Gaps in the Existing Public Health Informatics Training Programs: A Challenge to the Development of a Skilled Global Workforce

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Abstract

The objective of this study was to explore public health informatics (PHI) training programs that currently exist to meet the growing demand for a trained global workforce. We used several search engines, scientific databases, and the websites of informatics organizations; sources included PubMed, Google, the American Medical Informatics Association, and the International Medical Informatics Association. The search was conducted from May to July 2011 and from January to February 2012 using key words such as *informatics*, *public health informatics*, or *biomedical informatics* along with *academic programs*, *training*, *certificate*, *graduate programs*, or *postgraduate programs*. Course titles and catalog descriptions were gathered from the program or institution websites. Variables included PHI program categories, location and mode of delivery, program credits, and costs. Each course was then categorized based on its title and description as available on the Internet. Finally, we matched course titles and descriptions with the competencies for PHIs determined by Centers for Disease Control and Prevention (CDC). Descriptive analysis was performed to report means and frequency distributions for continuous and categorical variables. Stratified analysis was performed to explore average credits and cost per credit among both the public and private institutions. Fifteen PHI programs were identified across 13 different institutions, the majority of which were US-based. The average number of credits and the associated costs required to obtain PHI training were much higher in private as compared to public institutions. The study results suggest that a need for online contextual and cost-effective PHI training programs exists to address the growing needs of professionals worldwide who are using technology to improve public health in their respective countries.

Keywords: public health informatics; training; global workforce

Background

The primary focus of public health is prevention, with a key focus on responding to the health needs of individuals as well as populations. Informatics applications in public health are being increasingly used to gather, process, interpret, represent, and disseminate relevant information from a variety of sources.[1] Along with the rapid increase in the transference of information within and across public health programs and structures comes the need for trained professionals capable of managing data systems from a population perspective.[2] Computers and mobile devices-from cell phones to handheld personal digital assistants-are commonly used by today's health workers and policy makers.[3] These tools are essential to informatics, which has been defined as the science that studies the use and processing of data, information, and knowledge.[4] The term *biomedical informatics* was proposed to designate a new field of study that combines the use of information for problem solving and decision making with biomedicine.[5] But a more comprehensive denomination came with *biomedical and health informatics*, which was defined as the "optimal use of information, often aided by the use of technology, to improve individual health, health care, public health, and biomedical research."[6] Various subspecialties are included under this term, but defining them in more specific terms is difficult and not satisfactory from the public health perspective. Public health informatics (PHI) is the field in which today's information revolution meets the specific needs of public health.[7] It is also defined as information, computer science, and technology systematically applied to public health practice, research, and learning.[8]

Improvements in the quality of health services through health informatics have been achieved in developed and developing countries alike.[9, 10] The latter, often limited by structural deficiencies and stringent economies, are experiencing exponential growth in information and communication technology. This growth can be demonstrated in the number of mobile phones and

the extent of Internet access easily available to the general population.[11, 12] Currently, health providers can deliver good-quality medical service even in remote locations. Telehealth programs, for example, make use of satellite communications.[13] Many challenges and barriers still need to be overcome, however.[14] The need for public health informaticians in developing nations has been identified in many different studies and reports, and more collaboration among countries in organizing public health on a global scale is required.[15, 16] One way of promoting the global view on a local scale is through the development of partnerships between established international global health centers and local institutions based in developing nations, where learning centers can be created to facilitate the implementation of public health systems.[17]

The information revolution that has occurred since the beginning of the 21st century has laid the foundation for the development of PHI as a solid discipline. Since the establishment of an agenda for PHI training in 2001, numerous programs offering degrees and certificates in PHI have been created, and PHI competencies have been developed and vetted.[18] In 2002, the Public Health Informatics Competencies Working Group firmly established that public health professionals should have informatics competencies, which are defined as "a public health worker's measurable performance, skill, or knowledge related to the systematic application of information and computer science and technology to public health."[19] According to the Centers for Disease Control and Prevention (CDC), public health agencies employ two categories of public health informaticians: the first includes researchers, scientists, project managers, and program advisors, while the second is made up of chief information officers and other senior agency personnel.[20] To ensure the high level of competency required by these senior professionals in the 21st century, it is essential that we qualify public health informaticians with the best knowledge and methods available. A prior study analyzed existing biomedical and health information programs.[21] To our knowledge, no similar work has been done to examine PHI programs. It is extremely important, therefore, to determine the current availability of PHI programs and what they have to offer.

The primary objective of this study is to explore PHI training programs that currently exist in order to meet the growing demand for a trained PHI workforce. The goal is to examine, from the perspective of a possible stakeholder, what information is readily available online.

Methods

The search method, keywords, and databases used can be seen in Figure 1. The study was performed from May to July 2011 and from January to February 2012. Once we identified the PHI programs available, course titles and catalog descriptions were gathered from the program or institution websites. Programs not listing curricular details were removed from consideration. We used the Health Informatics World Wide website[22] in addition to other online search engines to gather information about the PHI programs. Once the information was collected, the institutions' websites were visited to verify the information. We directly contacted the institutions for which we could not find individual course descriptions, and they eventually referred us to the information provided on their websites. Data relating to several variables were gathered from the final list of analyzed programs. These variables included PHI program categories (short-term, certificate, master's or PhD, and fellowship programs), location (within the United States and outside the United States), mode of delivery (face-to-face, online, and both), and the minimum number of credits required to complete the program. Additional information gathered included total cost and cost per credit hour for the existing PHI programs. Each course was then categorized based on nonexclusive keywords found in its title and description available on the Internet into the following categories: public health, information/computer science, management, surveillance, evaluation, geography, global, legal, and research. Courses that presented the keyword *public health* were further categorized as epidemiology, biostatistics, health promotion, environmental health, or health administration courses, or, when we could not relate the course to a specific domain, as general public health courses. Finally, we matched the course titles and descriptions with the competencies for public health informaticians determined by the CDC.

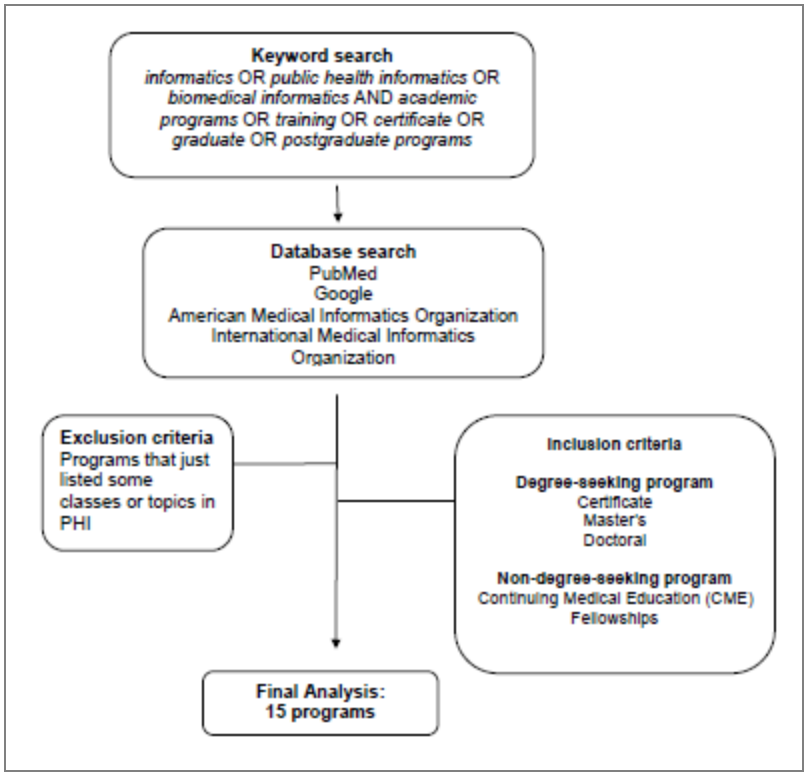

Figure 1: Flow Chart of the Search Conducted to Identify Existing PHI Training Programs

Statistical Analysis

Descriptive analysis was performed to report the means and frequency distributions for continuous and categorical variables as appropriate. Further stratified analysis was performed to explore average credits required and cost per credit among both the public and the private institutions. Similarly, we performed stratified analysis to determine the frequency distribution of the different program areas engaged in existing PHI training programs. All analysis was performed using SAS version 9.1.

Results

Our search showed that 15 programs across 13 institutions offered some kind of PHI training. Fourteen programs were US-based, and one was offered by an institution outside the United States (see Table 1). Eleven (73 percent) of the programs were certificate programs (see Figure 2). None of the institutions offered a PhD program specializing in PHI. Of the 13 institutions, 8 (62 percent) were public, and 5 (38 percent) were private.

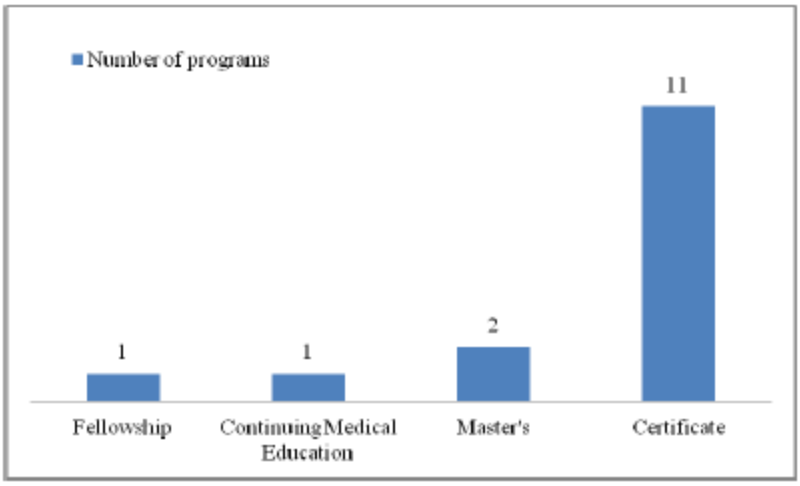

Figure 2: Types of PHI Training Programs

Of the PHI training programs offered by the public institutions, 67 percent (six of nine programs) were certificate programs, compared to 83 percent (five of six) of the programs that were offered by the private institutions. Of all the PHI training

programs, seven were offered completely online, and six used a face-to-face approach. In two programs, online and in-person classes complemented each other.

The average number of credits required to obtain a certificate in PHI was 18 (minimum 15, maximum 26). The average number of credits needed to obtain a certificate in PHI was much higher among private institutions as compared to public institutions. One institution offered 50 Continuing Medical Education (CME) units, while the other one did not mention the number of credits on the website. Two institutions offered master's degree programs in PHI, one requiring 48 credits and the other requiring 51. One public institution in the United States offered a two-year fellowship in PHI.

Table 1: Existing PHI Programs

Institution (Country)	Degree Offered	Credits	Tuition Costs	Delivery Mode	Website
Michigan State University (USA)	Graduate Certificate in Public Health Informatics	15	$16,804	Online	website
Rollins School of Public Health, Emory University (USA)	Graduate Certificate in Public Health Informatics	26	$38,220	In person	website
Rollins School of Public Health, Emory University (USA)	Master's of Science in Public Health (MSPH) in Public Health Informatics	48	$63,200	In person	website
Johns Hopkins (USA)	Certificate in Public Health Informatics	21	$19,383	Online	website
University of Illinois (USA)	Public Health Informatics Certificate Program	16	$11,840	Online	website
University of Illinois (USA)	Master in Public Health in Public Health Informatics	51	$37,740	Online	website
Nova Southeastern University (USA)	Graduate Certificate in Public Health Informatics	18	$9,630	Online	website
Indiana University (USA)	Certificate in Informatics for Public Health Professionals (Public Health Leader)	18	$16,417	In person	website
Columbia University Mailman School of Public Health (USA)	Certificate in Public Health Informatics	2 years	Not possible to determine	In person	website
University of Utah (USA)	AMIA 10×10 in Public Health Informatics	50 CME	$2,195	Online	website
University of Minnesota (USA)	Leadership in Health Information Technology for Health Professional Certificate	15	$13,167	Online and in person	website
University of Texas Health Science Center at Houston (USA)	Certificate in Public Health Informatics	15	$11,475	In person	website
Center for Disease Control and Prevention (USA)	Public Health Informatics Fellowship Program	2 years	Paid Fellowship	In person	website
Center for Public Health Informatics (India)	Certificate in Public Health Informatics	24	$1,000	Online	website

The average cost per credit hour for certificate programs in PHI offered in the United States was much higher in private institutions ($1,034 per credit hour) as compared to public institutions ($832 per credit hour). The average cost to acquire a certificate in PHI from a US-based private institution would be $22,411, as compared to $13,033 in a US-based public institution. The total average cost for US-based programs is $20,714, including the CME training. Programs offered completely online averaged $14,085 in tuition costs, including the CME training, while the remaining ones cost on average $27,901. One institution based outside the United States offered a PHI certificate for only $42 per credit hour, and the overall program fee was $1,000 for a one-year online program. The estimates of the above-mentioned program fees were based on the out-of-

state total costs found on the websites divided by the number of credits required to obtain a certificate in PHI, or the total program fees as mentioned in certain cases.

We found 125 courses across 15 PHI training programs delivering education related to the use of technology in public health. We categorized the courses based on their title and the description when available. Of the 125 courses, 74 had *public health* in the title or the description of the course, followed by *health* ($n = 27$), *clinical* ($n = 13$), and *population health* ($n = 4$). Seven courses were not classified, either because their title did not include the above terms, because their description did not include any of the above terms, or because no description was available. Ninety-three courses had an information/computer science component in the title or in the description of the courses when available. Fifteen courses included research, and twenty-seven specifically referred to evaluation in either the title or the description of the course. For the rest, 6 courses mentioned geography, surveillance was found in 9 courses, 22 courses were classified as legal, 24 were classified as management, and 7 were classified as global. For 42 courses, we could not find a description on the Internet. Of the 74 public health courses identified, 25 courses were classified into particular domains of public health, of which health administration was identified as the largest subspecialty, with 10 courses found (see Figure 3). The remaining 49 public health courses were not specific to any particular domain.

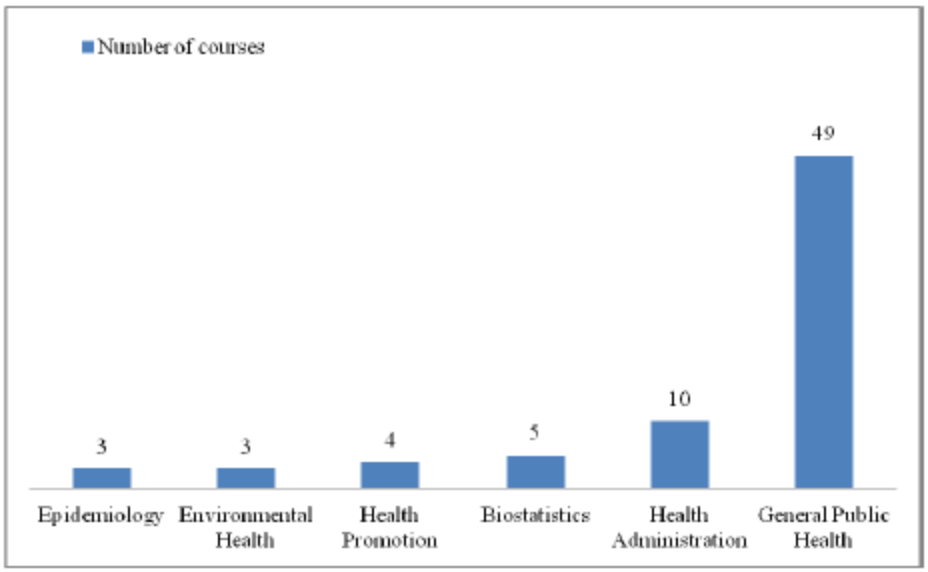

Figure 3: Number of PHI Training Courses within Public Health Domains

When we specifically matched the courses to the established CDC competencies for public health informaticians, all programs addressed at least some of the components.[23] The predominant themes were strategy development, knowledge and project management, interoperability, and integration with clinical and population health. However, in our analysis based on the titles and descriptions of the courses offered, no PHI program completely covered all of the CDC competencies. (see Figure 4).

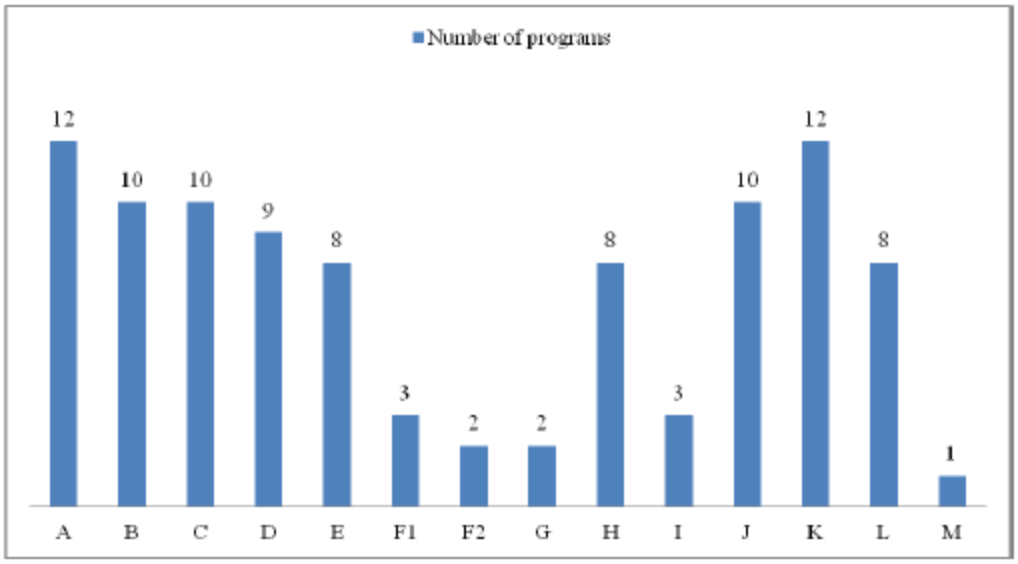

Figure 4: CDC Competencies Covered by Programs According to Course Titles and Available Description

CDC Competencies Covered by Programs According to Course Titles and Available Description

Note: The labeling of the competencies is based on the classification provided in Centers for Disease Control and Prevention and University of Washington's Center for Public Health Informatics. *Competencies for Public Health Informaticians.* Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, 2009. The competencies are as follows:

A. Supports development of strategic direction for public health informatics within the enterprise.

B. Participates in development of knowledge management tools for the enterprise.

C. Uses informatics standards.

D. Ensures that knowledge, information, and data needs of project or program users and stakeholders are met.

E. Supports information system development, procurement, and implementation that meet public health program needs.

F1. Manages IT operations related to project or program (for public health agencies with internal IT operations).

F2. Monitors IT operations managed by external organizations.

G. Communicates with cross-disciplinary leaders and team members.

H. Evaluates information systems and applications.

I. Participates in applied public health informatics research for new insights and innovative solutions to health problems.

J. Contributes to development of public health information systems that are interoperable with other relevant information systems.

K. Supports use of informatics to integrate clinical health, environmental risk, and population health.

L. Implements solutions that ensure confidentiality, security, and integrity while maximizing availability of information for public health.

M. Conducts education and training in public health informatics.

Discussion

The information age we currently live in was made possible by developments in information and communication technologies that contribute to social and economic improvements, such as higher employment and productivity, and consequently provide better access to an improved quality of life.[24] Information and communication technologies accomplish these benefits either directly, through improved healthcare provision and disease prevention, or indirectly, by contributing to broader determinants of population health such as improved social infrastructure and economic growth. Technology can play a role in higher learning and continuing education, enabling healthcare professionals in developing countries to be informed about advances in knowledge.[25]

There is a growing recognition worldwide that an essential component for the successful deployment of health information technology (HIT) is a competent workforce. It is increasingly recognized that well-trained PHI professionals should have knowledge not only of information technology but also of public health, business and management, and other disciplines. An assessment of the English workforce estimated that 25,000 full-time equivalents (FTEs) out of 1.3 million workers in the English National Health Services were employed in health informatics.[26] "[An] Australian analysis also focused on the 'health informatics' workforce that included all individuals who were involved in health information systems. This study estimated a workforce of about 12,000 individuals in a country with a population of about 21 million. . . . [An] analysis from Canada . . . estimated about 32,450 HIT professionals in Canada, although [it] did not provide overall numbers of healthcare professionals that would allow determination of staffing ratios."[27] A study in the United States focusing on the Nationwide Health Information Network (NHIN) "estimated [a] need for 7,600 FTE for installation of [electronic health records (EHRs)] . . . , 28,600 FTE for the . . . hospitals that do not have EHRs, and 420 FTE to implement the infrastructure to connect the network. Similarly, the Office of the National Coordinator for HIT (ONC) has estimated that the goals for EHR adoption . . . would require 50,000 new personnel."[28] These numbers do not address the specific workforce requirements for PHI professionals, however.

The worldwide need for skilled public health informaticians is evident. The workforce needs to understand the many facets of healthcare, including public health, health promotion, health services research, and information and communication technology.[29] Our Internet search for available PHI training programs resulted in only 15 programs offered by 13 different institutions. Of these, only one program was based outside the United States, although seven of them could be taken online. These numbers are not sufficient enough to adequately address the growing global demand for professionals in the field of PHI, especially when we consider the challenges that already exist.

The programs are not adequately standardized, and at times it was difficult to find the necessary information about the PHI courses and the competencies covered in these courses. Columbia University's Mailman School of Public Health has a new format for its graduate courses, and very little information is available regarding the PHI program itself. Johns Hopkins University describes the Certificate in Public Health Informatics and its main objectives but does not provide information for the individual courses that make up the program. This is also true for the Nova Southeastern University certificate program and the University of Utah short-term training program. Some of the new PHI programs had limited information available.

PHI programs should be more cost-effective and should be commonly offered as online modules to address global workforce deficiencies. Online programs have a higher potential for reaching larger audiences on an international level, as long-distance and web-based classes are not limited by physical or national boundaries. Additional solutions in developing countries, however, will involve improving education for workers and building workforce capacity.[30, 31] Some barriers and challenges are easily recognizable. We found only one PHI program established outside the United States, which is a considerable deficiency when trying to address the need for a competent workforce in countries with limited resources. The average cost for completing a PHI program from a US-based institution is around $20,714, which could be a major limiting factor for individuals in developing countries. Another possible limiting factor could be the cost of living for individuals preferring to complete a program in person. The average cost for programs offered completely online was $14,085, still a very high amount for professionals living in low- and middle-income countries.

Results of the analysis of the titles and the course descriptions of the existing PHI training programs helped us to demonstrate their cross-disciplinary nature. Various other disciplines apart from public health, such as information and computer science, geography, legal affairs, and management, are included in the curricula of PHI training programs. Global health was addressed

in a very limited manner, however, as only 7 out of 125 courses made a reference to health in a global perspective. This could be an important limiting factor when facing the growing need for public health informaticians in the developing world, where the context in which technology can help address healthcare issues is different from the US paradigm.

When analyzing the competencies covered in these courses, we found that they are mainly based on the competencies developed by the CDC.[32] The framework that these competencies primarily follow might not be adequate in the context of the developing world.[33] Furthermore, none of the existing courses covers all of the competencies proposed by the CDC, or at least it is not clear how they will be addressed from the curricula provided on the program or institution websites. Areas that appear to receive less coverage in the existing programs are management and monitoring of information technology operations, cross-disciplinary communication, and applied PHI research and education. Currently, it is very difficult to assess the level of training that is being offered to potential PHI professionals. The information provided online by the institutions that offer PHI programs can at times be confusing or even incomplete.

Several limitations exist in the current study. One limitation might be an incomplete search related to finding PHI programs. Existing PHI programs might include some programs for which information is not available on the Internet. We might have missed some programs due to information overload on the Internet even though every possible effort was made to identify the best sources for information about PHI programs. Another limitation might be the noninclusion of PHI programs not available in English. For the classification of the courses into one or more CDC competencies, we relied on the information provided by the course title and description, when available. Due to limited information and description on the Internet, we were not able to classify and categorize all of the courses or to match all of them with the CDC competencies. Contact was initiated with the universities for whom the information was not available on the Internet.

Despite these limitations, however, the existing scenario reflects a tremendous need to develop new contextual and cost-effective PHI training programs. Good quality must be ensured, while programs must also be accessible to the individuals who have the greatest need for such training to meet the healthcare needs of their populations through the successful adoption of technology. The currently available training has yet to meet the needs of the global workplace, providing individuals who have PHI training within specific competency domains.

The design, implementation, and management of public health information systems present a global challenge that can be addressed only by a workforce skilled in the area of PHI. More PHI programs that account for the specific challenges of the developing world must be designed and established. Creation of these programs should be stimulated, and public health researchers must undertake further study to investigate and identify what is needed to solidify the emerging discipline of PHI.

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