EDUCATING THE GLOBAL WORKFORCE FOR PUBLIC HEALTH

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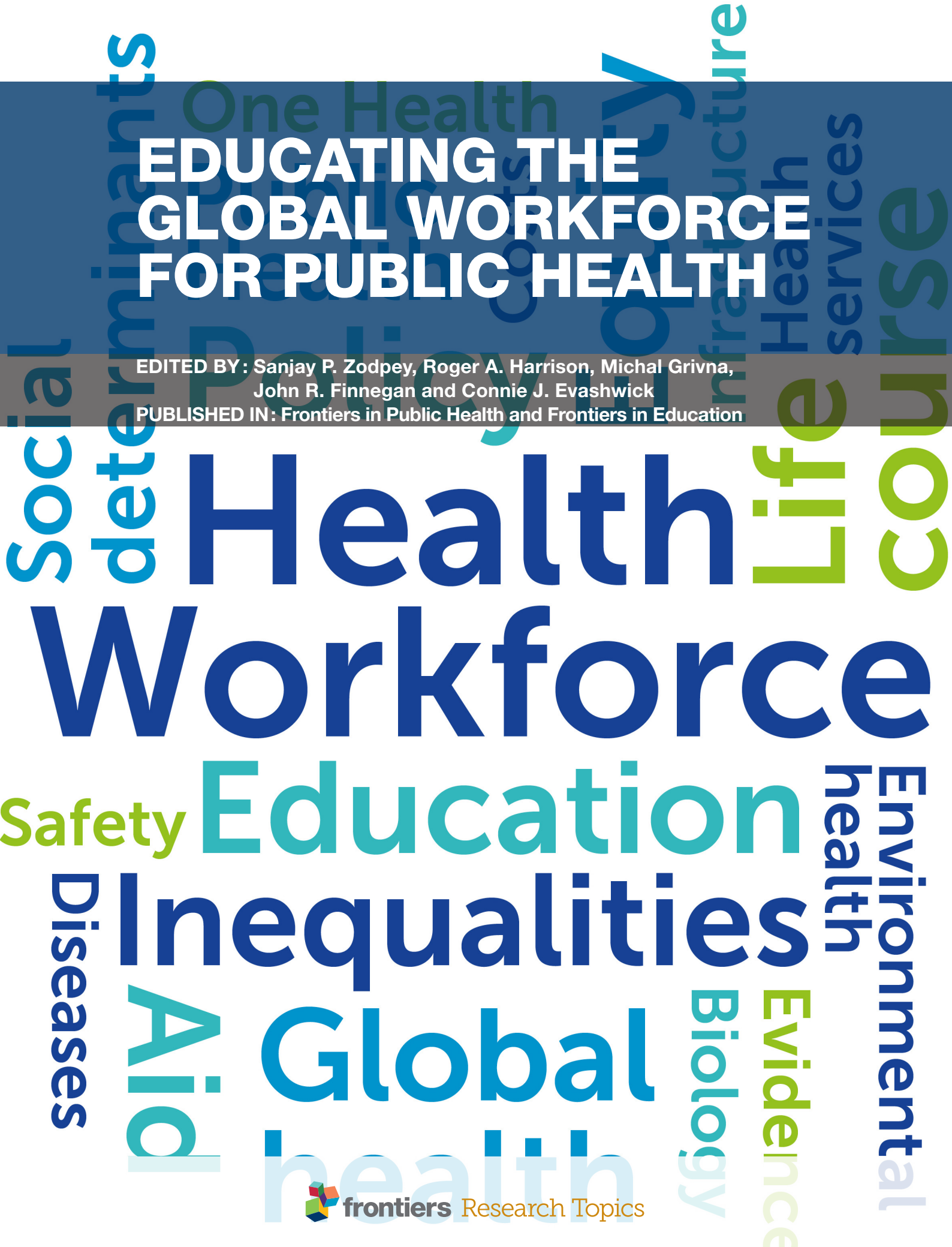

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EDUCATING THE GLOBAL WORKFORCE FOR PUBLIC HEALTH

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Good quality management of the health system demands a critical mass of health professionals with sound technical knowledge. The education that produces a workforce of appropriate size and skills is often a challenge in the delivery of quality health services. Incidentally, health professionals' education has not kept pace with the new emerging challenges. Recent globalization of health has further led to international migration of health professionals, thereby leading to cross-border recognition of health workers with an appropriate skill-mix, knowledge, and competence.

The Lancet Commission Report of 2010 highlighted the need to develop a common strategy at a global level for postgraduate medical, nursing, and public health education that reaches beyond the confines of national borders and the silos of individual professions. This vision would require a series of instructional and institutional reforms, which should be guided by two proposed outcomes: transformative learning and interdependence in education. The purpose of this Research Topic is to increase the shared understanding of the current status of the education of the health workforce around the globe, particularly those working in the public health sector. With this foundation, further research and evaluation studies can then be done with a perspective that addresses global workforce issues impacting access, prevention, and care.

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EDITORIAL
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Editorial: Educating the Global Workforce for Public Health

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Editorial on the Research Topic

Educating the Global Workforce for Public Health

A strong health workforce is one of the six building blocks of the World Health Organization's framework for health (1). A critical mass of health professionals with sound technical knowledge is necessary to manage a health system. The education that produces a workforce of appropriate size and skills is often a crucial limiting factor in the delivery of quality health services. The health workforce is characterized by its diversity and complexity, encompassing professionals from a wide range of occupational backgrounds and types of training. The purpose of this Research Topic is to increase the shared understanding of the current status of the education of the health workforce around the globe, particularly those working in the public health sector. With this foundation, further research and evaluation studies can then be done with a perspective that addresses global workforce issues impacting access, prevention, and care.

Education has traditionally been recognized as an important tool for creating trained health professionals. However, health professionals' education has not kept pace with the new emerging challenges, such as rapid demographic and epidemiological transitions, fresh emerging and re-emerging health challenges, new environmental and behavioral risks, and increasing appreciation of the social determinants of health. Recent globalization of health has led to international migration of health professionals, thereby leading to cross-border recognition of health workers with an appropriate skill-mix, knowledge, and competence. While some encouraging progress has been made in health workforce development globally, challenges such as investments, planning, and interventions for advancing the agenda of health workforce development continue to persist (2).

Restructured curricula and training programs are needed that emphasize primary care and prevention; basic, clinical and population sciences; evolving health-care competencies and skills; and new teaching-learning methodologies. The Lancet Commission Report (3) has also highlighted the need to develop a common strategy at a global level for postgraduate medical, nursing, and public health education that reaches beyond the confines of national borders and the silos of individual professions. This vision would require a series of instructional and institutional reforms, which should be guided by two proposed outcomes: transformative learning and interdependence in education (3).

With an aim toward advancing this agenda, this Research Topic invited manuscripts for a wide range of topics and article types. After thorough demand generation for papers, the RT received 10 submissions matching the criteria. Each article provides valuable insight into critical issues related to public health professionals' education for global engagement.

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Sawleshwarkar and Negin's article provides an introduction to the topic with a review of the competencies for global health (Sawleshwarkar and Negin). A comprehensive literature search using relevant keywords identified 13 relevant articles for review. Three aspects of global health competency domains emerged: burden of disease and health determinants, core public health skills, and soft skills.

Frankson et al. highlighted yet another dimension of competencies for global health—the "One Health" approach. The core competency domains considered critically important for guiding curriculum development and continuing professional education using the One Health approach were identified as "management," "communication and informatics," "values and ethics," "leadership," "teams and collaboration," "roles and responsibilities," and "systems thinking."

Bjegovic-Mikanovic and Otok describe the public health problems confronting public health professionals in European public health schools, the exit competencies at the end of their public health training, and the expectations of the prospective employees. Their article stresses the need for an interface between public health functions, competencies, and performance, the importance of competence-driven education, and furthermore, the need for educational institutions to look beyond national boundaries since public health challenges are increasingly global.

The article written by Pati et al. maps global health teaching in the Indian public health education context. Pati and colleagues conducted a thorough literature search of the public health programs including global health in India. They found that while this was being covered as part of larger public health programs, a distinct program for global health teaching is missing. They emphasized that more efforts need to be directed toward integrating global health into the broader public health curricula.

Negandhi et al. undertook a desk review of monitoring and evaluation (M&E) curricula and teaching in Masters programs globally, followed by a detailed review of M&E teaching across ten institutions representing four South Asian countries. The findings of the review were utilized to identify ten core competencies for M&E teaching in a consultative meeting of academicians from the four countries. The desk review showed similarities in M&E course content but variations in course structure and delivery. The identified core competencies included basic M&E concepts.

In addition to articles with a broad perspective, several articles from a single institution present case studies with lessons learned for wider application. Caron's article focuses on support for the recommendation that all undergraduates should have access to public health education (Caron). Her paper describes the experience of the University of New Hampshire in generating an educated citizenry that is aware of comprehensive public health conflicts, thereby contributing to both a local and global perspective on learning.

Doobay-Persaud et al. conducted a survey of students seeking admission to the MSc Global Health course at the Northwestern University, as well as a separate survey of those students already active. The aim was to describe the market characteristics for this degree, provide student backgrounds that will guide curricular and programmatic improvements, and determine if these students intend to pursue degrees in global health. Results showed a wide variety of disciplines represented in students' previous work histories, underscoring and supporting the inter-professional nature of the field and the workforce.

Kang's article focusing on improving global health competence among nursing undergraduates echoes the significance of global public health in today's clinical education (Kang). This article discusses the implementation and evaluation of four field training programs for undergraduates nursing students conducted in collaboration with nursing programs in developing countries.

Kershaw et al. emphasized the importance of developing health promotion skills through a self-directed project-based learning task during which the students of the medical degree program at United Arab Emirates University were introduced to public health and health promotion practice, and their soft skills such as literature searching, writing, presentation skills, and team work.

Zhao et al. presented the reforms needed in Chinese undergraduate preventive medicine programs in areas such as the traditional preventive medicine course content, revision of its curriculum structure, the need to increase practical experience, developing variety in teaching and assessment techniques, and systematic planning for curricular reforms.

Worldwide, immense focus is being placed on the public health response required to spread beyond national boundaries, and the need for the public health workforce to be appropriately armed with the knowledge, skills, and behaviors to handle these global health challenges of the 21st century. The Recife Declaration (2) has acknowledged international commitment toward building a stronger and competent health workforce for greater progress in the HRH field. The 10 articles from this Research Topic have artfully landscaped issues that directly or indirectly point toward how knowledge and skills can be imparted to public health students using innovative teaching techniques and updated curricula. Overall, this RT has stayed focused on its objective: to highlight the importance of "educating the global workforce in public health."

AUTHOR CONTRIBUTIONS

All five authors contributed significantly to the Editorial. SZ took the lead in articulating the editorial and preparing the first draft. CE edited the first draft and also added other significant details in the manuscript. MG, RH, and JF also gave their respective inputs to the manuscript from time to time.

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REVIEW
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A Review of Global Health Competencies for Postgraduate Public Health Education

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During the last decade, the literature about global health has grown exponentially. Academic institutions are also exploring the scope of their public health educational programs to meet the demand for a global health professional. This has become more relevant in the context of the sustainable development goals. There have been attempts to describe global health competencies for specific professional groups. The focus of these competencies has been variable with a variety of different themes being described ranging from globalization and health care, analysis and program management, as well as equity and capacity strengthening. This review aims to describe global health competencies and attempts to distill common competency domains to assist in curriculum development and integration in postgraduate public health education programs. A literature search was conducted using relevant keywords with a focus on public health education. This resulted in identification of 13 articles that described global health competencies. All these articles were published between 2005 and 2015 with six from the USA, two each from Canada and Australia, and one each from UK, Europe, and Americas. A range of methods used to describe competency domains included literature review, interviews with experts and employers, surveys of staff and students, and description or review of an academic program. Eleven competency domains were distilled from the selected articles. These competency domains primarily referred to three main aspects, one that focuses on burden of disease and the determinants of health. A second set focuses on core public health skills including policy development, analysis, and program management. Another set of competency domains could be classified as "soft skills" and includes collaboration, partnering, communication, professionalism, capacity building, and political awareness. This review presents the landscape of defined global health competencies for postgraduate public health education. The discussion about use of "global health," "international health," and "global public health" will continue, and academic institutions need to explore ways to integrate these competencies in postgraduate public health programs. This is critical in the post-MDG era that we prepare global public health workforce for the challenges of improving health of the "global" population in the context of sustainable development goals.

Keywords: global health, competencies, international health, postgraduate education, public health

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INTRODUCTION

In the post-MDG era, there is increasing recognition that health and sustainable development are inseparable in an increasingly globalized and interconnected world (1, 2). The complex interplay between humans, animals, and environment; dual burden of communicable and non-communicable diseases; emerging economies; and mobility of people are having profound political, social, and economic consequences (3). The concept of "global health" as the health of an interdependent global population is not only shaping our understanding of which and whose problems we tackle but also the way in which we educate students and design the global institutions that govern our collective efforts to protect and promote public health worldwide (3).

During the last decade, there has emerged a growing body of literature about global health. Based on MEDLINE searches, from 1996 to 2000, there were fewer than 50 publications with "global health" in either the title or abstract, which increased to more than 6,000 from 2011 to 2015. Global health has been defined in the context of various professional groupings such as medicine, nursing, oral health, pharmacy, allied health, and also medical subspecialties (4–10). Global health overlaps with international health and tropical medicine, and there are calls to explore similarities and differences between global health, international health, and public health (11, 12). The global aspect of this term has been debated, and several meanings have been discussed. Global may imply worldwide or transcending national boundaries, or it could signal the interdisciplinary nature of public health in a globalized world (2).

The generation of knowledge and its optimal use and application, especially in the field of global health and development, has garnered significant attention in recent years. There has been a dramatic growth in the number of educational programs that offer global health programs at undergraduate and postgraduate levels. A consensus definition for global health remains elusive. Commonly used is that of Koplan and colleagues who defined global health as "an area for study, research, and practice that places a priority on improving health and achieving equity in health for all people worldwide. Global health emphasizes transnational health issues, determinants, and solutions; involves many disciplines within and beyond the health sciences and promotes interdisciplinary collaboration; and is a synthesis of population-based prevention with individual-level clinical care" (12).

Educational competencies are informed by the needs of professional workforce and include a combination of knowledge, skills, and attitudes required for acceptable level of practice. Educational competencies are critical to curriculum development and evaluation, coordination across education programs, faculty development, and scholarship. The Institute of Medicine's report "Who Will Keep the Public Healthy? Educating Public Health Professionals for the 21st Century" published in 2003 identified eight emerging areas significant to the future of public health education, which included global health, communication, cultural competence, and ethics (13). The report also recommended that competencies in these emerging content areas need to be identified and incorporated in graduate public health education (13). Calhoun and colleagues described the development of the Association of School of Public Health's Core competency model for Master of Public Health (MPH) degree and discussed that the aim of these competencies was to provide knowledge, skills, and expected attributes of emerging public health professional (14). Recently, several reports including the Lancet Report on Health Professional education and the WHO report on "Transforming and Scaling up Health Professionals Education and Training" guidelines have highlighted the centrality of competency-driven education for bringing in educational reforms (15, 16). Calhoun and colleagues reviewed competency-based education program development in the context of global health workforce and discussed the status of competency model adoption across public health schools in the USA (17). This review analyzed the competency domains and outcomes using Blooms Taxonomy of educational outcomes showing that most competencies are in cognitive domain at a higher application level (17).

The recent literature in global health education has elicited several reviews that have sought to identify "core competencies" for various professional groups including medical, nursing, and public health education (5, 17–21). Academic institutions are also exploring the scope of their public health educational programs in the context of global health education to meet the demand for a global health professional in the context of the sustainable development goals. The American Association of Schools and Programs of Public Health Global Health Committee proposed a Global Health Competency Model, and the Consortium of Universities for Global Health (CUGH) global health subcommittee published four levels of interprofessional global health competencies (20, 21). There have been other attempts to describe global health competencies in the context of specific education programs and perspectives from stakeholders (22–25). The focus of these competencies has been variable with a range of different themes being described ranging from globalization and health care, analysis and program management, as well as equity and capacity strengthening. This review of the literature will provide a landscape of global health competencies and attempt to distill common competency domains to assist in curriculum development and integration in postgraduate public health education programs.

METHODS

Search Strategy

A literature review was conducted in April 2016 using six electronic databases using the keywords: TITLE-ABS (Global Adj3 health OR international Adj3 health) AND (education* or training* or universit* or curriculum* or college*) AND (competenc* or skill* or outcome* or objective*). The search was limited to English language only, and all document types were searched with a focus on primary research studies, evaluation reports, conference abstracts, and all types of review articles.

Title/abstract was searched in the following databases: Ovid Medline (1946–present), Embase (1974–present), Global

Health (1910–present), ERIC—Education (1966–present), EBM Reviews—Cochrane Database of Systematic Reviews (2005–present), and PsycINFO (1967–present). Additional search was undertaken using Scopus using keywords "global health" and "competenc*"to explore additional references.

Two reviewers (Shailendra Sawleshwarkar and Joel Negin) initially reviewed the titles and selected articles that discussed global health from an educational aspect for the abstract review. All shortlisted titles were directly imported into Endnote© version 7 (Thomson Reuters, Philadelphia, PA, USA). Duplicate results were then removed. During abstract review stage, studies related to specific medical, nursing, and medical subspecialties professions that were related to global health but not dealing with public health were excluded. After limiting abstracts to those related to global health from educational point of view, a full text review was conducted to identify those dealing with global public health education. At this stage, a detailed analysis was done of all those articles, and specific articles addressing global health competencies in the context of graduate public health education were identified. After going through the bibliographies of these articles a cross search was undertaken to identify any additional relevant articles.

Articles were discussed by two authors (Shailendra Sawleshwarkar and Joel Negin), and full review of the selected articles was undertaken. Information was extracted on global health competencies, year of publication, type of program—global health/international public health/public health/other, location of the review, method used for developing or describing competencies (if relevant), competency domains/themes, and list of competencies in each domain/theme.

Core competency articles were read in detail, and a list was generated with all competencies mentioned in these articles. A note was made if the article identified the competency domain directly in their article, and this was noted as "Yes," and if this was not identified, then "No" was recorded. If the article described the competency domains in the context of learning outcomes but competency domain was not explicitly stated then this was recorded as "Implied."

RESULTS

Figure 1 presents a flow chart of the search strategy. The titles of 6,242 references were screened by 1 independent reviewer, and 510 unique references were selected for abstract review. After limiting abstracts to those that dealt with global health education from public health aspect and after excluding duplicates, this reduced the number of abstracts to 126. Additional search with and cross references yielded 10 additional abstracts that were added and resulted in a total of 136 for a review. Fifteen articles described competencies either as a focus of the article or in the context of a program. Two of these were not included in the final set as one of them described the same program and as another article focused on global health research competencies. Thirteen articles described competencies in the context of public health education and are summarized in the **Table 1**.

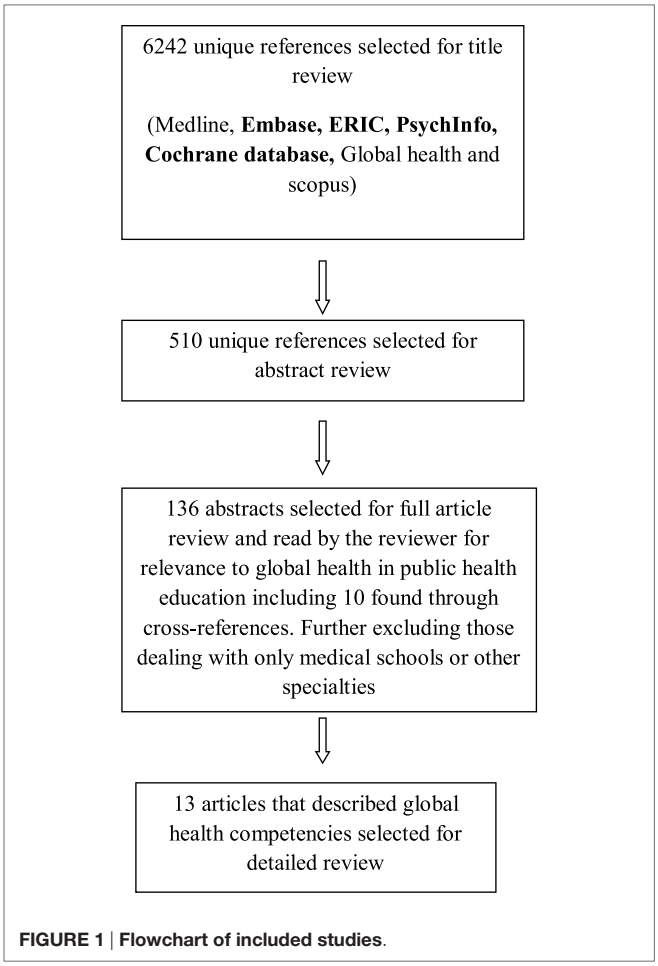

FIGURE 1 | Flowchart of included studies.

Article Characteristics

All the 13 shortlisted articles that described global public health competencies were published between 2005 and 2015 with 6 from the USA, 2 each from Canada and Australia, and 1 each from UK, Europe, and Americas (18–30). A range of methods were utilized to describe competencies and included literature review, interviews with experts and employers, surveys of staff and students, and description or review of an academic program.

Jogerst and colleagues described the work of Global Health Competency Subcommittee of CUGH to identify interprofessional global health competencies and proposed 2 competency levels with 13 competencies across 8 domains for the Global Citizen Level and 39 competencies across 11 domains for the Basic Operational Program-Oriented Level (21). Ablah and colleagues described a Global Health Competency Model developed through a multistage modified-Delphi process and described 7 domains and 36 competencies that complement the foundational public health competencies (20). Pfeiffer and colleagues conducted 26 semi-structured interviews with global health practitioners and leaders about the competencies and curriculum for global health professionals of the future and identified key knowledge (health systems and determinants of health) and skills (analytical, leadership and management, and policy development) areas (30).

TABLE 1 | Summary of 13 included articles in global health competency review.

Study working title/country	Description of competency domains/themes	Type of study	Comment/s
1. Global health education in UK universities (19)	1. Global burden of disease; 2. Epidemiology of tropical diseases; 3. Population mobility; 4. Social studies (broadly defined to include culture, social responsibility, humanism, and social change); 5. Socioeconomic determinants of health; 6. Health-care services; 7. Health systems; 8. Global governance; 9. Environmental change; 10. Population health; 11. Globalization; 12. Human rights and ethics; 13. International development; 14. Monitoring and evaluation; 15. Management and leadership; 16. Policy analysis and development	Review of literature among UK universities offering global health programs	Five out of six articles reviewed focused on global health for medical education
2. Improving global health education—USA (20)	1. Capacity strengthening 2. Collaborating and partnering 3. Ethical reasoning and professional practice 4. Health equity and social justice 5. Program management 6. Sociocultural and political awareness 7. Strategic analysis	Global health competency model developed through a multistage modified-Delphi process by the Association of Schools of Public Health	Focused on broader global health competencies for public health students
3. Being global in public health practice and research—Canada (18)	*Category: Public Health Sciences* Demonstrate knowledge of: 1. Historical and present north–south power dynamics; social and political contexts; and determinants of health. 2. Linkages between local and global health problems. 3. International organizations, their interactions, and their effects on local actions for health. *Category: Policy and Program Planning, Implementation, and Evaluation* 4. Work effectively and responsibly in low-resource settings to promote sustainable interventions for global health *Category: Partnerships, Collaboration, and Advocacy* 5. Foster self-determination, empowerment, and community participation in GH contexts. 6. Actively recognize the interaction between political and economic history, power, participation, and engagement globally. 7. Contribute to improving health equity at multiple levels, through systems changes. *Category: Diversity and Inclusiveness* 8. Critically self-reflect upon one's own social location and appropriately respond to others in their diverse locations. 9. Communicate effectively across disciplines and cultures. 10. Demonstrate commitment to global equity, social justice, and sustainable development. *Category: Communication* 11. Create social spaces for dialog between stakeholders across jurisdictions. *Category: Leadership* 12. Demonstrate willingness to be mentored across borders. 13. Mentor others and develop long-term relationships of trust locally and globally. 14. Educate oneself about global health issues on an ongoing basis	Commentary on global health practice and research competencies	Includes competencies for public health practice and also research

(*Continued*)

TABLE 1 | **Continued**

Study working title/country	Description of competency domains/themes	Type of study	Comment/s
4. Identifying interprofessional global health competencies—USA (21)	1. Global burden of disease. 2. Globalization of health and health care. 3. Social and environmental determinants of health. 4. Capacity strengthening. 5. Collaboration, partnering, and communication. 6. Ethics 7. Professional practice 8. Health equity and social justice. 9. Program management. 10. Sociocultural and political awareness. 11. Strategic analysis	Consortium of Universities for Global Health subcommittee through literature review, discussions, voting, and consensus	Describes interprofessional global health competencies at various levels including basic and program level (listed here)
5. Developing competencies for graduate school curriculum in international health—USA (22)	1. Identify, analyze, and challenge power structures. 2. Describe the major underlying and proximate determinants of adverse health in developing countries. 3. Apply community development skills, policy advocacy, and communication strategies to promote public health, while using human rights concepts and instruments to promote social justice. 4. Describe the burden of the most important health problems. 5. Be able to assess the appropriateness of intervention strategies. Evaluate and establish priorities to improve the health status of populations in low-resource settings. 6. Incorporate qualitative, quantitative, and operations research skills to design and apply reliable, valid, and ethically sound research. 7. Use collaborative and culturally relevant leadership skills. 8. Analyze and explain the role of transnational networks and global institutions. 9. Design, manage, and evaluate programs in developing countries in close collaboration with local institutions to assure equitable access to quality health care. 10. Design practical, culturally relevant, and communication programs. 11. Analyze and explain the economic, social, political, and academic conditions that can produce a strong health workforce	University of Washington (UW) international health program competencies through literature search, looking at other programs, expert reviews, and faculty and student survey	Describes competencies in the context of an international health educational program
6. Competency-based curricula to transform global health—USA (30)	*Knowledge:* 1. Upstream socioeconomic and environmental determinants of health. 2. Systems thinking—health care and political systems, capacity building *Skills:* 3. Analytic skills—epidemiology, monitoring, and evaluation, 4. Management and leadership skills—financial management, collaboration and teamwork, ability to work in different cultures 5. Policy analysis and development skills—"political savvy"	26 in-depth interviews with global health leaders	Article also explored training approaches and recruitment priorities. Discussion on interdisciplinary training, interprofessional collaboration, and implementation science
7. A case-based problem-based learning approach to prepare master of public health candidates for complexities of global health—USA (24)	*Background in global health:* 1. Describe historical, economic, political, social, and cultural factors that influence the health of populations around the world. *Critical thinking:* 2. Critique and design global health approaches affecting the health status of individuals, communities, and populations around the world. *Public health ethics:* 3. Evaluate and apply public health ethical frameworks to design programs, policies, and interventions intended to improve health services and health status of individuals, communities, and populations. *Systems thinking:* 4. Assess and incorporate spheres of influence or systems that affect global health challenges into policies to improve the health status of individuals, communities, and populations	Overarching Competencies for Core Global Health Course GH501: "Global Challenges and Opportunities," at Hubert Department of Global Health at the Rollins School of Public Health—Emory University, Atlanta, GA, USA Review of competencies and staff, employers and student inputs in context of curriculum review	Describes pedagogical approach, course structure, and logistics for implementing global health course

(*Continued*)

TABLE 1 | **Continued**

Study working title/country	Description of competency domains/themes	Type of study	Comment/s
8. Identifying competencies for Australian health professionals working in international health—Australia (23)	*Basic public health skills:* 1. Specific skills in public health, disease control and prevention, health promotion skills *Management skills:* 2. Management 3. Policy, planning, and development skills 4. Program planning, design, implementation, M&E 5. Multidisciplinary teamwork/team building 6. Communication skills—negotiation, mentoring, conflict resolution, advocacy, and liaison *Communication:* 7. English proficiency and local or second language 8. Written skills 9. Consultation or advisory skills *Cross-cultural skills* 10. Generic cross-cultural skills 11. Collaboration and partnership skills *Analytical and Research skills:* 12. Analytical skills 13. Research skills including research ethics	Literature review, job competencies review, key stakeholder interviews	Focus is on Australian professionals working in low- and middle-income countries (LMIC)
9. Defining and developing a global public health course for public health graduates—Nepal and Australia (29)	*Emerging areas relevant to global public health knowledge and skills:* 1. Globalization and health 2. Disease burden 3. Ethics and vulnerable groups 4. Culture, society, and politics 5. Policy and management *Relevant units to include in any global public health specialty course:* 1. Primary health care and health promotion in LMIC 2. Comparative health system 3. Program/project development, management, and evaluation 4. Management, leadership, teamwork 5. Globalization and health 6. Maternal and child health 7. Global disease burden 8. Culture, social system, social development, and health	Literature review and discussion about Relevant units to include in any global public health specialty course and rationale	Described mainly in the context of additional specialist competencies relevant to the context of LMIC that are needed to work in this field
10. Graduate Global Public Health Education—Canada (28)	1. Understand the political economy of global health issues. 2. Bring a determinants-of-health and population health perspective to problem analysis, policy development, and project design. 3. Be cognizant of the linkages between local and global health problems. 4. Work within the mandates, roles, and approaches of international organizations. 5. Build coalitions and work in partnership with the NGO sector and local community organizations. 6. Be sensitive to cultural differences and adapt methods to local contexts. 7. Understand broad ethical issues as they relate to equity globally. 8. Apply appropriate ethical approaches to international, country level, and local projects	The competencies are described as activities and outcomes in relation to student's prior experience at the "Global Health Concentration Model" at University of Toronto	Competencies are described in the context of review of a concentration model of global health education along with description of student backgrounds and outcomes
11. Fifteen years of the tropEd Masters in international health programme—Europe with international partners (25)	1. Analyze factors that influence health 2. Monitor and evaluate interventions 3. Collaborate across disciplines and borders 4. Identify research needs, analyze results 5. Formulate responses to complex international issues 6. Identify the influence of globalization on population health	Competencies described in the context of alumni survey of the relevance of the competencies gained by the Masters in International Health and perceived strengths and weaknesses of the program	Review of a program with European and other international partners from LMIC

(*Continued*)

TABLE 1 | **Continued**

Study working title/country	Description of competency domains/themes	Type of study	Comment/s
12. The Pan American Health Organization (PAHO) and international health—Americas (26)	The six main competencies stressed by the Program are 1. Situational analysis: the ability to analyze a situation in-depth so as to intervene successfully. 2. Policy formulation and decision-making: the capacity to develop and influence policies and strategies conducive to life and human health. 3. Negotiation and advocacy: the ability to understand and direct change processes in relation to a given problem or challenge that is shared by different groups or institutions. 4. Project management and cooperation: the ability to develop and establish relationships and reach collaborative agreements that are mutually beneficial in order to achieve specific objectives. 5. Production and dissemination of information: the ability to develop and communicate innovative information about international health. 6. Communication: the ability to formulate an argument and communicate it effectively to key stakeholders in order to achieve a desired outcome	Competencies described in the context of Leaders in International Health Program "Edmundo Granda Ugalde." Training Program in International Health developed by PAHO	Review of a program in Americas
13. Toward defining interprofessional competencies for global health education—USA (27)	1. To identify contextually relevant qualitative and quantitative information from the sciences, social sciences, and the humanities to inform global health work. 2. To read and interpret relevant literature from the sciences, social sciences, and humanities. 3. To practice ongoing discernment in relation to one's own interests, strengths, and values. 4. To appreciate natural, cultural, and human diversity. 5. To be able to take the perspective of others (both other professionals and persons from other cultures or contexts). 6. To be able to compare and contrast systems of care and the social production of health and well-being in different settings. 7. To translate research into practice. 8. To practice leadership and effective teamwork. 9. To effectively communicate ideas about health and well-being to other professions, community leaders, and the general public. 10. To optimize the potential of one's scope of practice within the context of a team. 11. To be able to articulate shared goals, ethics, and values within diverse teams. 12. To demonstrate established habits for self-guided, ongoing learning in relation to global health policies, focus regions, or countries, and topical areas of interest	These competencies were prepared by the author in preparation for a roundtable on interprofessional global health competencies at the University of Maryland Baltimore 2013 Based on the UW–GHI experience the Association of Schools and Programs of Public Health Global Health Competency Model, Interprofessional Education Collaborative Core Competencies for Interprofessional Collaborative Practice (IPEC Competencies), and the Framework for Twenty-First Century Civic Learning and Democratic Engagement published by the National Task Force on Civic Learning and Democratic Engagement	Focus on the interprofessional skills competency domain for graduate global health education

A few articles described global health competencies in the context of either a master's program in international health or tropical medicine or global health component of a program and included those at the course review at the Emory University (24), alumni survey at the University of Toronto (28), program review of international health program at the Pan American Health Organization (26), alumni survey of program run by the tropEd network (25), and curriculum development through review and survey at the University of Washington (22).

Global Health Competency Domains

The 13 articles listed various competency domains and described them—these are summarized in **Table 1**. These competency domains primarily refer to three main aspects, one that focuses on knowledge aspects of health and disease with inclusion of burden of disease and the determinants of health. A second set focuses on core public health skills including policy development, analysis, and program management. Another set of competency domains could be classified as "soft skills" with a combination of knowledge, skill, and attitude and include collaboration, partnering, communication, professionalism, capacity building, and political awareness. These 3 aspects of the 11 competency domain grouped as predominantly knowledge based, skill based, or a combination of knowledge, skill, and attitude are depicted in **Figure 2**. The list of competencies was reviewed, and similarly defined competencies were included under the same domain. There were some differences between articles regarding how these competencies were described and how they were grouped. This was more pronounced in the competency domains that discussed soft skills. Competency domains that were described by at least 6 of the 13 articles selected for review were included in the final list of 11 core

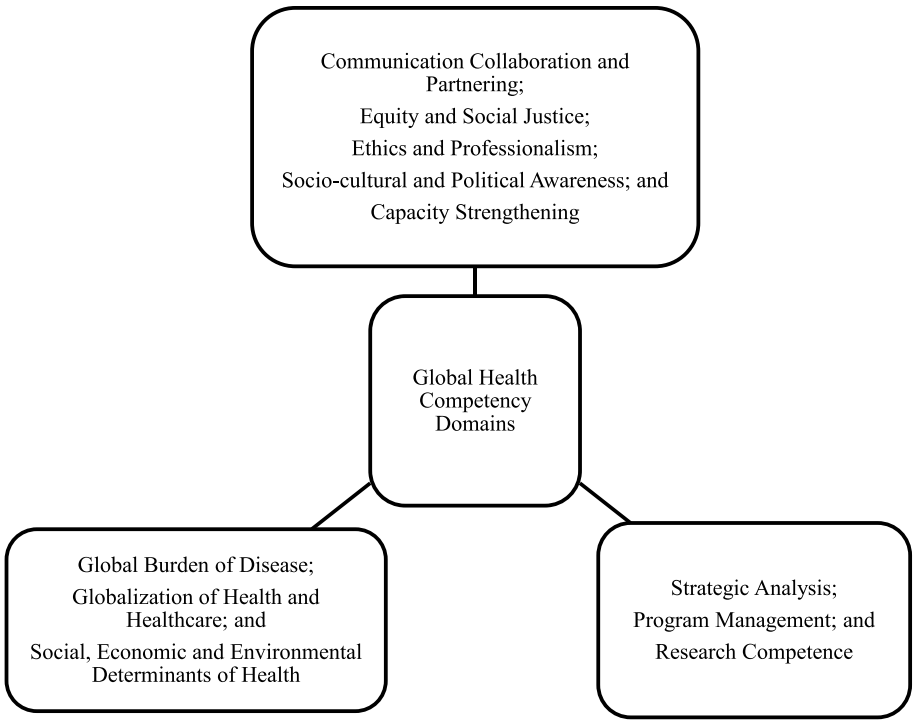

FIGURE 2 | **Global health competency domains for public health education**.

competency domains along with a summary of the key elements of the identified competency domains distilled from selected articles (**Table 2**). **Table 2** also lists the category (knowledge, skill, or attitude) of each competency domain as per the Bloom's Taxonomy for educational objectives (31).

Analysis of the frequency of competency domains identified by the selected articles is shown in **Figure 3** with domains 2, 8, and 10 being the most commonly identified domains. The competency domains that were mainly categorized as knowledge according to Bloom's Taxonomy included Global burden of Disease, Globalization of Health and Health care, and Social, Economic, and Environmental Determinants of Health. Those that could be categorized as both skill and attitude included mainly "soft skills" such as communication, collaboration and partnering, ethics and professionalism, capacity strengthening, and sociocultural and political awareness.

Although this list captures the most of the competencies described in the selected articles, there were few competencies that were not included as separate domains in the 11 core competencies. These included those with specific focus on disease conditions or groups such as maternal and child health or travel medicine or some components of health systems or broader themes such as primary health care, health promotion, or global governance.

DISCUSSION

Health is central to the discussions about achieving sustainable development, and there are calls to review the role of public health in this era of globalization through the recently proposed Global Charter for the Public's Health by the World Federation of Public Health Associations (32). Jenkins and colleagues argued for new conceptualization, review, and evaluation of "global public health" and also argued for curriculum change in public health education for the global public health workforce (33). Global health education has attracted increasing interest from academic institutions in the last decade. Current discussion about global health also presents an opportunity to explore integration of globalization, equity, political awareness, and interconnectedness in the public health curriculum in both high-income and low-income settings.

In this review, we identified 11 core competencies that may be relevant to postgraduate public health education. These competencies comprised those mainly dealing with knowledge such as global aspects of burden of disease and health care and mainly skill-based domains such as core public health skills of strategic analysis, and program management. The competencies also included those dealing with attitude and skill with key underlying themes of equity, ethics, professionalism, and human rights along with a set of "soft skills" such as communication, collaboration, partnering, and capacity strengthening and leadership were also identified. The competencies belonged to lower cognitive domains of 'understand' and 'apply' and also included a number of competencies with higher order cognitive domains of 'analysis' and 'evaluation.' The articles described mainly the knowledge aspects of health and disease and core public health skills of management and analysis

TABLE 2 | Core competency domains or themes for global health education and summary of the key elements of the identified competency domains distilled from selected articles.

Competency domain	Knowledge (K), skill (S), and attitude (A)	Key elements of the competency domain
Domain 1: Global Burden of Disease	K	• Basic understanding of burden of disease in all setting—high, middle, and low income including magnitude, distribution, and variations. • Ability to use available data to validate the health status of the population
Domain 2: Globalization of Health and Health Care	K	• Understanding of different health systems along with understanding of global health-care trends, human resources for health, and role of multiple stakeholders in planning and delivery health services. • Understanding influence of globalization on health and be cognizant of linkages between local and global health
Domain 3: Social, Economic, and Environmental Determinants of Health	K	• Understand social, economic, and environmental factors as determinants of population health. • Key determinants of health and their impact on access to and quality of health services in different contexts and apply it to policy development and problem analysis
Domain 4: Capacity Strengthening	K, S, and A	• Sharing of knowledge, skills, and resources to enhance public health programs to build human resource capacity and improve infrastructure. • Strengthen community capabilities, build community partnerships, and with community integration improve health of individuals and communities. • Analyze the economic, social, political, and academic conditions and address barriers to produce a strong health workforce
Domain 5: Ethics and Professionalism	K, S, and A	• Understanding of and an ability to resolve common ethical issues and challenges that arise when working within diverse economic, political, and cultural settings to address global health issues. • Evaluation and application of internationals standards and public health ethical frameworks in these settings. • Demonstrate integrity, regard, and respect for others in all aspects of professional practice and optimize the potential of one's scope of practice within the context of a team
Domain 6: Communication, Collaboration, and Partnering	S and A	• Effectively communicate ideas about health and well-being to other professions, community leaders, and the general public. • Communication skills including negotiation, mentoring, conflict resolution, advocacy, and liaison. • Multidisciplinary teamwork and team building and working in close collaboration with local institutions to design, manage, and evaluate programs in developing countries
Domain 7: Health Equity and Social Justice	K and S	• Apply social justice and human rights principles in addressing global health problems. • Demonstrate commitment to global equity, social justice, and sustainable development
Domain 8: Program Management	K and S	• Design, implement, and evaluate global health program to improve health of individuals and populations in a sustainable manner. • Apply project management techniques throughout program planning, implementation, and evaluation. • Ability to develop and establish relationships and reach collaborative agreements that are mutually beneficial in order to achieve program objectives
Domain 9: Sociocultural and Political Awareness	S and A	• Ability to work effectively within diverse cultural settings and across local, regional, national, and international political landscapes. • Being "Political savvy"—understand historical and present north–south power dynamics and social and political contexts
Domain 10: Strategic Analysis	S	• To conduct situational analysis and bring systems thinking and determinants-of-health and population health perspective to analyze a diverse range of complex and interrelated factors to develop context-specific intervention to improve global health issues
Domain 11: Research Competence	S and A	• Core public health research skills to incorporate qualitative, quantitative, and operations research skills to design and apply reliable, valid, and ethically sound research to identify innovative solutions for global health problems. • Additional specific global health research competencies include identification of actionable determinants, involving communities, partnering with local institutions, and respecting cultural diversity. • Translating research to policy and programs

[Harmer et al., Hagopian et al., and Karkee et al. generally did not include soft skills (19, 22, 29)]. Those articles that put more emphasis on "soft skills" typically did not include global burden of disease, but this may be due to assumption that it is a part of core public health knowledge (24, 26). The interprofessional competencies described by Jogerst et al. described two levels of competencies—global citizen level and basic program-oriented competencies (21). Global citizen level competencies

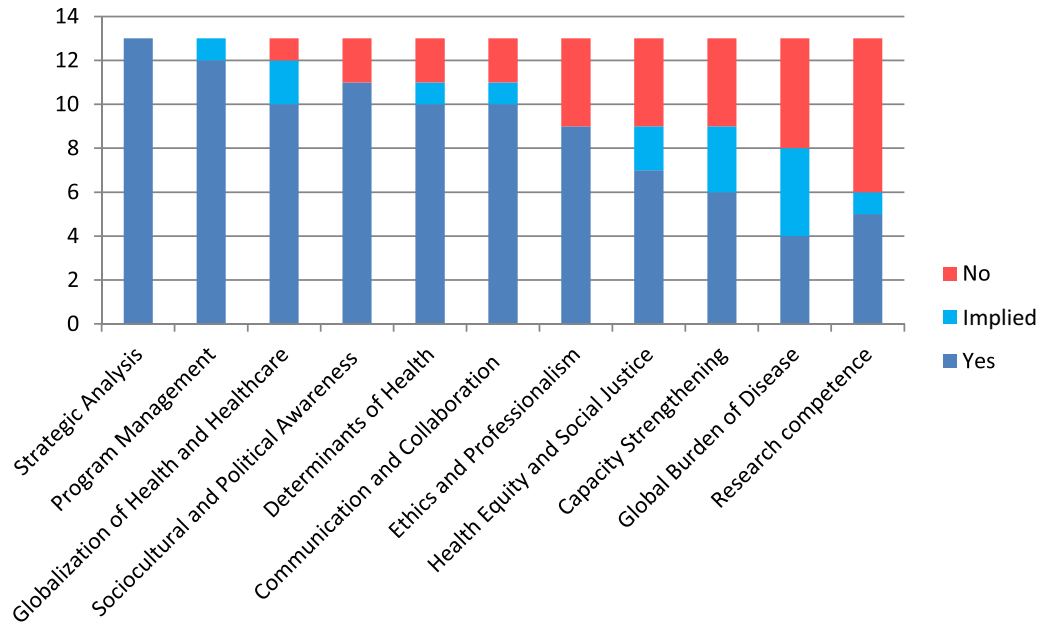

FIGURE 3 | Comparison of frequency of core competency domains/themes in selected articles (*n* = 13). Yes—directly describes competency domain. Implied—implies the identified competency domain. No—does not describe competency domain.

include those that focus on health and disease along with communication skills and sociopolitical and cultural awareness at the global citizen level. At the program level these include program management, capacity strengthening, and strategic analysis, which include core public health competencies but also add a set of skills that also described by Ablah et al. in the global health competency model (20, 21). The Global Health Competency Model described by Ablah et al. specifically mentioned that the global health competency domains should be constructed upon the foundational MPH core competencies (20).

Global health competencies have been described for many professional groups—medical (4, 7, 34), nursing (5), and allied health (6). There seem to be some differences in the core competency domains for clinical health professionals and public health professionals: those for medical professionals focus more on the global burden of disease and health-care services. In a large-scale consultation on global health competencies for UK postgraduate doctors in the United Kingdom, involving over 250 diverse stakeholders identified 5 key competencies, which focused on global epidemiology, determinants of health and health systems along with global governance and ethics/human rights (4). There is significant overlap in the competency domains with the MPH core competencies (version 2.3) by the United States Association of Schools of Public Health in 2006 (14), but additional "soft skills" can be seen as building on the core public health competencies (20). The new soft skills such as political awareness, communication, and collaboration are an important tool in today's globalized and politicized field of health.

The development of competencies allows for deeper thought on the definition and practice of global health. The similarities and differences in competencies are a good opportunity for academic public health institutions to engage in reviewing curriculum regarding knowledge, skill, and attitude required to prepare the global health professional. In their effort to define the field, Wernli and colleagues used a term "academic global health (AGH)" and suggested that it integrates the three traditional areas of health care, international health, and public health (35). They defined AGH as "within the normative framework of human rights, global health is a system–based, ecological and transdisciplinary approach to research, education, and practice which seeks to provide innovative, integrated, and sustainable solutions to address complex health problems across national boundaries and improve health for all" (35). The key dimensions described in this paper broadly deal with set of competency domains we have described in our paper including core knowledge areas in health care, core skills in public health, and set of "soft skills". These "new public health professional skills" have been highlighted in a recent paper describing the collaborative consultation by the World Federation of Public Health Association about how to adapt public health to a future role in global health (36). Global health education in public health programs needs to explore ways to incorporate the soft skills in the curriculum in addition to the technical focus on knowledge and skills to prepare the public health professional to face challenges of global health in the context of sustainable development.

Our review has a few limitations. There are a relatively few articles published about global health competencies, and hence we have also included articles that described competencies in the context of postgraduate programs in international health. We also recognize that global health competencies in individual programs in school of public health may not be published but are important, and we are planning to review this information

in future. This review only focused on literature published in English and so may have overlooked information that was published in other languages. In this review we mainly focused on domains of global health competencies and not detailed sub competencies and learning outcomes for each domain and learning outcomes and more detailed analysis of the identified competency domains. We plan to conduct the detailed analysis in the context of postgraduate public health educational program in the Asian region.

Most of our articles discussed competencies based on programs or discussions in developed countries with some limited representation from the Asia. While the concept of global health originated in the developed world, due to the nature of global health, the long-term relevance and success of education in global public health education depends on the adaptation of the curriculum in both high-income countries and low- and middle-income countries (LMIC) (35, 37). In a recent review, Rabbani and colleagues have argued that schools of public health in LMIC can contribute to overcoming several public health challenges faced by LMIC by building the capacity of cadres of competent and well-motivated public health workforce including educators, practitioners, and researchers (38).

CONCLUSION

This review presents the landscape of defined global health competency domains for postgraduate public health education. The discussion about use of "global health," "international health," and "global public health" will continue, and academic institutions need to explore ways to integrate these competencies in postgraduate public health programs. This is critical in the post-MDG era that we prepare global public health workforce for the challenges of improving health of the "global" population in the context of sustainable development goals.

AUTHOR CONTRIBUTIONS

SS and JN were involved in conception and design of the review; involved in the interpretation of the data; approved the final submitted version. SS worked on the first draft with review by JN.

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One Health Core Competency Domains

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The emergence of complex global challenges at the convergence of human, animal, and environmental health has catalyzed a movement supporting "One Health" approaches. Despite recognition of the importance of One Health approaches to address these complex challenges, little effort has been directed at identifying the seminal knowledge, skills, and attitudes necessary for individuals to successfully contribute to One Health efforts. Between 2008 and 2011, three groups independently embarked on separate initiatives to identify core competencies for professionals involved with One Health approaches. Core competencies were considered critically important for guiding curriculum development and continuing professional education, as they describe the knowledge, skills, and attitudes required to be effective. A workshop was convened in 2012 to synthesize the various strands of work on One Health competencies. Despite having different mandates, participants, and approaches, all of these initiatives identified similar core competency domains: management; communication and informatics; values and ethics; leadership; teams and collaboration; roles and responsibilities; and systems thinking. These core competency domains have been used to develop new continuing professional education programs for One Health professionals and help university curricula prepare new graduates to be able to contribute more effectively to One Health approaches.

Keywords: One Health, competency-based education, interdisciplinary studies, professional competence, medical education, veterinary education

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BACKGROUND AND RATIONALE

The last decade of the twentieth century and the first decade of the twenty-first century saw the emergence of a plethora of public health challenges at the convergence of human, animal, and environmental health, including bovine spongiform encephalopathy (BSE) and variant Creutzfeldt–Jakob Disease, H5N1 influenza, Nipah virus, West Nile Virus, 9/11 and the threat of bioterrorism, SARS, and the impact of climate change on global food systems. While the concept of zoonotic disease (i.e., diseases that are transmitted from animals to humans), and social and environmental determinants of health are well recognized in the public health community, education of medical professionals, by and large, remains segregated between human health (human medicine, nursing, public health), animal health (veterinary medicine, agricultural workers), and environmental health (ecologists).

A 2007 Salzburg Global Seminar, "New Century, New Challenges, New Dilemma: The Global Nexus of Animal and Public Health," recognized that progress on emerging issues like pandemic influenza response and global food security was slowed by the lack of communication and

collaboration among different health professions and the public and private sectors. The seminar focused attention on the need for training health professionals to think globally and facilitate transdisciplinary approaches to health improvement that bring together human, animal, and environmental health practitioners (1). Participants from public, private, academic, and philanthropic organizations reached consensus that this new group of professionals, referred to as "One Health" practitioners, needed to possess unique professional competencies, including "soft skills" to complement the depth of knowledge in their individual areas of expertise, although no specific set of core competencies was developed at that time.

The One Health approach recognizes that the health of humans, animals, and the environment are interdependent and that promoting optimal health in any of these sectors requires cross-sectoral collaboration, communication, and respect (2). The American Veterinary Medical Association defines One Health as "the collaborative effort of multiple disciplines – working locally, nationally, and globally – to attain optimal health for people, animals, and our environment" (3). Implementation of a One Health approach requires a team effort that brings together professionals who come from a variety of disciplines, including human medicine, veterinary medicine, ecosystem health, and agriculture. The Word Health Organization, World Organisation for Animal Health, and the Food and Agriculture Organization of the United Nations have recognized their shared responsibility to use One Health approaches for addressing a number of complex global challenges, such as rabies and antimicrobial resistance (4).

Although the One Health approach has resurfaced in recent years as a strategy to address complex problems at the interface of human, animal, and environmental health, little effort has been directed at identifying the seminal knowledge, skills, and attitudes necessary for individuals to successfully contribute to One Health efforts. The multidisciplinary nature of the One Health approach requires that One Health professionals are proficient in knowledge, skills, behaviors, and attitudes that go beyond the discipline-specific knowledge gained through traditional training programs. Identifying a set of One Health core competencies is critical to prepare professionals to tackle the health threats of the twenty-first century by working collaboratively with peers in other areas of expertise using a One Health approach. Education and training programs, which incorporate these core competencies, will create a workforce better able to address One Health challenges (5, 6).

THE PEDAGOGICAL PRINCIPLES UNDERLYING COMPETENCY-BASED EDUCATION AND TRAINING

Traditionally, professional training curricula and academic course design have been guided by topic-specific and knowledge-based standards. A competency-based approach also considers the skills, behaviors, and attitudes that graduates need to become proficient in their future profession (7). Although initially developed as a way to improve corporate strategy (8), core competencies have been found to provide an excellent foundation for developing professionally relevant training programs that better equip individuals to work collaboratively (9). Professionals working in interdisciplinary environments using One Health approaches to address complex public health challenges must possess knowledge, skills, behaviors, and attitudes that go beyond their discipline-specific knowledge. Identifying these core competencies is necessary to develop relevant training programs for One Health professionals (7–10).

The public health profession has recognized the value of core competencies for more than a decade. In 2006, the Association of Schools of Public Health adopted a competency-based educational model for the Master of Public Health degree. The model currently recognizes 12 domains and a total of 119 core competencies (11). In 2010, the Council on Linkages Between Academia and Public Health adopted a set of eight core competency domains to strengthen the public health workforce (12). Within each of these domains, core competencies were delineated for three tiers of public health positions: entry level, program management/supervisory level, and senior management/executive level. The domains in each of these models represent logical content categories that encompass multiple competencies. Domains are critical for curriculum development as they indicate the main areas in which a professional should be competent. Domains are intended to be stable over time, although the individual core competencies within a domain may be adapted for specific course goals (13). Because of their transferability, core competency domains are particularly useful when developing training programs for interdisciplinary fields.

Between 2008 and 2011, three groups independently embarked on separate initiatives to identify core competencies for One Health professionals – the Bellagio Working Group supported by the Rockefeller Foundation and University of Minnesota; the Stone Mountain Meeting (SMM) Training Workgroup; and the RESPOND Initiative funded by the United States Agency for International Development's Emerging Pandemic Threats Program (USAID/RESPOND). An additional activity, a 2012 workshop in Rome, was designed to integrate the findings of these three groups and synthesize a single set of One Health competencies. Here, we provide a brief overview of each of the original initiatives, a description of the core competency domains they have identified, and some examples of how these core competency domains have been used to develop training programs for One Health professionals.

Bellagio Working Group

The 2007 Salzburg Seminar set the stage for a follow-up activity sponsored by the Rockefeller Foundation. In September 2008, the University of Minnesota convened a multinational, multidisciplinary workgroup at the Rockefeller Foundation's Bellagio Center in Bellagio, Italy, to identify core competencies for global food systems leadership (14). Workgroup participants came from five continents and represented a variety of backgrounds, including governments, academia, non-governmental organizations, the private sector, and intergovernmental organizations, including several who had participated in the Salzburg Seminar. During the week-long process, the relevance of these same leadership competencies for all One Health professionals was recognized

since global food security and other food systems issues require a One Health approach. Five major domains and a set of personal characteristics were identified for successful One Health leadership. Following the meeting, indicators of competence in each domain were outlined for three workforce levels: foundational, intermediate, and advanced.

Stone Mountain Meeting Training Workgroup

The SMM Training Workgroup was established following the May 2010 international meeting *Operationalizing "One Health": A Policy Perspective – Taking Stock and Shaping an Implementation Roadmap* that took place in Stone Mountain, GA, USA (15). The goal of the SMM was to identify clear and concrete actions to move the concept of One Health from vision to implementation. During the meeting, participants deigned a 3- to 5-year vision of One Health encompassing four main areas: culture change, increased visibility, political will and financial support, and optimal coordinated efforts. Seven activities, including training, were identified as critical to attain this vision, and separate workgroups were formed to address these activities. The Training Workgroup comprised of over 50 subject matter experts from U.S. and international government and non-governmental agencies, academic institutions, and other public, animal, and environmental health organizations.

The Training Workgroup was tasked with several activities to build skills and expertise in One Health, including developing a list of essential core competencies for different levels of One Health practitioner. To draft the One Health core competencies, a wide range of existing core competency frameworks were reviewed, including the Association of Schools of Public Health Global Health Competency Model, the Guide to Senior Executive Service Qualifications of the U.S. Office of Personnel Management, the Leadership Core Competencies of the Farm Service Agency of U.S. Department of Agriculture, and the Core Learning Activities for the Nigerian Field Epidemiology and Laboratory Training Program. Through discussions with Workgroup members, the core competencies were refined to be more specific to One Health. The Workgroup identified essential core competency domains for three levels of One Health practitioners – field and entry level workers, program and project managers, and national policy leaders. Each domain was further defined with specific core competencies (16).

USAID/RESPOND

A multiagency Global One Health Core Competency Workgroup was assembled in 2011 under Tufts University leadership to develop a One Health core competency framework which could be used as a template to assess existing curricula and as an aid in the development or strengthening of university curriculum and workforce training programs (13). The workgroup was funded through USAID/RESPOND with the goal to build capacity for medicine, veterinary medicine, nursing, and public health faculty and trainees from countries in Southeast Asia (Thailand, Indonesia, Vietnam, and Malaysia) and Central and Eastern Africa (Republic of the Congo, Ethiopia, Uganda, Kenya, Tanzania, and Rwanda). Since these regions are "zoonotic hotspots," or areas where the risk of disease emergence is high, building capacity was critical to enable countries to manage pandemic threats in collaboration with each other and governmental agencies both within a country and across an entire region. Members of the workgroup included representatives of the United States Department of Agriculture, the Centers for Disease Control and Prevention, and academia.

The workgroup met several times in 2011 and 2012 and identified core competencies through a literature review of existing core competency frameworks in the public health, veterinary medicine, and infectious disease fields; telephone interviews with subject matter experts; and iterative feedback from interactive workshops with RESPOND African and Southeast Asian institutional partners in veterinary medicine, public health, nursing, and human medicine. The Workgroup distilled these core competencies into a set of One Health core competency domains and subdomains.

Rome Synthesis

Through funding provided by the Rockefeller Foundation, the Centers for Disease Control and Prevention, and the Food and Agriculture Organization of the United Nations, the University of Minnesota sponsored a workshop in Rome, Italy, in March 2012 to synthesize One Health Global Core Competencies (17). Attendees came from a broad range of One Health disciplines across the globe, and all worked actively on One Health approaches. Many of the attendees had participated in one or more of the previously mentioned efforts for developing One Health core competency frameworks. The workshop consisted of presentations from each of the different efforts, large group discussions, and small group activities. The immediate goal of the workshop was to validate the existing work related to One Health core competencies. The long range goal was to develop a consensus framework for One Health core competency domains that could be utilized by the global One Health community.

Workshop attendees reviewed nine existing competency frameworks to identify commonalities, including three specific to One Health (the previously mentioned frameworks developed by the Bellagio Working Group, the SMM Training Workgroup, and USAID/RESPOND). Attendees of the Rome meeting found that although the three One Health oriented groups developed their core competencies independently and drew from the expertise of a variety of professional disciplines, each initiative identified similar core competency domains (**Table 1**). These commonalities among the independent efforts were used to describe seven core competency domains, which were further defined with specific One Health core competencies. The major core competency domains identified were management, communication and informatics, values and ethics, leadership, team and collaboration, roles and responsibilities, and systems thinking.

RESULTS TO DATE

These One Health core competency frameworks outline the skills and behaviors necessary for successful performance within the One Health workforce. Educators at all levels of One Health training can use these frameworks as a resource for curriculum development. The competency framework is flexible enough to

TABLE 1 | Major One Health core competency domains identified during the Rome synthesis meeting using the Bellagio Working Group, the Stone Mountain Meeting Training Workgroup, and the RESPOND initiative core competency frameworks.

Source	Major domains						
	Management	**Communication and informatics**	**Values and ethics**	**Leadership**	**Team and collaboration**	**Roles and responsibilities**	**Systems thinking**
Bellagio working group	Working across boundaries	Communication	Ways of being[a]	Visionary and strategic	Influence	Change makers/ achieving results	Working across boundaries
SMM	Human capital management, resource management	Communicates lessons learned, communication	Integrity	Vision integration	Collaboration; diplomacy; builds diverse teams; interpersonal skills	Problem solving; flexibility; self-development	External awareness; strategic thinking
USAID/ RESPOND	Planning and management; analysis and assessment	Applied informatics; communication, and collaboration	Ethics and professionalism	Leadership and systems thinking	Communication and collaboration	Leadership	Leadership and systems thinking; cultural competence; policy and regulation
Rome synthesis	Leadership and management	Communication	Values and ethics	Leadership and management, conflict resolution	Teamwork		Systems analysis/ thinking (external awareness and big picture); creating an enabling environment and advocating change
Example competencies proposed during the Rome synthesis	Able to manage cross disciplinary teams – understands roles and responsibilities of team and its individual members – holds team accountable	Utilizes diplomacy – able to negotiate – able to resolve conflicts – achieves collaboration	Values honesty – possesses strong knowledge of self – possesses integrity	Advocates for change – fosters a change environment – understands individual and shared leadership models – possesses an external awareness (social, political, legal, and cultural)	Able to identify shared values and goals – values diversity of discipline, culture, ideas, background, and experience – establishes trust – thinks strategically		Awareness of big picture and interdependency of stakeholders – understands and embraces a One Health approach – able to identify problem and its impact on the system

[a]*Used to describe a portfolio of value-driven personal attributes: confidence, courage, credibility, emotional intelligence, empathy, ethics, passion, self-awareness, spirituality, and wisdom.*

allow educators the opportunity to tailor their learning objectives to local needs.

The Bellagio model has been used to develop in-service One Health leadership training programs in Africa, Asia, and the Americas aimed at university teaching staff and government officials. In 2010, Chiang Mai University, Thailand, piloted a One Health Leadership continuing professional education course based on the Bellagio model. The course is now the cornerstone of a Global Health Institute held annually at Chiang Mai University. These continuing professional education courses provide intensive experiential learning for working professionals over the course of 2–5 days. Self-assessment, individual skill building, group exercises, and reflections are used to create a positive climate for behavior change among adult learners.

Tufts University, along with USAID/RESPOND partners at the University of Minnesota Colleges of Veterinary Medicine, Public Health, Nursing, and Medicine, is using their framework with institutional partners across Southeast Asia and Africa. Having faculty from multiple disciplines, institutions, and countries agree on the major competency domains meant that the competency framework could be used to develop specific training modules to address the individual domains. The competency framework has been used to evaluate coverage in existing curricula, enhance current courses, and create new ones. Graduate programs emphasizing One Health approaches use the framework to guide curriculum design. Finally, the framework also facilitates identification of faculty development needs.

Faculty have used these frameworks to improve One Health programs and training for graduate students and early career professionals at the University of Minnesota. For example, faculty from the College of Veterinary Medicine, School of Public Health, and Humphrey School of Public Affairs created a new course, "Leadership to Address Global Grand Challenges," that is built around the One Health competency domains described here. Originally listed as a public health course entitled "Global One Health Leadership," the early course enrollment was primarily Master of Public Health Students. Changing the name to "Leadership to Address Global Grand Challenges" and listing the course in public affairs rather than in public health increased the diversity of students registering to include graduate students from veterinary medicine, public health, agriculture, liberal arts, education, and public affairs. The learning objectives of this course demonstrate the integration of the One Health competencies (**Table 2**). The course differs from most other graduate courses in that skill building and group activities predominate instead of lectures. The course also involves student-facilitated discussions with internal and external stakeholders on current complex challenges. Feedback from the course is overwhelmingly positive, with participants commonly citing the immediate usefulness of these skills in

TABLE 2 | Course objectives for PA5152, "Leadership to Address Global Grand Challenges: Focus on Food Systems," held May 23–27, 2016, at the University of Minnesota.

Course objectives
At the conclusion of the course, participants will have a deeper understanding of – and an opportunity to apply – leadership skills that foster collective action across industry, government, academia, and civil society sectors. Specifically, participants will:
1. Expand meta-leadership skills for: a. Leading one's self b. Leading in teams (where you have authority and responsibility) c. Leading up in organizations (where you may have responsibility but no authority) d. Leading across (where you have neither responsibility or authority)
2. Deepen understanding of global food system grand challenges and why they require integrative leadership approaches
3. Learn about, observe, and practice specific integrative leadership skills that include: a. Listening to understand and be understood b. Building trust and credibility c. Facilitating dialog, debate, and deliberation d. Aligning policy implementation tools with desired outcomes e. Anticipating and leveraging windows of opportunity f. Designing inclusive structures and facilitating decision-making processes g. Providing constructive feedback and fostering continuous self-improvement

their jobs, communities, and families. One hundred percent (100%) of the 28 participants in the last three One Health leadership courses taught in Thailand and the United States have mentioned communication competencies in their reflections on the question "What new One Health skills have I learned that I can use immediately?" The specific communications skills most commonly cited were listening (61%), collaboration skills (46%), and appreciating differences (29%).

In addition to providing guidance for curriculum and training design, core competency frameworks can be used to evaluate existing training programs. The SMM Training Workgroup plans to use their list of core competencies to identify gaps in existing One Health training programs. For example, involvement in the development of the One Health core competencies helped the One Health Coordination Center in the Animal and Plant Health Inspection Service of the United States Department of Agriculture identify the need for new in-service training of field staff so that staff members were better able to foster collaboration with local public health agencies. The One Health Systems Mapping and Analysis Resource Toolkit (OH-SMART) was designed to strengthen systems thinking competencies.

DISCUSSION

Although the three groups described here developed their core competencies independently and employed expertise from different disciplines, each initiative identified similar core competency domains. This consistency further substantiates the validity of these domains for One Health professionals. None of these domains are specific to any single discipline and, thus, can be easily adapted by different professions and institutions across the globe. Although this paper focused on the core competency domains, the individual core competencies within these domains can provide additional guidance for developing curricula relevant to local and national One Health needs.

These One Health core competency frameworks provide a common foundation for continuing professional education and training programs that move beyond the focus on discipline-specific knowledge. The overarching goal of One Health training is to impart trainees with the non-technical skills and attitudes that all One Health practitioners need, regardless of discipline or work level. Although many of the domains identified in this review are not traditionally incorporated into discipline-specific training programs, faculty who work in the field of One Health feel that such training is long overdue. The impetus driving the development of these One Health competency domains reinforces the need to equip public health professionals with a breadth of skills to complement their own specific areas of expertise.

The core competency frameworks designed by USAID/RESPOND and the Bellagio Working Group, and the core competency synthesis from the Rome Synthesis meeting were designed to assist in the development of One Health continuing professional education. These frameworks can be used by universities, governments, and regional networks as a starting point for identifying specific core competencies relevant to local needs, which can in turn be used to guide development of new training programs. Educators also can use the domains to identify strengths within existing curricula, as well as opportunities in the curricula to incorporate additional One Health learning needs.

Curriculum change is difficult, in part because acknowledging a need to change suggests to some that the current curriculum and/or the instructors delivering it are inadequate. Agreement on a set of competency domains may be less threatening as it acknowledges that the specific competencies in each domain vary by setting and require constant tweaking to meet the needs of the changing world around us. Some competencies can be achieved by modifying existing courses rather than creating brand new ones. For example, USAID/RESPOND is aware that many programs are overcrowded with material and encourages integrating training modules into existing courses, rather than trying to create new zoonotic disease and pandemic management courses. USAID/RESPOND worked with faculty to think about where existing cases could be replaced with cases designed to highlight One Health competencies.

The Global Health Security Agenda (GHSA) has recognized the importance of multidisciplinary coordination to prevent, detect, and respond to the disease threats facing health systems around the globe (18). In addition to an overall recommendation of utilizing multidisciplinary coordination to meet GHSA targets when possible, the GHSA Workforce Development Action Package specifically recommends the development of a multisectoral workforce to better detect global health threats (19). The One Health competency domains can serve as a resource for countries implementing the GHSA Workforce Development Action Package to ensure that graduates of their training programs are equipped to handle the complex health threats in their countries and regions.

As transdisciplinary One Health approaches continue to gain more attention worldwide, these common core competency domains can provide a foundation for developing and revising One Health training programs. Educators and organizations wishing to adopt One Health approaches can use these domains as a framework to help them evaluate current curricula, identify gaps and opportunities for enhancement of design curricula, and develop evaluation instruments.

AUTHOR CONTRIBUTIONS

CR and RF coordinated all workgroup activities associated with the Stone Mountain Meeting. KC and JA led the Stone Mountain Meeting Training Workgroup and the development of the workgroup's core competency domains. ML and RH led development of the USAID One Health Core Competency Framework. WH and LV led the Bellagio Working Group. WH and DO led the Rome Synthesis. WH and LV developed new university courses and continuing education programs based on these OH competencies. RF drafted the initial manuscript draft. All authors contributed to the idea and manuscript framework, revisions, and final manuscript approval.

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Educating the Public Health Workforce: A Scoping Review

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The aim of this scoping review was to identify and characterize the recent literature pertaining to the education of the public health workforce worldwide. The importance of preparing a public health workforce with sufficient capacity and appropriate capabilities has been recognized by major organizations around the world (1). Champions for public health note that a suitably educated workforce is essential to the delivery of public health services, including emergency response to biological, manmade, and natural disasters, within countries and across the globe. No single repository offers a comprehensive compilation of who is teaching public health, to whom, and for what end. Moreover, no international consensus prevails on what higher education should entail or what pedagogy is optimal for providing the necessary education. Although health agencies, public or private, might project workforce needs, the higher level of education remains the sole responsibility of higher education institutions. The long-term goal of this study is to describe approaches to the education of the public health workforce around the world by identifying the peer-reviewed literature, published primarily by academicians involved in educating those who will perform public health functions. This paper reports on the first phase of the study: identifying and categorizing papers published in peer-reviewed literature between 2000 and 2015.

Keywords: public health workforce, public health workforce training, public health workforce pedagogy, literature search, public health workforce education, health workforce worldwide, global health workforce

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INTRODUCTION

The World Health Organization (WHO) has a defined list of activities necessary to effectively keep the public healthy, continue to improve population health, and reduce global inequalities (2). As the enactors of these functions, the public health workforce is widely recognized as critical to promoting the health of communities within and across nations. The WHO (1), Institute of Medicine (3), the Centers for Disease Control and Prevention of the USA (4), and the Harvard School of Public Health and China Medical Board (5) have all highlighted the importance of educating the public health workforce to continue to improve health around the world. Recent recognition of the importance of the social determinants of health (6) has called even more attention to the need for comprehensive training of all those with primary or secondary public health roles.

Preparing those who will promote the health of the public is challenged by the unresolved, if academic, controversy about whether public health is a distinct discipline or not (7). "Health professionals who perform public health functions" and "public health professionals" are considered distinct by some and singular by others. A recent report by two universities in the United States

(US) (8) explains how different sources define the public health workforce differently and the resulting challenge this poses in getting an accurate count of practitioners and the related issue of calculating and ultimately creating optimum capacity.

Regardless of the methods used to define and enumerate its size, the "public health workforce" is huge and diverse (9). As such, educators have attempted to address effective methods to support workforce needs in terms of education and skills development. A wide array of competency frameworks exists which aim to link education to effective practice, both discipline-specific (10, 11) and interdisciplinary public health (12). Diversity also prevails across and within countries (13), with different organizations responsible for public health education and training. Some education and competency frameworks are linked to professional standards (14); others to accrediting agencies (15). Some organizations have recently come together to promote coordination of competencies across disciplines (16) and in support of a global perspective for international education and collective action on the ground (17). Arguably, this level of diversity in terms of workforce right through to local and global quality assurance sharply contrasts with other key health-related occupations, such as medicine, nursing, and dentistry. Thus, a fragmented and inconsistent approach to public health manpower planning and education seems endemic throughout the global public health community.

Moreover, for several decades, there has been a strengthening in using evidence-based principles to ensure effective design and delivery of education for medical, dental, and nursing students despite the methodological challenges it presents (18–21). Yet until recently, no specific journal was dedicated to the pedagogy for educating the public health students and future workforce. The complexity of public health as a discipline, along with a wide variation in training provision, makes it difficult to determine the strengths and weaknesses of different teaching practices for public heath students in higher education.

The fragmentation about how and in what to train the public health workforce becomes particularly detrimental in confronting an increasingly global world. Infectious diseases once contained in local regions now spread rapidly across continents. Advocacy campaigns that previously might have been local, regional, or at most, national, now quickly "go viral" through the use of social media. From the business perspective, multi-national trade deals are common; yet multi-national collaboration to prepare the public health workforce falls short. Accreditation, licensing, visas, foreign clinical privileges, and other barriers prevent health professionals, including those serving public health functions, in one country from working in another country, at least not without meeting extensive legal and training requirements.

This diminishes opportunities to create a global public health workforce with the capacity to address cross-national emergencies and the competencies required for global tasks. French et al. recommend "a systems approach" to education and manpower planning (5). It is unclear how other countries, governments, universities, and public health professional bodies are ensuring that workforce capacity building fits current needs and future projections.

The purpose of this study was to begin to build a basis for discussion about cross-national public health workforce education by identifying who is teaching what, where, and with what competency or learning objective framework. Phase 1 of the study is the scoping review reported here. From this base, subsequent analyses will examine the content of the literature and the implications for current and future worldwide education of the public health workforce.

MATERIALS AND METHODS

Scoping review has become an increasingly common tool to provide a descriptive overview of the reviewed materials as the body of literature worldwide has grown and become more accessible (22). A scoping review can be of particular use when the topic has not yet been extensively reviewed or is of a complex or heterogeneous nature (22), which is appropriate for public health workforce issues. This scoping review found and characterized the peer-reviewed literature from around the globe between 2000 and 2015 pertaining to the education of those providing public health functions at a professional level.

Search Process

Figure 1 shows the search process. Eligible studies were first identified from a search of the major databases of health and education-related publications: Scopus, PubMed, and ERIC. The search terms were developed from essential functions of public health and broadened with the use of additional medical subject headings, combined with Boolean operators. United Kingdom (UK) and US variations in spelling were accommodated. Main free-text search terms included Public Health, Environmental Health, Occupational Health, Biostatistics, Health Behavior, Health Education, Health Services Administration, Health Policy, Population Health, Health Regulations, Pedagogy, Competency, Learning outcomes, Accreditation, Certificate and licensure, Competencies, Interprofessional, and Service Learning. Only English language publications were included from January 1, 2000, to December 31, 2015.

The time frame 2000–2015 was selected as relevant because it is during this recent era that the use of competencies has come into being as a way to shape and evaluate education (23) and that worldwide communication methods, particularly the Internet, has fostered globalization, including the delivery of education (24). When the study was initiated in 2016, the last year for which complete data were available was 2015.

Inclusion Criteria

Given the diverse nature of public health roles, the review included journal articles that matched the WHO definition of essential activities for the public's health (2) and/or for which a published framework of educational competency or additional defined essential content existed either as a main or subspecialty. Primary disciplines, such as medical, nursing, and dental undergraduate degrees, were included along with public health, as were sub-specialties of public health, such as epidemiology, health administration, and health education. Definitions and competency frameworks were current through the end of 2015.

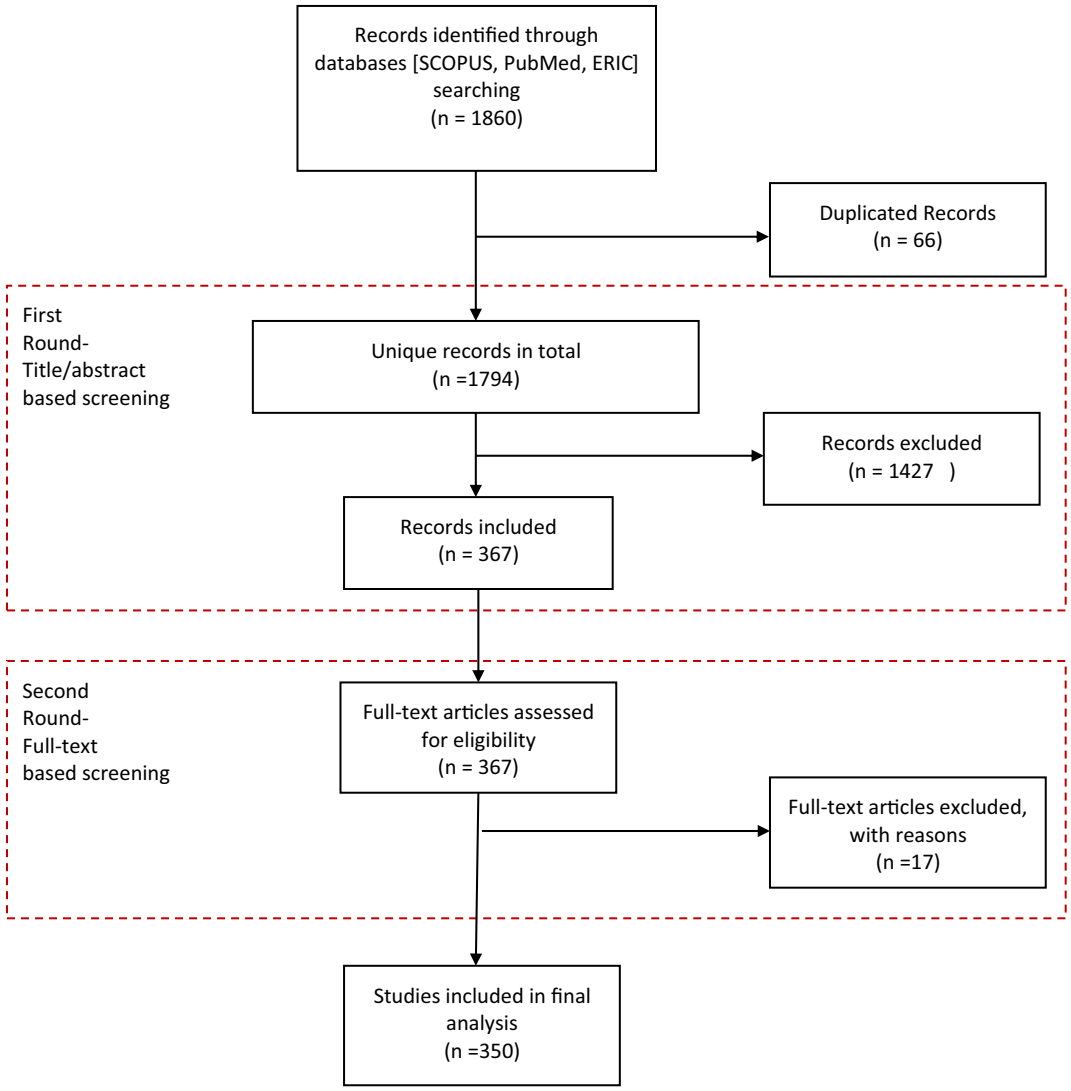

FIGURE 1 | Flow chart of literature review process.

Given that the focus was on "professional" public health providers, level of education was considered as that which provides a terminal degree leading to employment in public health in the relevant country. For example, in the US, a master's of public health (MPH) is the most common degree, as post-high school baccalaureate education in public health tends to take an "educated citizen" generalist outcome approach. In countries where post-high school education is 6 years and includes focused health professions education, such as China, articles deemed acceptable for the scoping review would include those covering baccalaureate curricula.

Selection Process

The first 100 citations were used as a pilot to go over the process iteratively until the acceptable level of interrater reliability with Cohen kappa >0.8 was reached (25). The first stage of the process was based on the title/abstract review. Four reviewers formed two pairs. Two reviewers of each pair reviewed the same 100 citations independently, then met to discuss and resolve discrepancies in whether a study met the inclusion criteria or not. For the studies without reaching agreement, full text articles were reviewed to finalize the consensus on the inclusion or exclusion. Once the interrater reliability level was acceptable, the rest of the unique citations after removing 100 sample citations were divided evenly for each of four reviewers to code "Yes" with 1, "No" with 2, and "Maybe" with 3. For the citations with the "Maybe" code, two pairs of review teams were formed with different members in the pilot process to ensure the coding reliability. Each pair reviewed half of the citations with the "Maybe" code until the consensus on inclusion/exclusion was reached. A final list of inclusive citations was identified after this entire iterative process.

Categorization Process

Data extracted from each article included authors, year of publication, country/region, discipline/program of study, and article "type." The type of articles referred to methodology and was based on the description for eligible articles used by an international, peer-reviewed, open-access journal of public health education (26). The category of curriculum/instruction/pedagogy encompassed description of a course, description of curriculum, case study (i.e., unique situation), description of field experience, or competency framework. The category of evaluation was used for articles reporting data on formal evaluation studies assessing the outcomes of courses, curricula, or specific teaching methods.

A challenge to the study was in assigning articles to just one specific category. For example, a case study might include a formal evaluation of student learning outcomes. The authors agreed to allow two classifications of article type for each article. This explains why the number of article types is greater than the number of individual articles in the reported results. A more detailed analysis using free-text mining considered the methodologies employed, independent of article type.

RESULTS

As shown in **Figure 1**, from 1,860 citations originally identified from the searches, a total of 350 articles met the final inclusion criteria for the review. The list is available in Data Sheet S1 in Supplemental Material.

Year of Publication

Figure 2 shows the number of articles published in each year. The distribution indicates that articles pertaining to the education of the public health workforce have steadily increased over the 15 years between 2000 and 2015.

Geographic Distribution

Table 1 shows the geographic location of the articles. A total of 46 countries and/or regions were included in the review, and all continents were represented. The predominant countries were those in North America and Europe. Of the 350 articles, 177 focused on education pertinent to the US. Twenty-four articles focused on the UK; 17 on Canada; and 14 on Australia. Several articles described multi-national efforts, including across

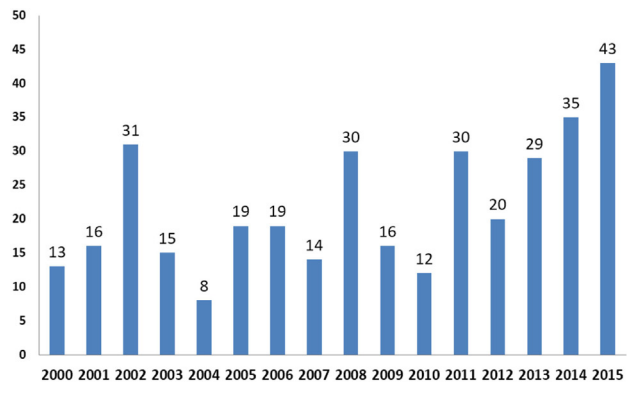

FIGURE 2 | Number of articles by year, 2000–2015.

TABLE 1 | Distribution of articles by geography.

Region and country	Number	Totals
North America		
Canada	17	
Mexico	2	
United States	148	
Total		177
Europe		
Europe (broad focus)	9	
United Kingdom	24	
Italy	3	
Ireland	2	
Germany	2	
Norway	1	
Netherlands	1	
Lithuania	2	
Switzerland	3	
Poland	1	
Turkey	3	
Spain	1	
Total		52
Eastern Europe	2	
Croatia	2	
Albania	1	
Bulgaria	1	
Russia	1	
Total		7
Mid-East		
Israel	5	
Jerusalem	1	
Palestine	1	
Saudi Arabia	2	
Kuwait	1	
Total		10
Asia	1	
China	2	
Hong Kong	1	
India	6	
Pakistan	2	
Sri Lanka	1	
Thailand	1	
Malaysia	1	
Total		15
Down Under		
Australia	14	
New Zealand	1	
New Caledonia	1	
Total		16
South America	2	
Brazil	3	
Chile	3	
Colombia	1	
Total		9
Africa	3	
South Africa	2	
Kenya	1	
Total		6
Multi-national/global		4
Total		296
No geographic area specified		72
Two countries or regions included		3

regions, or a global emphasis without being geographically specific.

Discipline

As shown in **Table 2**, the majority of articles focused on public health as a main discipline in general (166 in total) or sub-specialties of public health (60 in total), such as epidemiology, health management, or health education. Nonetheless, articles also emanated from the disciplines of medicine, nursing, dentistry, veterinary medicine, pharmacy, social work, and others.

Article Type

Table 3 gives the article types of the publications. The largest proportion of article types from the original list of 350 was for curriculum, instruction, pedagogy (36%, 102), followed by evaluation (24%, 84) and perspective/opinion (15%, 53). One-in-ten or less were identified as studies primarily focused on original research (10%, 36), case study (10%, 34), "other" (6%, 23), review (4%, 16), competency (4%, 13). Less than five articles met the format of a hypothesis/theory focused article, accreditation/certification, or commentary. When regrouped into a single category of original research, evaluation, teaching method, curriculum/instruction/pedagogy, and competency, 290 articles had focused on this as a part of the primary or secondary investigation.

As shown in **Table 4**, 97 (28%, 97) articles mentioned a research design keyword in the title or abstract. The most frequent study design mentioned was cross-sectional/survey design, stated in 76% of articles (74/97), 14% (14/97) conducted interviews, and 8% (8/97) employed focus groups. One study carried out a randomized controlled trial. Some studies were double counted with more than one keyword identified (such as mixed-methods studies).

Of the entire 350 articles, only 3 had a primary focus of accreditation/licensure/certification, and for 2 of these, this was the secondary topic of emphasis. The single randomized controlled trial, conducted in Canada and published in 2015, examined the benefits of learning compared with use of printed articles/resources.

TABLE 2 | Number of articles by discipline.

Discipline	Number of articles included in review
Public Health—General	168
Medicine	62
Public Health—Sub-Specialties	60
Biostatistics	7
Emergency Preparedness	2
Environmental Health	4
Epidemiology	15
Informatics	4
Health Education	13
Health Management/Health Admin	12
Nutrition	3
Multi-Disciplinary/Interdisciplinary	26
Nursing	13
Dentistry and Dental Hygiene	8
Veterinary Medicine	4
Social Work	4
Other	3
Pharmacy	2

TABLE 3 | Number of article types as the primary or secondary focus.

Article type (based on Frontiers' categories)	Primary	Secondary	Total	%
Curriculum, Instruction, Pedagogy	102	25	127	36.3
Evaluation	55	29	84	24.0
Perspective or Opinion	48	5	53	15.1
Teaching Method	29	14	43	12.3
Original Research	36	0	36	10.3
Case Study	31	3	34	9.7
Other	11	12	23	6.6
Review	15	1	16	4.6
Competency	13	0	13	3.7
Commentary (response to previously published article)	5	0	5	1.4
Hypothesis and Theory	4	1	5	1.4
Accreditation, Certification, Licensure	1	2	3	0.9
Book Review	0	0	0	0.00
Total	350		442	

N.B. percentages add up to more than as some articles were included in more than one "article type."

Authors

The distribution of authors was examined as an indication of the breadth of interest in the education of the public health workforce. The 350 articles were written by a total of 2,432 authors. The number of authors for an article averaged nearly 7, with a range from 1 to 17. Single author papers numbered only 16. The papers with a larger number of authors typically represented the work of multi-institutional task forces to develop competency models, such as global competencies or MPH competencies. As noted in the number of countries represented by the 350 articles, authors came from all over the world. Very few authors (less than 12) appeared on more than one paper. The most articles authored or coauthored by a single author numbered five.

DISCUSSION

The comprehensive review of literature investigating undergraduate and postgraduate education for the public health workforce identified 350 articles over 16 years from 2000 to 2015. The number of relevant publications increased steadily overtime,

TABLE 4 | Core methodologies based on text mining for key methodological terms.

Methodology	*n*	%
Randomization	1	0.29
Cross sectional	74	21.14
Cohort/longitudinal	0	0.00
Focus groups	8	2.29
Interviews	14	4.00
Total keyword(s) identified	97	27.71

N.B. total is less than 350 as articles with non-rigorous designs were excluded, such as articles describing courses or curricula.

suggesting increasing recognition in what historically has been an overlooked field. Many countries and all continents had conducted studies in this area. Few can deny that public health has become a global discipline. As such, educators around the world need to ensure effective pedagogy that meets the teaching needs of their own students and incorporates application and knowledge transfer to other populations.

The current review also identified a diverse public health workforce in terms of other professions and included medicine, nursing, dentistry, veterinary medicine, social work, pharmacy, physical therapy, occupational therapy, among others. The collection of articles revealed attention being given to components of education across the spectrum of public health workers, be it as sub-activity within their wider professional grouping or as a primary public health worker.

The distribution of authorship supports the assertion that interest in educating the public health workforce is starting to become widespread. Most articles were written by multiple authors, perhaps indicating the complexity of the subject matter and the value of multiple perspectives. Many were written by coauthors representing several institutions. In contrast to biomedical research or health systems research, where centers, institutes, and program projects have a research team that produces many articles, perhaps with variation in order to first author, neither single author nor institution dominated, with fewer than a dozen authors appearing more than once. This might indicate involvement by many people, but few, if any, centers dedicated to examining the pedagogy pertinent to the public health workforce.

By far, this is the largest and most current scoping review on the topic of public health workforce education. In the seminal work by Frenk et al. (5), only 221 of 11,054 articles (2%) reviewed for education related to the "health" workforce were focused on public health; the majority were for physicians 8,069 (73%) and 2,764 (25%) nurses. This leads to the conclusion that the education of those providing public health functions receives less attention, either from its own discipline or other health professions disciplines.

As noted by Evashwick et al. (7), articles about the education of the public health workforce are difficult to find for several reasons. These include that, unlike most health professions, until recently, public health had no journal of its own devoted to pedagogy. Yet they exist for medical education (for example, the *Indian Journal of Medical Education*), nursing education (for example, the *Journal of Nursing Education*), and dental education (for example, the *European Journal of Dental Education*), to name just a few. Furthermore, alongside the more context- and community-orientated focus of public health, there is a vast array of "gray literature," including that from government agencies, local health administrators, universities, and the third sector/non-government organizations. Consequently, the true size and scope of activity associated with educating the public health workforce is likely to be considerably bigger than that reported here and in other studies.

The results show a lack of rigorously controlled studies, either as randomized or non-randomized intervention studies. The results identified just one study of this article type. Yet this type of methodology is as well suited to examining the effectiveness of education interventions for different groups of students, as it is for a specific procedure, therapy, or policy. Moreover, it is used to inform education of other health-related disciplines (27). Despite the trend to base pedagogy on competencies, the education community as a whole seems to continue to use student grades and satisfaction questionnaires as the main markers of "effectiveness." Other methods/theoretical evaluation designs, for example, as a comparator against benchmarks or employer demands, are not the norm. The results from the current review support cross-sectional studies being the typical evaluation method of educational interventions for public health workers through higher education. Yet the many uncontrollable biases of cross-sectional studies in clinical epidemiology remain when transferred to other forms of enquiry. To promote the evolution of educational evaluation and adoption of evolving pedagogical frameworks, funders of educational provision and accrediting authorities need to consider more tightly controlled studies to demonstrate effectiveness of teaching interventions.

The link between educational programs and workforce needs was absent from the majority of articles. Although a few articles mentioned the need for "more" public health professionals, more experts in certain sub-disciplines, or specific content (such as training in gerontology), most articles did not relate to external projections of workforce need or demand. This calls to question the basis universities use to develop training programs. If there is no relationship to the job market, how do educational programs determine the content, or indeed, which degrees to offer? Leading experts have called for a systems approach to education and manpower planning (5) and countries, such as New Zealand, are trail-blazing efforts to project new demands and revise training accordingly (28).

The absence of any literature, except for three articles, specifically mentioning accreditation, licensure, or certification raises concern. The link between education and workplace outcomes comes into question and challenges university programs educating students to join the public health workforce to relate to current and future employment needs. A couple of studies reported on feedback from students, and one study surveyed alumni for their assessment of how well prepared they were for their subsequent job demands. Although accrediting authorities typically require feedback from alumni and/or employers of their graduates on the competencies learned through a training program, these apparently are not conducted in a way rigorous enough to warrant publication, or alternatively, those conducting the studies are not motivated to turn their information into publications for external audiences. At the same time, not all countries or accrediting bodies have such requirements, but that very few articles were identified in this global review is disconcerting.

A limitation of the methods of this scoping review was that it included different programs of study rather than examining those for final degrees in public health (e.g., Bachelors and Masters in Public Health). This was an intentional decision. Focusing on a degree alone would have excluded possibly informative research on the medical, nursing, dental students, among others, included in the review, many of whom are being taught key components

included in any public health degree. Moreover, degree titles, levels, and content vary across countries. An alternative approach would have been to have started the search by focusing on a particular profession/occupation group (e.g., nursing) and then searched for publications on education and public health as lower-level key words. The total number of studies included in the review might have been different using this approach. However, this path ran the risk of excluding other occupations not often regarded as participating in public health work-related activity. Yet another facet of the search criteria was using competencies. Traditional content areas, such as Maternal and Child Health, do not appear. Rather, the content would be spread across competencies, such as epidemiology or health promotion. The approach selected was chosen as the best to maximize finding relevant articles.

The scoping review did not attempt to critically assess any of the research studies, other than classifying by main study designs. By definition, a scoping review identifies and describes the breadth of literature but does not analyze the content (22). The content of the articles will be examined in detail for each category of article type as a next phase of the study. The category of curriculum, instruction, and pedagogy is of particular interest, as these are the articles that contain discussions of competencies, pedagogical techniques, evaluation outcomes, and cross-national comparisons.

As in most reviews of the literature, the search terms, their operation, and the different literature databases used all have strengths and weaknesses. Similarly, the review did not search the gray literature, including internal reports and program evaluations. No doubt, some work will have been missed, but it is unlikely this would have substantially changed the overall conclusions. Only literature published in English was used. Future review teams should include literature published in other languages, especially Spanish and those from emerging economies such as China, particularly in countries having extensive undergraduate and postgraduate education programs and emerging programs for Bachelor and Masters in Public Health degrees.

CONCLUSION

Like other aspects of health-related activity, educating students so that they can effectively execute public health roles requires pedagogical research and scholarship. The current scoping review identified a widely eclectic mix of articles, predominantly from North America and Europe that examined this activity in some way. The scoping review included many descriptive reports, cross-sectional studies, few formal evaluations, and just one randomized study on teaching methods for higher education in public health. The pool of studies on this subject is relatively small over the 16-year timeframe. Nonetheless, publishing on public health workforce education has increased over the years. Moreover, the articles represent the diverse landscape of public health and its international community. Using published literature to share basic knowledge of who is being trained, by whom, with what curricula, pedagogical elements, and evaluation methods lays the groundwork for the systems approach in educating the public health workforce. A workforce trained using contemporary approaches to education and current, global-oriented content is an essential component of creating a healthy population worldwide.

AUTHOR CONTRIBUTIONS

CE, DT, and RH conceived this study. DT conducted the literature search and revisions. MG, RH, DT, and CE participated equally in reviewing and categorizing the articles of the literature search. MG and DT produced the graphics. RH and CE produced the tables. CE, RH, DT, and MG contributed to the writing and editing of the text.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at http://www.frontiersin.org/articles/10.3389/fpubh.2018.00027/full#supplementary-material.

DATA SHEET S1 | Database of articles pertaining to health workforce education.

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PERSPECTIVE
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Preparation of European Public Health Professionals in the Twenty-first Century

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The public health profession in Europe has a leadership role for ensuring European's health in the twenty-first century and therefore must assume responsibility for advancing education for research and practice. Three fundamental questions are explored: (1) What are the main public health problems facing public health professionals; (2) What are their existing competencies after training; and (3) What competencies do European employers expect? The European Schools of Public Health assessed their best success to be in the field of health promotion, followed by disease prevention including identification of priority health problems, and elimination of health hazards in the community. Conversely, they see the least success in dealing with preparedness and planning for public health emergencies. From an employer's perspective, significant gaps between current and desired levels of performance at the job exist for all Essential Public Health Operations of World Health Organization. Based on prior research and recent European surveys of Schools and Departments of Public Health, the following recommendations are made, which emphasize the leadership role of the European public health community: (1) the preparation of public health professionals requires an interface between public health functions, competencies, and performance; (2) competence-based education is important and allows debates on the scope of the required education; (3) governments have to realize that the present lack of infrastructure and capacity is detrimental to the people's health; (4) as public health challenges are increasingly global, educational institutions have to look beyond the national boundaries and participate in European and global networks for education, research, and practice.

Keywords: public health, education, professionals, partnerships, Europe

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INTRODUCTION

Today public health professionals face many new and demanding challenges such as how to increase healthy life expectancy and to minimize health inequalities in times of repeated financial crises. Equity in health across the European region and beyond is viewed as one of the central goals of sustainable development and dedicated work of public health professionals to achieve improvements in planetary health (1, 2). To cope effectively with these challenges, it is essential to address the multiple socioeconomic, environmental, and individual determinants of health. This requires that the public health profession assumes leadership in the twenty-first century and understands that "working differently means leading and learning differently" (3).

This perspective article starts out with a description of the European landscape of professional education including reference to US American developments. Against this background, we try to find answers to three fundamental questions based on the published literature and the European survey of Schools and Departments of Public Health (SDPHs) (4):

(1) What are the main public health problems that we have to address in Europe and beyond?
(2) What are presently the exiting competences of public health professionals after training in Europe?
(3) What are the expectations of European employers of public health professionals?

THE EUROPEAN LANDSCAPE OF PROFESSIONAL EDUCATION

Globally and also within the European Region with its 53 countries, public health professionals are confronted with an extremely heterogeneous landscape. Nevertheless, the European public health education and training has the same cornerstones and develops along the Bologna Process, which is designed to harmonize the fragmented educational scene in Europe and to facilitate the international exchange of students and lecturers. Meanwhile, almost all European countries have fully joined in promoting the attractiveness of European Higher Education Area (5). The degree structure is now based either on two or three of the major strata—bachelor, master, and doctoral level (6). Application of the European Credit Transfer System (ECTS)[1] in academic programs is the primary instrument for the mutual recognition of diplomas and professional mobility. Recent challenges lead to the development of student-centered learning, modularization, focus on learning outcomes, and on applications for lifelong learning (7).

Despite many different educational backgrounds of the current public health workforce, consensus is emerging to focus on three main layers (8): (1) public health professionals; (2) health professionals; and (3) other professionals with job functions bearing on the population's health. Also, understanding of the different job settings is of great importance for accountable performance (9). A European set of competencies has been developed led by the Association of Schools of Public Health in the European Region (ASPHER) (10) and adopted by the World Health Organization (WHO) (11). The European competencies comprise six domains (abbreviated) (12): (1) methods in public health; (2) population health—its social and economic determinants; (3) population health—its material environmental determinants; (4) policy, economics, organization, management, and leadership; (5) health promotion, health education, health protection, and disease prevention; and (6) ethics. US American competence frameworks have also been discussed for many years (13). In 2014, the Council on Linkages Between Academia and Public Health Practice published a very differentiated set of competencies (14) organized according to eight domains. In spite of the different systems and wording, the contents are quite similar, especially in respect to an outcome-based education and the apparent need for interprofessional education and lifelong learning.

[1]One credit point of ECTS corresponds to 25–30 h of student's workload, thereof up to 30% in direct contact with a lecturer (through an interactive presentation, exercise, seminar, field work, or research).

EXPLORATION OF KEY QUESTIONS

What Are the Main Public Health Problems That We Have to Address in Europe and Beyond?

The competence acquired during the public health education has to support qualified performance to solve dominating (global) public health problems as there are threats to humanity (15) and planetary health (1) coming with climate change (e.g., floods, desertification), social inequity (e.g., poverty, hunger), insecurity (e.g., armed conflicts, terrorism), and instability (e.g., financial crises).

To some degree, public health functions and services are regionally specific (11, 16, 17), nevertheless in its document "Health Workforce 2030" WHO underlines the unmet global demand for qualified health professionals including the public health workforce (18). By now, public health interventions in all countries target predominantly socioeconomic factors (19). One of the most significant public health challenges—well-being—has attracted the particular interest of public health professionals. It represents one of the most complete and profound reflections of health. In the new European health policy "Health 2020," signed and adopted by 53 member states of the Region in September 2012, WHO stated that the aim is to improve the health and well-being of populations significantly (20). Moreover, in September 2015, 193 countries that are members of the United Nations signed the "2030 Agenda for Sustainable Development"; Goal 3 is specific: "to ensure healthy lives and promote well-being for all at all ages" (21).

What Are the Exiting Competences of Public Health Professionals after Training in Europe?

For this and the third question, we refer mainly to the unique regionwide surveys organized and published on behalf of ASPHER, "*the key independent European organisation dedicated to strengthening the role of public health by improving education and training of public health professionals for both practice and research*" (22). WHO Europe invited ASPHER to take the lead on the Essential Public Health Operation (EPHO) No. 7 on "Assuring a sufficient and competent public health workforce" (23).

Looking at the performance of public health professionals, while there are different published models of health system performance (24–26), very few of them exist in the field of public health and very often relate exclusively to the concept of management (27). ASPHER's approach assumes that performance varies and strives for success in achieving long-term objectives. Therefore, all four dimensions of the WHO performance model

should be included in a comprehensive assessment of public health performance in the future (25):

- *Availability* regarding space and time and the distribution and attendance of existing workers;
- *Competence* expressed as the combination of technical knowledge, skills, and behaviors;
- *Responsiveness* related to people who are treated decently, regardless of whether or not their health improves;
- *Productivity* connected to maximum effective public health services and health, reducing waste of staff time or skills.

The Global Independent Commission on Education of Health Professionals for the twenty-first century stated that vocational education had not kept pace with the new global challenges, largely because of fragmented, outdated, and static curricula that produce ill-equipped graduates (28). ASPHER (29) reacted by executing in 2011–2012 the first systematic survey of, at that time, 81 members, SDPHs. With a participation rate of 81.5%, the survey included the evaluation of exiting competencies of their Master of Public Health (MPH) graduates making use of the European list of public health competencies (10) and the EPHOs, endorsed by WHO (11).

Together more than 80 different master programs in the broader field of public health are offered in Europe. Although epidemiology maintains the first rank in a list of curricular contents, critical new areas like informatics, genomics, community-based participatory research, policy and law, global health, and ethics are also present. One major focus of the survey was the dimension of competencies for good public health performance (29). SDPHs assessed their best success to be in the field of health promotion, followed by disease prevention including identification of priority health problems, and health hazards in the community while they see the least success in dealing with preparedness and planning for public health emergencies.

However, European training capacities are entirely insufficient, even taking into consideration that not all MPH training programs in Europe are based on schools of public health and are not covered by the ASPHER survey. Their role in the development of the public health workforce warrants separate consideration. The ASPHER survey found an overall average of 46 graduates per institution per year (all programs of the Bologna levels and equivalents). This total annual number of 3,035 graduates by the institutions participating in the survey can by no means satisfy the need for public health professionals which for the European Union alone can be estimated to be 22,000 based on levels proposed for the United States (30, 31).

Given an accelerated globalization and the impact of developments outside of Europe, training for global public health has rapidly gained relevance. Global health is present in the curricula of 82% of ASPHER members with a median of 40 h, only a bit higher than recommended for medical students as a minimum (30 h) (32).

What Are the Expectations of European Employers of Public Health Professionals?

The ASPHER survey 2012–2013 identifies in addition to exit competencies of graduates also the current as well as the desired performance of public health professionals as determined by 63 out of 109 (57.8%) contacted European employers (33). Employers were asked: "*How often public health professionals in your job environment perform the task, which requires selected competence*?" Furthermore, they had to specify the current level of performance the desired level. It turned out that the regular performance of a particular competence is defined by what is "necessary" and driven by assigned tasks. Employed professionals rarely have occasion to perform a particular public health competence on an everyday basis or weekly. Significant gaps exist between current and desired levels of performance on the job for all EPHOs (4).

Schools and Departments of Public Health estimates of their success in terms of the public health exiting competencies of their graduates often are not in congruence with employers' estimates of current levels of performance of their staff (see the representative example of EPHO 7 with its related competencies in **Figure 1**). This observation can be due to a favorable overestimation by SDPHs or a generational representation in the sense that the current employees do not perform accordingly because they were educated in earlier times. In most areas however, SPHDs' opinion about their present success corresponds quite closely to desired levels of performance as stated by employers. The main exceptions as published (33) are EPHOs related to preparedness and planning for public health emergencies, health protection operations, and core communication for public health. SPHDs estimate their success considerably lower in those EPHOs than public health employers expect as desired level of performance. A way to improve this deficit could be to involve public and private employers already in the curriculum development.

NETWORKING AND PARTNERSHIPS IN PREPARING PUBLIC HEALTH PROFESSIONALS

The answers we found to the three questions discussed can be summarized as follows:

(1) Increasingly, Europe has to confront threats related to the rapid globalization and their upstream determinants, various strategies for improvement are formulated and adopted by the United Nations and the WHO. New research fields have been introduced like well-being.
(2) In spite of the high variation of the institutional format, there is considerable agreement on what kind and level of knowledge and skills are required and provided to equip public health graduates for a successful professional career. Nevertheless, the training capacity in public health is entirely insufficient, especially concerning global health and emergency preparedness.
(3) Potential employers of public health are in need of specific competencies to perform a specific task at a specific moment. In consequence, the master programs and even more continuing education have to allow for high flexibility responding to the requests of students and potential employers.

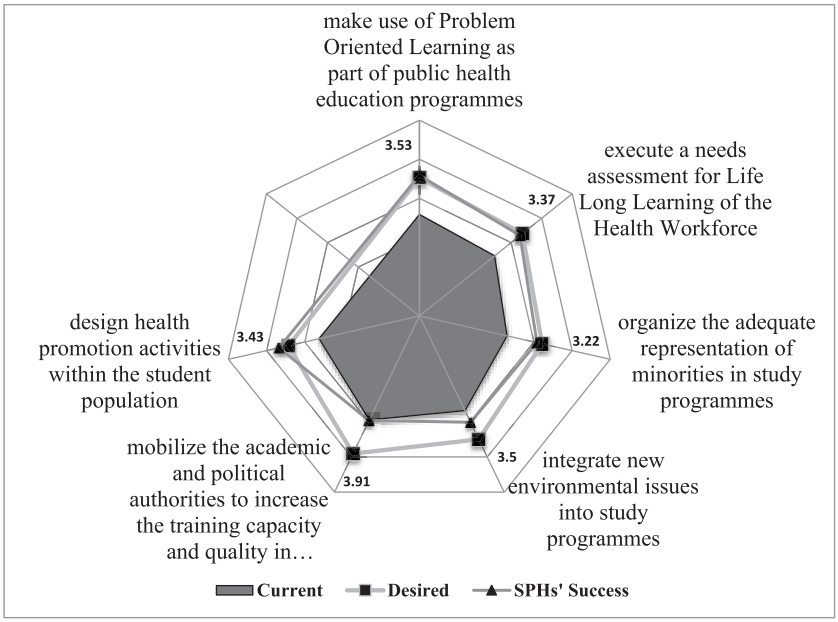

FIGURE 1 | **Essential Public Health Operation (EPHO) 7: assuring a competent public health and personal healthcare workforce**. [The rays in the spider web indicate the ranks in a 5-point Likert scale (3 = average, 5 = best) for the six competences selected to represent EPHO 7.] Source: ASPHER WG on Innovation and Good Practice in Public Health Education (4).

Given the small infrastructural base, the logical way forward is the advancement of partnerships joining capacities at the European and global level (32). Today learning from public health experience in other countries by including international students in the program and fostering mobility becomes increasingly important. Various forms of regional collaboration are improving outcomes in public health education and practice.

An example is the intergovernmental South-Eastern Europe Health Network (SEEHN) (34) of WHO Europe and in the recent past the Forum for Public Health Education, Training and Research in Southeastern Europe (35), supported by the European Stability Pact. Examples of such cooperation are common sets of flexible teaching materials which in the meantime comprise six thematic volumes with close to 250 modules on some 4,000 pages and the open-access South Eastern European Journal of Public Health (36), which also offers the second edition of the mentioned teaching books (37, 38).

This experience represents not only a valuable support for students and faculties but also has served to establish close collaboration across borders and among people who have been on different sides during the wars of the 90s. As an example, to the volume on Management in Health Care Practice, published 2008, 49 authors from 10 countries have contributed. There were many occasions to test teaching modules as applied (39) and learn through conferences/meetings, summer/winter schools, and students' conferences during a decade of cooperation.

Also, a joint project of the Open Society Foundations and ASPHER facilitated the establishment of schools of public health in selected countries of Southeastern Europe, with the primary focus on the development of teaching curricula at Masters' level in the field of public health sciences (40).

Schools of Public Health, Institutes of Public Health, and National Public Health Association have established a permanent collaboration to improve the performance of public health professionals. For example, ASPHER (7) and the European Public Health Association (41) are both regional members of the World Federation of Public Health Associations (WFPHA) (42), whereas the International Association of National Public Health Institutes is a member of the Advisory Board of WFPHA.

RECOMMENDATIONS

The authors recommend the following to prepare a competent public health leadership in Europe:

1. Preparing public health professionals requires an interface between public health functions, competencies, and performance. Analyzing the existing situation and planning for future needs, education and research are core composite parts in advancing a strong public health profession. Increasing cross-border mobility stimulates the higher educational institutions to become transnational actors.
2. Competence-based education is important and opens debates on the scope of the required education. Based on the recent ASPHER survey, the European schools are still on their way

preparing public health professionals to perform at highest levels.
3. Governments have to realize that investing in the public's health workforce bears high returns. The present lack of infrastructure and capacity is detrimental to the people's health.
4. As public health challenges are increasingly global, educational institutions have to look beyond the national boundaries and participate in European and global networks for education, research, and practice.

AUTHOR CONTRIBUTIONS

VB-M: conceptualization, introduction, sections 2 and 3, section on networking. RO: section on European landscape, section 1. VB-M and RO: recommendations.

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Global Health Teaching in India: A Curricular Landscape

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Today, health has transcended national boundaries and become more multifaceted. Global health has evolved as a new paradigm and is recently being identified as a thrust area now in India. Despite an existing need for a standardized global health curriculum, there is little information available on its education and curriculum in medical and health education space. In the Indian context, we are yet to have a fuller picture of the current status, including, content, structure, selection, teaching methods of global health, and how students are evaluated in India. The objective of this study was to map courses relating to studies on global health in India and analyze its mode of delivery. A detailed Internet search was carried out to identify global health courses and analyzed for: (i) whether global health is a part of the teaching curriculum, (ii) mode of teaching, (iii) broad contents, (iv) instructional formats, (v) assessment, and (vi) selection process. It was found that delivery of global health education in India was fragmented with limited focus at the undergraduate and postgraduate levels. Global health teaching was largely based on certificate courses or online courses, with hardly any institutions imparting a distinct global health education program. There is also no definite specification as to which institutes can impart teaching on global health education and what the specific eligibility requirements are. Our analysis suggests that efforts should be directed toward integrating global health education into broader public health curriculum. At the same time, the need for generation of global health leaders, creation of a common forum for addressing merits and demerits of global health issues, as well as creation of more opportunities for placements are recognized.

Keywords: global health, international health, public health education, curriculum, India

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INTRODUCTION

In recent years, the world has made rapid progress toward economic globalization, populations have become more multicultural and borders are being traversed easily. Health issues have therefore moved beyond communities and countries. Increased migration, international travel, commodity and food supply globalization, climate change, reemerging disease patterns and rising burden of chronic diseases, have caused health to transcend national boundaries and become more multifaceted. The concept of health is therefore no longer restricted to disease based and clinical interventions, but has evolved further to assume global dimensions (1).

With the above evolution, the scope of population health has broadened to accommodate two of the new emerging domains of public health–international and global health. Public health is usually viewed as having a focus on the health of the population within a specific country or community (2). International and global health, though often used interchangeably, are different entities. International health differs from public health in focusing on health issues outside of one's own country. In Koplan et al.'s view, international health caters to health issues, especially infectious diseases, and maternal and child health in low-income countries (2). Global health, on the other hand is not just limited to the location of problems, but focuses on the wider health determinants, and transnational health issues. Koplan et al. also proposed a working definition of global health as "an area or study, research, practice that places a priority on improving health and achieving equity in health among everyone worldwide" (2).

As increased awareness and growing interest on the new paradigm of global health takes place, the need for a standardized global health curriculum in medical education is also evident. Presently, there is limited knowledge on what should actually be the component of an appropriate global health training course to fill an existing gap in medical education. Initiatives to introduce global health discipline as an essential component of the medical education curriculum in developed countries have been made. However, despite the burden of preventable disease being largely predominant in low- and middle-income countries, little information is available on global health related education in these countries.

In the Indian context, global health is yet at its nascent stage and has only been recently identified as a thrust area. We are yet to have a fuller picture of the current status, including, course content, structure, selection, teaching methods of global health, and how students are evaluated in India. At the present policy level also, there is no focus on promoting global health as a part of regular medical curriculum (3). The objective of the present work is to map courses related to teaching of global health in India and analyze its mode of delivery and implications on policy. It is expected that the results would provide guidance and critical inputs for strengthening teaching on global health at multiple levels.

METHODOLOGY

To obtain the best available insights into the imparting of global health teaching in India, an iterative process was adopted. A detailed Internet search was carried out to identify global health courses using the Google search engine with "global health, global public health, international health, global issues, and universal health" as the key words. The websites of Association of Indian Universities, Indian Council of Medical Research, University Grants Commission, Medical Council of India, Dental Council of India, Indian Nursing Council, and Ministry of Health and Family Welfare were searched (3). A similar search in the websites of the Indira Gandhi National Open University (IGNOU), professional associations, namely, Indian Medical Association, Academy of Family Physicians of India, World Association of Family Doctors (WONCA), World Health Organization (WHO), and various public health institutes, corporate hospitals, and autonomous medical institutes, such as All India Institute of Medical Sciences (AIIMS), Christian Medical College (CMC), Vellore, Post Graduate Institute (PGIMER), Chandigarh, and Jawaharlal Institute of Post Graduate Medical Education and Research (JIPMER), Puducherry, were also carried out in October 2015. The search was limited to courses/programs offered in India and also to collaborations between Indian and foreign institutes, if any. Detailed information about the courses was collected from the institutions' designated websites as well as through mail and telephonic contacts. Short-term courses spanning few days—few weeks, seminars, and workshops were excluded. To examine the extent of global health teaching within the ambit of health professional education or any other courses, a thorough scan of respective curricula was also performed. The syllabi of community medicine in undergraduate medical, dental, nursing, and allied health sciences were analyzed to map the specific content. Further, masters/diploma in public health and management programs were also examined to identify global health teaching, if any.

We analyzed the course for: (i) whether global health is a part of the teaching curriculum, (ii) the mode of teaching, (iii) the broad contents, (iv) the instructional formats or methods used to teach, (v) assessment, if any, and (vi) the students' selection process. The specification on where, how, and what is taught was summarized and compiled into a matrix. To compare and contrast the existing global health education framework in India to that of the global landscape, an Internet search was conducted, and list of renowned institutes offering global health education worldwide was collected. The course contents were retrieved, analyzed for the main domains being dealt with, and then compared those being offered by the Indian institutes.

RESULTS

The global health courses being offered in India are shown in **Tables 1** and **2**. We see that global health education, as well as teaching, in India is currently at its nascent stage and is gradually growing. There are not many courses currently being offered as main domains. The Centre for International Politics, Organization and Disarmament (CIPOD), is one of the oldest Centres of the School of International Studies, which offers MPhil and PhD on various courses related to international affairs along with global health issues and their management. The global and public health program in Manipal University covers the international aspects of environmental health, maternal and child health, infectious diseases, epidemiology, and health policies. It includes weekly field-based practicum and implementation of various WHO programs at respective levels. The Global Institute of Medical Sciences (GIMS), Baroda and Indian Institute of Tourism and Travel Management (IITTM), Gwalior provide management courses, whereas Indian Institute of Health Management Research (IIHMR), Jaipur and Indian Institute of Public Health and Hygiene (IIPHH), New Delhi provide public health courses where global health forms an interlinking component. Whereas the former two institutes have provisions to take graduates in any discipline for the course, the latter selects only healthcare

TABLE 1 | Global health courses being offered in India: location, domain, certification, duration, and fee.

Center	Location	Domain	Certification	Duration	Fee
Courses with global health as the main domain					
Manipal University	Karnataka	International affairs and public health	Degree in global and public health program	1 year	Rs. 2.5 lakhs
CIPOD, Jawaharlal Nehru University	New Delhi	International issues, health, globalization, economy, politics, and relations	MPhil, PhD, MA	2–4 years	Within Rs. 5,000
Courses with global health as a part of the main domain					
GIMS	Baroda, Gujarat	Global health, acts, management, metrics, and assessments	PG Diploma in Public Health Management	1 year	Rs. 13,000
GIMS	Baroda, Gujarat	Global issue, travel issues, policies, and management	Diploma in Medical Tourism	6 months	Rs. 10,000
IITTM	Gwalior, Madhya Pradesh	Medical tourism, travel, international business, and issues	Post Graduate Diploma in Management	2 years	Rs. 2.5–3 lakhs
IIPHH	New Delhi	Public health and education	Diploma in Public Health	1 year	–
CMC, Vellore	Tamil Nadu	Global health issues and policies	Masters in Family Medicine	2 years	Rs. 90,000
IIHMR, Jaipur in association with John Hopkins University	Jaipur	Real world situations in public health and its management	Certificate for Master's in Public Health	1.5 years	–
Online courses with global/international health as the main domain					
Public Health Foundation of India in collaboration with SDSN edu	New Delhi	Global public health	Digital Certificate on Global Public Health	11 weeks	Open course and free
Apollo Medvarsity IPPC	Apollo Hospital, Hyderabad	Global best practices related to child health	Certificate in International Postgraduate Pediatrics	1 year	–

TABLE 2 | Global health courses being offered in India: correspondence, eligibility, seats, and affiliation.

Center	Correspondence	Eligibility	Seats	Affiliated to
Courses with global health as the main domain				
Manipal University	admissions@manipal.edu	Graduate	–	Manipal University
CIPOD, Jawaharlal Nehru University	directoradmissions@mail.jnu.ac.in	Any graduate	–	Jawaharlal Nehru University
Courses with global health as a part of the main domain				
GIMS	gimsindia2010@gmail.com	Graduates, MBBS, BHMS, social science, BPT, etc.	40	Global Educare Trust, New Delhi
GIMS	gimsindia2010@gmail.com	10 + 2 graduate	40	Global Educare Trust, New Delhi
IITTM	iittm@sancharnet.in	Bachelor's degree (10 + 2 + 3) in any discipline	93	AICTE, AIU
IIPHH	iphhadmission2013@gmail.com	Health workers and professionals	–	Director of Technical Education and Training, Govt. of NCT Delhi
CMC, Vellore	dedu@cmcvellore.ac.in	Medical Council of India recognized MBBS	100	CMC, Vellore
IIHMR, Jaipur in association with John Hopkins University	iihmr@iihmr.edu.in	Doctoral degree/bachelors degree with high quality experience	–	IIHMR
Online courses with global/international health as the main domain				
PHFI in collaboration with SDSN edu	gphmooc@phfi.org	Health care professionals	Online	PHFI SDSN edu
Apollo Medvarsity IPPC	apollohealthcity@apollohospitals.com	MBBS	Online	AHERF and Medvarsity

CIPPOD, Centre for International Politics, Organization and Disarmament; GIMS, Global Institute of Medical Sciences; IPPC, International Postgraduate Pediatric Certificate; AHERF, Apollo Hospitals Educational and Research Foundation; CMC, Christian Medical College; IIHMR, Indian Institute of Health Management Research; PHFI, Public Health Foundation of India; IITTM, Indian Institute of Tourism and Travel Management; IIPHH, Indian Institute of Public Health and Hygiene. AICTE, All India Council for Technical Education; AIU, Association of Indian Universities

–Indicates that exact data could not be retrieved.

professionals. Courses are jointly offered by distinguished faculty from Johns Hopkins Bloomberg School of Public Health and IIHMR, who are involved in public health locally, nationally, and internationally. There are many other schools of international studies which mainly cater to global politics, public administration, and legal issues. These have not been included in the matrix since global health as such is not their domain. Online courses with global/international health as the main domain are provided presently by Public Health Foundation of India (in collaboration with SDSN edu) and Apollo Medvarsity IPPC.

Further, we made an effort to collect the topics being covered as part of the curriculum in the 10 best ranked institutes of the world as per QS World University rankings, having separate departments for global affairs and imparting global health education. A radar diagram was used for comparison of the global and the Indian scenario (**Figure 1**). An overview of the radar diagram shows that these institutes mostly cater to teaching the topics on health systems, health economics, global nutrition, public health; maternal and child health; global infectious and non-communicable diseases, humanitarian studies, population ethics, international security, cultural policies, global governance, migration, human development, poverty, environment, synthetic biology, immunology, emergencies, and disaster management. It was found that, Indian institutes mostly cater to topics such as diseases, public health, crisis management, and legal issues. However, these global institutes do have collaborations with India and have taken up many research activities and trainings. But an independent organization which could take up the whole lot of subjects that are being taught in reputed institutes worldwide is lacking in India. On the other hand, if we try to segregate the various subjects and delve deep into their curricular perspectives, we get tinges of global health being taught in various institutes under different domains in India, which are undoubtedly not sufficient.

DISCUSSION

Health has transcended national boundaries, facilitated by increased globalization, migration of people and increased permeability of borders by wars. Control of infectious diseases has become challenging and chronic diseases are becoming more and more prevalent. It is therefore important that health professionals have sufficient preparedness to treat patients across varied disease and geographical profiles. Further, the Sustainable Development Goals, adopted in 2015, presented a major milestone in unifying efforts toward global development, thereby causing significant shift in health priorities. With increasing recognition of global health as a distinct domain, what assumes prime importance is the strengthening of existing capacity and building new capacity that can support present health related academic programs in imparting global health education. Professionals including researchers and practitioners should therefore be imparted necessary training to help them acquire a global health perspective and enable them to evaluate medical and health issues in the global context.

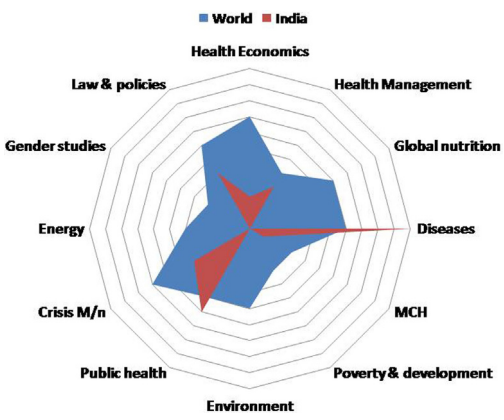

FIGURE 1 | Radar diagram for comparison of topics being covered under global/international health, worldwide, and in India.

Global Landscape

Globalization has led to increased pathogen flow, information, finance, business, and also migration of people within and across countries. The global health needs therefore have remained similar for populations worldwide, including countries like India. It is therefore prudent to understand how western countries have catered to the delivery of global health education. Dedicated global health courses have started to appear in the UK, Sweden, the Netherlands, USA, Finland, Germany, Canada, Australia, New Zealand, and Peru (4).

In Sweden, global health has been a part of the medical curriculum at the Karolinska Institute since 1996. It now has a Centre for Global Health (CGH), an interdisciplinary platform dedicated to improving health and achieving health equity for people worldwide, through research, education, and training. Through its CGH, the Karolinska Institute offers a 1-year Master's Programme in Global Health that aims at providing a common knowledge base, teaching on different specific areas of global health and a research to be carried out either in Sweden or in a low- or middle-income country. The CGH also offers a PhD program in Biology of Infections and Global Health Programme and supports several interdisciplinary and online courses in global health. Postgraduate programs in global health are also offered at the Uppsala University, Umeå University and University of Gothenburg in Sweden. The Swedish Research School in Global Health is a partnership between Umeå University, Karolinska Institutet, and Lund University and provides interdisciplinary encounters through seminars, courses and workshops.

In the United Kingdom, several universities are offering BSc in global health. For example, at the Imperial College, London, the Global Health BSc is a 1-year course, launched in 2010 for undergraduates from medical and other relevant undergraduate programs. Similar full time program for undergraduates and postgraduates are also offered by several other universities such as the University of Oxford, University of Edinburgh, and University of Glasgow. Intercalated BSc Global health is offered by the University of Manchester, which is another 1-year program for medical students, designed to analyze the impact of major social, economic, political, cultural, and environmental factors on health challenges. At the University College London, the Institute for

Global Health (IGH; also called UCL institute since August 2013) is an interdisciplinary collaboration working on health and development in a global context. The IGH offers yearlong global health—BSc course at undergraduate level; masters, diploma, and certificate degrees in global health at post graduate level; and also offers research degree programs such as MPhil or PhD in global health. The Global Health Education and Learning Incubator at Harvard University support innovative learning, teaching, and dialog about global challenges.

Global health also forms an important priority research area for the University of Amsterdam. The Amsterdam Institute for Global Health and Development under the University of Amsterdam is a network on research, education, training, and policy advice across disciplines. The Maastricht University and the Vrije Universiteit in the Netherlands offer 1- and 2-year Master's Programme in Global Health, respectively.

A website review of medical schools in the United States of America (USA) conducted in 2013 indicated that 32 out of the 133 surveyed schools offered structured global health programs to students, but there was lack of uniformity and standardization across programs (5). A report by the CSIS Global Health Policy Center in 2009 analyzed the expansion of University engagement in global health in the USA and Canada to find that 41 universities had pan-university institute or centers, and 11 universities had global health programs within existing departments and divisions (6). Academic conferences, societies, consortiums, and associations have also been established internationally to coordinate the effort of global health education, research, and practice. The Consortium of Universities for Global Health (CUGH) founded in 2008 by the Bill and Melinda Gates Foundation and the Rockefeller Foundation and the Global Health Education Consortium (GHEC), another non-governmental agency founded in 1991, are few such examples which consist of faculty and health care educators dedicated to addressing global health challenges. In 2011, the merger between CUGH and GHEC was completed leading to a stronger membership base and the expansion of educational resources.

Indian Landscape

In India, global health education has recently been garnering attention. The first and essential step for enhancing capacity in this direction is to understand the current status of the curriculum and design newer models. We therefore conducted a curricular mapping to assess the present status of global health teaching in India. Using an iterative process, we inventoried independent academic programs on global health as well as examined teaching of global health within undergraduate and postgraduate health professional education. In the following paragraphs, we analyze the current positioning of global health teaching in India and discuss the potential implications of our findings against the backdrop of growing importance of global health.

Fragmented Delivery of Global Health Education

An analysis of the **Tables 1** and **2** shows that in India, the delivery of global health education is presently fragmented. Global health teaching is imparted either as (i) a certificate course (ii) as an online course, or (iii) as part of the topic being covered in modules of masters of public health/diploma in public health/medical tourism or in public health management courses. Moreover, it is also observed that apart from very few institutions, global health teaching is offered along with several other domains such as international health and public health but never as a single entity. There appears to be hardly any institutions which are imparting global health education in the form of a distinct educational program. Globally, in developed countries, education in global health encompasses distinct undergraduate and postgraduate level programs such as bachelors, masters, or even PhD. In contrast we see that the framework of global health education in India is yet at its nascent stage. The content of global health teaching in India caters to those such as global health issues, policies, management, globalization, affairs, and organizations. There is also no definite pattern with respect to teaching global health neither is there any focus or approach to impart it independently as a subject in our country. Areas of interest such as energy, feminism, politics, nutrition, migration, environment, and poverty at global levels do not seem to arouse much interest for studies in India. Some faculties might just include them in their discussions or lectures as a part of their liking or interest. This may be attributed to the fact that while we as a country may have undoubtedly evolved economically, but the growth has not been parallel.

Need for Building Greater Interest among Medical Professionals

It is often observed that to improve income standards, the student community often prefers opting for courses which warrant better returns financially after jobs. But placements of global health studies do not promise such illuminating future as far as jobs are concerned. Thus such courses in India remain limited to either being studied in parts or being taken up as online courses or in continuation with some foreign funding agencies. The topic has thus never been given enough priority that we at our levels try and initiate a separate course curriculum for it.

For health professionals to have a strong voice in health related discussions and role in addressing pressing health problems, it is important that they have good hold on the international dimensions of their subject and global health topics become integral part of the medical education (7). Exploring global health issues will also aid the general development of a health professional. Although, many research and training programs are being carried out in India, yet, they are not independent curriculums. Organizations take up such projects only in collaboration with foreign funding agencies or as part of any short-term training. Moreover, few professionals in India tend to teach global health and related issues out of their personal interest and inquisitiveness, although it does not form a part of any curriculum.

Lack of Focus on Global Health Education at Undergraduate and Postgraduate Level

Indian universities and schools have just begun to realize the need for introducing global health curricula. India currently has 398 medical colleges (3), but none of them have started imparting global health education to its students. The curriculum in the medical colleges of India at the undergraduate and postgraduate

level lacks global perspectives of all health related issues. Details about few of the international organizations in health are covered up in Community Medicine. Even the curriculum for postgraduates in Community Medicine shares a similar picture with only some parts dedicated to global health, such as international health regulations and global networks. The column for eligibility criteria in **Table 2** also indicates that there is no definite categorization or specification with respect to who can pursue the course. While mere graduation is the desired criteria in certain cases, there are also few other institutes that offer it to MBBS students only.

RECOMMENDATIONS

Global health has so far been primarily defined by institutions from developed countries and in terms of their working with developing countries. Despite the fact that the burden of preventable disease is more concentrated in the middle- and low-income countries, most of the global health centers are located in high-income countries. This may be attributed to the following reasons: (i) centers in low- and middle-income countries are engaged in global health issues but under other labels. For example, several centers in low- and middle-income countries have recently been funded by the National Heart, Lung and Blood Institutes to undertake chronic disease prevention activities, though the focus seems to be on national programs of work; (ii) global health may be seen to be separated from the health needs of low- and middle-income countries which are already grappling under the pressure of many other challenging issues; (iii) strong national public health institutions help in instigating an interest in global public health among masses, which are usually lacking in LMIC (8). There is a danger that all this new energy for global health will lead to it becoming an activity developed through the lens of rich countries, ostensibly for the benefit of poor countries, but without the key ingredients of a mutually agreed collaborative endeavor (9). It is therefore important and essential that global health education emerges as a global priority for medical and health education curriculum.

The teaching curricula should cover methods and skills to describe the global health status, to compare differences in health status with a global perspective, to prioritize medical and health issues, to effectively obtain relevant and objective evidence supporting global health decision-making. Local and global data on populations can often be found in existing sources, such as various types of yearbooks published by governments and datasets from the WHO and the World Bank, most of which are available on the web. Many traditional descriptive and comparative methodologies and skills can be taught along with lessons on global epidemiology covering GIS technology for global spatial and geographic mapping. Teaching of global health needs to be integrated into broader public health curriculum which will enable students to demonstrate full array of knowledge, skills, and attitudes and be better prepared for a wide variety of global workforce positions. Further, more placement opportunities for students having taken up global health courses should be considered such that students are encouraged to take up this field professionally.

Teachings and learning can be acquired from various international bodies, non-profit organizations and agencies in the implementation of successful interventions across the world. Similar to the economic globalization, one key part to global health intervention research is to teach students how to optimize the health resource allocation with a global perspective to maximize the effect of an intervention strategy and to minimize health inequality across countries/regions and the globe thus promoting equity.

Global health education should also aim for incorporation of cross-cultural component into the training program thus necessitating the teaching of programs like economic globalization, geography, foreign languages, communication, diplomacy, sociology, cross-cultural psychology, and international health systems. A study by Bozorgmehr on global health education framework, emphasized on the territorial, trans-territorial and the supra-territorial dimensions of global health, but the framework did not specify a prescriptive catalog of topics for global health with detailed educational outcomes, since it was not a curricular proposal (10).

Development of a global health education framework should also consider building on existing strengths in the country in terms of public health delivery, leadership, systems, and training. This should also entail working through national and global collaborations to facilitate sharing of knowledge and expertise on matters related to global health teaching.

Taking into consideration the above recommendations and based on analysis of existing research, a template syllabus for global health has been proposed (**Table 3**). The proposed syllabus encompasses key essential elements that should become part of global health teaching and may be customized as per individual country/program needs.

Finally, design and development of global health programs and global health teaching should encompass ethical considerations. While global health training frequently includes field experiences, these may sometimes lead to ethical challenges such as burden on the host in the resource-constrained setting; negative impact on patients, community, and trainees; unbalanced relationships among institutions and trainees; and issues related to sustainability and optimal resource utilization (11). It is therefore critical that as global health education framework is developed, the pros and cons of global health training programs are assessed. The guidelines on ethics and best practices for field-based global health training in institutions, trainees, and sponsors proposed by the Working Group on Ethics Guidelines for Global Health Training could be utilized effectively for assessment and improvement of existing programs as well as design of new programs.

LIMITATIONS

This study only considered teaching programs in global health containing clinical or public health component and is mainly targeted for health professionals. Thus, academic programs in social and humanities stream relating to global health or international studies (social and psychological dimensions) were not included in our study purview and hence have not been described

TABLE 3 | Proposed template syllabus for global health teaching.

Module I: Basic concepts in global health	
01.	Defining and measuring global health
02.	Global health definitions, case studies
03.	Historical origin and evolution
04.	Health systems and global health
Module II: Understanding the key global health challenges	
01.	Current global health status
02.	Global burden of disease
03.	Global health priorities for twenty-first century
04.	Global health at the human–animal–ecosystem interface
Module III: Cross-cutting themes in global health and emerging trends	
01.	Environment, climate, and migration
02.	Food, water, and sanitation
03.	Health disparities
04.	Women's health
05.	Emerging, remerging infectious diseases
06.	NCD and injuries
07.	Maternal and child health
08.	Childhood immunization
09.	Adolescent health
10.	Neglected tropical diseases
11.	Antimicrobial resistance
Module IV: Global health diplomacy	
01.	Overview of global health diplomacy
02.	Global health actors and activities
03.	Global health financing
04.	Global health policy and governance
05.	Drivers of policy for global health diplomacy
06.	Globalization, trade, work, and health
07.	Foreign policy and health
Module V: Global health security	
01.	Global health security
02.	Pandemics and health security responses
03.	Health in complex humanitarian emergencies
04.	Humanitarian response and humanitarian dilemmas
05.	Global health equity
06.	Values in global health
07.	Toward a social justice approach to global health
Module VI: Research, development, innovation, and technology for global health	
01.	The environment, sustainable development, and health
02.	Universal health coverage in the context of aging
03.	Sustaining good health with equity at low cost
04.	Science and technology for global health
05.	Scaling up effective models in global health delivery

in this study. The given list may not be exhaustive owing to two reasons. First, despite our iterative search strategy, we might have omitted few programs inadvertently. Second, being a cross-sectional time-bound study, any program that got newly inducted after our search may have not been incorporated in our results. Nevertheless, we suggest undertaking similar exercise at periodic interval to have an updated scenario. In addition, the data uploaded on institute sites might not provide the exact scenario or might not be updated, thereby sometimes presenting a distorted picture, which might be a limitation for our study as a part of Internet search.

CONCLUSION

We suggest that academic institutions can contribute in closing the developing country/developed country dichotomy by generating global health leaders who can address developing and developed country priorities simultaneously wherever they are based. A common forum addressing merits and demerits of all global health issues or affairs might provide an insight for what to include in the curriculum for studies on such matters. We can create more opportunities for placement of students after taking up the global health courses, so that students are instigated and inspired to take up the study as profession. A broader public health curriculum that integrates global health can be created, which will assist faculty in preparing students for a variety of global health programs. This will enable students to demonstrate full array of knowledge, skills, and attitudes and be better prepared for a wide variety of global workforce positions. Global health, as a branch of science and a discipline in the broad field of medicine, should be taught after developing a comprehensive framework with a focus on descriptive global health, global health etiology, and global health intervention in such a way that an era of global health begins where there is optimal allocation of limited resources with maximization of people's health and the medical and other health professionals are actively taking part in shaping the global health movement.

AUTHOR CONTRIBUTIONS

All the authors have made a substantial contribution to the conception and design and/or the analysis and interpretation of data, drafting the article as well as revising it critically for intellectual content.

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frontiers in Public Health

CURRICULUM, INSTRUCTION, AND PEDAGOGY
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How Do Masters of Public Health Programs Teach Monitoring and Evaluation?

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Introduction: The health systems in developing countries face challenges because of deficient monitoring and evaluation (M&E) capacity with respect to their knowledge, skills, and practices. Strengthening M&E training in public health education can help overcome the gaps in M&E capacity. There is a need to advance the teaching of M&E as a core element of public health education.

Objectives: To review M&E teaching across Masters of Public Health programs and to identify core competencies for M&E teaching in South Asian context.

Materials and methods: We undertook two activities to understand the M&E teaching across masters level programs: (1) desk review of M&E curriculum and teaching in masters programs globally and (2) review of M&E teaching across 10 institutions representing 4 South Asian countries. Subsequently, we used the findings of these two activities as inputs to identify core competencies for an M&E module through a consultative meeting with the 10 South Asian universities.

Results: Masters programs are being offered globally in 321 universities of which 88 offered a Masters in Public Health, and M&E was taught in 95 universities. M&E was taught as a part of another module in 49 institutions. The most common duration of M&E teaching was 4–5 weeks. From the 70 institutes where information on electives was available, M&E was a core module/part of a core module at 42 universities and an elective at 28 universities. The consultative meeting identified 10 core competencies and draft learning objectives for M&E teaching in masters programs in South Asia.

Conclusion: The desk review showed similarities in M&E course content but variations in course structure and delivery. The core competencies identified during the consultation included basic M&E concepts. The results of the review and the core competencies identified at the consultation are useful resources for institutions interested in refining/updating M&E curricula in their postgraduate degree programs. Our approach for curriculum development as well as the consensus building experience could also be adapted for use in other situations.

Keywords: monitoring and evaluation, public health, competency, curriculum, masters program

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INTRODUCTION

Monitoring and evaluation (M&E) provides information about the performance of government policies, programs, and projects. It can identify what works, what does not work, and provide information about why. M&E also provides information about the performance of governments, ministries and agencies, and managers and their staff (1). Evaluation is critical to public health programs locally and globally, as donors, governments, and others strive to improve program performance and validate their investments.[1] M&E skills are particularly important for public health professionals. However, health systems in developing countries are challenged with deficient M&E capacity with respect to their knowledge, skills, and practices (2). In order to address this deficient capacity, there is a need to develop the supply of these skills to match demand as it grows among these countries (3). Public health trainings, especially among masters level programs, produce a large number of public health professionals across the world. Public health graduates are expected to assume several roles, including undertaking M&E. Strengthening M&E training in public health programs can help overcome the gaps in M&E capacity.

With public health education undergoing major reforms, the advent of the twenty first century has seen academic education move away from the traditional knowledge-based approach and the use of competency-based models is increasingly gaining relevance, since competency-based education has the potential to align the public health education program with health systems priorities (4, 5). As a response to national and global public health systems priorities, many public health institutes are developing and adopting new curricula to include contemporary solutions to public health issues. This shift toward competency-based public health education gained worldwide momentum after the publication of the seminal report on "Health Professionals for a new century: transforming education to strengthen health systems in an interdependent world" in 2010 (6). This report highlighted the need to undertake institutional and instructional reforms for responding to the challenges of the twenty first century. As a part of the instructional reforms, the report suggests adopting a competency-based curriculum to address public health challenges in diverse contexts (6). Competency-based education allows for a highly individualized learning process rather than the traditional, one-size-fits-all curriculum (7).

While competency frameworks can guide institutes to equip their graduates with the necessary skills to perform as effective public health professionals, there is a need to identify the competencies that underpin these functions. Many public and private sector institutions/universities across the globe offer masters level programs in public health that encompass the core elements of public health. Many schools of public health in India as well as in neighboring countries of Bangladesh, Nepal, and Sri Lanka offer Masters in Public Health (MPH) degree programs. Public health schools in these countries have engaged in collaborative efforts in public health education and public health research activities. However, our exploratory analysis of the curriculum of 34 Indian institutes offering MPH degrees showed that M&E competencies are often left out of masters level public health training. Efforts by individual schools to include M&E competencies were sporadic and not standardized.

A discussion on understanding competencies and curriculum-related issues for M&E is timely in the Asian context as many countries are moving toward revamping public health education. In this context, we undertook the present activity to review M&E teaching across Masters of Public Health programs and to identify core competencies necessary for M&E teaching in South Asian institutes.

MATERIALS AND METHODS

In 2013, we undertook two activities to understand the M&E teaching across masters level programs: (1) desk review of M&E curriculum and teaching in Masters programs globally and (2) review of M&E teaching across 10 institutions representing four South Asian countries. Subsequently, we used the findings of these 2 activities as inputs to identify core competencies for an M&E module through a consultative meeting with the 10 South Asian institutions.

Desk Review of M&E Curriculum and Teaching in Masters Programs

We first compiled a country list using the online World Atlas[2] and Wikipedia.[3] We identified universities offering MPH programs in each country by using the Google search engine, SOPHAS portal,[4] webometrics,[5] Wikipedia,[6] PubMed,[7] Association of Schools of Public Health website,[8] Google and Google Scholar,[9] Cochrane library,[10] and University libraries. The online search was restricted to English language. Key words for the search included "MPH, public health courses, department of health sciences, public health specialization, Masters of Public Health, Master in Public Health, public health universities, public health schools, MSc in Public Health." We also contacted public health practitioners and personal contacts in the field of public health for information on any other institute offering M&E courses. The contact persons from individual institutes offering Masters programs were asked about other institutes offering similar programs in their countries. The process was repeated until no new institutes could be identified.

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To obtain information about M&E teaching, we additionally searched university websites using key words such as "MPH/MSc syllabus/programs/curriculum, department of health sciences, Post Graduate MPH courses, monitoring, evaluation, M&E, M&E track, management, planning, implementation, program design in public health, university handbook, reports." We included M&E teaching in any form, either as a separate module, as part of another module, or as a separate track within the Masters program. We obtained detailed information of M&E curricula within the Masters programs from university websites and brochures. All the data obtained were entered systematically into a matrix on an excel spreadsheet. The quantitative data were analyzed in the form of proportions.

Colleagues from MEASURE Evaluation (a project based at University of North Carolina, Chapel Hill, United States of America) independently undertook a review of postgraduate level M&E course content offered globally. This supplementary review was undertaken to provide necessary background information for PHFI to use in preparation for the consultative meeting.

Review of M&E Teaching across 10 Institutions across Four South Asian Countries

We enlisted South Asian organizations/institutes offering public health programs identified through the desk review. Eventually, 10 institutes across India, Sri Lanka, Nepal, and Bangladesh were included in this review based on their willingness to participate. A questionnaire was mailed to each of these institutes to obtain additional information about the M&E teaching within their MPH programs (including pedagogy, topics covered under the M&E module, and the competencies acquired by the graduates at the end of the M&E course). All the information collected in the questionnaire was entered into an excel spreadsheet. The data were analyzed descriptively, mainly in the form of proportions.

Consultative Meeting to Identify Core Competencies for an M&E Module

Two representatives from each of the 10 identified institutions from South Asia participated in a 2-day consultative meeting to identify core competencies for an M&E module. These participating individuals comprised public health experts, most of whom were in a senior teaching position within their institutions and had an expertise in monitoring and/or evaluation. The findings from the desk review and review of the M&E teachings across the 10 institutions from the four South Asian countries were deliberated upon among the participants. Additionally, the group also discussed the draft internal document on competencies for basic M&E training developed by Global Evaluation & Monitoring Network for Health (GEMNet-Health network has a mission of empowering member institutions to ensure access to quality M&E training, research, and services) during the discussions. We divided the participants into four groups while ensuring that no two participants from the same institute were in the same group. The objective of this group activity was to list core competencies and additional competencies that were important for MPH graduates. Each of the four groups listed the M&E competencies that they felt were "core" and "additional" to create a combined list of expected competencies. A voting exercise was undertaken to help individual participants choose M&E competencies that they felt were core (must include), additional (maybe included), and not to be included. At the end of the voting exercise, we listed the competencies in a matrix and discussed the statements. We removed duplicate statements and adopted a standard terminology across all statements until the group arrived at a consensus on the competency statements.

The desk review included online search for readily available curricula of different programs across the world, and a consultation for deliberations. This activity was carried out within commonly accepted educational settings, involving normal educational practices and instructional strategies. It did not involve any vulnerable groups, hence was exempted from ethics clearance.

RESULTS

Desk Review of M&E Curriculum and Teaching in Masters Programs

Across 194 countries, 321 universities offering Masters programs were identified (Asia = 124, Europe = 57, North America = 68, South America = 12, Africa = 37, Australia = 23). Of these 321 universities, 88 offered an MPH, and M&E was taught in 95 universities (Asia = 23, Europe = 9, North America = 37, Africa = 13, Australia = 13). Some of these institutions offered masters level programs such as MSc Public Health, Masters in Monitoring and Program Evaluation, and Masters of Health Evaluation, which covered M&E components in their curriculum. Overall, these institutes teach M&E either as an individual track within the Masters program, as an independent module or as part of another module.

M&E was taught as part of another module across 49 institutions. These modules ranged from health systems management, planning and financing, economic evaluation, health informatics, health promotion and behavioral sciences, health care systems and policy development to population health, public health leadership, and management and research methodology. Ten institutions covered it as an independent track within the Masters program, while 41 programs covered it as an independent module. The most common duration of M&E teaching (where available) was 4–5 weeks. From the 70 institutes where information on electives was available, M&E was a core module/part of a core module at 42 universities and an elective at 28 universities.

Of the courses for which information was available, 57.9% were on-campus classroom-based programs; few distance-learning/online teaching and learning courses for M&E were also offered (4.2%). Some universities (9.5%) offer a combination of both, on-campus and off-campus M&E teaching. The pedagogic methods to teach M&E were multimodal and included lectures, case studies, tutorials, seminars, group work, individual assignments, e-learning, workshops, and audio–visual clips. Common student evaluation methods included a theory examination, problem-solving assignment (individual/group), dissertation/project/thesis, developing a program evaluation plan, evaluation

of a national health program, etc. There was overlap between the listed competencies and the topics covered in the syllabus. A list of the most common competencies across different institutions are as follows:

- Define the planning cycle with a specific focus on M&E of programs.
- Determine the need for conducting program evaluation and develop goals.
- Define and describe the steps in planning a health program, including M&E.
- Develop skills of planning and management through M&E of public health programs.
- Conceptualize and design an evaluation program and conduct the evaluation, including pretesting and data collection, data analysis, and interpretation and application of the results relevant to their area of work/interest in a real-world setting.
- Make appropriate evaluation choices suited to a range of scenarios.
- Demonstrate the use of M&E tools and techniques for planning.
- Gain experience in/understand and apply major M&E frameworks, models, and approaches for evaluation of public health programs in different contexts.
- Critically appraise a range of evaluations.
- Write real-world health and population-level evaluation proposals.

M&E Teaching across 10 Institutions from 4 South Asian Countries

The 10 institutions from South Asia that participated in the consultation included (i) BRAC University, Dhaka; (ii) National Institute of Preventive and Social Medicine (Bangladesh), (iii) Datta Meghe Institute of Medical Sciences, Sawangi, Wardha; (iv) Manipal University, Manipal; (v) National Institute of Epidemiology, Chennai; (vi) Public Health Foundation of India, New Delhi; (vii) Tata Institute of Social Sciences, Mumbai (India), (viii) BP Koirala Institute of Medical Sciences, Dharan; (ix) Institute of Medicine, Kathmandu (Nepal), and (x) University of Kelaniya, Colombo (Sri Lanka).

The duration of the MPH program was 2 years in 6 out of the 10 institutes. Of the remaining four institutes, two offered a 1-year MPH, while two other institutes offered a 1.5-year MPH. All institutes were either accredited or affiliated with a university for their MPH programs. Seven institutes covered M&E teaching as part of some other module such as health system management, research methodology, health management information systems, epidemiology, or public health planning. At BP Koirala Institute of Medical Sciences, Nepal, M&E was included as an elective internship for 3 months and included a posting in the district health system for Public Health Practice. M&E was an independent module at PHFI and Manipal University, while BRAC University offered M&E as an independent module as well as a separate track within the MPH program.

The duration of M&E instruction ranged from as short as 5 days to an entire semester of 6 months. At a few institutes, almost two-thirds of the entire duration of M&E teaching was dedicated to field practicum. It was evident from the information provided by the institutes that field work/project/dissertation was an important component of instruction as it drew on students' M&E skills and was included in the curriculum at most institutes. The data on topics covered in M&E teaching were available for eight institutes (PHFI was excluded because the program was not launched at the time of the review) and are presented country-wise in **Figure 1**.

The pedagogic methods applied to M&E teaching across these institutes were varied. These included didactic lectures, assignments, field practicum/field visits, group discussions, case studies, journal clubs, mock evaluations, interactive workshops, presentations, and internship. Most institutes also evaluated students based on a project that drew on their M&E skills. At program completion, students were commonly expected to:

- Demonstrate an understanding of, and apply the principles of needs assessment and analysis in public health.
- Use available data sources and data analysis and synthesis techniques related to needs assessment functions.
- Articulate the use of needs assessments for program planning, implementation, evaluation, and modification.
- Explain assessment methodologies and techniques for both external (community) and internal (organizational) uses, use program planning principles, and strategies in public health.
- Apply the steps involved in translating needs assessment information into public health policy.
- Conceptualize the elements of health systems to effectively design, develop, implement, and evaluate public health interventions.

A 2-day consultation was held in September 2013 at New Delhi with representation from the 10 identified South Asian institutions. In order to identify core/essential competencies for an M&E module, the group reviewed the findings from the PHFI and MEASURE Evaluation global reviews of M&E curriculum; review of M&E teaching across the 10 South Asian institutions; and the draft GEMNet-Health competency document. The group identified the following 10 competencies as core competencies:

- Ability to comprehend basic M&E concepts and the importance of M&E and differentiate between M&E.
- Ability to identify and design M&E frameworks.
- Ability to collect, manage, analyze, and interpret data.
- Ability to identify and develop indicators.
- Ability to develop and use M&E tools.
- Ability to identify and engage stakeholders at all levels.
- Ability to assess data quality.
- Ability to use M&E data in decision-making.
- Ability to identify appropriate evaluation design and method.
- Ability to write reports, communicate, and disseminate M&E information.

After reaching upon an agreement on the 10 core competencies for the M&E curriculum, the group also developed a draft list of learning objectives for these 10 competencies and a short-term

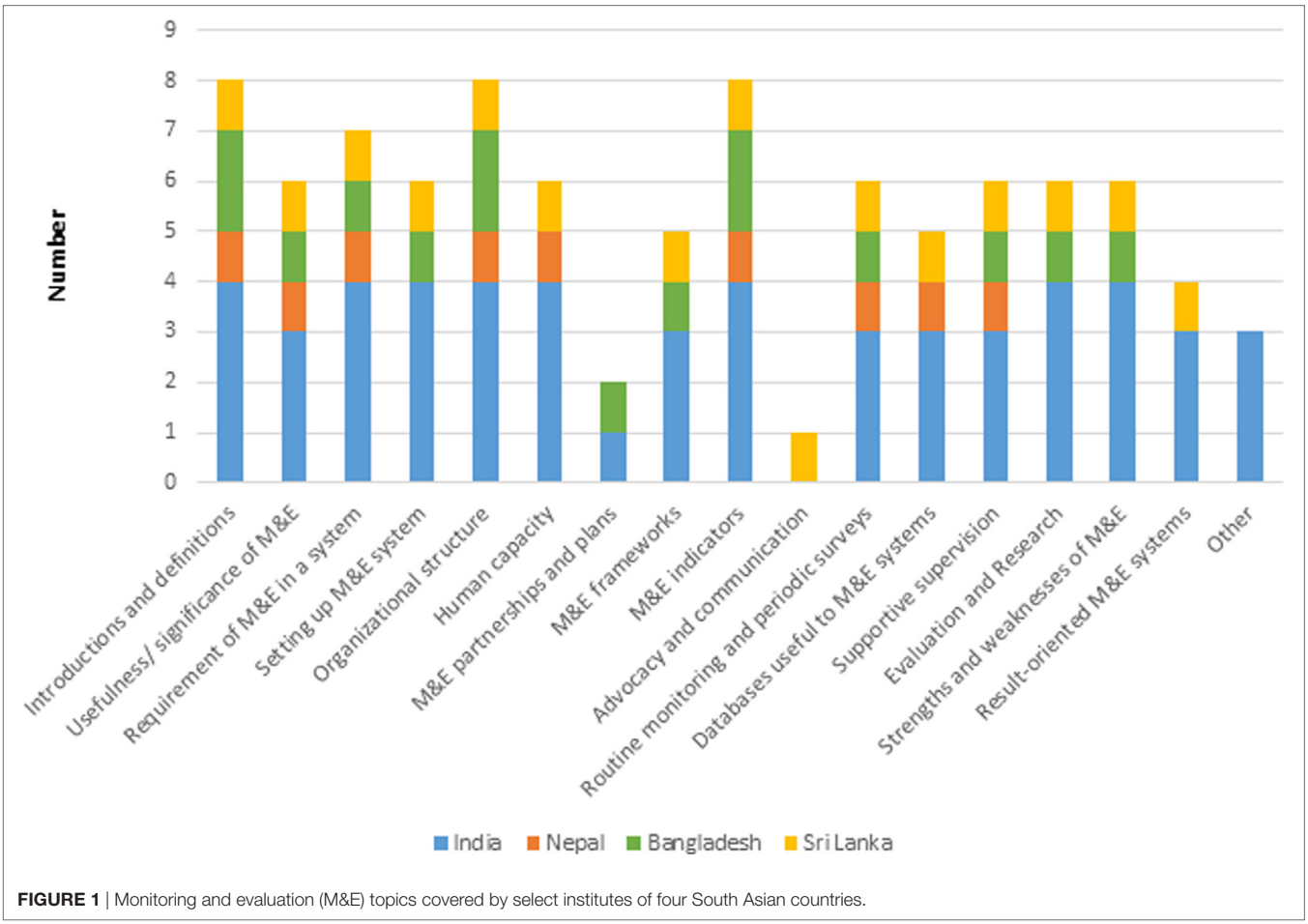

FIGURE 1 | Monitoring and evaluation (M&E) topics covered by select institutes of four South Asian countries.

plan for their own institute to incorporate these competencies in their syllabi.

DISCUSSION

There were many similarities between the different M&E courses included in this review. First, there was a great deal of similarity between M&E course content at different global universities. Such similarity between M&E course content globally can be expected largely on the basis of perspective and knowledge base that M&E courses are expected to cover. A majority of programs were carried out over the course of 4–5 months or one semester. This is expected as modular teaching across most global universities that follow a semester-based pattern where students take multiple modules to complete the credit requirements for a semester. A large number of institutes included in the study offered M&E teaching on-campus; online/distance education courses were very few. This was surprising given the wide reach and applications of distance-learning modules in MPH curriculum globally. While anecdotal information suggests that core modules with higher credits (like epidemiology, biostatistics, and public health principles) are offered in a dual-mode (virtual and in-person) across many MPH programs, M&E teaching is still more conventional in its offering. This could stem from the higher complexity and application-based content of M&E modules that makes it challenging to design and deliver a fully online module.

There was large variability in the course structure of M&E teaching in our review. Courses differed in several ways; there were inclusions of evaluation of ethical, cultural and political issues in public health in some courses, albeit context- and country-specific. This is important from the context of M&E teaching as the students need to contextualize the M&E methods and apply it within their unique health system context. While many courses included working in groups or on projects, only one-third of courses included practical experience as a competency. As such, even though country and context-specific competencies are not included in many curricula, students may indeed be acquiring related skills through their group work or project work. Most courses did not focus on country-specific issues; it would be interesting to further explore how M&E coursework is or could be better tailored to different student populations or practical needs. The use of tools and resources was largely unaddressed as a competency or a topic. This could translate into MPH graduates possessing limited knowledge about preexisting M&E tools and resources. There were wide variations in the emphasis on different

topics across the curriculum. For example, course time devoted to data analysis varied (some covered data analysis generally; some spent a significant portion of the course covering statistical issues or methodologies).

The very design of a competency-driven curriculum for an M&E module in MPH programs remains a challenge. This is because M&E is an application-driven subject that draws upon the graduates' knowledge base from a variety of other modules offered in the MPH program, ranging from modules on basic public health principles to health systems functioning and across the spectrum of qualitative to quantitative research methods. In the presence of such wide overlap, it is natural for individual Masters programs to offer the relevant M&E components across a group of modules rather than as a part of a specific module. Alternately, M&E can be offered as a capstone module in the last semester of the MPH program where it brings together all the relevant theory and prepares the graduates to apply their learnings across the health system. Institutes could also proceed in creating a separate M&E track that could provide a more systematic and detailed understanding of the subject from its basics to its application. Individual schools will have to undertake a multi-stakeholder analysis to understand the dynamics of teaching the M&E content is these different forms.

The overall focus of the curriculum content centered more on evaluation than on monitoring. Due to the more advanced methods used in evaluation, it may be that there are more often courses specifically dedicated to evaluation, while monitoring is usually included within a larger discussion of M&E, program planning and management, or program assessment. It is also likely that the search terms we used in the global review disproportionately picked up evaluation, rather than monitoring.

With particular reference to institutes offering MPH programs in South Asia, the participating institutions highlighted the need for sharing knowledge and experience across the institutions. This type of institutional and instructional support, through collaboration, can provide technical guidance for conducting workshops; financial support for meetings/curriculum-re-design; development of internship exchange programs; guidance for updating existing M&E modules; opportunities for faculty development; and assistance in online course development. The global M&E curriculum review and the identification of core M&E competencies are useful inputs for designing an M&E module that meets the needs of these South Asian countries. Successful acquisition of competencies from improved instruction will equip graduates with relevant skills to undertake M&E activities at their workplaces. This consultation provided a common platform for institutes across these four countries to share and connect for future endeavors.

This list of core competencies for M&E teaching in Masters programs evolved after a consultative dialog between academics and is informed by a comprehensive review of global M&E teaching across Masters programs. These could serve as a template that may be adopted by other countries, particularly from Asia or developing countries across the globe. Although the health system context and needs across countries vary, in our opinion, the overall competencies identified by these four countries could be applicable in other settings. Additionally, if countries plan to develop their own set of competencies, our methodology may guide their efforts.

Monitoring and evaluation is a core element of public health and its teaching should be included in public health education. This will enable public health professionals to better confront and resolve system-based and context-specific M&E challenges. The role of a strong M&E framework in designing programs, selecting an appropriate intervention, delivery of the intervention, and its M&E is backed by evidence from within the health systems. Maternal and Child Health Integrated Program introduced mHealth for integrating mobile technology into health programs and developed a global M&E framework for program implementers to help them develop national M&E plans to monitor the implementation of the program (8). M&E can and should be integrated into the daily work of health professionals and other relevant stakeholders. Once set up, these systems can generate data and information allowing for greater transparency and accountability and help identifying lessons learned. It lists an example about how an evaluation of a domestic violence intervention in the maternity and sexual health services in a UK hospital helped the partners built on the results of the evaluation to further improve the intervention.[11] All public health interventions, which eventually get monitored and evaluated, operate within a sociocultural–political milieu and this should be included in M&E teaching. Their role becomes particularly relevant within the context of evaluation studies.

Several different factors limited the results of this work. We looked only at M&E teaching leading to a Masters degree. Some universities offered short courses or workshops that have been excluded from this review. This review is predominantly driven by a secondary search and did not seek the perspective of the students. The review draws upon information that is available in public domain, or was amenable to search by the study team. Some excluded institutes had limited information readily available on their websites, especially in developing countries. Their curricula could not be accessed without the use of a valid username and password. There were instances of some websites that were last updated more than 3 years ago. Although we used Google Translate, there were many non-English programs, especially in Latin America, where we did not translate the course details to English. The list of core competencies developed during the consultation predominantly reflected the views of developing countries, particularly from South Asia, as the opinion of the consultation participants reflected the health system context and needs in their individual countries.

CONCLUSION

The desk review found that there were similarities in the M&E course contents, but variations in the course structure and

[11] *Strengthening Health System Responses to Gender-Based Violence in Eastern Europe and Central Asia: A Resource Package*. (2017). Available from: http://www.health-genderviolence.org/guidance-for-health-care-professionals-in-strengthening-health-system-responses-to-gender-based-v-15.

delivery. During the consultation, 10 core M&E competencies were identified. These included core M&E concepts including indicators, tools for data collection, analyses, frameworks, etc.

The desk review results and the core M&E competencies identified at the consultation are useful resources for institutions interested in refining/updating M&E curricula in their postgraduate degree programs. Our approach for curriculum review as well as the consensus building experience for identifying core M&E competencies could also be adapted for use in other situations. M&E is being recognized as a core discipline of public health, and its role is evident in the context of M&E of public health interventions.

The partnerships built through this process could contribute to other collaborative activities for the consortium of South Asian Universities, such as sharing of knowledge, M&E capacity building for faculty, development of M&E course outlines for MPH programs; and identifying core competencies and topics for M&E tracks/concentrations in MPH programs.

AUTHOR CONTRIBUTIONS

HN, PN, SZ, HK, and RD were involved in the conceptualization, design and conduct of the review, as well as drafting the manuscript. LH and MG provided technical inputs to the manuscript and helped in finalizing the manuscript.

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The Educated Citizen and Global Public-Health Issues: One Model for Integration into the Undergraduate Curriculum

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The Educated Citizen Initiative proposes that an understanding of public-health issues is a core component of an educated citizenry and is essential to develop one's societal responsibility. This initiative supports the Institute of Medicine's recommendation that "all undergraduates should have access to education in public health." Furthermore, the Liberal Education and America's Promise (LEAP) framework developed by the Association of American Colleges and Universities supports the "integration of public-health education into general and liberal education with an aim to produce an educated citizenry." The LEAP framework is implemented by teaching about the role of social determinants in a population's health status; the significance of personal and social responsibility; and providing skills for inquiry, critical thinking, problem solving, and evaluation. This article describes one university's experience in generating an educated citizenry cognizant of comprehensive public-health conflicts, thus contributing to both a local and global perspective on learning.

Keywords: undergraduate public health, global public health, refugees, liberal education, public health

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PUBLIC HEALTH AND LIBERAL EDUCATION

Winslow, often referred to as the Father of Public Health, defined public health as:

> … the science and art of preventing disease, prolonging life and promoting physical health and efficacy through organized community efforts for the sanitation of the environment, the control of community infections, the education of the individual in principles of personal hygiene, the organization of medical and nursing services for the early diagnosis and preventive treatment of disease, and the development of the social machinery which will ensure every individual in the community a standard of living adequate for the maintenance of health … to enable every citizen to realize his or her birthright and longevity (1).

The Institute of Medicine (IOM) of the United States' National Academy of Sciences defines public health as: "fulfilling society's interest in assuring conditions in which people can be healthy" (2). Thus, public health's main mission is to promote health, prevent disease, and protect human populations. In order to achieve this mission, public health operates at various levels of government, private, and non-profit sectors.

In 2003, the IOM stated that a well-educated public-health workforce was essential to keep the public healthy. As a result, the IOM recommended that "all undergraduates should have access to education in public health" (3). The IOM further challenged academia that undergraduate public health should be viewed not solely as a professional credential but as a part of the educator's responsibility to help develop educated citizens (3).

Albertine et al. stated that the significance of developing a liberal arts curriculum is to educate students, the future citizenry, about key public-health principles:

> We need citizens who can help as individuals to change social behavior and who are aware of the need for systemic health care, good nutrition, decent housing, and sustainable urban centers. We need to rely on leaders who are able to consider benefits and harms to groups, minority as well as majority, and to engage in systems thinking, understanding how multiple factors interact. These are abilities essential to citizenship for the health of the world (4).

The Educated Citizen and Public Health Initiative, which was developed by the Association of American Colleges and Universities (AAC&U), the Association for Prevention Teaching and Research, and the Council on Colleges of Arts and Sciences, is the response to the IOM's call that "all undergraduates should have access to education in public health" (3). The Educated Citizen Initiative supports that an understanding of public-health issues is a core component of a public who has been educated, and it is necessary to develop one's social duty (5).

Liberal education can also contribute to this call-to-action to educate citizens who can think critically and pull from different disciplines to develop practical recommendations on complex public-health issues. Liberal education is a "… philosophy of education that empowers individuals with core knowledge and transferable skills and cultivates social responsibility and a strong sense of ethics and values" (6). AAC&U's Liberal Education and America's Promise (LEAP) report proposes a joint approach that utilizes the strengths of a liberal education and public-health education; one, "… that advocates for integrative, interdisciplinary, and applied knowledge and practice, for community outreach and civic responsibility across all undergraduate programs, for global awareness and responsibility, and for open pathways among the arts and sciences and professional schools and between the campus and the wider world. The campaign underscores the importance of learning for a free society and development of human talent" (7).

Albertine et al. stated that "We need citizens who possess an ability to think about the big picture, beyond the individual or the constituency" (4). Thus, the integration of public health into liberal education will help to generate an educated citizen who possesses "a wide breadth of knowledge, adaptable skills, principled values and a sense of societal responsibility" (8). The purpose of this article is to demonstrate how one course, Global Public Health Issues, is contributing toward the education of a citizenry that thinks critically about their fellow citizen from a local and global perspective.

GLOBAL PUBLIC HEALTH

The University of New Hampshire (hereinafter referred to as the "University") is a public university founded in 1866 and is located in Durham, NH, USA. The University is educating approximately 13,000 undergraduate students and 2,500 graduate students. More than 200 degree programs are offered on the University's three campuses (9).

The course titled, Global Public Health Issues, is offered by the Department of Health Management and Policy that offers the following courses/program: a Bachelor of Science degree with undergraduate courses specific to health administration and public health, a minor in Public Health (but not a major in Public Health), and a graduate Master's in Public Health Program. The Global Public Health Issues course is taught by a tenured, full professor, and is taught once per year (fall semester). Originally, this course was open to freshmen and allowed for a small enrollment of 20 students to assist with the acclimation of new students to college courses where they could "find their voice" in a smaller class and not be intimidated by upperclassmen. More recently, this course has been open to Honors students participating in the Honors Program Symposium (see below for discussion) at the University. Honors students need to meet certain criteria, including having a 3.40 minimum grade point average, to be invited to participate in such a program. Honors courses are capped at 20 students, so the class size is small, relatively speaking, for a class size at this public academic institution. The course is taught twice a week in 80-min sessions for the duration of the semester (15 weeks), thus allowing for approximately 28 in-person class sessions due to federal and state holidays (e.g., Labor Day, Veteran's Day) that are observed.

Using the perspective of public health, the course covers factors associated with the development of health problems and efforts to prevent disease in impoverished areas. Students also explore the role of social communication, politics, religion, economics, education, and culture in contributing to global public-health issues and integrate these factors and values in developing solutions to the widespread public-health issues impacting communities worldwide. Students learn about the magnitude of public-health issues in the developing world (e.g., communicable and non-communicable disease, women and child health, nutrition, and unintentional injuries), how health is assessed, and how health systems work together effectively to improve global health. **Box 1** highlights the anticipated knowledge, skills, and values that the student will acquire by the end of the course, including how these attributes will be achieved.

This course is taught in a seminar format utilizing a mixture of teaching methods including lecture, class discussion, group work, and the incorporation of literature and the arts to illustrate central themes and course principles. The course assessments include written work in essay-format exams; analysis and synthesis of course material and peer-reviewed literature to propose feasible solutions to complex global public-health issues *via* a case-study method; and a comprehensive scenario-based assignment that requires the student to orally present (as part of a team) a relevant global public-health issue and to develop practical recommendations at the government, community, and individual levels.

BOX 1 | Course objectives for global public health issues.[1]

A. Knowledge
At the conclusion of the course, students should be able to describe and generally assess the following:

1. Key public-health concepts (e.g., demographics, determinants of health, epidemiologic transition of disease, measures of health status, etc.).
2. The burden of disease in developing countries and its impact on a community's health.
3. Critical issues in the organization and delivery of health services.
4. Impact of globalization on the spread of disease.
5. Role of social and cultural factors in affecting a society's vulnerability to morbidity and mortality.
6. Critical issues in the organization and delivery of public-health and health-care services to control and prevent morbidity and mortality.

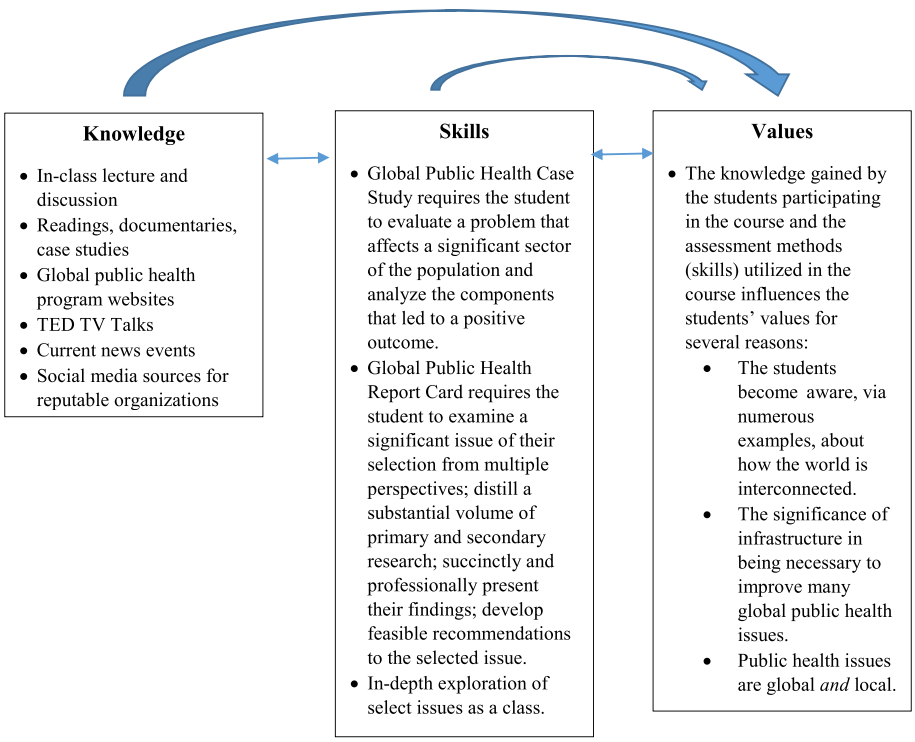
B. Skills
After taking this course, students will be able to:

1. Describe methods used to assess population health.
2. Describe organized efforts to address the health of developing countries.
3. Identify links among health, social, and economic factors that affect population health.

C. Values
At the conclusion of this course, students will:

1. Appreciate key factors in global health and how they interact to address critical public-health issues.
2. Appreciate the interconnectedness of a community's health with the health of the social, political, economic, and physical environment.

The schematic below illustrates the inter-relationship among the knowledge, skills, and values taught in the course and the student assessment methods (which are highlighted in the narrative and **Box 2**).



[1] These course objectives are based on Riegelman RK, Albertine S, Persily NA, Kaelin MW, Cashman S. *Curriculum Guide for Undergraduate Public Health Education.* Available at http://c.ymcdn.com/sites/www.aptrweb.org/resource/resmgr/undergraduateph/curriculum_guide_version3.pdf

HONORS PROGRAM SYMPOSIUM

In the 2015–2016 academic year, the Honors Program at the University developed interdisciplinary "supercourses" that were composed of four courses and each met the University's Discovery Program designation (10). The Discovery Program is "the core curriculum that provides students a solid foundation for inquisitive problem solving, scientific reasoning, an appreciation of the arts and humanities, research skills, and communication. It is based on a breadth of courses in a variety of disciplines that

the faculty collectively believe are essential to a liberal education. Courses within the eight disciplinary categories expose students to topics in the arts, humanities, philosophy, social sciences, physical and biological sciences, and technology to prepare them with transferable skills for a lifetime of learning and creative endeavors as globally focused, socially responsible citizens in the world in which they live" (11).

The interdisciplinary courses that comprised the Honors Program Symposium were each taught by one faculty member and they convened five times over the duration of the semester for plenary sessions in which "distinct disciplinary approaches" to examine a particular issue or problem was modeled (10). Examples included a faculty panel discussion regarding avian flu; participation in an international health-focused University-wide seminar series; viewing a film on tuberculosis in Swaziland followed by an in-class, interdisciplinary group discussion; and lastly, student-created videos on any topic related to the Honors Program Symposium. The goal was to have all students participate in a common Honors experience with an interdisciplinary focus.

The Global Public Health Issues course is one of the courses in the first Honors Program Symposium offered by the University which is focused on the following theme: reinventing healthy communities nationally and globally: medical, legal, and cultural perspectives. The rationale for this theme is as follows. "Communities are comprised of a social fabric that connects diverse populations and their access and utilization of health care, and their attainment and maintenance of health. This Honors Symposium will engage Honors students in the study of community and the health of the constituents who reside in these communities *via* multidisciplinary lenses that include the following: (1) comparing public-health issues in developed versus developing countries with varied health systems and analyzing the root causes that account for these differences; (2) examining how individuals have and do relate to, and engage in, a changing health-care system that is influenced by not only medicine but also by science, law, and society; (3) considering how techno-scientific developments, transnational flows, environmental transformations, and historical inequities intersect to shape how individuals know and experience their bodies cross-culturally; and (4) developing a value-based understanding of personal accountability and social advocacy in the community context. Together, these courses will enable today's student to be an active participant in their community and to provide them with the knowledge and skills to 'think globally and acting locally' as we pursue health for all" (12).

GLOBAL PUBLIC HEALTH STUDENT ASSESSMENTS

In general, there were three student assessments implemented throughout the semester.

Global Public Health Case Study

Students select a case study from peer-reviewed sources [e.g., *American Journal of Public Health* articles and/or *Ruth Levine's Case Studies in Global Health: Millions Saved* published (2007) by Jones and Bartlett Publishers]. Each evidence-based case study describes how major public-health efforts can and have changed the health of populations around the globe. Once a case study has been selected, the student is provided a series of questions for completion. The questions are thought-provoking and require the students to utilize information from the case itself, as well as conduct research about the public-health issue to answer the questions.

Global Public Health Report Card

A major assignment for the course is a Global Public Health Report Card where the student is presented with a scenario and must consider their selected public-health issue from a multidisciplinary perspective. This assignment is highlighted in **Box 2**.

Global Public Health Essay Exams

Two in-class exams and a cumulative final are implemented in the course. These exams are short essay in design and require the student to recall course materials (e.g., readings, text chapters, lecture notes, class discussions, and documentaries) to specifically and concisely answer each question. **Box 2** highlights representative exam questions.

GLOBAL PUBLIC HEALTH ISSUES

In addition to the assessment methods referenced above, three specific global public-health issues were examined in-depth in this course: childhood lead poisoning, refugee resettlement, and complex humanitarian emergencies. These issues not only emphasize the theme of the Honors Program Symposium but also highlight the relationship between public health and liberal education.

- The first conflict, childhood lead poisoning is presented as a wicked problem that is multifactorial and possesses no obvious resolution due to the numerous stakeholders and their varied interests (13). This case stems from the faculty member's involvement in a pediatric fatality of a 2-year-old Sudanese refugee child in a northern New England community, hence, how a local public-health issue can be a problem for refugees. At the time, the Centers for Disease Control and Prevention's action level for childhood lead poisoning was 10 μg/dl. This refugee child presented with an elevated blood lead level of 391 μg/dl (14). In this case, childhood lead poisoning "illustrates how understanding a community's ecology can build community capacity to affect local environmental management by (1) forming an academic–community partnership and (2) developing a place-specific strategy grounded in the cultural–experiential model of risk" (13). The students develop feasible, primary, secondary, and tertiary prevention methods for this complex public-health issue in the African refugee community, a disproportionately affected population.
- The second conflict addressed in the course is the refugee resettlement model in general, and specifically in New Hampshire. The lens used to examine this issue is that "communities are important health determinants for resettled refugees. The risk for lead poisoning among African refugee children

BOX 2 | Global public health assessments.

Global Public Health Report Card

You are working for the World Health Organization and you have been given 30 min to meet the Director-General to provide a brief overview of your progress in improving global health.

To make the most of the limited time with the Director-General, you have decided to develop a "snapshot" of the global public-health issue for your selected geographic region in the form of a Global Public Health Report Card.

This Global Public Health Report Card should be concise (no more than 10 pages), well-developed, and utilize graphics (e.g., tables, charts, maps, photos).

At minimum, the following topics should be presented in the Global Public Health Report Card:

1. An executive summary in one paragraph that summarizes all the points you want to make.
2. Describe the major public-health issue of concern.
3. Description of the population most affected by this public-health issue (including demographics and the health status of the community).
4. Description of the region's social, physical, economic, political, and cultural environments.
5. Specific to this public-health problem, how does the community's health compare to specific standards, e.g., Healthy People 2020, WHO, CDC.
6. The major stakeholders in this specific public-health problem.
7. What is the community/government doing to address the major public-health problem? Are they doing enough, in your opinion? Explain your position.
8. Recommendations for the community and the individual (describe at least two specific recommendations for each).
9. Cost and consequences of this global public-health problem to the community/region/country.
10. Your recommendations to the Director-General on how the health of this specific population can be improved; propose at least two specific interventions.

Global Public Health Essay Exams

The following are representative short essay exam questions requiring the student to recall course materials (e.g., readings, text chapters, lecture notes, class discussions, and documentaries) to specifically and concisely answer each question:

1. Describe how public health differs from medical care.
2. Compare, by providing at least three reasons, why polio eradication efforts are more challenging than the approach utilized in the smallpox eradication program.
3. As countries develop economically, briefly explain the most important changes that occur in their burden of disease and the reasons for these changes.
4. Describe the health-care and public-health systems of two different countries.
5. Discuss three human rights issues pertaining to people with a stigmatized disease.
6. Identify and describe the four health behavior change models discussed in class.
7. Using one of the health behavior change models discussed in class, briefly describe how you would encourage the adoption of a healthy behavior in a large sector of the population.
8. Which environmental health issue discussed in class is the most important and why?
9. Explain how women are not the problem but can be the solution to a developing country's prosperity. Include at least two examples from our class discussions/readings.
10. Identify the Millennium Development Goals and briefly describe the significance of each.

who resettle in the United States remains elevated, despite the gradual decrease in childhood lead poisoning in this country. I argue that the refugee resettlement process is a restricted system with a limited infrastructure that inadvertently contributes to the disproportionate burden of lead poisoning cases experienced by resettled African refugee children" (14). Childhood lead poisoning in a resettled African refugee population is presented as a case study of environmental inequality. The students research the process in other states and countries and propose practical recommendations for public-health practitioners and stakeholders to reduce and ultimately eliminate this unintended environmental inequality.

- The third conflict examined in the course is the migration of immigrants from Syria to other countries. The students examine the management of this complex humanitarian emergency *via* scholarly articles and news media (including social media sources). The students then develop and submit a Letter to the Editor of a news source they prefer, stating their rationale for their opinion and proposed resolution of this unprecedented tragedy. Class time is set aside to discuss and debate the varied perspectives on this developing issue.

CONCLUSION

Educators need to be creative in responding to the IOM's call to action that "all undergraduates should have access to education in public health" (3). This article highlights how a course focused on global public-health issues can utilize the features of a liberal education to help develop an educated citizenry by having students examine public-health issues that may be local but are affecting a global population and how global issues have the potential, and in some instances are affecting one's local community. Furthermore, academic institutions should consider how to use existing courses to develop programs, such as the Honors Symposium described herein, to promote an interdisciplinary approach to solving complex public-health issues, as well as provide public-health education.

Students enrolled in this course evaluated the course and its role in the Honors Symposium favorably. The students were prompted to provide comments related to course content, grading, or structure. A few select student comments include the following:

- "I took this class to fulfill a discovery requirement and it has had such a tremendous and positive influence on me. I had no experience with public health and now having taken this course, I look at the world and its various health issues very differently and I realize how important it is to have an awareness of public health, whereas before this class I did not."
- "There was never a class that I didn't leave feeling like my eyes had been opened to something I had never considered and that I had learned something that made me want to change the world."
- (This course made me care) "deeply about [my] community, locally and globally. If it wasn't for already having a direction

for a career, I would seriously consider going into public health … but I know for the rest of my life it will be a deep interest of mine and I will absolutely do what I can to better the lives of people who do not have the good health that I am able to enjoy."

Hill et al. surveyed 50 liberal arts colleges with respect to their offering a course, program, track, or concentration in global public health. The authors reported that all colleges surveyed offered one course with a global public-health theme (15). The authors stated that the "Values of a liberal arts education are found in the study of global and public health: social responsibility, critical thinking, ethical reasoning, and knowledge of the wider world … Capturing interest in global public health will enhance the curriculum and student experience" (15). I support this view, based on my own experience with teaching this introductory course in Global Public Health Issues. Future plans involve offering this course at my academic institution more than once per year to not only Honors students but also all classes of students to allow for an introduction to the significance of public-health issues globally and locally *via* the lens of liberal education. A consideration to this proposal is that the assessment methods, as currently developed, are labor intensive on the part of the student completing the work and the faculty member grading the work. Thus, the assessment methods would require revision should the course be scaled to allow for larger class sizes.

The future implications of this effort are that the professional knowledge and skills obtained through such a model will result in not only an educated population but also one who can make informed decisions and participate on a personal level in activities that promote health not only for themselves and their families but also their community, state, nation, and the world in which they live.

AUTHOR CONTRIBUTIONS

The author is the sole, corresponding author of the work described in this manuscript. She has designed and implemented the work described. The perspective provided in the manuscript is her own.

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Global Health Master's Students: Demographics and Career Goals

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The Master of Science in Global Health (MSGH) at Northwestern University (NU) is a new competency-based graduate degree program designed to prepare students to enter the global health workforce. The purpose of our research is to determine the market characteristics for this degree, provide student backgrounds that will guide curricular and programmatic improvements, and determine if these students intend to pursue careers in global health. This study examines survey responses from students admitted to the MSGH program between 2014 and 2015. Survey data were collected by the NU School of Professional Studies as a part of the online admissions application process. During the same period, all active students in the program were invited to complete a separate, online survey asking about their global health experience, skills, and career goals. Application responses were analyzed using descriptive statistics. Free-text responses from the survey were hand coded using 10 categorical variables developed through an inductive process. Fifty-four individuals were admitted to the MSGH program within 12 months of its inception. Of these, 78% were female, and the average age was 36 years. Of those who responded to questions about current employment, 57% were working in a health science field, 11% in government or public administration, and less than 10% responded in all other categories. Responses from the online survey revealed that most students had some prior global health experiences primarily in the medicine and mission/volunteer categories, 45 and 50%, respectively. Responses regarding career aspirations were spread evenly across categories, and nearly all students intended to join the global health workforce. Medicine was identified most frequently as a desired field for future careers (30%), followed by government and policy (25%). The wide variety of disciplines represented in students' previous work histories underscores and supports the interprofessional nature of the field and the workforce. This diversity extends to both educational backgrounds and prior field experience and necessitates pedagogical techniques that can appeal to a wide array of students, particularly a majority female population. Findings regarding desired future employment suggest that career advising will need to adapt to market demands, prioritizing project and program management-related careers.

Keywords: curriculum, workforce, demographics, admissions, interprofessional, master's, global health

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INTRODUCTION

In this era of globalization, foreign policy and antipoverty development agendas are becoming more comprehensive and interdisciplinary; and health interventions are routinely a component of any effective program (World Health Organization, Organisation for Economic Co-operation and Development, World Bank, 2008; World Health Organization, 2016). In response, demand for professionals equipped with a global health skill set has grown (Eichbaum et al., 2015), and US universities have, in turn, developed master's level degree programs in global health to meet the needs of job seekers in this field. Between 2001 and 2011, it is estimated that the number of comprehensive global health programs offered in the US rose from 6 to 78 (Matheson et al., 2014; Merson, 2014). Today's global health professionals require skills that are not taught in traditional healthcare-focused degree programs, such as a MD, RN, or MPH. These programs are time and resource intensive and tend to focus primarily on the clinical, research, and practice skills required in these roles. The specific skills of cultural humility, flexibility, diplomacy, collaboration, resilience, systems thinking, communication, critical thinking, and sociopolitical awareness should be accompanied by deep content and contextual knowledge of global health (Jogerst et al., 2015; Lucas, 2016; Rudy et al., 2016). Although there are occasionally global health certificates, concentrations, and field experiences offered within these programs, preparing graduates for careers in global health is not the intent of most health degrees. Given that 74% of the current job offerings in global health require a master's degree or higher, as noted in a recent survey (Eichbaum et al., 2015), the need for graduate education with global health-specific training is well established.

The Master of Science in Global Health (MSGH) at Northwestern University (NU) is a new degree program focusing on the interprofessional competencies required specifically for careers in global health. The degree is offered through NU's School of Professional Studies (SPS) and represents a collaboration between SPS and the Feinberg School of Medicine's Center for Global Health (CGH). The SPS provides financial and administrative support and CGH is responsible for providing core faculty and developing curricula and course material. The final curriculum is representative of the most current set of global health competencies covering the following domains: (1) global burden of disease; (2) globalization of health and health care; (3) determinants of health; (4) capacity strengthening; (5) collaboration, partnering, and communication; (6) ethics; (7) professional practice; (8) health equity and social justice; (9) program management; (10) sociocultural and political awareness; and (11) strategic analysis (Jogerst et al., 2015; Doobay-Persaud, 2016). These peer-reviewed interprofessional competency domains, developed by the Consortium of Universities for Global Health (CUGH) Competency Subcommittee, are rooted in the original Association of Schools & Programs of Public Health competency framework (Ablah et al., 2014). The degree is offered in an online and asynchronous format designed to accommodate nontraditional students, such as working adults and international students. The MSGH program is designed for health, engineering, business, psychology, anthropology, government and policy, and other professionals to gain targeted skills and translate their existing degrees into a global health context. Additional information about program goals is available on the MSGH website. Given both the recent introduction and the paucity of similar programs, the general characteristics of students pursuing MSGH degrees are not clearly defined.

Now in its third year, MSGH is undergoing a curriculum assessment and review. The purpose of our current research is threefold: (1) describe the characteristics of students seeking a master's level degree in global health, and specifically through online programs; (2) provide student background data to inform continuous improvements to the MSGH coursework and program design; and (3) determine whether students pursuing these advanced degrees intend to enter the global health workforce.

METHODS

Survey data was collected during this period by SPS through questions included in the online MSGH application for admission (Supplementary Material). Questions regarding age, educational background, and current employer were required responses, while gender, race, and additional employment details were optional. For this study, SPS shared responses to the required questions and the optional question regarding industry of employment. Survey responses from students admitted to the MSGH program between 2014 and 2015 were analyzed. Chi-square and Fisher exact tests were performed to examine differences between student types, and descriptive statistics were generated to describe the cohort.

During this first year of the program, all students classified as "active" were also invited to complete a separate, online self-assessment with survey questions related specifically to their global health experience, skills, and career goals. The "active" cohort was defined as all those who were matriculated into the program, although not all of them had enrolled in classes when surveyed. The online survey was emailed to all active students by the faculty director of MSGH. The survey asked respondents to provide information about their previous global health-related experience and their future plans related to global health, as well as their skill level in 11 defined global health competency areas (Jogerst et al., 2015). This competency data collection is ongoing and will be used for further curriculum assessment and improvement.

From the online survey, free-text responses to the items "Please briefly describe your previous experience related to global health?" and "What are your future plans related to global health?" were extracted, deidentified, and analyzed for common themes. Two of the authors employed hand coding using categorical variables developed through an inductive process, as no validated instruments to code global health experience are currently available. Each response was coded for all of the categories represented in the text; therefore, the coding attributes were not mutually exclusive. Reviewers completed the coding separately, and results of coding and any discrepancies were discussed until final categorizations were determined. From the coding, percentages were calculated out of the total number of responses for each question.

RESULTS

For the 2015 academic year, SPS admitted 54 students to the MSGH program. Of these 54 students, 49 matriculated during this same period, becoming classified as "active" by SPS. All active students received an email invitation to complete the online survey. In total, 20 students completed the additional survey during the first year, corresponding to 40% of the active student population.

Analysis of applicant data reveals that 54 individuals were admitted to the MSGH program within 12 months of its inception. Of these, 78% (42/54) were female. The average age was 36 (22–67 years), with 22% (12/54) being younger than 25 years and 26% (14/54) being older than 45 years. Of note, 22% (12/54) of students had a degree in health care (MD or RN) (**Table 1**). Forty-seven applicants responded to the employment details. Fifty-seven percent of these individuals (27/47) were working in health science, 11% (5/47) in government or public administration, and under 10% working in each of the areas of education, information technology marketing/sales, and hospitality/tourism (**Table 2**; **Figure 1**).

All 20 respondents to the online survey filled out free-text responses to the "Previous Experience" and "Future Plans" fields. Through an inductive process, 10 categories were identified from responses to each question, and these were formalized into a coding scheme (**Table 3**). This analysis also revealed which students had previous global health field experience versus those who had none. Distinct responses regarding previous experience and future plans were coded according to the devised scheme.

The students' previous global health experiences fell overwhelmingly in the "Medicine" and "Mission Trip/Volunteer" categories, 45% (9/20) and 50% (10/20), respectively, with smaller numbers of responses representing "Business/Industry," "Non-profit/Non-Governmental Organization (NGO)," "Epidemiology," and "Government/Policy." If the responses were unclear, they were categorized as "Unknown/Unable to Categorize" (**Table 3**; **Figure 2**). Three respondents fell into this last category. Coded responses about future careers were spread more evenly across the categories. All professional categories were represented in at least two individual text responses outside of "Mission Trip/Volunteer" with zero responses. "Medicine" had the highest response rate with 30% (6/20) of coded responses, followed by "Government/Policy" with 25% (5/20). "Non-profit/Non-Governmental Organization," "Project Management," "Undecided," and "Unknown/Unable to Categorize" all had low response rates of 10% (2/20) or less (**Table 3**; **Figure 2**).

TABLE 1 | Gender, age, and clinical degree, from Master of Science in Global Health application data.

Characteristic	*n* or Mean	Percentage (total *N* = 54)
Female	42	77.78
Age Range (22–67 years)	36	
Under 25 years	12	22.22
Over 45 years	14	25.93
MD/RN	12	22.22
Non-MD/RN	42	77.78

TABLE 2 | Industry of employment, from Master of Science in Global Health application data.

Industry	*n*	Percentage (total *N* = 47)
Business management and administration	2	4.26
Education and training	2	4.26
Government and public administration	5	10.64
Health science	27	57.45
Hospitality and tourism	2	4.26
Human services	1	2.13
Information technology	1	2.13
Law/public safety and security	3	6.38
Marketing/sales and service	2	4.26
Mathematics and science	1	2.13
Technology and engineering	1	2.13

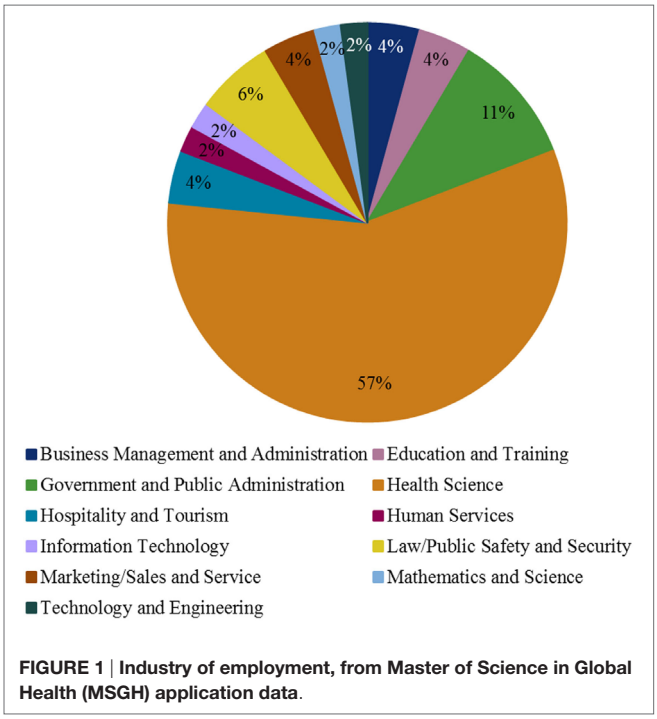

FIGURE 1 | Industry of employment, from Master of Science in Global Health (MSGH) application data.

DISCUSSION

This study provides some initial insight into the characteristics of students seeking master's level education in global health. These data can inform graduate schools as they consider the structure of their global health programs, design curricula to complement prior student knowledge, and target the novel skill set necessary for this discipline. For example, programs should be aware of the overwhelmingly female interest in global health education and the implications for gender-based obstacles like health and safety issues and career longevity (Downs et al., 2014).

The wide variety of disciplines represented in students' previous work histories underscores and supports the interprofessional nature of the field and the workforce. This diversity is encouraging as we aim to educate the next generation of global

TABLE 3 | Free-text survey responses from Master of Science in Global Health students, coding global health experience and future plans for industry.

	n	Percentage (total *N* = 20)
Please briefly describe your previous experience related to global health? ("Previous Experience")[a]		
Medicine: doctor, clinical, nurse, RN, medical school, medicine, medical, physician, EMT, pharmacy	9	45
Epidemiology: surveillance, epidemiology, track [disease]	1	5
Government/policy: policy, military, diplomacy, health system	1	5
Business/industry: industry, company, entrepreneur, venture	2	10
Academic: research, academic, university, education	0	0
Non-profit/non-governmental organization (NGO): 501(c)(3), non-profit, NGO (specific non-profit or NGO name)	2	10
Mission trip/volunteer: mission, volunteer	10	50
Program management: program manager, program management, program	0	0
None (reference career change)	0	0
Unknown/unable to categorize	3	15
What are your future plans related to global health? ("Future Plans")[a]		
Medicine: doctor, clinical, nurse, RN, medical school, medicine, medical, physician, EMT, pharmacy	6	30
Epidemiology: surveillance, epidemiology, track [disease]	2	10
Government/policy: policy, military, diplomacy, health system	5	25
Business/industry: industry, company, entrepreneur, venture	3	15
Academic: research, academic, university, education	4	20
Non-profit/non-governmental organization: 501(c)(3), non-profit, NGO (specific non-profit or NGO name)	2	10
Mission trip/volunteer: mission, volunteer	0	0
Program management: program manager, program management, program	2	10
Undecided	2	10
Unknown/unable to categorize	2	10

[a]*Categories are not mutually exclusive.*

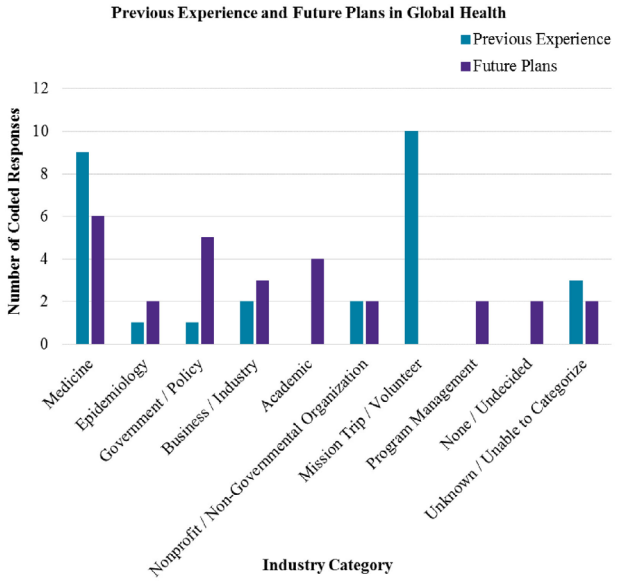

FIGURE 2 | Previous global health experience and future plans by industry of active Master of Science in Global Health students.

health practitioners and necessitates pedagogical techniques that can appeal to a wide array of students. Indeed, a 2016 report by the UN High-Level Commission on Health Employment and Economic Growth included promoting "intersectoral collaboration" as a key recommendation for meeting growing global healthcare needs (UN High-Level Commission on Health Employment and Economic Growth, 2016). The majority of students had previous global health experience as well as self-identification in the health science field. These are features that may represent both desired admission criteria and applicant characteristics. We expected a high proportion of students with a health science background, specifically medical health professionals; therefore, the lower proportion of MDs and RNs in the student cohort was a surprising finding. In addition, the large number of students with experience on medical missions offers programs and educators an opportunity for dialog around this aspect of global health. This information can be used in curriculum design, particularly around the field experience, a common component in global health education. Finally, as global health educational programs grow, so do needs for measurement and programmatic improvement. To that end, our categorization scheme for global health field experiences and careers proposes a standardized tool, which future educators can validate, expand, and improve.

Recent studies regarding employment in global health have revealed that most jobs are actually within the NGO and multi-national organization sectors, with 84% of positions being related to program management (Eichbaum et al., 2015). This is in stark contrast to the low number of students who, upon entering the MSGH program, indicated seeking careers in this field of global health work. Based on this information, career advising by both faculty and staff will need to adapt to market realities. Instead, many of the students pursuing these degrees are hoping to go on to careers in medicine. The discrepancy between previous experiences in volunteer or medical mission work compared with future aspirations was significant. This could be due to the temporary nature of these missions, which typically lack a career trajectory and are frequently the entryway for students into the world of global health. This finding, however, may also reflect the changing language and principles around the model of medical service abroad (Loh et al., 2015).

LIMITATIONS

Limitations of our study include a small sample size, since the program is in its infancy, and a short period of time to collect application data and survey responses. The study did not attempt an in-depth analysis of students' prior global health experiences or future career aspirations. Follow-up through deeper qualitative research methods including focus groups, key informant, or semi-structured interviews could yield a richer picture of these particular global health students and potentially contribute more to a comprehensive overview of students seeking to graduate with degrees in global health.

CONCLUSION

Nearly all of the MSGH students included in this study plan on incorporating global health into their future career plans, supporting our initial hypothesis that students applying to these programs represent the future global health workforce. Our study revealed pedagogically relevant learner demographics such as age and gender, significant prior experience in global health, and a diverse set of employment backgrounds. This information can serve as a learner needs assessment to align and improve the curriculum, enable faculty to leverage peer-learning opportunities, and target course material for diverse students.

In addition, while the CUGH competencies were developed for the global health learner, these competencies need validation and refinement for professionals who are not only preparing for long-term careers in the field, but are seeking expertise on a graduate degree level. Further exploration of career trajectories and skills desired by potential employers will inform MSGH curriculum design and program competencies. For instance, emerging research from employers cites both the importance and the absence of business effectiveness and interpersonal skills in the global health workforce (Rudy et al., 2016). Since many MSGH programs are nascent, efforts should be made to communicate the value of these degrees to global health employers and to align curricula with employer needs. Additional data from other programs will be necessary to truly assess student needs, target the most valuable skills, and effectively shape global health graduate education.

ETHICS STATEMENT

The Northwestern University Institutional Review Board Office reviewed the protocol for this work and determined that it is exempt from the guidelines for research involving human subjects.

AUTHOR CONTRIBUTIONS

AD-P, SG, and NS made substantial contributions to the design of the study and the collection and interpretation of student survey data. AD-P, SG, NS, and RM participated in drafting the work and revising it critically for intellectual content relevant to global health education; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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SUPPLEMENTARY MATERIAL

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CASE REPORT
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An Effective Model for Improving Global Health Nursing Competence

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This paper proposed an effective model for improving global health nursing competence among undergraduate students. A descriptive case study was conducted by evaluation of four implemented programs by the author. All programs were conducted with students majoring in nursing and healthcare, where the researcher was a program director, professor, or facilitator. These programs were analyzed in terms of students' needs assessment, program design, and implementation and evaluation factors. The concept and composition of global nursing competence, identified within previous studies, were deemed appropriate in all of our programs. Program composition varied from curricular to extracurricular domains. During the implementation phase, some of the programs included non-Korean students to improve cultural diversity and overcome language barriers. Qualitative and quantitative surveys were conducted to assess program efficacy. Data triangulation from students' reflective journals was examined. Additionally, students' awareness regarding changes within global health nursing, improved critical thinking, cultural understanding, and global leadership skills were investigated pre- and post-program implementation. The importance of identifying students' needs regarding global nursing competence when developing appropriate curricula is discussed.

Keywords: nursing competence, global health nursing, program effectiveness, evaluation, culture understanding

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INTRODUCTION

Advances in medical technology, free traffic between countries, and burgeoning multicultural families provide new challenges to nursing education. In Korea, and in other countries, how to prepare students majoring in healthcare sciences has generated fervent discussion. Appropriate methods for training students to demonstrate appropriate attitudes regarding a culturally diverse landscape are needed (1–3).

Conceptualizing global health nursing has also been challenging. Archambault (4) outlined the following core factors: being a global citizen, social justice, equity in health, and health determinants. Subsequently, the Canadian Association of Graduate School of Public Health implemented research to identify core global health competencies, which include six categories: global burden of a disease; health implications of migration, travel, and displacement; social and environmental determinants of health; globalization of health and healthcare; healthcare in low-resource settings; and health as a human right and developmental resource. Previous research provides a useful guideline for improving global nursing competence within undergraduate nursing programs (3). Nursing education in the Republic of Korea developed during the pre-committee of nursing education accreditation in 2000. In 2011, the committee was designated as an accreditation board by the Ministry of Education. The committee has since been evaluating and accrediting 4-year bachelors in nursing programs and 3-year college programs. One of the educational objectives of

a bachelor's degree in nursing program is global nursing competency, and most programs strive to attain this goal through diverse efforts (5).

In other countries, several studies have clarified global health competency since the late 1990s (3, 5–9), and quantitative and qualitative data analytic methods have been implemented (10–12). Some work has even been done in South Korea since 2000 (13–16). Especially, four consecutive programs to increase undergraduate nursing students' global nursing competency were provided by a university where the author works (14–18). However, few studies have done a student needs assessment before program operation and design. Thus, we have been limited in our ability to assess program efficacy both before and after its implementation (14–18).

On the other hand, the United Nations has enacted a resolution of outlining 17 sustainable development goals for global citizenry. This resolution is aimed at reducing health service inequalities while improving individuals' overall health status (19). Prior to this resolution, the World Health Organization (WHO) recommended a global nursing education standard in 2010, and global nursing competence was included as a necessary core outcome (20, 21). Therefore, an effective global health nursing program model needs to include nursing competence for implementation, and the program model proposed by this research would contribute to preparing potential global nursing leaders undertaking nursing programs.

METHODS

Research Design

This was a descriptive case study that analyzed global health and nursing programs, mostly Korean nursing students, for developing an effective program model regarding global nursing competency targeted toward undergraduate nursing students.

Research Target

Global health and nursing programs implemented from 2013 to 2015 were the focus of our study. Four programs were used, and operated in an Asian country within the development stage and dealing with low healthcare resources.

Data Collection

Information regarding the program's plan and effect of each program were collected from published research papers on these programs (14–18).

Data Analysis

All gathered data were analyzed for whether the programs assessed students' needs, programs' credit approval, program efficacy variables, and any other special characteristics regarding effectiveness.

RESULTS

General Characteristics

The programs were implemented during an academic vacation of less than 2 weeks (see **Table 1**). Case 1 was held in Thailand to help improve global disaster responses (14) Case 2 was held in the Philippines for increasing global nursing leadership (15). Case 3 (16) and Case 4 (17) were operated in Vietnam to increase global assistance and leadership understanding. Participants' majors varied from mostly nursing to other health care-related fields.

TABLE 1 | General program characteristics.

	Purpose	Field training place	Student major
Case 1	International disaster response program	Caren village, Thailand	Nursing and paramedic
Case 2	Capacity building for global nursing leadership	Manila, Philippines	Nursing only
Case 3	Understanding improvement to international development cooperation	Hochimin and Binh Dinh province, Vietnam	Nursing and health-related majors
Case 4	Improvement to global nursing leadership	Hanoi and Hue city, Vietnam	Nursing and health-related majors

Needs Assessment Results

Case 4 was the only program that assessed undergraduate students' global health nursing competency between a present and desired level using a systematic tool (17). Case 4 then applied priorities based on differences in competency levels and developed and implemented a program. However, the other three programs (14–16) did not survey students' needs prior to program operation, so no pre–post assessments were possible. For instance, Case 1 used the International Council of Nurses' four disaster competencies to assess participants' knowledge prior to program operation. Cases 2 and 3 pre-evaluated students' critical thinking and global leadership abilities.

Program Design

All four programs were designed to run for over 1 week. Program design was mainly conducted by nursing professors, with help from situ experts; however, only Case 4 considered six categories of global health nursing competency prior to designing the program (17). Case 1 focused on the effects of displacement and health as a human right related to global disaster responses (14). Cases 2 and 3 comprised health determinants within low-resource environments and examined healthcare globalization (15, 16). The scope of visitations from special organizations included the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), the WHO Western-pacific regional office, *in situ* universities and affiliated hospitals, and elementary schools or other hospitals commissioned through official Korean developmental assistance (14–18). Participants commonly prepared case-relevant health education materials for children in all four programs (See **Table 2**).

Program Implementation

Providing facilitation including monitoring and feedback while implementing a program, as well as considering program development, is essential for overseas implementation (See **Table 3**).

TABLE 2 | Composition of the four programs.

	Pre-learning	Program		
		Special lecture	Health education	Visitation
Case 1	5-case analysis for 5 weeks	Definition and types of disasters and refugees Ethical considerations of health issues for the dispatched population Community health assessment		UNESCAP[a] Thailand–Burma Border Consortium Caren refugee village
Case 2	Lectures, discussion presentation for a 2-day workshop	Tuberculosis project WHO[b] activities UN functions and roles Career development	Children in elementary school and low economic villages	WHO West-pacific regional office University of Philippines Community nursing practice
Case 3	2-credit course completion	Vietnam health care system UN roles and how to join Nursing career development	Children in elementary school, Binh dinh Hospital, and others	KOICA[c] Hochimin and other universities Hochimin Hospital
Case 4	2-credit course completion	Healthcare systems in Vietnam and Korea Global nursing leadership Information technology Future direction of Vietnam Nurses Association (VNA) UN functions and roles	Elementary school and nursing home residents in Hue city, along with other activities	KOICA Hanoi Hue university Hue general hospital Hue-Halla nursing education Center

[a]*United Nations Economic and Social Commission for Asia and the Pacific.*
[b]*World Health Organization.*
[c]*Korea International Cooperation Agency.*

TABLE 3 | Facilitation for program implementation.

	Mentor	Group formation	Interpreter
Case 1	2 professors 1 field expert	4–5 participants/group	1 field expert from Thailand
Case 2	2 professors 1 field expert	4–5 participants/group	5 students from Vietnam
Case 3	5 Professors	4–5 participants/group	5 students from Philippines
Case 4	4 professors 1 field expert	4–5 participants/group	5 students from Vietnam

For all programs, three to five professors guided participants with the help of five to six volunteers from each country (14–17). *In situ* experts took on a coordination role in order to address any unexpected changes during implementation, and participants were placed into groups of four or five in four programs (14–17). Except for Case 1, the other three programs invited one student to serve as a team member helper/interpreter to reduce any language barriers or cultural misconceptions. After the education component, groups had time to share what they learned. Students were better able to understand each member's cultural differences, communalities, and how to communicate and cooperate.

Program Evaluation

Programs tried to identify any knowledge/attitude changes after program participation via a quantitative survey, along with qualitative methods employing group interviews and reflective journal assessments provided by the students (See **Table 4**). Case 1 used the *t*-test, whereas the other three programs' effects were analyzed by paired *t*-tests. Cases 3 and 4 used a similar method, but Case 4 identified students' needs assessment, while Case 3 did not assess participants' needs prior to designing the program (14–18).

TABLE 4 | Evaluation methods of four programs.

	Quantitative method		Qualitative method
	Survey tools	Measurement	
Case 1	Pre–post disaster competency survey using questionnaires developed by researchers (Cronbach's α value 0.87)	*t*-test with Wilcoxon signed ranks	Content analysis of two additional open-ended questions followed by interview during the post-test
Case 2	Pre–post survey on critical thinking disposition and global leadership ability using Yoon and Song's questionnaire (Cronbach's α value 0.84 and 0.88, respectively)	Paired *t*-test	none
Case 3	Pre–post survey on critical thinking disposition and global leadership ability using Yoon and Song's questionnaire (Cronbach's α value 0.84 and 0.88, respectively)	Paired *t*-test	Content analysis of reflective journal written by participants
Case 4	Pre–post knowledge and attitude change survey using questionnaires developed Kang and Piao (Cronbach's α value 0.87)	Paired *t*-test	Content analysis of reflective journal written by participants

The effect of each program was unique to the program's intended outcomes. Case 1 showed significant knowledge change in disaster competency after the program (14), whereas Case 2 and Case 3 showed positive change in critical thinking disposition and global leadership ability after program participation (15, 16). Case 4 also showed a statistical difference in global health nursing knowledge after the program (18) (See **Table 5**).

TABLE 5 | Summary of meaningful results.

	Pre- mean ± SD	Post- mean ± SD	Wilcoxon's signed-rank test *Z*-value		Paired *t*-test	
			z	*p*	*t*	*p*
Case 1	2.18 ± 0.68	6.30 ± 0.84	−3.73	0.000		
Case 2	93.9 ± 11.5[a]	95.9 ± 12.5			−2.038	<0.043
	58.9 ± 10.0[b]	61.6 ± 9.2			−3.414	0.001
Case 3	101.12 ± 10.81[a]	103.82 ± 10.20			−4.000	0.001
	67.10 ± 7.45[b]	69.42 ± 7.36			−3.420	0.001
Case 4	21.58 ± 3.73	29.19 ± 8.40			−6.081	0.000

[a]*Critical thinking disposition.*
[b]*Global leadership ability.*

TABLE 6 | Effective model to design a program for global nursing competency.

Assessment	Design	Implementation	Evaluation
Open course	Participant selection	Mixed-nationality participants Writing a reflective journal	Analyzing reflective journals
Pre-survey needs assessment	Program composition according to the survey results	Group activities: community health assessment, visitation to low-resource health institutions, and health education	Debriefing and presentation post-survey
Site selection	Expert review	Monitoring activities	Feedback

On the other hand, content analysis on the reflective journal between Case 3 and Case 4 differed in their sub-concepts and domains. In Case 3, 15 sub-concepts outlining global health, nursing, and capacity development emerged (16). However, Case 4 addressed competencies regarding global nursing, global leadership, and cultural understanding (18). This was possible because participants' needs regarding global health nursing were pre-evaluated in Case 4. As such, Case 4 reflected more practical thinking of the participants.

DISCUSSION

Case 4 was the only program that assessed participants' educational needs in order to do a pre- and post-implementation investigation for improving global health nursing competency. The other programs intended to provide relevant knowledge developing self-studies and workshops. Additionally, Case 4 operated as a one-semester course before *in situ* training. Overall, to accomplish objectives for global nursing competency education, it is necessary to create a fundamental and systematic plan for building curricula in accordance with students' desired level of competency (18).

Hwang (22) recommended an educational program that was devised by analyzing trainees' educational needs. Curtin (23) and Dirk (24) also argued the importance of assessing students' needs. Considering the current status of global nursing programs, which are mostly provided as an extracurricular program rather than curricular program, it is more necessary to plan for the achievement of the program's purpose within a very limited time duration.

During the design phase, all programs operated for 1 week within a one or two-semester student exchange program. This type of strategy helps to ease financial burden and forces implementers to be efficient with their program, which can help increase program efficacy. When designing a global health nursing program, global disease burden, health globalization, and social determinants were considered first based on previous research (9). Field experience was recommended for students from diverse social and cultural backgrounds in order to boost program effectiveness. All four cases within the current study included this within its program design.

The field experience component is a unique strategy that can help overcome language and cultural barriers during health education activities, special lectures, and group work discussions and presentations. For instance, Case 1 excluded health education for refugees because visitation to a refugee camp was strictly controlled (14). Thus, students conducted visits at refugee-related UN and non-governmental organizations, lectures, and discussions. Case 1 provided four instances where students could analyze and submit a case report. This was deemed as an important substitute to direct, *in situ* learning experiences (13, 14).

The other three programs (except Case 1) compared the effect of the program using paired *t*-tests and two of them added content analysis for further understanding of participants' attitude change in global health nursing. It is highly recommended to plan a similar program to attain the objective of global nursing competency in 4-year nursing programs. Quantitative and qualitative methods were used to assess most of the cases. Quantitatively, assessments of changes in knowledge and attitudes were common; qualitative methods included group interviews, open-ended questions, and journal/diary reviews. Results from Case 4 are similar to those from Saiboon et al. (25) in terms of overseas field experience provisions for stimulating career advancement and facilitating global leadership, as well as understanding cultural diversity.

CONCLUSION AND RECOMMENDATION

In conclusion, what would be an effective model for improving global nursing competency programs for undergraduate students? It is very useful to identity the benefits and limitations of analyzed programs in this research. As shown in **Table 6**, during the first assessment phase, credit-based or non-credit-based formats need to be considered. Previous knowledge should also be examined in order to engage student interest. A baseline needs assessment should follow so as to adequately accomplish the nursing program's educational objectives. Finally, a training site needs to be decided upon and additional factors (e.g., finances, route, and program content) need to be determined.

During the second phase (design), program content is developed based on the prior needs assessment and comments from field experts. Participant selection should then proceed by considering requirements and course objectives. If participants are "global citizens," sustainable developmental goals for health equality or any effort therein could maximize the field experience.

In the implementation phase, grouping participants should help promote better understanding of the healthcare and

cultural environment, providing a more mutually dynamic learning experience. Furthermore, real-time monitoring and feedback from staff, professors, and field experts can aid program efficacy.

To evaluate the program's effectiveness, both quantitative and qualitative methods are necessary to determine program effectiveness, as well as changes to knowledge and attitudes among participants. However, evaluations of participants' critical thinking and leadership abilities may be somewhat inappropriate when addressing program effectiveness. This is because most participants embody these traits more than the average student.

The present study outlined an effective model for improving global health nursing competency. Based on needs assessment pre-survey, specific variables representing program effectiveness should be scrutinized to better promote a program's objectives.

A few program limitations should be noted. For instance, only a small number of students could reasonably participate due to financial strains and the ability to select an appropriate field site. Thus, table-top case simulations and field program briefing sessions may be needed to provide indirect learning experiences. Nevertheless, both direct and indirect methods could have immense utility for facilitating global health nursing competency.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and approved it for publication.

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Integrating Public Health and Health Promotion Practice in the Medical Curriculum: A Self-Directed Team-Based Project Approach

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Preparing health professionals in health promotion (HP) and disease prevention is essential for improvement of population health, community HP, and better health care for individuals. The aim of this article is to describe an HP project in the form of a major self-directed project-based learning task integrated within the curriculum in the second year of the medical degree program at United Arab Emirates University. The project introduces students to public health and HP practice and develops students' literature searching, writing, presentation skills, and team work. Students learn the principles underlying behavioral change, and the design of HP programs and materials, through a lecture format. Small groups of students each choose a specific health topic for their project. Over 11 weeks, students obtain information about their topic from appropriate sources (library, PubMed, Google Scholar, credible health sources such as World Health Organization). Using the principles learned in the lectures, they develop appropriate materials for their target audience: for example, posters, a pamphlet, social media content, or a video or radio message. Students seek advice from specialist faculty as needed. In week 12, each team presents their project background, rationale, and materials to their colleagues in a seminar format open to all faculty. They then submit the materials they developed for assessment. Group marks are assigned for presentations and materials. Key concepts are assessed by multiple choice questions in comprehensive course examinations. By participation in the HP project, many students develop a solid background in prevention. The information retrieval, writing, and presentation skills, as well as experience of team work, are valuable both for the remaining years of their training and their future careers.

Keywords: health promotion, health education, undergraduate public health education, self-directed learning, student projects, health professions education research, project-based learning

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BACKGROUND AND RATIONALE FOR THE EDUCATIONAL ACTIVITY

Preparing medical professionals in health promotion (HP) and disease prevention is considered an essential step for community HP, better health care for individuals, and development of population health strategies (1–5). The World Federation for Medical Education identified HP as one of its

priorities in the Edinburgh Declaration (6). The World Health Organization and others identified the training of health-care providers in public health and community medicine as a key measure for better health care and for improving population health (4, 7–9), yet in the last century, courses in HP and prevention in the medical curriculum were patchy and unsystematic (3); they gained more attention only recently (10–14).

Garr et al. suggest that prevention teaching should be a priority and should be incorporated throughout the medical curriculum under the supervision of specialized faculty responsible for monitoring its content and quality (1). Studies have reported that not only do medical students begin their program with poor knowledge about healthy lifestyle and prevention, but also that their health, their personal lifestyle, and their perceptions about the importance of preventive approaches all deteriorate during their studies (11, 12, 15, 16). Such reports have raised fears that future health-care providers may contribute to worsening HP and public health practice, both by their lack of knowledge and skills in health education and promotion practice, and by being negative role models (16, 17). In the United Arab Emirates (UAE), a fast developing country in the Middle East, chronic diseases and lifestyle-related health problems are increasingly placing a burden on the health-care system (18–24), hence it is particularly important to address these issues in the medical curriculum.

The United Arab Emirates University (UAEU) offers an HP course component in the second year of the medical degree. This builds on content and skills developed through a self-directed lifestyle project earlier in the program. Lifestyle related elements were introduced to the medical curriculum for first year medical students at UAEU in 2001, reported previously by Barss et al. (16). The authors recommended that more training and education related to public health medicine should be part of the medical curriculum to ensure graduates are well prepared to meet national health priorities, in addition to improving students' own health and practice regarding lifestyle and disease prevention. A self-directed HP project was also included in the curriculum for first year students in 2001. Fundamental changes to the curriculum from 2011 took the HP project to its current format in the second year of the curriculum. To the best of our knowledge, no other universities in the UAE or the region offer a self-directed HP project in the medical curriculum that aims to educate students on both knowledge and skills relevant to this topic.

The aim of this article is to describe this HP project, a major self-directed learning task integrated within the curriculum in the second year of the medical program in UAEU. The project introduces students to public health and HP practice and requires application of literature searching, writing, presentation skills, and team work.

THE PEDAGOGICAL FRAMEWORK AND PEDAGOGICAL PRINCIPLES UNDERLYING THE EDUCATIONAL ACTIVITY

The course element that is described here, the HP project, is in the form of a project component in a one semester course entitled Professional Practice and Communication 3 (PP&C3), one of four consecutive one semester PP&C courses in the first 2 years (PreMed) of the degree program. These four courses introduce concepts in medical practice, while at the same time equipping students with problem-solving and analytical tools as well as communication skills for research and professional practice. In PP&C3, content for medical practice includes theoretical underpinnings of HP, health education, and interventions focused on population health, as well as topics in ethics and professionalism.

Project-based learning falls in the broad field of active learning. The benefits of project-based learning are explained by social cognitive and constructivist learning theories (25). Project-based learning is similar to problem-based learning in that learning is driven by problem-solving, but the production of an artifact by a collaborative student team links it firmly to activity theory (26). Helle et al. posit six key features of project-based learning in higher education relevant to cognitive psychology and the promotion of effective learning (25). The project described attempts to comply with all of these.

The first key feature is problem orientation: a specific question encourages a search for knowledge and the development of expertise. Our students must develop their understanding of theory and practice of HP to develop their project. Second, project-based learning requires students to create a concrete artifact, but to do this they must not only learn subject matter: they must also apply generic skills such as time management and team work. Production of HP materials while working in independent teams clearly fulfils this criterion. Third, students are in control of their own learning, deciding for themselves how to solve project-related problems. Specialist faculty are available to support our student teams but do not intervene unless essential. Fourth, projects are commonly situated in an authentic context. This is the most problematic area for our HP project, because although all materials must be designed for the local context there are limited opportunities to test them. Fifth, projects may require several formats for communication of products, and this is built in to our project, students being required to produce not only the artifact in the form of HP materials but also a progress report and a group oral presentation. Finally, projects may stimulate students to take responsibility for their own learning and improve positive motivation. The analysis of our student questionnaire about the project attempts to establish the extent to which this was achieved.

COMPETENCIES UNDERLYING THE PROJECT AS RELATED TO LEARNING OBJECTIVES

The MD program at CMHS has six program learning outcomes that students must achieve, related broadly to knowledge and its application to the patient; communication; patient care; lifelong learning; professionalism; and the health-care system. HP project is particularly relevant to PLO 2, "Demonstrate communication skills that are effective in the exchange of information and collaboration with patients, their families, and health professionals," but it also supports development of competency in skills for

lifelong learning, knowledge development, and professionalism. Course learning objectives (CLOs) for the PP&C3 course as set out in the course description include that students should be able to: (1) critically evaluate published research; (2) describe the ethical implications of conducting research involving animals and humans; (3) apply models of behavioral change and principles of HP and education to design a project for HP; (4) work effectively in teams to produce an effective HP project for a target group; (5) identify types of argument in formal oral contexts (scientific presentations and debates); (6) explain professional, ethical, and moral issues related to best medical practice and scientific endeavor; (7) demonstrate in writing the critical reflective skills essential to being a reflective practitioner; and (8) apply appropriate communication skills for a range of audiences and communicative needs.

The HP project aims specifically to promote achievement of objectives 3, 4, and 8 through a productive team project, which requires students to use appropriate communication skills to demonstrate understanding of how HP theories work in practice. Students also need to show they are developing the professional attributes to work in a team and demonstrate communication skills, both written and oral. The design of the HP project integrates the teaching and assessment of these concepts; in addition, it requires students to apply research skills and critically appraise articles (CLO 1) to research the background and epidemiology of their chosen HP topic.

LEARNING ENVIRONMENT (SETTING, STUDENTS, AND FACULTY)

The student population consists of second year students in a 6-year undergraduate program at the College of Medicine & Health Sciences, UAEU, in Al Ain, UAE. All students are UAE nationals, first language Arabic; the language of instruction is English. Some students read slowly and have poor research skills, hence benefit from learning tasks which explicitly require them to read. Male and female students are taught separately, and outside the educational context their lives are quite different: the males are free to leave the hostel when they wish and can easily meet outside class, whether for study or social reasons, but some females have less social freedom than others and cannot leave the hostel or meet colleagues who live elsewhere outside of class hours. Those faculty members involved in the teaching for this project are specialists in related topics such as HP, public health and education, and communication skills. Visiting faculty include specialists from the local Ministry of Health (Health Authority Abu Dhabi) and a health education professional from a nearby hospital.

PEDAGOGICAL FORMAT

The HP project is a group task completed over the first 10 teaching weeks of a one semester course. The Course Coordinator assigns students to teams of five to seven people (depending on cohort or class size). Students are ranked according to their scores in research essay writing and presentation skills in the first year of the program, as these scores are predictors of ability in speaking, reading, and writing, all essential for the project. Then, the top students will all go to different teams and so on to ensure that all teams have a mix of abilities. They participate in a team building exercise (entitled Lost at sea) during the first week of classes (27), and then for the whole semester are required to sit with their teams for class activities, both those directly related to the project and other learning tasks, to encourage a team ethos. Some students complain about being in assigned groups rather than friendship groups, so a brief discussion of the importance of team work in the medical context is included.

We then explain the project to the students. We first clarify the rationale behind teaching HP content and explain they will develop team work skills as well as research and communication skills through application of HP theory to a topic of their own choice. Discussion of key public health issues at this stage heightens student awareness of possible topics.

For the project, students must identify a target health behavior and explain why it is a health problem; identify a target group for intervention; identify the behavior change goal; develop an action plan and tools (e.g., pamphlets, posters, videos, and audio files) for their target audience; and finally submit HP material for evaluation by faculty from the Institute of Public Health (IPH) and present their material to colleagues and faculty orally. All CMHS faculty and students are invited to attend the oral presentations.

Key concepts in HP are taught in lecture format by IPH Faculty and specialist staff from the Ministry of Health and a hospital health education department. Topics include theory of HP and education; models of behavioral change; HP planning; HP needs; HP tools development; focus groups in research and health education; and HP evaluation. Critical appraisal and analysis of journal articles, medical ethics, and research ethics are taught in lecture, group work and discussion format by faculty from the Departments of Medical Education and Family Medicine, using a range of materials as appropriate. Development of problem-solving and communication skills is tackled through the design of the HP project: to encourage application of problem-solving and analytical skills students are required to put HP theory into practice while working in their teams to develop locally relevant HP materials.

Table 1 shows the basic schedule of activities, both in and out of timetabled class time, and deadlines.

Students are expected to complete the bulk of project-related work out of class, but some scheduled class time is also devoted to project work, facilitated by Medical Education staff who ask and answer questions. This is particularly necessary for female students for the reasons described earlier. Students are regularly reminded that sufficient reading of appropriate sources must underpin choice of topic and target audience, and there are class sessions devoted to developing skills for selecting and reading research articles. These skills are introduced in the first semester of the PreMed program but developing proficiency takes time. Teams are free to choose their own topics, but oral discussion of topics with team members before approval by the Course Coordinator in week 5 ensures that students have done sufficient background research, and also that all team members are in agreement. Once a broad topic has been approved, teams

TABLE 1 | Project elements: timing and team work.

Week	Lectures	Students self-directed work	Skills development	Assessment/comments
Week 1	Introduction to health promotion (HP)	Teams assigned by faculty	Team formation and team work	Teams of 5–8 students
Weeks 2–4	Theory and models in HP HP needs assessment	Team building Literature search for health priority	Team work Literature search and journal reading	Specialist faculty available for advice
Week 5	HP planning Focus groups—theory and practice	Selection of HP topic and target population	Clarifying HP messages	Topic submission, approval by faculty to match national public health priorities
Weeks 6–9	Models of behavioral change HP tools development	Further background reading	Team work Tools development	
Week 7	Focus groups—theory and practice	Further background reading Team work on tools and materials	Team work Tools development	Formative feedback on simulated task
Week 8	Communicating health information HP evaluation	Team work on tools and materials	Use of social media Testing materials	
Week 9	Clarifying HP messages	Progress report	Progress report writing and submission	Assessment of progress report
Weeks 10–11		Editing materials	Group oral presentation skills Editing and review	Week 10: midterm examinations (Individual Marks)
Week 12		HP oral presentation Submission of all tools/materials		Presentations are open to all faculty and assessed for both content and presentation skills (group marks) public health and HP specialists assess the tools (group marks)
Week 13		Reflective writing	Reflection and critical appraisal	Reflection on teamwork confirms development of professionalism, clarifies areas for improvement

do further reading and are also encouraged to discuss their topic with appropriate clinical faculty.

Focus group practice is a simulation led by an HP professional from the neighboring hospital: project teams play the role of focus group members, evaluating extant locally produced HP materials. *Progress reports* follow a standardized format, requiring teams to answer specific questions about their project objectives and design, and are completed in class on paper to encourage full team participation in the drafting of responses. This task is particularly helpful for teams who may have been slow to get started on developing materials: some of our undergraduates struggle with time management.

The oral presentation (week 12) must include discussion of the importance of the health topic addressed; details of the target group addressed in their health message and why they were chosen; explanation of the model and theory of behavioral change selected; description and demonstration of the type of materials developed, including rationale, goal, and specific messages in the materials; strengths and weaknesses of the materials; and recommended modalities for evaluation of the impact of the project on knowledge, attitudes, and practices of the target group. All members of the team must speak, and all team members get the same mark, so students are encouraged to practice together and to coach those students with weaker oral skills. 20 min is allocated for each team, including time for questions. Medical Education faculty assess each team on communication skills and team work. IPH faculty assess content of presentations as well as quality of materials. The HP project forms a key component of assessment for the course (20%). Key HP concepts are also assessed by MCQs in course examinations.

RESULTS TO DATE/ASSESSMENT (PROCESSES AND TOOLS; DATA PLANNED OR ALREADY GATHERED)

Impact of the project on students' understanding of HP, health education, and lifestyle and health was assessed after completion of the projects by a self-administered hard copy questionnaire for each cohort 2013–2015 ($n = 206$). The questionnaire focused primarily on students' perception of impact of the HP project on their knowledge and skills development in research skills, understanding and application of HP, team work, and communication skills. There were 37 statements which students assessed using a 4-point Likert scale, where 1 = strongly agree; 2 = agree; 3 = disagree; and 4 = strongly disagree. The questionnaire also included 14 yes/no questions about any changes students had made in their personal lifestyle as a result of the HP project. The data on those questions are not analyzed herein.

The data concerning HP project impact were entered into Statistical Package for Social Sciences version 21 and then transferred to Stata version 14 for statistical analysis (28, 29). Overall student evaluations of the statements were tabulated as frequencies and percentages under four themes: communication skills; team work; understanding and application of HP concepts; and research process and academic integrity (**Table 2**). Chi-square tests and Fischer Exact tests were applied to compare responses of male and female students, and those data are presented as a clustered bar chart (**Figure 1**).

Overall response rate for the questionnaire was 57.1% (206/361). A higher proportion of males [75.6% (59/78)]

TABLE 2 | Students' evaluation of health promotion (HP) project ($N = 206$).

Knowledge/skills	Strongly agree	Agree	Disagree	Strongly disagree
	n (%)	*n* (%)	*n* (%)	*n* (%)
The HP project				
1. Research process and academic integrity				
Helped in learning how to search medical/scientific literature	89 (43.4)	105 (51.2)	11 (5.4)	0 (0.0)
Helped in learning how to use research journals for future medical practice	73 (35.6)	109 (53.2)	22 (10.7)	1 (0.5)
Helped me to understand research in medical journals	69 (33.5)	113 (54.9)	20 (9.7)	4 (1.9)
Encouraged me to conduct future research in public health	43 (21.0)	99 (48.3)	50 (24.4)	13 (6.3)
Helped in learning how to prepare for future evidence-based practice	74 (36.1)	107 (52.2)	21 (10.2)	3 (1.5)
Helped in learning how to protect my future patients and populations	62 (30.1)	116 (56.3)	22 (10.7)	6 (2.9)
2. Understanding and application of HP concepts				
Helped in learning how to use different models of HP	94 (45.6)	95 (46.1)	16 (7.8)	1 (0.5)
Stimulated interest in public health and community medicine	60 (29.3)	101 (49.3)	36 (17.5)	8 (3.9)
Motivated me to have more teaching in public health	48 (23.3)	86 (41.8)	60 (29.1)	12 (5.8)
Improved my perceptions about public health	63 (30.7)	114 (55.6)	24 (11.7)	4 (2.0)
Stimulated me to think in new ways about health	68 (33.3)	100 (49.0)	32 (15.7)	4 (2.0)
Helped me to understand the importance of prevention	87 (42.4)	98 (47.8)	17 (8.3)	3 (1.5)
Helped in learning how to promote healthy lifestyles in my community	94 (45.6)	94 (45.6)	16 (7.8)	2 (1.0)
Helped in learning how to work with patient education	65 (31.5)	113 (54.9)	23 (11.2)	5 (2.4)
Helped in learning how to work in a community	93 (45.4)	87 (42.4)	19 (9.3)	6 (2.9)
Helped in learning how to incorporate insights from a focus group into HP materials	51 (25.0)	122 (59.8)	31 (15.2)	0 (0.0)
Helped in learning how to develop culturally appropriate materials for a United Arab Emirates target group	116 (56.3)	78 (37.9)	10 (4.8)	2 (1.0)
Helped in learning how to develop attractive and appealing designs for a target audience	101 (49.0)	92 (44.7)	10 (4.8)	3 (1.5)
Helped in learning how to develop clear and simple HP messages for laypersons	102 (49.8)	97 (47.3)	6 (2.9)	0 (0.0)
Helped in learning how to choose appropriate media vehicle(s) for different HP purposes	116 (56.8)	85 (41.7)	3 (1.5)	0 (0.0)
Helped in learning how to select a target population for a health issue	116 (56.3)	87 (42.2)	3 (1.5)	0 (0.0)
Helped me to understand how to conduct a focus group interview	76 (36.9)	111 (53.9)	16 (7.8)	3 (1.5)
Helped in learning how to use a focus group to evaluate materials	78 (37.9)	110 (53.4)	18 (8.7)	0 (0.0)
Helped in learning how to evaluate HP interventions using pre- and posttesting on KAP	74 (35.9)	110 (53.4)	21 (10.2)	1 (0.5)
3. Working in teams				
Helped in learning how to work in a team	108 (52.7)	72 (35.1)	16 (7.8)	9 (4.4)
Helped in learning how to collaborate with other organizations	39 (18.9)	101 (49.0)	50 (24.3)	16 (7.8)
4. Written and oral communication skills				
Helped in learning how to develop my communication skills	60 (29.1)	123 (59.7)	19 (9.2)	4 (1.9)
Helped in learning how to do a good presentation	106 (51.4)	85 (41.3)	12 (5.8)	3 (1.5)
Helped me to understand the importance of communication with patients/community	80 (38.8)	106 (51.5)	18 (8.7)	2 (1.0)

n: frequency.

Frequencies may not always add up to total sample size due to missing values. Percentages do not sum up to 100% because of rounding off.

responded than females [51.9% (147/283)]. The response rates in 2013, 2014, and 2015 were 45.1% (60/133), 72.1% (93/129), and 53.5% (53/99) respectively. Lower response rates may be related to timing of questionnaire distribution. Topics of student projects for 3 cohorts of students (61 projects) were categorized to identify themes (**Figure 2**). Types of HP materials (posters, leaflets, etc.) developed by students were categorized to identify which were most frequently produced (**Figure 3**).

Overall, the students perceived that HP project had a positive impact on the development of their knowledge and skills. The majority of students strongly agreed or agreed that the HP project helped in developing their skills in communication, team work, and research, and their understanding of and interest in HP concepts (**Table 2**). A higher proportion of females than males strongly agreed that HP project developed their knowledge and skills. The clustered bar chart shows those areas where there were significant differences between female and male students' perception of the impact of HP project on their knowledge and skills (**Figure 1**). Such differences in their strong agreement with the statements were noted in the following areas: how to do a presentation (56% females vs 39% males, p: 0.008); how to conduct a focus group discussion (43% females vs 22% males, p: 0.048); how to use medical journals (41% females vs 22%, $p < 0.001$); how to develop culturally appropriate teaching (60 vs 48%, p: 0.036); how to work in a community (47 vs 41%, p: 0.026); and how to think in new ways about health (45 vs 25%, $p < 0.001$). Where how to understand medical research is concerned there was a difference in level of disagreement (10% females disagree vs 16% males disagree or strongly disagree, p: 0.030).

Objective measures of students' knowledge include student responses to MCQs related to HP topics during the course examinations. As the project has been part of the PP&C3 course since its inception, we do not have data to compare student performance on examinations using a project-based learning approach with a more traditional, lecture-based approach. Examination score averages and course mark averages are comparable with those on other courses in the second year of our program.

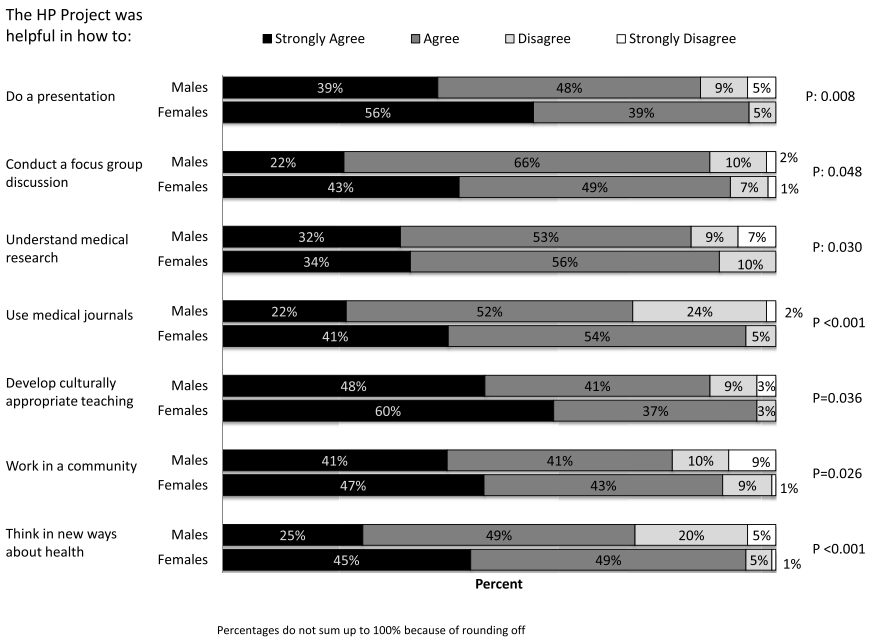

FIGURE 1 | Students' assessment of the impact of health promotion project, by gender (n = 206).

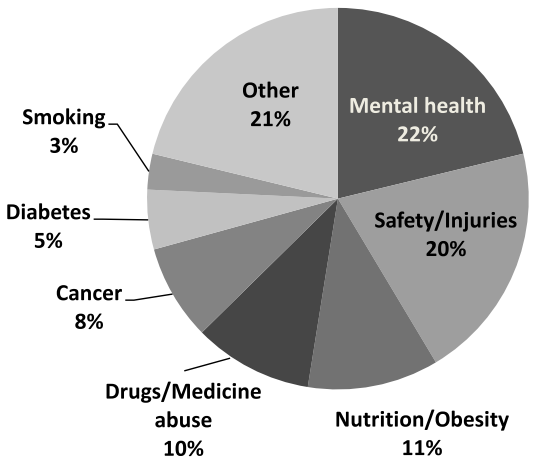

FIGURE 2 | Topics of health promotion projects 2013–2015 (n = 61).

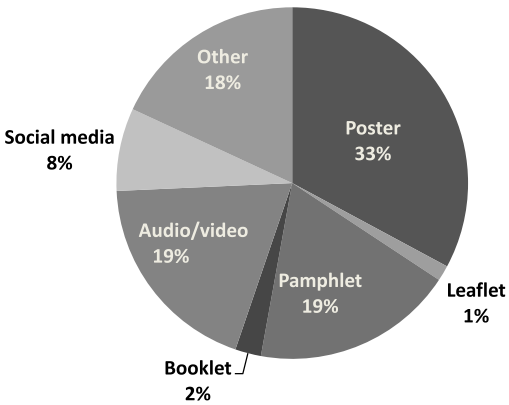

FIGURE 3 | Health promotion tools developed by type 2013–2015 (n = 210).

Faculty members' opinions about the project were not taken at this stage. Subjective evaluation by faculty suggests there has been improvement over time in students' critical thinking and appraisal skills, and in the quality of HP materials. This was apparent from the quality of the projects presented by the students and the topics chosen, as well as by improved oral and written presentation skills. The topics have evolved over the years to cover the country's key public health priorities. Students' project materials have shown greater variety, especially where use of social media content to increase the effectiveness of HP messages in reaching the wider community is concerned.

DISCUSSION

The HP project aimed to improve students' knowledge and understanding of HP as well as to develop their communication, research, and planning skills. The results of this study showed that most students agreed that the project was helpful to improve their critical thinking, communication skills, research, presentation, and planning skills.

Our use of project-based learning is innovative in this field; as far as we are aware, UAEU is the first university in the UAE or broader region to introduce such a project in the teaching curriculum of a medical program and hence to evaluate its effectiveness and its influence on students. In medical education,

there has long been a focus on problem-based learning (30). Team-based learning is also becoming increasingly common (31). Project-based learning is well known in fields such as engineering and education (30, 32), but in medical education it is relatively unknown.

The project is an important introduction to public health early in the medical curriculum. Students receive some basic education and information about public health topics in the first year, and subsequently public health topics are explored in the third and fourth years (Pre-Clinical program) and finally in the fifth year during their public health clerkship rotation (see Supplementary Material). The importance of such integration of HP and prevention education across the medical curriculum and in different preclinical and clinical courses has been emphasized by others (5, 7, 13, 15, 16, 33–37). It is vital to teach physicians different strategies and models of HP to improve their communication with patients and community (9, 38).

Our students have also indicated improvement in planning and research skills. A key element of the HP project is allowing students sufficient time to make mistakes while selecting a topic. Some teams select an appropriate topic on the first day, but others learn much from the requirement to quickly find reliable sources to back up claims that a rather esoteric topic needs HP activity.

Differences between the assessment of the effectiveness of the project between male and female students should be investigated further to establish the reasons. Not only are male and female students taught separately but male cohorts are also smaller. In the three cohorts 2013–2015, male class size was 33, 23, and 22 students, whereas female classes were 99, 114, and 78 students respectively. Average size of male project teams was also smaller. In 2014, when the difference was greatest, there were 5 male teams of 4–5 students, and 16 female teams of 7–8 students. Team size would influence the amount of work individuals must do. The larger number of female teams meant that female students were exposed to a greater variety of HP topics and approaches during the team project presentations. Furthermore, three Medical Education faculty (one for the males, and two splitting the female class) shared the teaching of communication skills, research skills, and project team support, hence the learning experience of males and females was not identical. Finally, sociocultural aspects could play a role. Differences between male and female students' perceptions of the effectiveness of the project could therefore be related to any of the abovementioned factors.

Improving students' knowledge about HP will be helpful in disease prevention and in chronic disease management, both of which depend on facilitating change in people's behavior and lifestyle. Gregg and O'Hara (39) argue that a new system of values and principles is needed to enable practitioners to perform the tasks in contemporary HP. This supports Baum's definition of the new public health concept (40), which emphasizes the need for more integration of the values and principles of HP in medical curricula to prepare practitioners for the challenges in this field. The approach to HP needs to be holistic and follow a salutogenic approach integrated in all levels of care (41, 42). The focus and design of this project and the students' positive experience of it indicate the importance and the value of such a modality for improving HP practice in the UAE.

ACKNOWLEDGMENT OF ANY CONCEPTUAL, METHODOLOGICAL, ENVIRONMENTAL, OR MATERIAL CONSTRAINTS

Although we evaluated the students' perception of the project, it would be helpful to gather formal feedback from teaching faculty to improve the teaching/learning process, assessment design, and evaluation criteria. We have nevertheless already identified a number of areas where the design or implementation of the project could be improved.

Students learn about HP through their own research for the project, but key topics in HP are introduced in standard lecture format. If faculty are in agreement a flipped classroom approach could be adopted for these sessions to promote more discussion of issues. Team-based learning for this content, while desirable, is precluded by timetabling constraints as effective team-based learning sessions would need longer class sessions than the 45 min available.

The current arrangement of simulated focus group practice exposes students to the general principles of focus groups, but project teams do not get to test their own materials, instead relying on unsystematic feedback from colleagues or faculty. Until 2011, when the HP project was included in the first year of our program, students met with authentic focus groups to evaluate their draft HP materials. When the HP project was moved to year 2, this was discontinued because of logistical and time constraints. Discussion of draft HP materials with appropriate members of the public would improve authenticity of the project task, one of the key criteria for projects in higher education. But as PP&C3 is one of seven courses students are taking, introducing a requirement to arrange a focus group would put undesirable pressure on students. It would be particularly tricky for female students.

Each team of students can freely choose the HP topic to present in their project provided that they find sufficient relevant background information to support their theme. Although prevention remains the focus, students sometimes chose topics based on personal interest, and national public health priorities can be missed. However, if students are unable to show appropriate sources to support their choice of topic, an unusual topic is rejected. This puts such groups under pressure to identify a new topic and complete the project to deadline, but it provides a valuable lesson in the need for reliable evidence in medicine and health care. For this reason, we are reluctant to assign lists of topics for students to select from.

Occasionally students report problems with team dynamics, especially members not participating fully. In such cases, they are advised to try and tackle the problem themselves. In the last 4 years, there was only one team that needed calling in as a group for faculty intervention to help solve problems related to group dynamics and commitment to the task.

Initially there was no proper mechanism to identify whether students had used published sources inappropriately in their HP project materials. Currently SafeAssign (a plagiarism detection tool that is part of the Blackboard virtual learning environment) is

used to check text of student produced materials, but more needs to be done to ensure that health education materials developed by students follow copyright ethics, especially where the use of images is concerned. Use of appropriate sources for background material is checked during class project sessions or when groups meet with faculty outside class times. Sources are also cited in the mid-project review and in presentations, but it is possible that poor academic practice is not always identified when assessing project oral presentations in real time.

RECOMMENDATIONS/FUTURE DIRECTIONS

Students are producing high quality projects and materials that could well be used by UAE health authorities in their HP campaigns. Those colleagues from outside CMHS who participate in teaching are invited to attend the presentations, but work commitments can make this problematic, therefore in future we should systematically share materials produced. Furthermore, such a project-based learning approach could also be used within other courses: for example, design of clear patient information and education for pharmacology, or production of review materials for other students. This course also potentially offers a platform for collaboration and integration with academic departments in other colleges within the university, for example, mass communication or education.

CONCLUSION

Integrating public health and HP practice in the medical curriculum by means of a project-based learning component is an innovative way of encouraging active learning. We offered interactive learning opportunities through student-directed team projects, and this increased student engagement with the area; gave students a solid background in prevention; and led to improved understanding of HP practice, as evidenced by student perceptions of the project as well as evaluation of HP materials produced and examination results. The project also required students to develop and apply research, writing, and presentation skills to an authentic task. The experience of productive team work is also invaluable both for the remaining years in medical school and for their future careers. Such projects could be included in more medical curricula and be tailored to meet the public health needs of the local community, the medical profession, and patients.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of Ethics guidelines of the CMHS UAE University Ethics Committee. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the CMHS UAE University Ethics Committee.

AUTHOR CONTRIBUTIONS

All the authors assisted in the interpretation of data and manuscript drafting; reviewed final version.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at http://journal.frontiersin.org/article/10.3389/fpubh.2017.00193/full#supplementary-material.

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Analysis of the Preventive Medicine Undergraduate Curriculum in China: The West China School of Public Heath Experience: A Case Study

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In China, the preventive medicine undergraduate professional training program is the major approach to training public health practitioners. The history of undergraduate education in public health/preventive medicine in China is reviewed utilizing the West China School of Public Health at Sichuan University as an example for analyzing this undergraduate major and its curriculum. Needed reforms in the Chinese undergraduate preventive medicine programs are presented, including review of the traditional preventive medicine course content, revision of its curriculum structure, the need to increase practical experience and to develop variety in teaching and assessment techniques, and systematic planning for curriculum reform. Current efforts at reform of the preventive medicine undergraduate program at Sichuan University's West China School of Public Health are presented.

Keywords: preventive medicine, undergraduate public health education, professional public health training, public health education, preventive medicine education

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THE HISTORY OF PUBLIC HEALTH UNDERGRADUATE EDUCATION IN CHINA

Before 1949, a system of specialized public health higher education in China did not exist. In addition to public health education provided by the Peking Union Medical College Dongdan Health Office for interested physicians and nurses, only a few schools, such as Huaxi Union University School of Medicine in Chengdu and Tongji University School of Medicine in Shanghai, had established a department of public health and offered public health programs for medical students. At that time, some scholars who had completed advanced education overseas returned to China when the country decided to carry out public health education and scientific research. Chen Zhiqian (also known as Dr. C. C. Chen), Zhu Zhanggeng, Xu Suen, and others created a health education core at the bachelor's level at Nanjing Central University Medical School (Weilian, 1988). However, due to the influence of World War II and the conditions related to it, China was unable to establish a public health education system in the first half of the twentieth century.

After 1949, China began to focus on the professional training of public health practitioners. China Medical University and Shenyang Medical College merged and established China's first independent professional public health department, initiating China's public health education system. It is important to recognize that in China medical education is a baccalaureate degree.

In August 1950, China's first national health practice conference established the "Four Health Practice Principles" with "Prevention First" at their core. At that time, there were three medical schools training public health practitioners. Following the conference, China gradually introduced the former Soviet Union's health and epidemic prevention system, and in 1953, formally established health and epidemic prevention centers in order to improve the health-care system. In 1954, Soviet experts began to train Chinese public health educators. At this time, China was threatened by acute communicable infectious diseases such that the demand for public health practitioners was urgent, as well as the need for training more practitioners for the future. In 1954, the first National Medical Higher Education Conference was held in Beijing. This meeting unified medical specialty higher education, the corresponding academic system, and the development of the curriculum and teaching plans. In 1955, a major change occurred with a nationwide reorientation of the medical schools. Six institutions, Beijing Medical College, Shanghai First Medical College, Harbin Medical College, Wuhan Medical College, Sichuan Medical College (West China Union University) and Shanxi Medical College, established independent departments of public health to provide public health professional higher education and training, forming China's public health education system.

In 1963, the State Ministry of Education promulgated the College Professional Directory with 10 majors set up under the category of "Health Professional," including medicine, public health, pediatric medicine, oral medicine, pharmacy, medicinal chemistry, nursing, medical technology, and traditional Chinese medicine and therapy (Ministry of Higher Education of P. R. China, 1963).

China's public health higher education system was modeled on the former Soviet Union's system with its major disciplines of epidemiology, biostatistics, environmental health, occupational health, nutrition and food health, school hygiene, health professional, and several others. The development of the new system's public health courses was based on these disciplines. Although China has been learning from western countries since the 1980s, the public health education system has not changed, and these disciplines are still the required courses in the curriculum of public health higher education in China. In the mid-1980s, the health professional category changed its name to preventive medicine. However, it was changed in name only with the program requirements remaining basically the same. In point of fact, the preventive medicine major was identical to a public health major in other national systems.

By 1978, there were 21 higher education institutions offering the public health major in addition to a baccalaureate degree in medicine. By 1986, there were 36 higher education institutions with the number reaching 44 in 1998. During this time, the average number of newly enrolled students for each institution averaged between 40 and 60. For those institutions that established the public health major in the 1950s, the number of newly enrolled students approached 100 per year. Since 1988, the number of universities establishing a major in public health has increased continuously. According to the national Ministry of Education, this number reached to 51 in 2002. A total of 2,541 students graduated with a major in public health in 2002, 3,307 students graduated in 2003, and the newly enrolled numbers for each of those years were 4,189 and 5,103, respectively. By 2004, there were 60 institutions with a major in public health. According to university statistics, this number reached 88 in 2009 and 93 in 2014, having more than doubled in number since 1998. Every year, more than 10,000 students now graduate from these institutions.

After 1978, there were three major changes and revisions to the College Professional Directory. In the 1987 edition, the national Ministry of Education created a new category called "Preventive Medicine" with four majors, preventive medicine, environmental health, sanitary technology, and nutrition and food health, created under this category (Ministry of Education of P. R. China, 1987). This replaced the original category "Health Professional." In the 1993 edition, maternal and child health was formally introduced into preventive medicine, making a total of five majors under this category (Ministry of Higher Education of P. R. China, 1993). The third revision of the College Professional Directory occurred in 1998 with all majors other than preventive medicine deleted from the directory (State Ministry of Education Higher Education Core, 1998). However, due to the insistence of the West China School of Public Health at Sichuan University, the major in sanitary technology was included in the 2003 edition. Now more than 30 universities offer this major nationwide.

The goal of public health/preventive medicine in China is to train practitioners, who have deep understanding of the knowledge and skills in public health/preventive medicine and who have the capacity to fulfill the required tasks in such public health institutions as the various Centers of Disease Control (CDC) and other health authority agencies. There are four major areas available in the job market for graduates: first, working in a public health professional institution at various levels; i.e., centers of disease control and prevention, occupational disease prevention centers, health-related laboratory agencies, health education centers, community health departments, etc.; second, working at health authority agencies providing health management and service at various levels of government, i.e., environmental protection agencies, food and drug agencies, and customs inspection and quarantine departments; third, working at public health-related companies, i.e., pharmaceutical, insurance and third party laboratory companies; and fourth, performing research and teaching related to work in hospitals or universities.

UNDERGRADUATE PUBLIC HEALTH/ PREVENTIVE MEDICINE CURRICULUM

The Academic System and Curriculum Structure of Undergraduate Public Health/ Preventive Medicine in China

Since the establishment of the public health education system in China, the public health/preventive medicine program began as a 4-year program during the 1950s to the late 1970s, and a 6-year program from 1980 to 1987, and finally it became a 5-year program from 1988 on.

The Chinese public health/preventive medicine undergraduate program is composed of five parts: basic public health courses, basic medical courses, clinical courses, public health/preventive medicine foundations and professional courses, and practice courses (see **Table 1**). The first four parts are theory-based. Public health/preventive medicine courses are centered on "five major public health components" (environmental health, workplace hygiene, nutrition and food hygiene, child health, radiological), epidemiology, and biostatistics. Practical courses include clinical practice, public health practicum, and capstones. The practical content, respectively, focuses on three areas: clinical skills, public health vocational skills, and scientific research training. As shown in **Table 1**, the time of the practicum that directly relates to the training of public health vocational skills is relatively short. One of the aims of the capstone project is to train students to understand the basic processes of scientific research and to develop their scientific research ability.

It may be noted in **Table 1** that there is a significantly larger number of theoretical courses than practice-based courses among the public health/preventive medicine required courses. Fewer courses are designed to develop students' professional skills. Among the elective courses, the proportion of practice-based elective courses is relatively large and the proportion of cross-disciplinary elective courses is relatively small. Due to the nature of the public health courses, they can be divided into two categories: public health basic courses and public health specialized courses. Basic courses can be divided into methodological and natural science courses; specialized courses can be divided into traditional courses and sociology courses.

Table 2 demonstrates that the public health programs in China are composed of traditional health science (39.0%), methodology (26.5%), and social science (16.2%) courses. Meanwhile, Sichuan University and Fudan University offer an introduction to public health courses in the early years of the student's undergraduate education.

TABLE 1 | The structure of China's six universities' public health/preventive medicine undergraduate professional curriculum (credits).

University	HUST (%)	SCU (%)	CSU (%)	FDU (%)	ZSU (%)	ZJU (%)
Requirements	89.7	84.8	88.4	95.8	84.0	90.7
Theoretical courses	85.0	82.9	88.4	91.5	80.1	83.8
Basic courses	30.6	25.0	39.6	25.2	33.1	39.4
Basic medical courses	20.5	30.0	23.7	29.1	27.8	21.1
Clinical courses	27.3	13.0	17.7	13.5	24.3	15.0
Public health foundation	21.6	32.0	18.9	32.1	14.8	24.5
Practical courses	15.0	17.1	24.7	8.5	19.9	16.2
Clinical practice	57.1	40.0	46.3	53.3	38.1	23.8
Practicum	9.5	20.0	14.8	6.6	14.3	19.0
Capstone	33.3	40.0	38.9	40.0	47.6	57.2
Electives	10.3	15.2	11.6	4.2	16.0	9.3
Professional elective	–	35.3	27.6	75.0	67.5	30.0
Interdisciplinary elective	–	45.0	20.7	–	–	20.0
Quality oriented education courses	–	13.0	51.7	25.0	32.5	50.0
Creative courses	–	7.0	–	–	–	–

HUST, Huazhong University of Science and Technology; SCU, Sichuan University; CSU, Center South University; FDU, Fudan University; ZSU, SunYat-SenUniversity; ZJU, Zhejiang University.

The Chinese Undergraduate Preventive Medicine Programs: Needed Reforms

Curriculum and Traditional Course Content Review

China's public health/preventive medicine educational program has a long history, and the current curriculum model has become dated (Chengsong, 2014). Since the establishment of hygiene studies in the 1950s, the "three-stage" (Wang et al., 2012) (basic–clinical–prevention) teaching style has been utilized, and the curriculum model has been unchanged. Basic science and clinical medicine courses have comprised a significant percentage of the program's coursework. The specialized courses are still composed of the "five major public health components," including epidemiology and biostatistics, providing core public health/preventive medicine content (Yuan et al., 2012). The result has been that students have obtained a solid foundation in the biomedical aspects of the program.

Necessary Public Health Curriculum Structure Revisions

China's public health education curriculum structure and content has failed to meet the requirements of modern public health. Updating of curriculum has been slow and has failed to reflect modern trends in public health/preventive medicine practitioner development. It lacks core courses in the humanities and non-scientific areas (Wang et al., 2001). The public health/preventive medicine program has been considered outdated (Cheng et al., 2007) with inadequate education in emergency response capabilities, on-site ethical practice, scientific research, and other significant areas of public health/preventive medicine knowledge.

Increase Practicum Time and Choice of Venues

Among the three categories of practice courses, the public health-related practicum makes up the smallest proportion of the curriculum, leading directly to a paucity of knowledge of public health practice for students (He, 2013). Usually, the public health practicum focuses on the different CDC levels in China, health authority agencies, and the customs inspection and quarantine departments.

Increase Variety in Teaching Techniques

Currently, the course format is based on a lecture approach (Zhang et al., 2005) with few courses offering laboratory experience or field practice. Even though students acquire a solid foundation of theoretical knowledge, the curriculum is inadequate to develop practice capacity (Jin et al., 2010). There is too great an emphasis on theoretical knowledge with little to connect it to real-world practice with a failure to expend energy on creative and practice skills (Cheng et al., 2007).

Innovate and Develop Curriculum Assessment

In terms of curriculum assessment, the public health/preventive medicine program's major assessment process is based on testing the students' degree of mastery of knowledge. The main purpose

TABLE 2 | Public health course credit for preventive medicine undergraduates in five Chinese universities.

Course	HUST	SCU	FDU	ZJU	JLU	$\bar{x} \pm s$	$\sum$	%
Total credit of public health course	32.0	51.0	36.0	42.0	46.5	41.5 ± 7.7	207.5	100.0
Methodology discipline	10.0	13.0	10.5	10.5	11.0	11.0 ± 1.2	55.0	26.5
Epidemiology	5.0	6.0	4.5	6.0	5.0	5.3 ± 0.7		
Statistics	4.0	5.0	4.0	2.5	5.0	4.1 ± 1.0		
Health education	1.0	2.0	2.0	2.0	1.0	1.6 ± 0.5		
Natural science disciplines	3.0	10.0	6.5	8.0	10.5	7.6 ±3.0	38.0	18.3
Sanitary chemistry	–	2.0	2.5	5.5	5.0	3.8 ± 1.8		
Sanitary microbiology	–	3.0	2.0	–	2.5	2.5 ± 0.5		
Toxicology	–	5.0	2.0	2.5	3.0	3.1 ± 1.3		
Health inspection	3.0	–	–	–	–	–		
Social science disciplines	4.0	9.0	6.0	7.0	7.5	6.7 ± 1.9	33.5	16.2
Social medicine	1.5	2.0	2.0	3.0	2.0	2.1 ± 0.5		
Health management	2.5	2.0	2.0	2.0	2.5	2.2 ± 0.3		
Health supervision	–	3.0	–	2.0	1.5	2.2 ± 0.8		
Health law	–	2.0	2.0	–	1.5	1.8 ± 0.3		
Traditional health science	15.0	19.0	13.0	16.5	17.5	16.2 ± 2.3	81.0	39.0
Environmental health	4.0	5.0	3.5	4.5	5.0	4.4 ± 0.7		
Occupational health and occupational medicine	5.0	5.0	3.5	4.5	5.0	4.6 ± 0.7		
Nutrition and food hygiene	4.0	6.0	3.5	4.5	5.0	4.6 ± 0.9		
Child and adolescent health	2.0	3.0	2.5	3.0	2.5	2.6 ± 0.4		
Introduction to public health	–	1.0	1.0	–	–	–		

HUST, Huazhong University of Science and Technology; SCU, Sichuan University; FDU, Fudan University; ZJU, Zhejiang University; JLU, Jilin University.
Data from the official website of each school.

of the examinations is to examine the student's base of theoretical knowledge. At present, China has not developed a unified and authoritative public health/preventive medicine program assessment and evaluation mechanism. The assessment of a school's public health/preventive medicine curriculum is to a certain extent reflected in the Ministry of Education's organized undergraduate teaching level assessment and the selection of quality courses at all levels. At the same time, there is a lack of nationwide authority for public health/preventive medicine education certification and standardization. In order to improve the processes of public health/preventive medicine education, program assessment mechanisms need to be strengthened and improved.

Systematic Planning for Curriculum Reform

Due to the initiation of the national school reform effort in 2000, the majority of China's public health colleges were merged into comprehensive universities. Utilizing the comprehensive universities' advantages has not occurred to any significant degree nor has it been studied in practice. Although some current research has focused on the reform of public health/preventive medicine education, no research has approached reform from a holistic point-of-view. As an example of the difficulty in reforming the curriculum, cross-linking, cross-penetration, and integration between courses within the program has not occurred (He, 2013).

Improve Variation between Universities

The objectives of the public health/preventive medicine programs among the different schools are similar. No clear difference is apparent between the various universities' public health/preventive medicine programs regardless of the level of the university or its style. The institutions having the objective of educating public health/preventive medicine practitioners should utilize their respective regional advantages and develop their own characteristic courses based on the societal needs of the population served.

CURRICULUM REFORM DEVELOPMENT AND PRACTICE AT SICHUAN UNIVERSITY'S WEST CHINA SCHOOL OF PUBLIC HEALTH

Due to the profound changes in China's economic and social life as well as the process of globalization, some infectious diseases have been revived, new infectious diseases have emerged, chronic diseases have become increasingly prominent, and public health crises/emergencies have been occurring more frequently. The practice of public health and public health education has been facing unprecedented challenges. Accordingly, public health education reform is required to fulfill the historic mission of improving the health of the public and to meet its socioeconomic requirements. Sichuan University's West China School of Public Health is one example of a university that is revising its public health/preventive medicine curriculum.

The Basis for Curriculum Reform

The reform of the West China School of Public Health preventive medicine undergraduate major was based on the "Public Health Education Basic Requirements (PHEBR)" (Chinese Preventive Medicine Association of Public Health Education Branch and the Public Health Dean/Department Director Contact Conference, 2006) Based on global experience, the PHEBR includes public health practice guidelines centered on professional knowledge and core competency. The PHEBR is composed of a total of 37 competency items divided into six areas: (1) professionalism,

i.e., consciously establish, strengthen, and maintain the values of the public health practitioner; (2) medical foundation, i.e., learning the appropriate way to utilize basic medical knowledge; (3) population health, i.e., thinking through the needs of the population served and building a profound understanding of socio-ecological health model; (4) health management and social mobilization, i.e., understanding modern management concepts, knowledge and skills, and being aware of the appropriate use of health-related resources; (5) information management, i.e., correctly collect and utilize various types of health-related information and apply it in practice; (6) scientific research, i.e., being able to critically assess existing knowledge, technology, and information, and apply it in professional activities and research.

Training Objectives: Excellence for the People

Modern public health practice and public health education have increasingly highlighted the need for broad human engagement, extensive social participation, diverse cultural understanding, strict ethical principles and legal norms, human and environmental understanding, international vision and global cooperation, and cross-integration between management and information technology. Preventive medicine professional education objectives should be based on current reality and engaging the future. In addition, due to the specific aspects of public health, there is a need for preventive medicine undergraduate students to develop a caring attitude toward their fellow humans and society in general. They should also keep in mind the need for a spirit of constantly seeking quality improvement. Considering the history and characteristics of the West China School of Public Health, training objectives for the preventive medicine undergraduate program includes developing a profound humanistic background, a rigorous scientific spirit, a strong sense of innovation, and a broad international viewpoint.

Adjust the Curriculum Structure

The preventive medicine undergraduate curriculum at the West China School of Public Health includes two phases. The first phase includes two stages: (1) general education and professional basic science education and (2) personalized education. The course credits for the general education stage account for 20.95% of the total credits applied toward graduation. The professional basic science course credits account for 29.76% and personalized education course credits account for 49.29% of the total credits in this phase. The second phase of the curriculum consists of two parts: (1) public health theoretical courses and (2) field practicum. The practicum includes a traditional clinical practice practicum, a graduation capstone project, experimental courses, and innovative educational activities. In addition, there are three different types of theoretical public health elective courses offered, including courses in academic research, practical application of knowledge, and innovative exploration.

The Reformed Curriculum and Teaching Techniques

The reformed curriculum has the following characteristics: based on the basic requirements and needs of public health in China, the undergraduate public health/preventive medicine program curriculum has been integrated and reformed. In the new program, some courses in the original curriculum, such as maternal and child health and children and juvenile health were combined and integrated to form a new "Maternal, Child and Youth Health" course. The environmental health and occupational health courses were combined to form the "Environmental and Occupational Health" course.

New courses were created and added to the curriculum based on the development of new disciplines, including such courses as "Introduction to Public Health" and "Evidence-based Public Health Practice." Education in the humanities, management, and research practice were strengthened. The "three-phases" curriculum format was changed into five components in the new curriculum program, including: "personality and literary," "expression and understanding," "development basis," "profession and service," and "research and inquiry."

Implementation of a public health case and health project teaching method occurred in order to improve the student's ability to self-learn. The traditional classroom teaching methods including the use of a lecture style of teaching has significant shortcomings; however, for the foreseeable future, it will remain the major teaching methodology for public health teaching, especially as the basic learning theory. Classroom teaching is irreplaceable for the time being. In the reform of traditional classroom teaching methods, several new teaching methods are advocated: (1) research teaching methods; (2) the gradual development of the public health case teaching methodology; (3) a public health project teaching method (PH-PTM); and (4) other research teaching methods. The public health case teaching method has the following characteristics: (1) clearly enunciated teaching relevance; (2) concise cases with informative content; (3) appropriate questions and instruction; and (4) knowledge content involved in the case that students can easily obtain through a variety of means. The PH-PTM can be divided into five stages: (1) clarifying project tasks; (2) making plans; (3) implementing plans; (4) evaluating results; and (5) applying outcomes.

The quality management of practitioner training was strengthened, including changing assessment methodologies by mobilizing "teaching" and "learning" processes. In the process of evaluating student performance, the entire learning process became the focus of assessment: (1) using multiple testing methods such as presentations and case analyses instead of a single closed book examination; (2) changing the one-time final examination to several quizzes to encourage student learning throughout the semester; (3) developing additional non-standard examination questions to encourage creative thinking; (4) emphasizing teaching assessment and evaluation, especially student feedback; and (5) introducing a peer evaluation process in course teaching. Peers are required to communicate with lecturers after class and discuss certain topics, such as teaching content, teaching methods, and classroom management, in order to improve the teaching ability of faculty members.

SUMMARY

In 2015, the Fifth Plenary Session of the 18th Central Committee Conference of China raised the concern of "Healthy China" to a

national strategic level. In August 2016, the National Conference on Health developed the themes of putting the people's health at the center of health policy development by concentrating on prevention as the driving force of health policy, utilizing both Chinese traditional and western-style medicine, considering health issues in the development of all public policies, and involving the public in the development of the new policies. The Health China 2030 Plan pointed out that the core of the healthy China strategy is a new policy based on good health and health practices. Talented public health practitioners are the key human health resource required to implement the "Healthy China" strategy and achieve the "prevention first" policy. The undergraduate education of public health/preventive medicine students is a key element in developing talented public health practitioners. By reviewing the history of public health/preventive medicine practitioner education in China, analyzing the current situation and difficulties in the public health/preventive medicine curriculum, and reviewing the practice and experience of curriculum reform in public health colleges, the requirements of a new era in the education of public health/preventive medicine practitioners in China has been presented.

AUTHOR CONTRIBUTIONS

LZ drafted the paper under the supervision of XM. RW, JX, and CL provided data input and research assistance. QC and JH were responsible for translation and finial editing of the manuscript.

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