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Establishment of a Global Health Curriculum for Undergraduates in China: A Delphi Study

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Abstract

Objective: This study aimed to establish the first global health curriculum for undergraduates in China.

Design: The Delphi methodology was used to determine expert consensus on which courses should be included in the global health undergraduate curriculum. A literature review and a workshop proceeding were performed to generate courses. Then a two-round Delphi process was conducted with 28 invited experts from universities, health administrative departments, and non-governmental organizations (NGOs) to rate courses using a 5-point Likert scale. Additionally, the experts could alter, add or delete courses if necessary. Consensus was predefined as a mean score at or above 4 and the percent agreement (proportion of panel members scoring 'very important' or 'important') no less than 75%.

Results: The response rates in the two-round Delphi process were 85.7% and 70.8%, respectively. In the first round, twelve courses did not reach the inclusion criteria and were deleted. Based on the comments made by the participants, 32 courses were screened out to be included in round two. In the second round, the consensus was reached on 31 courses which were selected as the final curriculum. These courses were categorized into five modules, including General Knowledge, Methodology, Global Health Issues, Intercultural Communication, Health Policy and Program Management.

Conclusion: This study established the first global health curriculum for undergraduates in China. It will provide guidance for other educational institutions to develop similar programs or curricula in the future.

Keywords: global health; undergraduates; curriculum; Delphi

Article Summary

Strengths and limitations of this study

- This is the first study to develop a global health curriculum for undergraduates in China.
- This study take advantage of the Delphi methodology to gather expert opinions and consensus on the curriculum.
- A pilot survey was completed by faculty members at Wuhan University to explore the readability and feasibility of the questionnaire.
- A limitation of the study is that all of the foreign panel members were from the U.S. with no experts from other countries besides China.

Introduction

With the rapid development of the global economy, health issues and health inequality have quickly become the challenges for every country.[1] Today it is clear that infectious diseases have no borders and can spread readily from one country to another.[2 3] Many global health (GH) issues and major diseases can only be effectively controlled and resolved through the combined efforts deriving from international collaborations.[2] A competent GH workforce with sufficient training and expertise is needed to improve and maintain local and global health conditions.[4 5] Therefore, GH education in universities has become a new focus and has attracted widespread attention throughout the world.[6]

In the past few years, GH education has grown rapidly in developed countries. From 2011 to 2014, nearly 95% of the publications related to GH education were from North America and European countries.[7] Conversely, only 2.9% came from Asia.[7] The gap in the quantity of studies on GH education between developed and developing countries is obvious. In addition, undergraduate programs in GH are mainly concentrated in developed countries, including the United States (U.S.), the United Kingdom (U.K.), and Canada.[6 7] For example, the Blizard Institute of Queen Mary University of London offers a Bachelor of Science (BS) degree in GH to help students develop an understanding of a range of public health issues at the global level.[8] In the U.S., the University of Southern California provides a BS program in GH which is composed of courses in the basic sciences, international relations, health promotion and disease prevention.[9] However, such programs are rare in developing countries. There is an urgent need to establish and develop GH education programs in these countries.

As China has moved from an aid receiving country to an aid providing country,

there is an increasing demand for Chinese health professionals with knowledge and competency in GH.[10] Over the past few years, Peking University, Fudan University, and Wuhan University have established GH Departments and research centers to train GH professionals.[11] However, systematic studies focusing on curriculum development for GH education are very limited at present.

This paper examines a Delphi process for developing the first GH undergraduate curriculum in China. The curriculum was developed and reviewed by international GH experts. The results of this study may be helpful to educators and students in other institutions interested in developing GH education and training programs.

Methods

We employed the Delphi method to develop a GH curriculum for undergraduates. The Delphi method is an iterative process to gather and provide information by using a series of questionnaires to determine the degree to which experts agree about the issue discussed.[12] There are three phases in this study. Ethical approval was obtained from the ethical committee of School of Health Sciences, Wuhan University.

Phase One

Generation of the Initial Draft and Questionnaire

Three members of the writing team (LG, PG and SYL) performed a web search to identify available curricula related to GH undergraduate programs in February 2013. Curricula from four universities (Arizona State University, Georgetown University, Kent State University and University of Southern California) were selected. Then a literature review was conducted via Google and PubMed using the search terms 'name of school'+ 'global health', 'global health program', 'bachelor of global health

or international health'. Six articles that are highly relevant to GH education were retrieved.[13-18]

In March 2013, during a workshop on GH undergraduate education, we held a brainstorming exercise to generate ideas on the potential courses to be included in the GH undergraduate curriculum. To guide the workshop discussion, we adopted a widely cited GH definition: "GH is an area for study, research, and practice that places a priority on improving health and achieving equality in health for all people worldwide. GH emphasizes transnational health issues, determinates 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".[19] Nine GH educators, twelve public health educators, and ten multidisciplinary experts from Peking University, Fudan University and Wuhan University were invited to attend. The courses that were generated were discussed in depth and categorized into six modules, including General Knowledge, Interdisciplinary Knowledge, Methodology, Global Health Issues, Intercultural Communication, Health Policy and Program Management.

According to the collected information above, we generated an initial draft of GH undergraduate curriculum composed of 52 courses in 6 modules. Then we designed a questionnaire for experts to review and determine which courses should be included in the curriculum. Each course was described with course name, learning objectives and a short description of course content.

Phase Two

Pilot Survey

Before the formal investigation, 5 faculty members at Wuhan University were

invited to complete a pilot survey to explore the readability and feasibility of the questionnaire. Based on their feedback, the first version of questionnaire was developed for the Delphi study.

Recruitment of Members in the Delphi Study

The inclusion criteria of Delphi panel members were defined before the recruitment. The candidates were selected from universities, health administrative departments, and non-governmental organizations (NGOs). They should have GH experience such as teaching related courses, conducting related research, or working in the international health organizations. Limited by time and budget, we recruited 28 panel members as previously recommended for Delphi studies.[20]

Phase Three

Delphi Round One

In the first round, all 28 panel members received the questionnaire with an informed consent form by email. They were invited to rate the 52 courses with a 5-point Likert scale[21] from 1 (not important) to 5 (very important). In addition, they were asked to alter, add or delete courses if necessary. The mean, standard deviation of scores and percent agreement (scoring 'very important' or 'important') were calculated for each course. Complete data was collected from 24 panel members and the results were used to revise the questionnaire and establish a second version.

Delphi Round Two

The survey process of the second round was identical to the first one. The panel members in round two were invited to re-rate the selected courses. We sent the second version of questionnaire to 24 panel members who had participated in round one, and 17 of them responded. Based on the articles published by Diamond et al.[20], Delbecq et

al.[22], and Ludwig[23], this number is sufficient to conduct the subsequent data analysis.

Data Analysis

All statistical analyses were performed in IBM SPSS Statistics 19.0. The mean and standard deviation of scores were used to describe the concentration and dispersion degree. Level of importance for each course was determined by the mean score. The percent agreement of each course was the proportion of panel members who rated the course as 'very important' and 'important'. There have been no universally accepted criteria for consensus in a Delphi study.[12] Miller indicated that if a certain percentage of the votes fall into a predefined range, consensus can be achieved.[24] In this study, we define that when the mean score is 4.0 or above and the percent agreement is no less than 75%, the consensus is reached.[20 25]

Results

Demographics of the Members in the Delphi Panel

We selected 28 experts to participate in the Delphi process. In round one, 24 (85.7%) experts participated in the survey. In round two, 17(70.8%) of the 24 experts responded. The experts in the Delphi panel have different academic background and expertise, including nutrition, physiology, epidemiology, environmental health, and health policy. There are five members from overseas universities (Duke University, University of Florida, University of Hawaii, and University of Tennessee) who have been actively participating in academic activities in China and known Chinese GH education very well. Most participants were less than 50 years old, with more than 5 years of GH experience. The detailed demographic characteristics of the Delphi panel are shown in Table 1.

Delphi Round One

Fifty-two courses were rated by 24 panel members with a scale of 1-5. Twelve courses didn't reach the inclusion criteria and were deleted (Table 2). One course (International Health Project Management) was added according to the opinions of the participants. The name of six courses was revised as suggested (Table 3). In addition, Social Anthropology and Medical Anthropology were merged into Culture Anthropology. Principles and Application of GIS, Global Burden of Disease, and Behavior, Psychology, and Health were incorporated into Research Methods in Global Health, Epidemiology, and Mental Health respectively. The course of Race, Culture and Health was incorporated into Health Social Determinants, which was then integrated into Introduction to Global Health. Comparative Health Systems, Introduction to Global Health Organizations, and Global Health Promotion were incorporated into Global Health Governance. Following feedback, the Interdisciplinary Knowledge module was incorporated into the module of General Knowledge. Introduction to Global Health was moved from the module of Global Health Issues to the module of General Knowledge. As a result, the revised curriculum contained 5 modules and 32 courses.

Delphi Round Two

In the second round, 32 courses were rated by 17 remaining participants. There are no significant differences in the distributions of gender (Fisher's exact test p=1.000), age (Fisher's exact test p=0.433), global health experience (Fisher's exact test p=1.000) and organization (Pearson Chi-square p=0.680) between the participants of the first and second rounds. The results of the second round are listed in Table 4. Organizational Behavior didn't reach the inclusion criteria and was removed from the curriculum. Finally, the consensus was reached on 5 modules and 31 courses.

Table 1. Demographic characteristics of the members in the Delphi panel

Characteristics	Round 1 (N=24)	Round 2 (N=17)
Gender, n (%)		
Male	18 (75.0)	12 (70.6)
Female	6 (25.0)	5 (29.4)
Age (years), n (%)		
< 50	18 (75.0)	15 (88.2)
⩾50	6 (25.0)	2 (11.8)
Global health experience (years), n (%)		
< 5	6 (25.0)	5 (29.4)
⩾5	18 (75.0)	12 (70.6)
Organization, n (%)		
Universities	14 (58.3)	11 (64.7)
Other institutions[a]	10 (41.7)	6 (35.3)

[a]Other institutions are health administrative departments and NGOs.

Table 2. Global Health Curriculum: score of each course in round one

Module	Name of course	Mean±SD	Agreement(%)
General	Preventive Medicine	4.63±1.01	92
Knowledge	Introduction to Ethics	4.29±0.62	92
	Introduction to Clinical Medicine	4.17±0.82	83
	Probability and Mathematical Statistics	4.00±0.98	71[b]
	Pathogenic Organisms	3.87±1.06[a]	67[b]
	Basis of Computer Engineering	3.79±0.98[a]	71[b]
	Medical History	3.54±1.06[a]	58[b]
	Physiology	3.43±1.12[a]	46[b]
	Human Anatomy	3.22±1.13[a]	42[b]
	Biochemistry	3.09±0.90[a]	25[b]
	Advanced Mathematics	3.04±1.04[a]	21[b]
Interdisciplinary	Introduction to Sociology	4.38±0.71	88
Knowledge	Global Health Economics	4.38±0.82	88
	Social Psychology	4.17±0.82	83
	Medical Anthropology	4.13±0.74	79
	Social Anthropology	4.09±0.73	75
	Race, Culture and Health	4.09±0.73	75
	Organizational Behavior	4.08±0.72	79
	Behavior, Psychology and Health	4.00±0.67	79
	Introduction to Eastern and Western Philosophy	4.00±0.67	79
Methodology	Epidemiology	5.00±0.00	100
	Biostatistics	4.75±0.68	96
	Research Methods in Global Health	4.73±0.46	100
	Literature Review	4.35±0.78	88
	Common Statistical Software	4.33±0.70	96
	Principles and Application of GIS	4.24±0.77	79
Global Health	Environment and Health	4.71±0.55	96
Issues	Health Social Determinants	4.67±0.70	96
	Introduction to Global Health	4.67±0.56	96
	Global Burden of Disease	4.65±0.57	92
	Non-Communicable Diseases	4.63±0.58	96
	Food and Nutrition Security	4.63±0.58	96
	Communicable Diseases	4.58±0.65	92
	Maternal and Child Health	4.58±0.65	92
	Case Studies in Global Health	4.48±0.59	92
	Global Health and Aging	4.43±0.73	92
	Global Mental Health	4.30±0.82	83
Intercultural	Health Professional English	4.71±0.55	96
Communication	International Law	4.30±0.82	83
	Intercultural Communication	4.26±0.86	79
	Modern International Relationship	4.13±0.74	79
	International Political Economy	4.13±0.74	79
	Major World Religions	3.54±0.78[a]	46[b]

Module	Name of course	Mean±SD	Agreement(%)
Intercultural Communication	The Second Language (French)	3.42±0.83[a]	58[b]
	Global History	3.33±0.96[a]	38[b]
Health Policy and Program Management	Global Health Internship	4.42±0.72	88
	Comparative Health Systems	4.42±0.72	88
	Global Health Diplomacy Practice	4.35±0.98	79
	Global Health Management	4.26±0.86	79
	Introduction to Global Health Organizations	4.26±0.75	75
	Global Health Promotion	4.24±0.77	79
	Hygienic Managerialism	4.09±0.90	71[b]

[a]Mean score < 4.0

[b]Percent agreement < 75%

Likert scale: 1=not important, 2= somewhat important, 3= moderately important, 4= important, 5 = very important

Table 3. Renaming of courses

	Original course name	Course name after renaming
1	Global Health Economics	Health Economics
2	Maternal and Child Health	Introduction to Maternal and Child Health
3	Global Mental Health	Mental Health
4	Environment and Health	Environment and Global Health
5	International Law	International Health Law
6	Global Health Management	Global Health Governance

Table 4. Final Global Health Curriculum: score of each course in round two

Module	Name of course	Mean±SD	Agreement(%)
General	Preventive Medicine	4.53±0.51	100
Knowledge	Health Economics	4.47±0.62	94
	Introduction to Global Health	4.41±0.80	82
	Introduction to Sociology	4.35±0.70	88
	Introduction to Ethics	4.29±0.69	88
	Introduction to Clinical Medicine	4.12±0.93	76
	Social Psychology	4.12±0.73	82
	Culture Anthropology	4.00±0.71	76
	Introduction to Eastern and Western Philosophy	4.00±0.87	76
	Organizational Behavior	3.71±0.77[a]	65[b]
Methodology	Epidemiology	4.70±0.47	100
	Research Methods in Global Health	4.59±0.71	88
	Biostatistics	4.59±0.51	100
	Literature Review	4.06±0.75	76
	Common Statistical Software	4.06±0.66	82
Global Health	Non-communicable Diseases	4.65±0.49	100
Issues	Environment and Global Health	4.53±0.72	88
	Case Studies in Global Health	4.53±0.51	100
	Communicable Diseases	4.35±0.70	88
	Introduction to Maternal and Child Health	4.29±0.69	88
	Global Health and Aging	4.24±0.66	88
	Food and Nutrition Security	4.12±0.73	82
	Mental Health	4.00±0.71	76
Intercultural	Health Professional English	4.47±0.62	94
Communication	International Health Law	4.35±0.79	82
	Intercultural Communication	4.06±0.75	76
	International Political Economy	4.00±0.87	76
	Modern International Relationship	4.00±0.71	76
Health Policy	Global Health Internship	4.65±0.61	94
and Program	Global Health Governance	4.59±0.62	94
Management	International Health Project Management	4.47±0.62	94
	Global Health Diplomacy Practice	4.24±0.83	76

[a]Mean score < 4.0

[b]Percent agreement < 75%

Likert scale: 1=not important, 2= somewhat important, 3= moderately important, 4= important, 5 = very important

Discussion

This study established the first preliminary version of GH curriculum for undergraduates in China. Through a two-round Delphi study, panel members reached consensus on 31 courses from 5 modules. This curriculum aimed to train students to solve health problems both inside and outside national borders.

The module of General Knowledge contains interdisciplinary courses covering psychological, social, economic, and philosophical dimensions. It is well accepted that the interdisciplinary knowledge is critical for GH undergraduates to recognize social, political and economic factors of diseases and completely understand the current and emerging GH issues from different perspectives.[19 26-28] Most GH undergraduate programs in the U.S. encourage interdisciplinary coursework.[29] Allegheny College, Arizona State University, Georgetown University, and University of California San Diego all offer interdisciplinary courses such as sociology, political sciences and economics which, however, are set in elective modules.[30-33] In our GH undergraduate degree program, students are required to master interdisciplinary knowledge, which will ensure them to successfully carry out related GH activities.

Through the web search of GH undergraduate curricula abroad, we found that Kent State University provided a special course on the application of GIS in health research.[34] As the most efficient way for global spatial and geographic mapping,[35] GIS technology should be included in Methodology module. However, considering that it may be difficult for students to understand the learning material, panel members suggested incorporating GIS technology into Research Methods in Global Health and students could choose this course as an elective one for further study. Also, we found that many colleges and universities in the U.S. provided research method courses in their GH undergraduate curricula. For example, the University of Southern

California offered "core studies", as one of the required modules, which includes Health Behavior Statistical Methods, Health Behavior Research Methods and Directed Research.[9] In the review of GH undergraduate education in the U.K., research methods and epidemiology were two of the most frequently offered courses, and they were emphasized in the programs at University of Oxford and Kings College.[6] As the Global Health Education Consortium has proposed the "Methods, Tools, and Skills" module in GH undergraduate education,[36] we believe that research methods are absolutely necessary in GH undergraduate curriculum..

The training of intercultural competency is a challenge for the success of GH education programs.[35] The most frequently mentioned core competency of GH in medical schools is 'be able to communicate with different populations and work under various cultural environments and medical systems'.[37 38] This was a main focus of our GH undergraduate degree program and was emphasized repeatedly by potential employers of GH graduates. Sociocultural and political awareness is needed by GH professionals to work effectively across diverse geographical and cultural areas with a variety of populations and health policies.[39 40] The ability of problem-solving in practical work should also be improved among GH professionals to deal with health problems in different regions and healthcare systems.

The module of Health Policy and Program Management contains both of domestic and overseas internships in GH fields. Prior studies have highlighted the benefits of GH internships: (1) opening doors to applying the course theory within domestic and international resource-limited settings and engaging in collaborative research throughout the world;[41] (2) helping increase knowledge, skills and confidence, and better cultural sensitivity;[42 43] (3) providing opportunities for graduate programs and jobs.[29] Practicum or internship experiences have been consistently underscored in GH

undergraduate programs abroad. The five GH undergraduate programs (Allegheny College, Arizona State University, Duke University, New York University and University of California San Diego) require students to have practicum experiences and another three (Arizona State University, Mercer University and New York University) require students to have international experiences.[29] These experiences are part of transformational learning components for GH undergraduates and should be promoted and encouraged in GH undergraduate programs.

The GH undergraduate curriculum in our study has much in common with those developed in the Western countries. It lays the foundation for Chinese GH students to study and work abroad in the future. So far it has been put in place and the first group of students has successfully completed this program in 2017. The curriculum has been tested in both teaching and learning practices. Currently, the faculty members of School of Health Science at Wuhan University are obtaining feedback from these graduates, assessing the outcomes for further improvement.

A limitation of this study is that all of the foreign panel members were from the U.S. with no experts from other countries besides China. In order to address this limitation, our study started with a systematic review of GH education based on previous research and international literature. With the development of GH education in both developed and developing countries, further work is needed to invite experienced GH educators from more countries to share their experience on cultivation of GH undergraduates and discuss this proposed GH undergraduate curriculum to identify areas of strength and weakness for our future research.

Conclusion

In this study, the consensus was reached on 5 modules with 31 courses in the GH

undergraduate curriculum among international experts after two rounds of Delphi processes. This study broke new ground by establishing the first GH undergraduate curriculum in China. We hope that our study will provide some guidelines and references for other institutions to set up their GH programs or curricula. This may help facilitate GH education in China as well as in other developing countries in the near future.

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Competing interests None declared.

Ethical approval This study was approved by the ethical committee of School of Health Sciences at Wuhan University. Consent was obtained from all participants.

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Reference

1. Xiang H, Mao ZF, Qin H, et al. Preliminary exploration of the training of global health professionals in China. Mod Prev Med 2015;42(2):382-4. [in Chinese].

2. Xiao HY, Wang PG, Mao ZF, et al. Theory and practice of global health professional personnel training in China. Northwest Med Educ 2015;3:406-8. [in Chinese].

3. Ehn S, Agardh A, Holmer H, et al. Global health education in Swedish medical schools. Scand J Public Health 2015;43:687-93.

4. Frenk J, Chen L, Bhutta ZA, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. Lancet 2010;376:1923–58.

5. Fineberg HV, Hunter DJ. A global view of health--an unfolding series. N Engl J Med 2013;368(1):78-9.

6. Harmer A, Lee K, Petty N. Global health education in the United Kingdom: a review of university undergraduate and postgraduate programmes and courses. Public Health 2015;129(6):797-809.

7. Liu Y, Zhang Y, Liu Z, et al. Gaps in studies of global health education: an empirical literature review. Glob Health Action 2014;8(1):25709.

8. Queen Mary University of London. BSc in Global Health. 2018. http://www.qmul.

ac.uk/undergraduate/coursefinder/courses/114962.html (accessed 12 Mar 2018).

9. University of Southern California. USC health promotion, disease prevention and global health programs. 2018. https://hpdp.usc.edu/education.php?sub=BSGH (accessed 12 Mar 2018).

10. Wang PG. The Discussion of the Cultivation Mode and Path of Compound Talents of Global Health. Med Soc 2013;26(7):92-4. [in Chinese].

11. Zhang CX, Mao ZF. Fundamentals of the discipline of global health. Chin J Dis Control Prev 2014;18(10):1003-7. [in Chinese].

12. Hsu CC, Sandford BA. The Delphi technique: making sense of consensus, Practical Assess Res Eval 2007;12:1-8.

13. Brewer TF, Saba N, Clair V. From boutique to basic: a call for standardised medical education in global health. Med Educ 2009;43:930–3.

14. Walling A, Merando A. The fourth year of medical education: a literature review. Acad Med J Assoc Am Med Coll 2010;85(11):1698-704.

15. Johnson O, Bailey S L, Willott C, et al. Global health learning outcomes for medical students in the UK. Lancet 2012, 379(9831):2033-5.

16. Stys D, Hopman W, Carpenter J. What is the value of global health electives during medical school. Med Teach 2012;35(3):209-18.

17. Khan OA, Guerrant R, Sanders J, et al. Global health education in U.S. medical schools. BMC Med Educ 2013;13(1):1-7.

18. Peluso MJ, Forrestel AK, Hafler JP, et al. Structured global health programs in U.S. medical schools: a web-based review of certificates, tracks, and concentrations. Acad Med J Assoc Am Med Coll 2013;88(1):124-30.

19. Koplan JP, Bond TC, Merson MH, et al. Towards a common definition of global health. Lancet 2009;373(9679):1993-5.

20. Diamond IR, Grant RC, Feldman BM, et al. Defining consensus: A systematic review recommends methodologic criteria for reporting of Delphi studies. J Clin Epidemiol 2014;67(4):401-9.

21. Likert R. A technique for the measurement of attitudes. Arch Psych 1932;22(140): 1-55.

22. Delbecq AL, Van de Ven AH, Gustafson DH. Group techniques for program planning. Glenview, IL: Scott, Foresman, and Co; 1975.

23. Ludwig B. Predicting the future: Have you considered using the Delphi methodology? JOE 1997;35(5):1-4.

24. Miller LE. Determining what could/should be: The Delphi technique and its

application. Paper presented at: The annual meeting of the Mid-Western Educational Research Association.2006, October; Columbus, Ohio.

25. Downing J, Knapp C, Muckaden MA, et al. Priorities for global research into children's palliative care: results of an international delphi study. BMC Palliat Care 2015;14(1):1-10.

26. Rowson M, Willott C, Hughes R, et al. Conceptualising global health: theoretical issues and their relevance for teaching. Glob Health 2012;8(1):36.

27. Palmer VS, Mazumder R, Spencer PS. Interprofessional global health education in a cosmopolitan community of North America: the iCHEE experience. Acad Med 2014;89(8):1149.

28. Pfeifle A, Earnest M. The creation of an institutional commons: institutional and individual benefits and risks in global health interprofessional education. J Law Med Ethic 2014;42:45–9.

29. Drain PK, Mock C, Toole D, et al. The Emergence of Undergraduate Majors in Global Health: Systematic Review of Programs and Recommendations for Future Directions. Am J Trop Med Hyg 2017;96(1):16.

30. Allegheny College. Global Health Major. 2018. http://sites. allegheny.edu/global health/global-health-major/ (accessed 12 Mar 2018).

31. Arizona State University. Global Health Undergraduate Degrees. 2018. https://webapp4.asu.edu/programs/t5/roadmaps/%20ASU00/%20LASSHBA/null/ALL/%202017 (accessed 12 Mar 2018).

32. Georgetown University. Biology of Global Health Major. 2018. https://biology.georgetown.edu/undergraduate/globalhealth (accessed 12 Mar 2018).

33. University of California San Diego. Bachelor of Arts in Global Health. 2018. http://globalhealthprogram.ucsd.edu/undergraduate-program/major.html (accessed 12 Mar 2018).

34. Kent State University. BSPH in Global Health. 2018. https://www.kent.edu/publichealth/bachelor-science-public-health-bsph-global-health (accessed 12 Mar 2018).

35. Chen X. Understanding the development and perception of global health for more effective student education. Yale J Biol Med 2014;87(3):231-40.

36. Xiang H, Mao ZF, Qin H. Review of undergraduate programs on global health in American universities. Mod Prev Med 2015;42(1):190-2. [in Chinese].

37. Battelkirk B, Barry MM, Taub A, et al. A review of the international literature on health promotion competencies: identifying frameworks and core competencies. Glob Health Promot 2009;16(2):12-20.

38. Peluso MJ, Encandela J, Hafler JP, et al. Guiding principles for the development

of global health education curricula in undergraduate medical education. Med Teach 2012;34(8):653-8.

39. Jogerst K, Callender B, Adams V, et al. Identifying interprofessional global health competencies for 21st-century health professionals. Ann Glob Health 2015;81(2): 239-47.

40. Wilson L, Callender B, Hall TL, et al. Identifying global health competencies to prepare 21st century global health professionals: report from the global health competency subcommittee of the consortium of universities for global health. J Law Med Ethic 2014;42(s2):26–31.

41. Francis ER, Goodsmith N, Michelow M, et al. The global health curriculum of Weill Cornell Medical College: how one school developed a global health program. Acad Med J Assoc Am Med Coll 2012;87(9):1296.

42. Jeffrey J, Dumont RA, Kim GY, et al. Effects of international health electives on medical student learning and career choice: results of a systematic literature review. Fam Med 2011;43(1):21-8.

43. Ladding S, Zink T, Howard C, et al. International electives at the University of Minnesota global pediatric residency program: opportunities for education in all accreditation council for graduate medical education competencies. Acad Pediatr 2012;12(3):245.

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Development of a Global Health Bachelor Curriculum in China: A Delphi Study

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Abstract

Objective: This study aimed to establish the first global health bachelor curriculum in China.

Design: The Delphi methodology was used to determine expert consensus on which courses should be included in the global health bachelor curriculum. A literature review and a workshop proceeding were performed to generate courses. Then a two-round Delphi process was conducted with 28 invited experts from universities, health administrative departments, and non-governmental organizations (NGOs) to rate courses using a 5-point Likert scale. Additionally, the experts could alter, add or delete courses as appropriate. Consensus was predefined as a mean score of 4 or above and the percent agreement (proportion of panel members scoring 'very important' or 'important') no less than 75%.

Results: The responses in the two-round Delphi process were 85.7% and 70.8%, respectively. In the first round, twelve courses did not meet the inclusion criteria and were removed. Based on the participants' comments, 32 courses were included in Round two. In the second round, the consensus was reached on 31 courses which were selected as the final curriculum. These courses were categorized into five modules, including General Knowledge, Methodology, Global Health Issues, Intercultural Communication, Health Policy and Program Management.

Conclusion: This study established the first global health bachelor curriculum in China. It will provide guidance for other educational institutions to develop similar programs or curricula in the future.

Keywords: global health; bachelor; curriculum; Delphi

Article Summary

Strengths and limitations of this study

- This is the first study to develop a global health bachelor curriculum in China.
- This study take advantage of the Delphi methodology to gather expert opinions and consensus on the curriculum.
- A pilot survey was completed by faculty members at Wuhan University to explore the readability and feasibility of the questionnaire.
- A limitation of the study is that all of the international panel members were from the U.S. with no experts from other foreign countries.

Introduction

With the rapid development of the global economy, more and more Chinese go abroad to study, work and travel, in the meanwhile, more and more foreigners are visiting China for the same reasons. Health issues and health inequality have quickly become the challenges not only for China but other countries.[1] Today it is clear that infectious diseases have no borders and can spread readily from one country to another.[2 3] Many global health (GH) issues and major diseases can only be effectively controlled and resolved through international collaboration.[2] A competent GH workforce with sufficient training and expertise is needed to improve and maintain local and GH.[4 5] Therefore, GH education in universities has become a new focus and has attracted widespread attention throughout the world.[6]

Over the past few years, GH education has increasingly been recognized and included in the curriculum in most western countries. From 2011 to 2014, nearly 95% of the publications related to GH education originated from North America and European countries.[7] Conversely, only 2.9% emanated from Asia.[7] The gap in the quantity of studies on GH education between high-income and middle-income countries is obvious. In addition, bachelor programs in GH are mainly concentrated in high-income countries, including the United States (US), the United Kingdom (UK), and Canada.[6 7] For example, the Blizard Institute of Queen Mary University of London offers a Bachelor of Science (BS) degree in GH to help students develop an understanding of a range of public health issues at the global level.[8] In the US, the University of Southern California provides a BS program in GH composing of courses in the basic sciences, international relations, health promotion and disease prevention.[9] Such programs, however, are rare in middle-income countries. There is an urgent need to establish and develop GH education programs in these

middle-income countries.

As China has moved from an aid-receiving country to an aid-providing country, there is an increasing demand for Chinese health professionals with knowledge and competency in GH.[10] Over the past few years, Peking University, Fudan University, and Wuhan University have established GH Departments and research centers to train GH professionals and promote China's involvement in GH activities worldwide.[11] The GH programs can not only provide Chinese health professionals to go abroad to help the developing world, but also educate international students to help their own countries to address health issues and health inequalities. In addition, these programs can help China establish a better health care system and provide evidence for future health policy making to address health issues and health inequalities domestically. Nowadays, studies focusing on curriculum development for GH education in China are very limited.

This paper examines a Delphi process for developing the first GH bachelor curriculum in China. The curriculum was developed and reviewed by international GH experts. The results of this study may be helpful to educators and students in other institutions interested in developing GH education and training programs in China and other countries.

Methods

We employed the Delphi method to develop a GH bachelor curriculum. The Delphi method is an iterative process to gather and provide information by using a series of questionnaires to determine the degree to which experts agree about the issue discussed.[12] There were three phases in this study. Ethical approval was obtained from the ethical committee of School of Health Sciences, Wuhan University.

Phase One

Generation of the Initial Draft and Questionnaire

Three members of the writing team (LG, PG and SYL) undertook a web search to identify available curricula related to GH bachelor programs in February 2013. Curricula from four universities (Arizona State, Georgetown, Kent State and Southern California) were selected. A literature review was then conducted via Google and PubMed using the search terms 'name of school'+ 'global health', 'global health program', 'bachelor of global health or international health'. Six articles that are highly relevant to GH education were retrieved.[13-18]

In March 2013, during a workshop on GH bachelor education, we held a brainstorming exercise to generate ideas on the potential courses to be included in the GH bachelor curriculum. To guide the workshop discussion, we adopted a widely cited GH definition: "GH is an area for study, research, and practice that places a priority on improving health and achieving equality in health for all people worldwide. GH emphasizes transnational health issues, determinates 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".[19] Nine GH educators, 12 public health educators, and 10 multidisciplinary experts from Peking University, Fudan University and Wuhan University were invited. The courses that were generated were discussed in depth and categorized into six modules, including General Knowledge, Interdisciplinary Knowledge, Methodology, Global Health Issues, Intercultural Communication, Health Policy and Program Management.

According to the collected information above, we generated an initial draft of GH

bachelor curriculum comprised of 52 courses in six modules. We designed a questionnaire for experts to review and determine which courses should be included in the curriculum. Each course was described with course name, learning objectives and a short description of the course content.

Phase Two

Pilot Survey

Before the formal investigation, five faculty members at Wuhan University were invited to complete a pilot survey to explore the readability and feasibility of the questionnaire. Based on their feedback, the first version of questionnaire was developed for the Delphi study.

Recruitment of Members in the Delphi Study

The inclusion criteria of Delphi panel members were defined before recruitment. The candidates were selected from universities, health administrative departments, and non-governmental organizations (NGOs). They should have GH experience in terms of teaching, research, or working for the international health organizations. Limited by time and budget, we recruited 28 panel members according to the recommendations for Delphi studies.[20]

Phase Three

Delphi Round One

In the first round, all 28 panel members were sent an email with the questionnaire and the informed consent form. They were invited to rate the 52 courses on a 5-point Likert scale[21] from 1 (not important) to 5 (very important). In addition, they were asked to alter, add or delete courses as appropriate. The mean, standard deviation and

percent agreement (scoring 'very important' or 'important') were calculated for each course. Complete data were collected from 24 of 28 panel members and the results were used to revise the questionnaire and establish a second version.

Delphi Round Two

The survey process for Round two followed that of Round one. The 24 panel members who had participated in Round one were invited to re-rate the selected courses. They were sent the second version of questionnaire, and 17 of them responded. Based on Diamond et al.[20], Delbecq et al.[22], and Ludwig[23], this number is sufficient to conduct subsequent data analysis.

Data Analysis

All statistical analyses were performed using IBM SPSS Statistics 19.0 to generate descriptive stats. The importance for each course was determined by the mean score. The percent agreement of each course was the proportion of panel members rating the course as 'very important' and 'important'. There have been no universally accepted criteria for consensus in a Delphi study.[12] Miller indicated that if a certain percentage of the votes fall into a predefined range, consensus can be achieved.[24] In this study, we define that a mean score is of 4.0 or above and the percent agreement is no less than 75%, the consensus is reached.[20 25]

Participants and public involvement

There was no participant involved in developing the questionnaire or designing or conducting the study. We didn't seek advice from the participants to interpret the results of the study. No plans have been conceived to disseminate the results to the study participants.

Results

Demographics of the Delphi Panel members

In Round one, 24 (85.7%) of the 28 invited experts participated. In Round two, 17 (70.8%) of the 24 responded. Delphi panel members had different academic background and expertise, and worked in the following areas: nutrition, physiology, epidemiology, environmental health, and health policy. Five panel members from American universities (Duke, Florida, Hawaii and Tennessee) had been associated with Chinese universities and were familiar with Chinese GH education. Most participants were less than 50 years old, with more than 5 years of GH experience. There are no significant differences in the distributions of gender (Fisher's exact test p=1.000), age (Fisher's exact test p=0.433), global health experience (Fisher's exact test p=1.000) and organization (Pearson Chi-square p=0.680) between the participants of the first and second rounds. The detailed demographic characteristics of the Delphi panel are shown in Table 1.

Delphi Round One

Of the 52 courses rated by panel members, 12 courses did not meet the inclusion criteria and were removed (Table 2). One course (International Health Project Management) was added based on the recommendations of 4 panel members. Six courses were renamed (Table 3). In addition, Social Anthropology and Medical Anthropology were combined to form a course called Culture Anthropology. Principles and Application of GIS, Global Burden of Disease, and Behavior, Psychology, and Health were incorporated into Research Methods in Global Health, Epidemiology, and Mental Health, respectively. The course of Race, Culture and Health was incorporated into Health Social Determinants, which was then integrated into Introduction to Global Health. Comparative Health Systems, Introduction to

Global Health Organizations, and Global Health Promotion were incorporated into Global Health Governance. Following feedback, the Interdisciplinary Knowledge module was incorporated into the module of General Knowledge. Introduction to Global Health was moved from the module of Global Health Issues to the module of General Knowledge. As a result, the revised curriculum contained five modules and 32 courses.

Delphi Round Two

In the second round, 32 courses were rated by 17 participants. The results of the second round are listed in Table 4. Organizational Behavior did not meet the inclusion criteria and was removed. Finally, consensus was reached on five modules and 31 courses.

Table 1. Demographics of the Delphi panel members

Characteristics	Round 1 (N=24)	Round 2 (N=17)
Gender, n (%)		
Male	18 (75.0)	12 (70.6)
Female	6 (25.0)	5 (29.4)
Age (years), n (%)		
< 50	18 (75.0)	15 (88.2)
⩾50	6 (25.0)	2 (11.8)
Global health experience (years), n (%)		
< 5	6 (25.0)	5 (29.4)
⩾5	18 (75.0)	12 (70.6)
Organization, n (%)		
University	14 (58.3)	11 (64.7)
Other institutions[a]	10 (41.7)	6 (35.3)

[a] Health administrative departments and NGOs.

Table 2. Course scores in Round one

Module	Course	Mean±SD	Agreement(%)
General Knowledge	Preventive Medicine	4.63±1.01	92
	Introduction to Ethics	4.29±0.62	92
	Introduction to Clinical Medicine	4.17±0.82	83
	Probability and Statistics	4.00±0.98	71[b]
	Pathogenic Organisms	3.87±1.06[a]	67[b]
	Basis of Computer Engineering	3.79±0.98[a]	71[b]
	Medical History	3.54±1.06[a]	58[b]
	Physiology	3.43±1.12[a]	46[b]
	Human Anatomy	3.22±1.13[a]	42[b]
	Biochemistry	3.09±0.90[a]	25[b]
	Advanced Mathematics	3.04±1.04[a]	21[b]
Interdisciplinary Knowledge	Introduction to Sociology	4.38±0.71	88
	Global Health Economics	4.38±0.82	88
	Social Psychology	4.17±0.82	83
	Medical Anthropology	4.13±0.74	79
	Social Anthropology	4.09±0.73	75
	Race, Culture and Health	4.09±0.73	75
	Organizational Behavior	4.08±0.72	79
	Behavior, Psychology and Health	4.00±0.67	79
	Introduction to Eastern and Western Philosophy	4.00±0.67	79
Methodology	Epidemiology	5.00±0.00	100
	Biostatistics	4.75±0.68	96
	Research Methods in Global Health	4.73±0.46	100
	Literature Review	4.35±0.78	88
	Common Statistical Software	4.33±0.70	96
	Principles and Application of GIS	4.24±0.77	79
Global Health Issues	Environment and Health	4.71±0.55	96
	Social Determinants of Health	4.67±0.70	96
	Introduction to Global Health	4.67±0.56	96
	Global Burden of Disease	4.65±0.57	92
	Non-Communicable Diseases	4.63±0.58	96
	Food and Nutrition Security	4.63±0.58	96
	Communicable Diseases	4.58±0.65	92
	Maternal and Child Health	4.58±0.65	92
	Case Studies in Global Health	4.48±0.59	92
	Global Health and Aging	4.43±0.73	92
	Global Mental Health	4.30±0.82	83
Intercultural Communication	Health Professional English	4.71±0.55	96
	International Law	4.30±0.82	83
	Intercultural Communication	4.26±0.86	79
	Modern International Relationship	4.13±0.74	79
	International Political Economy	4.13±0.74	79
	Major World Religions	3.54±0.78[a]	46[b]

Module	Course	Mean±SD	Agreement(%)
Intercultural Communication	The Second Language (French)	3.42±0.83[a]	58[b]
	Global History	3.33±0.96[a]	38[b]
Health Policy and Program Management	Global Health Internship	4.42±0.72	88
	Comparative Health Systems	4.42±0.72	88
	Global Health Diplomacy Practice	4.35±0.98	79
	Global Health Management	4.26±0.86	79
	Introduction to Global Health Organizations	4.26±0.75	75
	Global Health Promotion	4.24±0.77	79
	Hygienic Managerialism	4.09±0.90	71[b]

[a]Mean score < 4.0

[b]Percent agreement < 75%

Likert scale: 1=not important, 2= somewhat important, 3= moderately important, 4= important, 5 = very important

Table 3. Recommended course name changes

	Original course name	Course name after renaming
1	Global Health Economics	Health Economics
2	Maternal and Child Health	Introduction to Maternal and Child Health
3	Global Mental Health	Mental Health
4	Environment and Health	Environment and Global Health
5	International Law	International Health Law
6	Global Health Management	Global Health Governance

Table 4. Final Global Health Curriculum: course scores in Round two

Module	Course	Mean±SD	Agreement(%)
General Knowledge	Preventive Medicine	4.53±0.51	100
	Health Economics	4.47±0.62	94
	Introduction to Global Health	4.41±0.80	82
	Introduction to Sociology	4.35±0.70	88
	Introduction to Ethics	4.29±0.69	88
	Introduction to Clinical Medicine	4.12±0.93	76
	Social Psychology	4.12±0.73	82
	Culture Anthropology	4.00±0.71	76
	Introduction to Eastern and Western Philosophy	4.00±0.87	76
	Organizational Behavior	3.71±0.77[a]	65[b]
Methodology	Epidemiology	4.70±0.47	100
	Research Methods in Global Health	4.59±0.71	88
	Biostatistics	4.59±0.51	100
	Literature Review	4.06±0.75	76
	Common Statistical Software	4.06±0.66	82
Global Health Issues	Non-communicable Diseases	4.65±0.49	100
	Environment and Global Health	4.53±0.72	88
	Case Studies in Global Health	4.53±0.51	100
	Communicable Diseases	4.35±0.70	88
	Introduction to Maternal and Child Health	4.29±0.69	88
	Global Health and Aging	4.24±0.66	88
	Food and Nutrition Security	4.12±0.73	82
	Mental Health	4.00±0.71	76
Intercultural Communication	Health Professional English	4.47±0.62	94
	International Health Law	4.35±0.79	82
	Intercultural Communication	4.06±0.75	76
	International Political Economy	4.00±0.87	76
	Modern International Relationship	4.00±0.71	76
Health Policy and Program Management	Global Health Internship	4.65±0.61	94
	Global Health Governance	4.59±0.62	94
	International Health Project Management	4.47±0.62	94
	Global Health Diplomacy Practice	4.24±0.83	76

[a]Mean score < 4.0

[b]Percent agreement < 75%

Likert scale: 1=not important, 2= somewhat important, 3= moderately important, 4= important, 5 = very important

Discussion

This study established the first recommended GH bachelor curriculum in China. Through a two-round Delphi study, panel members reached consensus on 31 courses in five modules, which are to train students to gain essential knowledge and various skills to serve and practice in GH field. We believe that the curriculum will provide students with a strong background in understanding and addressing GH issues and prepare students to become health professionals with international competencies.

The module of General Knowledge comprises interdisciplinary courses covering psychological, social, economic, and philosophical dimensions. It is well accepted that interdisciplinary knowledge is critical for GH undergraduates to recognize social, political and economic factors of disease and understand the current and emerging GH issues from different perspectives.[19 26-28] Most GH bachelor programs in the U.S. encourage interdisciplinary coursework.[29] Allegheny College, Arizona State University, Georgetown University, and the University of California San Diego all offer interdisciplinary courses such as sociology, political sciences and economics which, however, are set in elective modules.[30-33] In our GH bachelor program, students are required to master interdisciplinary knowledge, which will ensure them to successfully work in GH field.

Through the web search of GH bachelor curricula abroad, we found that Kent State University provided a special course on the application of GIS in health research.[34] As the most efficient way for global spatial and geographic mapping,[35] GIS technology should be included in the Methodology module. However, considering that it may be difficult for students to understand the learning material, panel members suggested incorporating GIS technology into Research Methods in Global Health and students could choose this course as an elective one for further study. Also, we found that

many colleges and universities in the US provided research method courses in their GH bachelor curricula. For example, the University of Southern California offered "core studies", as one of the required modules, which includes Health Behavior Statistical Methods, Health Behavior Research Methods and Directed Research.[9] In the review of GH bachelor education in the UK, research methods and epidemiology were two of the most frequently offered courses, and they were emphasized in the programs at University of Oxford and Kings College.[6] As the Global Health Education Consortium has proposed the "Methods, Tools, and Skills" module in GH undergraduate education,[36] we believe that research methods are essential in the GH bachelor curriculum..

Intercultural competency training is a challenge for the success of GH education programs.[35] The most frequently mentioned core competency of GH for health care professionals is 'be able to communicate with different populations and work under various cultural environments and medical systems'.[37 38] This competency was also a main focus of our GH bachelor program and was emphasized repeatedly by potential employers of GH graduates of degrees. Sociocultural and political awareness is needed by GH professionals to work effectively across diverse geographical and cultural areas with a variety of populations and health policies.[39 40] The ability of problem-solving in practical work should also be improved among GH professionals to deal with health problems in different regions and healthcare systems.

The module of Health Policy and Program Management comprises both domestic and international internships. Prior studies have highlighted the benefits of GH internships which include: (1) opening doors to applying the course theories in settings of limited resources domestically and internationally and engaging in collaborative research throughout the world;[41] (2) helping increase knowledge,

develop skills and gain confidence and better cultural sensitivity;[42 43] (3) providing opportunities for graduate programs and jobs.[29] Practicum or internship experiences have been consistently emphasized in GH bachelor programs abroad. The five GH bachelor programs in the US (Allegheny College, Arizona State University, Duke University, New York University and University of California San Diego) require students to have practicum experiences and another three (Arizona State University, Mercer University and New York University) require students to have international experiences.[29] These experiences are part of transformational learning components for students and should be promoted and encouraged.

Our study was to identify the required GH major courses for a GH bachelor degree. All of the 31 courses listed in the curriculum are required GH major courses without elective courses, which are much more than the major courses required in the American universities for a GH bachelor degree. In spite of this, the course contents of our curriculum have much in common with those found in the Western countries. They lay the foundation for Chinese GH students to study and work abroad in the future. This curriculum was implemented in September 2013 and the first group of students successfully completed the GH bachelor program in 2017. Tested in both teaching and learning practices, the curriculum was proven to be practical. We would like to summarize the previous research work during the development of the curriculum to provide some information for future improvement of the curriculum. Currently, the faculty members of School of Health Sciences at Wuhan University are obtaining feedback from these graduates.

A limitation of this study is that all of the international panel members were from the US. In the preparation phase, due to our limited professional network and financial support to recruit Delphi participants, we were not able to seek opinions from any

academics and GH practitioners from other foreign countries. Five years later, with the development of GH education worldwide, we will continue to try to get feedback from those GH colleagues from more countries to share their experience on cultivation of GH undergraduates and discuss the proposed GH bachelor curriculum to identify areas of strength and weakness for further improvement.

Conclusion

In this study, the consensus was reached on five modules with 31 courses in the GH bachelor curriculum among international experts after two rounds of a Delphi study. This study broke new ground by developing the first GH bachelor curriculum in China. We hope that our study will provide some guidelines and references for other institutions to set up their GH programs or curricula. This may help facilitate GH education in China as well as in other middle-income countries in the near future.

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Competing interests None declared.

Ethical approval This study was approved by the ethical committee of School of Health Sciences at Wuhan University. Consent was obtained from all participants.

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Reference

1. Xiang H, Mao ZF, Qin H, et al. Preliminary exploration of the training of global health professionals in China. Mod Prev Med 2015;42(2):382-4. [in Chinese].

2. Xiao HY, Wang PG, Mao ZF, et al. Theory and practice of global health professional personnel training in China. Northwest Med Educ 2015;3:406-8. [in Chinese].

3. Ehn S, Agardh A, Holmer H, et al. Global health education in Swedish medical schools. Scand J Public Health 2015;43:687-93.

4. Frenk J, Chen L, Bhutta ZA, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. Lancet 2010;376:1923–58.

5. Fineberg HV, Hunter DJ. A global view of health--an unfolding series. N Engl J Med 2013;368(1):78-9.

6. Harmer A, Lee K, Petty N. Global health education in the United Kingdom: a review of university undergraduate and postgraduate programmes and courses. Public Health 2015;129(6):797-809.

7. Liu Y, Zhang Y, Liu Z, et al. Gaps in studies of global health education: an empirical literature review. Glob Health Action 2014;8(1):25709.

8. Queen Mary University of London. BSc in Global Health. 2018. http://www.qmul.

ac.uk/undergraduate/coursefinder/courses/114962.html (accessed 12 Mar 2018).

9. University of Southern California. USC health promotion, disease prevention and global health programs. 2018. https://hpdp.usc.edu/education.php?sub=BSGH (accessed 12 Mar 2018).

10. Wang PG. The Discussion of the Cultivation Mode and Path of Compound Talents of Global Health. Med Soc 2013;26(7):92-4. [in Chinese].

11. Zhang CX, Mao ZF. Fundamentals of the discipline of global health. Chin J Dis Control Prev 2014;18(10):1003-7. [in Chinese].

12. Hsu CC, Sandford BA. The Delphi technique: making sense of consensus, Practical Assess Res Eval 2007;12:1-8.

13. Brewer TF, Saba N, Clair V. From boutique to basic: a call for standardised medical education in global health. Med Educ 2009;43:930–3.

14. Walling A, Merando A. The fourth year of medical education: a literature review. Acad Med J Assoc Am Med Coll 2010;85(11):1698-704.

15. Johnson O, Bailey S L, Willott C, et al. Global health learning outcomes for medical students in the UK. Lancet 2012, 379(9831):2033-5.

16. Stys D, Hopman W, Carpenter J. What is the value of global health electives during medical school. Med Teach 2012;35(3):209-18.

17. Khan OA, Guerrant R, Sanders J, et al. Global health education in U.S. medical schools. BMC Med Educ 2013;13(1):1-7.

18. Peluso MJ, Forrestel AK, Hafler JP, et al. Structured global health programs in U.S. medical schools: a web-based review of certificates, tracks, and concentrations. Acad Med J Assoc Am Med Coll 2013;88(1):124-30.

19. Koplan JP, Bond TC, Merson MH, et al. Towards a common definition of global health. Lancet 2009;373(9679):1993-5.

20. Diamond IR, Grant RC, Feldman BM, et al. Defining consensus: A systematic review recommends methodologic criteria for reporting of Delphi studies. J Clin Epidemiol 2014;67(4):401-9.

21. Likert R. A technique for the measurement of attitudes. Arch Psych 1932;22(140): 1-55.

22. Delbecq AL, Van de Ven AH, Gustafson DH. Group techniques for program planning. Glenview, IL: Scott, Foresman, and Co; 1975.

23. Ludwig B. Predicting the future: Have you considered using the Delphi methodology? JOE 1997;35(5):1-4.

24. Miller LE. Determining what could/should be: The Delphi technique and its

application. Paper presented at: The annual meeting of the Mid-Western Educational Research Association.2006, October; Columbus, Ohio.

25. Downing J, Knapp C, Muckaden MA, et al. Priorities for global research into children's palliative care: results of an international delphi study. BMC Palliat Care 2015;14(1):1-10.

26. Rowson M, Willott C, Hughes R, et al. Conceptualising global health: theoretical issues and their relevance for teaching. Glob Health 2012;8(1):36.

27. Palmer VS, Mazumder R, Spencer PS. Interprofessional global health education in a cosmopolitan community of North America: the iCHEE experience. Acad Med 2014;89(8):1149.

28. Pfeifle A, Earnest M. The creation of an institutional commons: institutional and individual benefits and risks in global health interprofessional education. J Law Med Ethic 2014;42:45–9.

29. Drain PK, Mock C, Toole D, et al. The Emergence of Undergraduate Majors in Global Health: Systematic Review of Programs and Recommendations for Future Directions. Am J Trop Med Hyg 2017;96(1):16.

30. Allegheny College. Global Health Major. 2018. http://sites. allegheny.edu/global health/global-health-major/ (accessed 12 Mar 2018).

31. Arizona State University. Global Health Undergraduate Degrees. 2018. https://webapp4.asu.edu/programs/t5/roadmaps/%20ASU00/%20LASSHBA/null/ALL/%202017 (accessed 12 Mar 2018).

32. Georgetown University. Biology of Global Health Major. 2018. https://biology.georgetown.edu/undergraduate/globalhealth (accessed 12 Mar 2018).

33. University of California San Diego. Bachelor of Arts in Global Health. 2018. http://globalhealthprogram.ucsd.edu/undergraduate-program/major.html (accessed 12 Mar 2018).

34. Kent State University. BSPH in Global Health. 2018. https://www.kent.edu/publichealth/bachelor-science-public-health-bsph-global-health (accessed 12 Mar 2018).

35. Chen X. Understanding the development and perception of global health for more effective student education. Yale J Biol Med 2014;87(3):231-40.

36. Xiang H, Mao ZF, Qin H. Review of undergraduate programs on global health in American universities. Mod Prev Med 2015;42(1):190-2. [in Chinese].

37. Battelkirk B, Barry MM, Taub A, et al. A review of the international literature on health promotion competencies: identifying frameworks and core competencies. Glob Health Promot 2009;16(2):12-20.

38. Peluso MJ, Encandela J, Hafler JP, et al. Guiding principles for the development

of global health education curricula in undergraduate medical education. Med Teach 2012;34(8):653-8.

39. Jogerst K, Callender B, Adams V, et al. Identifying interprofessional global health competencies for 21st-century health professionals. Ann Glob Health 2015;81(2): 239-47.

40. Wilson L, Callender B, Hall TL, et al. Identifying global health competencies to prepare 21st century global health professionals: report from the global health competency subcommittee of the consortium of universities for global health. J Law Med Ethic 2014;42(s2):26–31.

41. Francis ER, Goodsmith N, Michelow M, et al. The global health curriculum of Weill Cornell Medical College: how one school developed a global health program. Acad Med J Assoc Am Med Coll 2012;87(9):1296.

42. Jeffrey J, Dumont RA, Kim GY, et al. Effects of international health electives on medical student learning and career choice: results of a systematic literature review. Fam Med 2011;43(1):21-8.

43. Ladding S, Zink T, Howard C, et al. International electives at the University of Minnesota global pediatric residency program: opportunities for education in all accreditation council for graduate medical education competencies. Acad Pediatr 2012;12(3):245.

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Development of a Global Health Bachelor Curriculum in China: A Delphi Study

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Abstract

Objective: This study aimed to establish the first global health bachelor curriculum in China.

Design: The Delphi methodology was used to determine expert consensus on which courses should be included in the global health bachelor curriculum. A literature review and a workshop proceeding were performed to generate courses. Then a two-round Delphi process was conducted with 28 invited experts from universities, health administrative departments, and non-governmental organizations (NGOs) to rate courses using a 5-point Likert scale. Additionally, the experts could alter, add or delete courses as appropriate. Consensus was predefined as a mean score of 4 or above and the percent agreement (proportion of panel members scoring 'very important' or 'important') no less than 75%.

Results: The responses in the two-round Delphi process were 85.7% and 70.8%, respectively. In the first round, twelve courses did not meet the inclusion criteria and

were removed. Based on the participants' comments, 32 courses were included in Round two. In the second round, the consensus was reached on 31 courses which were selected as the final curriculum. These courses were categorized into five modules, including General Knowledge, Methodology, Global Health Issues, Intercultural Communication, Health Policy and Program Management.

Conclusion: This study established the first global health bachelor curriculum in China. It will provide guidance for other educational institutions to develop similar programs or curricula in the future.

Keywords: global health; bachelor; curriculum; Delphi

Article Summary

Strengths and limitations of this study

- This is the first study to develop a global health bachelor curriculum in China.
- This study take advantage of the Delphi methodology to gather expert opinions and consensus on the curriculum.
- A pilot survey was completed by faculty members at Wuhan University to explore the readability and feasibility of the questionnaire.
- A limitation of the study is that all of the international panel members were from the U.S. with no experts from other foreign countries.

1

Introduction

With the rapid development of the global economy, more and more Chinese go abroad to study, work and travel, in the meanwhile, more and more foreigners are visiting China for the same reasons. Health issues and health inequality have quickly become the challenges not only for China but other countries.[1] Today it is clear that infectious diseases have no borders and can spread readily from one country to another.[2 3] Many global health (GH) issues and major diseases can only be effectively controlled and resolved through international collaboration.[2] A competent GH workforce with sufficient training and expertise is needed to improve and maintain local and GH.[4 5] Therefore, GH education in universities has become a new focus and has attracted widespread attention throughout the world.[6]

Over the past few years, GH education has increasingly been recognized and included in the curriculum in most western countries. From 2011 to 2014, nearly 95% of the publications related to GH education originated from North America and European countries.[7] Conversely, only 2.9% emanated from Asia.[7] The gap in the quantity of studies on GH education between high-income and middle-income countries is obvious. In addition, bachelor programs in GH are mainly concentrated in high-income countries, including the United States (US), the United Kingdom (UK), and Canada.[6 7] For example, the Blizard Institute of Queen Mary University of London offers a Bachelor of Science (BS) degree in GH to help students develop an understanding of a range of public health issues at the global level.[8] In the US, the University of Southern California provides a BS program in GH composing of courses in the basic sciences, international relations, health promotion and disease prevention.[9] Such programs, however, are rare in middle-income countries. There is

an urgent need to establish and develop GH education programs in these middle-income countries.

As China has moved from an aid-receiving country to an aid-providing country, there is an increasing demand for Chinese health professionals with knowledge and competency in GH.[10] Over the past few years, Peking University, Fudan University, and Wuhan University have established GH Departments and research centers to train GH professionals and promote China's involvement in GH activities worldwide.[11] The GH programs can not only provide Chinese health professionals to go abroad to help the developing world, but also educate international students to help their own countries to address health issues and health inequalities. In addition, these programs can help China establish a better health care system and provide evidence for future health policy making to address health issues and health inequalities domestically. Nowadays, studies focusing on curriculum development for GH education in China are very limited.

This paper examines a Delphi process for developing the first GH bachelor curriculum in China. The curriculum was developed and reviewed by international GH experts. The results of this study may be helpful to educators and students in other institutions interested in developing GH education and training programs in China and other countries.

Methods

We employed the Delphi method to develop a GH bachelor curriculum. The Delphi method is an iterative process to gather and provide information by using a series of

questionnaires to determine the degree to which experts agree about the issue discussed.[12] There were three phases in this study. Ethical approval was obtained from the ethical committee of School of Health Sciences, Wuhan University.

Phase One

Generation of the Initial Draft and Questionnaire

Three members of the writing team (LG, PG and SYL) undertook a web search to identify available curricula related to GH bachelor programs in February 2013. Curricula from four universities (Arizona State, Georgetown, Kent State and Southern California) were selected. A literature review was then conducted via Google and PubMed using the search terms 'name of school'+ 'global health', 'global health program', 'bachelor of global health or international health'. Six articles that are highly relevant to GH education were retrieved.[13-18]

In March 2013, during a workshop on GH bachelor education, we held a brainstorming exercise to generate ideas on the potential courses to be included in the GH bachelor curriculum. To guide the workshop discussion, we adopted a widely cited GH definition: "GH is an area for study, research, and practice that places a priority on improving health and achieving equality in health for all people worldwide. GH emphasizes transnational health issues, determinates 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".[19] Nine GH educators, 12 public health educators, and 10 multidisciplinary experts from Peking University, Fudan University and Wuhan

University were invited. The courses that were generated were discussed in depth and categorized into six modules, including General Knowledge, Interdisciplinary Knowledge, Methodology, Global Health Issues, Intercultural Communication, Health Policy and Program Management.

According to the collected information above, we generated an initial draft of GH bachelor curriculum comprised of 52 courses in six modules. We designed a questionnaire for experts to review and determine which courses should be included in the curriculum. Each course was described with course name, learning objectives and a short description of the course content.

Phase Two

Pilot Survey

Before the formal investigation, five faculty members at Wuhan University were invited to complete a pilot survey to explore the readability and feasibility of the questionnaire. Based on their feedback, the first version of questionnaire was developed for the Delphi study.

Recruitment of Members in the Delphi Study

The inclusion criteria of Delphi panel members were defined before recruitment. The candidates were selected from universities, health administrative departments, and non-governmental organizations (NGOs). They should have GH experience in terms of teaching, research, or working for the international health organizations. Limited by time and budget, we recruited 28 panel members according to the

recommendations for Delphi studies.[20]

Phase Three

Delphi Round One

In the first round, all 28 panel members were sent an email with the questionnaire and the informed consent form. They were invited to rate the 52 courses on a 5-point Likert scale[21] from 1 (not important) to 5 (very important). In addition, they were asked to alter, add or delete courses as appropriate. The mean, standard deviation and percent agreement (scoring 'very important' or 'important') were calculated for each course. Complete data were collected from 24 of 28 panel members and the results were used to revise the questionnaire and establish a second version.

Delphi Round Two

The survey process for Round two followed that of Round one. The 24 panel members who had participated in Round one were invited to re-rate the selected courses. They were sent the second version of questionnaire, and 17 of them responded. Based on Diamond et al.[20], Delbecq et al.[22], and Ludwig[23], this number is sufficient to conduct subsequent data analysis.

Data Analysis

All statistical analyses were performed using IBM SPSS Statistics 19.0 to generate descriptive stats. The importance for each course was determined by the mean score.

The percent agreement of each course was the proportion of panel members rating the course as 'very important' and 'important'. There have been no universally accepted criteria for consensus in a Delphi study.[12] Miller indicated that if a certain percentage of the votes fall into a predefined range, consensus can be achieved.[24] In this study, we define that a mean score is of 4.0 or above and the percent agreement is no less than 75%, the consensus is reached.[20 25]

Patients and public involvement

This study has not involved any patient. We consider the participants in the Delphi study as part of the public involvement. There was no participant involved in developing the questionnaire or designing or conducting the study. We didn't seek advice from the participants to interpret the results of the study. No plans have been conceived to disseminate the results to the study participants.

Results

Demographics of the Delphi Panel members

In Round one, 24 (85.7%) of the 28 invited experts participated. In Round two, 17 (70.8%) of the 24 responded. Delphi panel members had different academic background and expertise, and worked in the following areas: nutrition, physiology, epidemiology, environmental health, and health policy. Five panel members from American universities (Duke, Florida, Hawaii and Tennessee) had been associated with Chinese universities and were familiar with Chinese GH education. Most

participants were less than 50 years old, with more than 5 years of GH experience. There are no significant differences in the distributions of gender (Fisher's exact test p=1.000), age (Fisher's exact test p=0.433), global health experience (Fisher's exact test p=1.000) and organization (Pearson Chi-square p=0.680) between the participants of the first and second rounds. The detailed demographic characteristics of the Delphi panel are shown in Table 1.

Delphi Round One

Of the 52 courses rated by panel members, 12 courses did not meet the inclusion criteria and were removed (Table 2). One course (International Health Project Management) was added based on the recommendations of 4 panel members. Six courses were renamed (Table 3). In addition, Social Anthropology and Medical Anthropology were combined to form a course called Culture Anthropology. Principles and Application of GIS, Global Burden of Disease, and Behavior, Psychology, and Health were incorporated into Research Methods in Global Health, Epidemiology, and Mental Health, respectively. The course of Race, Culture and Health was incorporated into Health Social Determinants, which was then integrated into Introduction to Global Health. Comparative Health Systems, Introduction to Global Health Organizations, and Global Health Promotion were incorporated into Global Health Governance. Following feedback, the Interdisciplinary Knowledge module was incorporated into the module of General Knowledge. Introduction to Global Health was moved from the module of Global Health Issues to the module of General Knowledge. As a result, the revised curriculum contained five modules and 32 courses.

Delphi Round Two

In the second round, 32 courses were rated by 17 participants. The results of the second round are listed in Table 4. Organizational Behavior did not meet the inclusion criteria and was removed. Finally, consensus was reached on five modules and 31 courses.

Table 1. Demographics of the Delphi panel members

Characteristics	Round 1 (N=24)	Round 2 (N=17)
Gender, n (%)		
Male	18 (75.0)	12 (70.6)
Female	6 (25.0)	5 (29.4)
Age (years), n (%)		
< 50	18 (75.0)	15 (88.2)
⩾50	6 (25.0)	2 (11.8)
Global health experience (years), n (%)		
< 5	6 (25.0)	5 (29.4)
⩾5	18 (75.0)	12 (70.6)
Organization, n (%)		
University	14 (58.3)	11 (64.7)
Other institutions[a]	10 (41.7)	6 (35.3)

[a] Health administrative departments and NGOs.

Table 2. Course scores in Round one

Module	Course	Mean±SD	Agreement(%)
General	Preventive Medicine	4.63±1.01	92
Knowledge	Introduction to Ethics	4.29±0.62	92
	Introduction to Clinical Medicine	4.17±0.82	83
	Probability and Statistics	4.00±0.98	71[b]
	Pathogenic Organisms	3.87±1.06[a]	67[b]
	Basis of Computer Engineering	3.79±0.98[a]	71[b]
	Medical History	3.54±1.06[a]	58[b]
	Physiology	3.43±1.12[a]	46[b]
	Human Anatomy	3.22±1.13[a]	42[b]
	Biochemistry	3.09±0.90[a]	25[b]
	Advanced Mathematics	3.04±1.04[a]	21[b]
Interdisciplinary	Introduction to Sociology	4.38±0.71	88
Knowledge	Global Health Economics	4.38±0.82	88
	Social Psychology	4.17±0.82	83
	Medical Anthropology	4.13±0.74	79
	Social Anthropology	4.09±0.73	75
	Race, Culture and Health	4.09±0.73	75
	Organizational Behavior	4.08±0.72	79
	Behavior, Psychology and Health	4.00±0.67	79
	Introduction to Eastern and Western Philosophy	4.00±0.67	79
Methodology	Epidemiology	5.00±0.00	100
	Biostatistics	4.75±0.68	96
	Research Methods in Global Health	4.73±0.46	100
	Literature Review	4.35±0.78	88
	Common Statistical Software	4.33±0.70	96

	Principles and Application of GIS	4.24±0.77	79
Global Health Issues	Environment and Health	4.71±0.55	96
	Social Determinants of Health	4.67±0.70	96
	Introduction to Global Health	4.67±0.56	96
	Global Burden of Disease	4.65±0.57	92
	Non-Communicable Diseases	4.63±0.58	96
	Food and Nutrition Security	4.63±0.58	96
	Communicable Diseases	4.58±0.65	92
	Maternal and Child Health	4.58±0.65	92
	Case Studies in Global Health	4.48±0.59	92
	Global Health and Aging	4.43±0.73	92
	Global Mental Health	4.30±0.82	83
Intercultural Communication	Health Professional English	4.71±0.55	96
	International Law	4.30±0.82	83
	Intercultural Communication	4.26±0.86	79
	Modern International Relationship	4.13±0.74	79
	International Political Economy	4.13±0.74	79
	Major World Religions	3.54±0.78[a]	46[b]
Module	**Course**	**Mean±SD**	**Agreement(%)**
Intercultural Communication	The Second Language (French)	3.42±0.83[a]	58[b]
	Global History	3.33±0.96[a]	38[b]
Health Policy and Program Management	Global Health Internship	4.42±0.72	88
	Comparative Health Systems	4.42±0.72	88
	Global Health Diplomacy Practice	4.35±0.98	79
	Global Health Management	4.26±0.86	79
	Introduction to Global Health Organizations	4.26±0.75	75
	Global Health Promotion	4.24±0.77	79

Hygienic Managerialism	4.09±0.90	71[b]

[a]Mean score<4.0

[b]Percent agreement<75%

Likert scale: 1=not important, 2= somewhat important, 3= moderately important, 4= important, 5 = very important

Table 3. Recommended course name changes

	Original course name	Course name after renaming
1	Global Health Economics	Health Economics
2	Maternal and Child Health	Introduction to Maternal and Child Health
3	Global Mental Health	Mental Health
4	Environment and Health	Environment and Global Health
5	International Law	International Health Law
6	Global Health Management	Global Health Governance

Table 4. Final Global Health Curriculum: course scores in Round two

Module	Course	Mean±SD	Agreement(%)
General	Preventive Medicine	4.53±0.51	100
Knowledge	Health Economics	4.47±0.62	94
	Introduction to Global Health	4.41±0.80	82
	Introduction to Sociology	4.35±0.70	88
	Introduction to Ethics	4.29±0.69	88
	Introduction to Clinical Medicine	4.12±0.93	76
	Social Psychology	4.12±0.73	82
	Culture Anthropology	4.00±0.71	76
	Introduction to Eastern and Western Philosophy	4.00±0.87	76
	Organizational Behavior	3.71±0.77[a]	65[b]
Methodology	Epidemiology	4.70±0.47	100
	Research Methods in Global Health	4.59±0.71	88
	Biostatistics	4.59±0.51	100
	Literature Review	4.06±0.75	76
	Common Statistical Software	4.06±0.66	82
Global Health	Non-communicable Diseases	4.65±0.49	100
Issues	Environment and Global Health	4.53±0.72	88
	Case Studies in Global Health	4.53±0.51	100
	Communicable Diseases	4.35±0.70	88
	Introduction to Maternal and Child Health	4.29±0.69	88
	Global Health and Aging	4.24±0.66	88
	Food and Nutrition Security	4.12±0.73	82
	Mental Health	4.00±0.71	76
Intercultural	Health Professional English	4.47±0.62	94
Communication	International Health Law	4.35±0.79	82

	Intercultural Communication	4.06±0.75	76
	International Political Economy	4.00±0.87	76
	Modern International Relationship	4.00±0.71	76
Health Policy and Program Management	Global Health Internship	4.65±0.61	94
	Global Health Governance	4.59±0.62	94
	International Health Project Management	4.47±0.62	94
	Global Health Diplomacy Practice	4.24±0.83	76

[a]Mean score<4.0

[b]Percent agreement<75%

Likert scale: 1=not important, 2= somewhat important, 3= moderately important, 4= important, 5 = very important

Discussion

This study established the first recommended GH bachelor curriculum in China. Through a two-round Delphi study, panel members reached consensus on 31 courses in five modules, which are to train students to gain essential knowledge and various skills to serve and practice in GH field. We believe that the curriculum will provide students with a strong background in understanding and addressing GH issues and prepare students to become health professionals with international competencies.

The module of General Knowledge comprises interdisciplinary courses covering

psychological, social, economic, and philosophical dimensions. It is well accepted that interdisciplinary knowledge is critical for GH undergraduates to recognize social, political and economic factors of disease and understand the current and emerging GH issues from different perspectives.[19 26-28] Most GH bachelor programs in the U.S. encourage interdisciplinary coursework.[29] Allegheny College, Arizona State University, Georgetown University, and the University of California San Diego all offer interdisciplinary courses such as sociology, political sciences and economics which, however, are set in elective modules.[30-33] In our GH bachelor program, students are required to master interdisciplinary knowledge, which will ensure them to successfully work in GH field.

Through the web search of GH bachelor curricula abroad, we found that Kent State University provided a special course on the application of GIS in health research.[34] As the most efficient way for global spatial and geographic mapping,[35] GIS technology should be included in the Methodology module. However, considering that it may be difficult for students to understand the learning material, panel members suggested incorporating GIS technology into Research Methods in Global Health and students could choose this course as an elective one for further study. Also, we found that many colleges and universities in the US provided research method courses in their GH bachelor curricula. For example, the University of Southern California offered "core studies", as one of the required modules, which includes Health Behavior Statistical Methods, Health Behavior Research Methods and Directed Research.[9] In the review of GH bachelor education in the UK, research methods and epidemiology were two of the most frequently offered courses, and they were emphasized in the programs at University of Oxford and Kings College.[6] As the Global Health

Education Consortium has proposed the "Methods, Tools, and Skills" module in GH undergraduate education,[36] we believe that research methods are essential in the GH bachelor curriculum..

Intercultural competency training is a challenge for the success of GH education programs.[35] The most frequently mentioned core competency of GH for health care professionals is 'be able to communicate with different populations and work under various cultural environments and medical systems'.[37 38] This competency was also a main focus of our GH bachelor program and was emphasized repeatedly by potential employers of GH graduates of degrees. Sociocultural and political awareness is needed by GH professionals to work effectively across diverse geographical and cultural areas with a variety of populations and health policies.[39 40] The ability of problem-solving in practical work should also be improved among GH professionals to deal with health problems in different regions and healthcare systems.

The module of Health Policy and Program Management comprises both domestic and international internships. Prior studies have highlighted the benefits of GH internships which include: (1) opening doors to applying the course theories in settings of limited resources domestically and internationally and engaging in collaborative research throughout the world;[41] (2) helping increase knowledge, develop skills and gain confidence and better cultural sensitivity;[42 43] (3) providing opportunities for graduate programs and jobs.[29] Practicum or internship experiences have been consistently emphasized in GH bachelor programs abroad. The five GH bachelor programs in the US (Allegheny College, Arizona State University, Duke University, New York University and University of California San Diego) require students to have practicum experiences and another three (Arizona State University,

Mercer University and New York University) require students to have international experiences.[29] These experiences are part of transformational learning components for students and should be promoted and encouraged.

Our study was to identify the required GH major courses for a GH bachelor degree. All of the 31 courses listed in the curriculum are required GH major courses without elective courses, which are much more than the major courses required in the American universities for a GH bachelor degree. In spite of this, the course contents of our curriculum have much in common with those found in the Western countries. They lay the foundation for Chinese GH students to study and work abroad in the future. This curriculum was implemented in September 2013 and the first group of students successfully completed the GH bachelor program in 2017. Tested in both teaching and learning practices, the curriculum was proven to be practical. We would like to summarize the previous research work during the development of the curriculum to provide some information for future improvement of the curriculum. Currently, the faculty members of School of Health Sciences at Wuhan University are obtaining feedback from these graduates.

A limitation of this study is that all of the international panel members were from the US. In the preparation phase, due to our limited professional network and financial support to recruit Delphi participants, we were not able to seek opinions from academics and GH practitioners from other foreign countries. As we and others know, it's important to seek advice from GH educators, researchers, and practitioners working in low-income countries. They know much better than those in high-income countries about the knowledge and skills needed to function in the field and to offer solutions to solve GH issues in low-income countries, which are useful trainings for

GH workforce. Five years later, with the development of GH education worldwide, we will continue to try to get feedback from those GH colleagues from low-income countries to share their experience on cultivation of GH undergraduates and discuss the proposed GH bachelor curriculum to identify areas of strength and weakness for further improvement.

Conclusion

In this study, the consensus was reached on five modules with 31 courses in the GH bachelor curriculum among international experts after two rounds of a Delphi study. This study broke new ground by developing the first GH bachelor curriculum in China. We hope that our study will provide some guidelines and references for other institutions to set up their GH programs or curricula. This may help facilitate GH education in China as well as in other middle-income countries in the near future.

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Reference

1. Xiang H, Mao ZF, Qin H, et al. Preliminary exploration of the training of global health professionals in China. Mod Prev Med 2015;42(2):382-4. [in Chinese].

2. Xiao HY, Wang PG, Mao ZF, et al. Theory and practice of global health professional personnel training in China. Northwest Med Educ 2015;3:406-8. [in Chinese].

3. Ehn S, Agardh A, Holmer H, et al. Global health education in Swedish medical schools. Scand J Public Health 2015;43:687-93.

4. Frenk J, Chen L, Bhutta ZA, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. Lancet 2010;376:1923–58.

5. Fineberg HV, Hunter DJ. A global view of health--an unfolding series. N Engl J Med 2013;368(1):78-9.

6. Harmer A, Lee K, Petty N. Global health education in the United Kingdom: a review of university undergraduate and postgraduate programmes and courses.

Public Health 2015;129(6):797-809.

7. Liu Y, Zhang Y, Liu Z, et al. Gaps in studies of global health education: an empirical literature review. Glob Health Action 2014;8(1):25709.

8. Queen Mary University of London. BSc in Global Health. 2018. http://www.qmul. ac.uk/undergraduate/coursefinder/courses/114962.html (accessed 12 Mar 2018).

9. University of Southern California. USC health promotion, disease prevention and global health programs. 2018. https://hpdp.usc.edu/education.php?sub=BSGH (accessed 12 Mar 2018).

10. Wang PG. The Discussion of the Cultivation Mode and Path of Compound Talents of Global Health. Med Soc 2013;26(7):92-4. [in Chinese].

11. Zhang CX, Mao ZF. Fundamentals of the discipline of global health. Chin J Dis Control Prev 2014;18(10):1003-7. [in Chinese].

12. Hsu CC, Sandford BA. The Delphi technique: making sense of consensus, Practical Assess Res Eval 2007;12:1-8.

13. Brewer TF, Saba N, Clair V. From boutique to basic: a call for standardised medical education in global health. Med Educ 2009;43:930–3.

14. Walling A, Merando A. The fourth year of medical education: a literature review. Acad Med J Assoc Am Med Coll 2010;85(11):1698-704.

15. Johnson O, Bailey S L, Willott C, et al. Global health learning outcomes for medical students in the UK. Lancet 2012, 379(9831):2033-5.

16. Stys D, Hopman W, Carpenter J. What is the value of global health electives during medical school. Med Teach 2012;35(3):209-18.

17. Khan OA, Guerrant R, Sanders J, et al. Global health education in U.S. medical schools. BMC Med Educ 2013;13(1):1-7.

18. Peluso MJ, Forrestel AK, Hafler JP, et al. Structured global health programs in U.S. medical schools: a web-based review of certificates, tracks, and concentrations. Acad Med J Assoc Am Med Coll 2013;88(1):124-30.

19. Koplan JP, Bond TC, Merson MH, et al. Towards a common definition of global health. Lancet 2009;373(9679):1993-5.

20. Diamond IR, Grant RC, Feldman BM, et al. Defining consensus: A systematic review recommends methodologic criteria for reporting of Delphi studies. J Clin Epidemiol 2014;67(4):401-9.

21. Likert R. A technique for the measurement of attitudes. Arch Psych 1932;22(140): 1-55.

22. Delbecq AL, Van de Ven AH, Gustafson DH. Group techniques for program planning. Glenview, IL: Scott, Foresman, and Co; 1975.

23. Ludwig B. Predicting the future: Have you considered using the Delphi methodology? JOE 1997;35(5):1-4.

24. Miller LE. Determining what could/should be: The Delphi technique and its application. Paper presented at: The annual meeting of the Mid-Western Educational Research Association.2006, October; Columbus, Ohio.

25. Downing J, Knapp C, Muckaden MA, et al. Priorities for global research into children's palliative care: results of an international delphi study. BMC Palliat Care 2015;14(1):1-10.

26. Rowson M, Willott C, Hughes R, et al. Conceptualising global health: theoretical issues and their relevance for teaching. Glob Health 2012;8(1):36.

27. Palmer VS, Mazumder R, Spencer PS. Interprofessional global health education in a cosmopolitan community of North America: the iCHEE experience. Acad Med 2014;89(8):1149.

28. Pfeifle A, Earnest M. The creation of an institutional commons: institutional and individual benefits and risks in global health interprofessional education. J Law Med Ethic 2014;42:45–9.

29. Drain PK, Mock C, Toole D, et al. The Emergence of Undergraduate Majors in Global Health: Systematic Review of Programs and Recommendations for Future Directions. Am J Trop Med Hyg 2017;96(1):16.

30. Allegheny College. Global Health Major. 2018. http://sites. allegheny.edu/global health/global-health-major/ (accessed 12 Mar 2018).

31. Arizona State University. Global Health Undergraduate Degrees. 2018. https://webapp4.asu.edu/programs/t5/roadmaps/%20ASU00/%20LASSHBA/null/ALL/%202017 (accessed 12 Mar 2018).

32. Georgetown University. Biology of Global Health Major. 2018. https://biology.georgetown.edu/undergraduate/globalhealth (accessed 12 Mar 2018).

33. University of California San Diego. Bachelor of Arts in Global Health. 2018. http://globalhealthprogram.ucsd.edu/undergraduate-program/major.html (accessed 12 Mar 2018).

34. Kent State University. BSPH in Global Health. 2018. https://www.kent.edu/publichealth/bachelor-science-public-health-bsph-global-health (accessed 12 Mar 2018).

35. Chen X. Understanding the development and perception of global health for more effective student education. Yale J Biol Med 2014;87(3):231-40.

36. Xiang H, Mao ZF, Qin H. Review of undergraduate programs on global health in American universities. Mod Prev Med 2015;42(1):190-2. [in Chinese].

37. Battelkirk B, Barry MM, Taub A, et al. A review of the international literature on health promotion competencies: identifying frameworks and core competencies. Glob Health Promot 2009;16(2):12-20.

38. Peluso MJ, Encandela J, Hafler JP, et al. Guiding principles for the development of global health education curricula in undergraduate medical education. Med Teach 2012;34(8):653-8.

39. Jogerst K, Callender B, Adams V, et al. Identifying interprofessional global health competencies for 21st-century health professionals. Ann Glob Health 2015;81(2): 239-47.

40. Wilson L, Callender B, Hall TL, et al. Identifying global health competencies to prepare 21st century global health professionals: report from the global health competency subcommittee of the consortium of universities for global health. J Law Med Ethic 2014;42(s2):26–31.

41. Francis ER, Goodsmith N, Michelow M, et al. The global health curriculum of Weill Cornell Medical College: how one school developed a global health program. Acad Med J Assoc Am Med Coll 2012;87(9):1296.

42. Jeffrey J, Dumont RA, Kim GY, et al. Effects of international health electives on medical student learning and career choice: results of a systematic literature review. Fam Med 2011;43(1):21-8.

43. Ladding S, Zink T, Howard C, et al. International electives at the University of Minnesota global pediatric residency program: opportunities for education in all accreditation council for graduate medical education competencies. Acad Pediatr 2012;12(3):245.