3 = Fair amount; 4 = A great deal
§ 1 = Not sure; 2 = Less; 3 = About the same; 4 = More