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# BMJ Open

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

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4 **1 Establishment of a Global Health Curriculum for Undergraduates in**  
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6 **2 China: A Delphi Study**  
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3 **Abstract**

4 **Objective:** This study aimed to establish the first global health curriculum for  
5 undergraduates in China.  
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8 **Design:** The Delphi methodology was used to determine expert consensus on which  
9 courses should be included in the global health undergraduate curriculum. A literature  
10 review and a workshop proceeding were performed to generate courses. Then a  
11 two-round Delphi process was conducted with 28 invited experts from universities,  
12 health administrative departments, and non-governmental organizations (NGOs) to  
13 rate courses using a 5-point Likert scale. Additionally, the experts could alter, add or  
14 delete courses if necessary. Consensus was predefined as a mean score at or above 4  
15 and the percent agreement (proportion of panel members scoring 'very important' or  
16 'important') no less than 75%.  
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19 **Results:** The response rates in the two-round Delphi process were 85.7% and 70.8%,  
20 respectively. In the first round, twelve courses did not reach the inclusion criteria and  
21 were deleted. Based on the comments made by the participants, 32 courses were  
22 screened out to be included in round two. In the second round, the consensus was  
23 reached on 31 courses which were selected as the final curriculum. These courses  
24 were categorized into five modules, including General Knowledge, Methodology,  
25 Global Health Issues, Intercultural Communication, Health Policy and Program  
26 Management.  
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29 **Conclusion:** This study established the first global health curriculum for  
30 undergraduates in China. It will provide guidance for other educational institutions to  
31 develop similar programs or curricula in the future.  
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34 **Keywords:** global health; undergraduates; curriculum; Delphi  
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3 **1 Article Summary**

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5 **2 Strengths and limitations of this study**

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7 **3** ♦ This is the first study to develop a global health curriculum for undergraduates in  
8  
9 **4** China.

10  
11 **5** ♦ This study take advantage of the Delphi methodology to gather expert opinions  
12  
13 **6** and consensus on the curriculum.

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15 **7** ♦ A pilot survey was completed by faculty members at Wuhan University to explore  
16  
17 **8** the readability and feasibility of the questionnaire.

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19 **9** ♦ A limitation of the study is that all of the foreign panel members were from the  
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21 **10** U.S. with no experts from other countries besides China.  
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## 1 Introduction

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

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

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

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3 1 there is an increasing demand for Chinese health professionals with knowledge and  
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5 2 competency in GH.<sup>10</sup> Over the past few years, Peking University, Fudan University,  
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7 3 and Wuhan University have established GH Departments and research centers to train  
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9 4 GH professionals.<sup>11</sup> However, systematic studies focusing on curriculum development  
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11 5 for GH education are very limited at present.

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13 6 This paper examines a Delphi process for developing the first GH undergraduate  
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15 7 curriculum in China. The curriculum was developed and reviewed by international  
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17 8 GH experts. The results of this study may be helpful to educators and students in other  
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19 9 institutions interested in developing GH education and training programs.  
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## 23 11 **Methods**

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26 12 We employed the Delphi method to develop a GH curriculum for undergraduates.  
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28 13 The Delphi method is an iterative process to gather and provide information by using  
29  
30 14 a series of questionnaires to determine the degree to which experts agree about the  
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32 15 issue discussed.<sup>12</sup> There are three phases in this study. Ethical approval was obtained  
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34 16 from the ethical committee of School of Health Sciences, Wuhan University.  
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### 40 18 ***Phase One***

#### 41 19 *Generation of the Initial Draft and Questionnaire*

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44 20 Three members of the writing team (LG, PG and SYL) performed a web search to  
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46 21 identify available curricula related to GH undergraduate programs in February 2013.  
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48 22 Curricula from four universities (Arizona State University, Georgetown University,  
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50 23 Kent State University and University of Southern California) were selected. Then a  
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52 24 literature review was conducted via Google and PubMed using the search terms  
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54 25 ‘name of school’+ ‘global health’, ‘global health program’, ‘bachelor of global health  
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3 or international health'. Six articles that are highly relevant to GH education were  
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5 retrieved.<sup>13-18</sup>

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7 In March 2013, during a workshop on GH undergraduate education, we held a  
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9 brainstorming exercise to generate ideas on the potential courses to be included in the  
10  
11 GH undergraduate curriculum. To guide the workshop discussion, we adopted a  
12  
13 widely cited GH definition: "GH is an area for study, research, and practice that  
14  
15 places a priority on improving health and achieving equality in health for all people  
16  
17 worldwide. GH emphasizes transnational health issues, determinates and solutions;  
18  
19 involves many disciplines within and beyond the health sciences and promotes  
20  
21 interdisciplinary collaboration; and is a synthesis of population-based prevention with  
22  
23 individual-level clinical care".<sup>19</sup> Nine GH educators, twelve public health educators,  
24  
25 and ten multidisciplinary experts from Peking University, Fudan University and  
26  
27 Wuhan University were invited to attend. The courses that were generated were  
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29 discussed in depth and categorized into six modules, including General Knowledge,  
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31 Interdisciplinary Knowledge, Methodology, Global Health Issues, Intercultural  
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33 Communication, Health Policy and Program Management.  
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37 According to the collected information above, we generated an initial draft of GH  
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39 undergraduate curriculum composed of 52 courses in 6 modules. Then we designed a  
40  
41 questionnaire for experts to review and determine which courses should be included  
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43 in the curriculum. Each course was described with course name, learning objectives  
44  
45 and a short description of course content.  
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## 50 ***Phase Two***

### 51 ***Pilot Survey***

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54 Before the formal investigation, 5 faculty members at Wuhan University were  
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1 invited to complete a pilot survey to explore the readability and feasibility of the  
2 questionnaire. Based on their feedback, the first version of questionnaire was  
3 developed for the Delphi study.

#### 4 *Recruitment of Members in the Delphi Study*

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

### 12 *Phase Three*

#### 13 *Delphi Round One*

14 In the first round, all 28 panel members received the questionnaire with an  
15 informed consent form by email. They were invited to rate the 52 courses with a  
16 5-point Likert scale<sup>21</sup> from 1 (not important) to 5 (very important). In addition, they  
17 were asked to alter, add or delete courses if necessary. The mean, standard deviation  
18 of scores and percent agreement (scoring 'very important' or 'important') were  
19 calculated for each course. Complete data was collected from 24 panel members and  
20 the results were used to revise the questionnaire and establish a second version.

#### 21 *Delphi Round Two*

22 The survey process of the second round was identical to the first one. The panel  
23 members in round two were invited to re-rate the selected courses. We sent the second  
24 version of questionnaire to 24 panel members who had participated in round one, and  
25 17 of them responded. Based on the articles published by Diamond et al.<sup>20</sup>, Delbecq et

1 al.<sup>22</sup>, and Ludwig<sup>23</sup>, this number is sufficient to conduct the subsequent data analysis.

### 2 3 ***Data Analysis***

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

## 13 14 **Results**

### 15 ***Demographics of the Members in the Delphi Panel***

16 We selected 28 experts to participate in the Delphi process. In round one, 24  
17 (85.7%) experts participated in the survey. In round two, 17(70.8%) of the 24 experts  
18 responded. The experts in the Delphi panel have different academic background and  
19 expertise, including nutrition, physiology, epidemiology, environmental health, and  
20 health policy. There are five members from overseas universities (Duke University,  
21 University of Florida, University of Hawaii, and University of Tennessee) who have  
22 been actively participating in academic activities in China and known Chinese GH  
23 education very well. Most participants were less than 50 years old, with more than 5  
24 years of GH experience. The detailed demographic characteristics of the Delphi panel  
25 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.

1 **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 <sup>a</sup>	10 (41.7)	6 (35.3)

2 <sup>a</sup>Other institutions are health administrative departments and NGOs.

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

Module	Name of 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 Mathematical Statistics	4.00±0.98	71 <sup>b</sup>	
	Pathogenic Organisms	3.87±1.06 <sup>a</sup>	67 <sup>b</sup>	
	Basis of Computer Engineering	3.79±0.98 <sup>a</sup>	71 <sup>b</sup>	
	Medical History	3.54±1.06 <sup>a</sup>	58 <sup>b</sup>	
	Physiology	3.43±1.12 <sup>a</sup>	46 <sup>b</sup>	
	Human Anatomy	3.22±1.13 <sup>a</sup>	42 <sup>b</sup>	
	Biochemistry	3.09±0.90 <sup>a</sup>	25 <sup>b</sup>	
	Advanced Mathematics	3.04±1.04 <sup>a</sup>	21 <sup>b</sup>	
	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	
	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 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 <sup>a</sup>	46 <sup>b</sup>	

Module	Name of course	Mean±SD	Agreement(%)
Intercultural Communication	The Second Language (French)	3.42±0.83 <sup>a</sup>	58 <sup>b</sup>
	Global History	3.33±0.96 <sup>a</sup>	38 <sup>b</sup>
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 <sup>b</sup>

1 <sup>a</sup>Mean score < 4.0

2 <sup>b</sup>Percent agreement < 75%

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

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1 **Table 3.** Renaming of courses

	<b>Original course name</b>	<b>Course name after renaming</b>
6	1 Global Health Economics	Health Economics
7	2 Maternal and Child Health	Introduction to Maternal and Child Health
8	3 Global Mental Health	Mental Health
10	4 Environment and Health	Environment and Global Health
11	5 International Law	International Health Law
12	6 Global Health Management	Global Health Governance

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

Module	Name of 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 <sup>a</sup>	65 <sup>b</sup>
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

2 <sup>a</sup>Mean score < 4.03 <sup>b</sup>Percent agreement < 75%

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

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## 1 Discussion

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

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

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

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3 1 California offered "core studies", as one of the required modules, which includes  
4  
5 2 Health Behavior Statistical Methods, Health Behavior Research Methods and  
6  
7 3 Directed Research.<sup>9</sup> In the review of GH undergraduate education in the U.K.,  
8  
9 4 research methods and epidemiology were two of the most frequently offered courses,  
10  
11 5 and they were emphasized in the programs at University of Oxford and Kings  
12  
13 6 College.<sup>6</sup> As the Global Health Education Consortium has proposed the "Methods,  
14  
15 7 Tools, and Skills" module in GH undergraduate education,<sup>36</sup> we believe that research  
16  
17 8 methods are absolutely necessary in GH undergraduate curriculum..

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20 9 The training of intercultural competency is a challenge for the success of GH  
21  
22 10 education programs.<sup>35</sup> The most frequently mentioned core competency of GH in  
23  
24 11 medical schools is 'be able to communicate with different populations and work under  
25  
26 12 various cultural environments and medical systems'.<sup>37 38</sup> This was a main focus of our  
27  
28 13 GH undergraduate degree program and was emphasized repeatedly by potential  
29  
30 14 employers of GH graduates. Sociocultural and political awareness is needed by GH  
31  
32 15 professionals to work effectively across diverse geographical and cultural areas with a  
33  
34 16 variety of populations and health policies.<sup>39 40</sup> The ability of problem-solving in  
35  
36 17 practical work should also be improved among GH professionals to deal with health  
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38 18 problems in different regions and healthcare systems.

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41 19 The module of Health Policy and Program Management contains both of domestic  
42  
43 20 and overseas internships in GH fields. Prior studies have highlighted the benefits of  
44  
45 21 GH internships: (1) opening doors to applying the course theory within domestic and  
46  
47 22 international resource-limited settings and engaging in collaborative research  
48  
49 23 throughout the world;<sup>41</sup> (2) helping increase knowledge, skills and confidence, and  
50  
51 24 better cultural sensitivity;<sup>42 43</sup> (3) providing opportunities for graduate programs and  
52  
53 25 jobs.<sup>29</sup> Practicum or internship experiences have been consistently underscored in GH  
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3 1 undergraduate programs abroad. The five GH undergraduate programs (Allegheny  
4  
5 2 College, Arizona State University, Duke University, New York University and  
6  
7 3 University of California San Diego) require students to have practicum experiences  
8  
9 4 and another three (Arizona State University, Mercer University and New York  
10  
11 5 University) require students to have international experiences.<sup>29</sup> These experiences are  
12  
13 6 part of transformational learning components for GH undergraduates and should be  
14  
15 7 promoted and encouraged in GH undergraduate programs.

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18 8 The GH undergraduate curriculum in our study has much in common with those  
19  
20 9 developed in the Western countries. It lays the foundation for Chinese GH students to  
21  
22 10 study and work abroad in the future. So far it has been put in place and the first group  
23  
24 11 of students has successfully completed this program in 2017. The curriculum has been  
25  
26 12 tested in both teaching and learning practices. Currently, the faculty members of  
27  
28 13 School of Health Science at Wuhan University are obtaining feedback from these  
29  
30 14 graduates, assessing the outcomes for further improvement.

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32  
33 15 A limitation of this study is that all of the foreign panel members were from the U.S.  
34  
35 16 with no experts from other countries besides China. In order to address this limitation,  
36  
37 17 our study started with a systematic review of GH education based on previous  
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39 18 research and international literature. With the development of GH education in both  
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41 19 developed and developing countries, further work is needed to invite experienced GH  
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43 20 educators from more countries to share their experience on cultivation of GH  
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45 21 undergraduates and discuss this proposed GH undergraduate curriculum to identify  
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47 22 areas of strength and weakness for our future research.  
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## 53 24 **Conclusion**

54  
55 25 In this study, the consensus was reached on 5 modules with 31 courses in the GH  
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3 1 undergraduate curriculum among international experts after two rounds of Delphi  
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5 2 processes. This study broke new ground by establishing the first GH undergraduate  
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7 3 curriculum in China. We hope that our study will provide some guidelines and  
8  
9 4 references for other institutions to set up their GH programs or curricula. This may  
10  
11 5 help facilitate GH education in China as well as in other developing countries in the  
12  
13 6 near future.

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30  
31 14 drafted this manuscript with the help of SYL, YSL, XYL, FFL, ZFM, YAL and HX.  
32  
33 15 All authors contributed to writing, revising and editing the manuscript. All authors  
34  
35 16 read and approved the final version of the manuscript.

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42 19  
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44 20 **Competing interests** None declared.

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48 22 **Ethical approval** This study was approved by the ethical committee of School of  
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50 23 Health Sciences at Wuhan University. Consent was obtained from all participants.

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# BMJ Open

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

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SCHOLARONE™  
Manuscripts

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4 **1 Development of a Global Health Bachelor Curriculum in China: A**  
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6 **2 Delphi Study**  
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11 4 Li Guan<sup>1,2\*</sup>, Pan Gao<sup>1,2\*</sup>, SuYang Liu<sup>1,2</sup>, YiSi Liu<sup>1,2</sup>, XiangYu Li<sup>1,2</sup>, FeiFei Liu<sup>1,2</sup>, ZongFu Mao<sup>1,2</sup>,  
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3 **Abstract**

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

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9 **Design:** The Delphi methodology was used to determine expert consensus on which  
10  
11 courses should be included in the global health bachelor curriculum. A literature  
12  
13 review and a workshop proceeding were performed to generate courses. Then a  
14  
15 two-round Delphi process was conducted with 28 invited experts from universities,  
16  
17 health administrative departments, and non-governmental organizations (NGOs) to  
18  
19 rate courses using a 5-point Likert scale. Additionally, the experts could alter, add or  
20  
21 delete courses as appropriate. Consensus was predefined as a mean score of 4 or  
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23 above and the percent agreement (proportion of panel members scoring ‘very  
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25 important’ or ‘important’) no less than 75%.  
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29 **Results:** The responses in the two-round Delphi process were 85.7% and 70.8%,  
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31 respectively. In the first round, twelve courses did not meet the inclusion criteria and  
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33 were removed. Based on the participants’ comments, 32 courses were included in  
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35 Round two. In the second round, the consensus was reached on 31 courses which  
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37 were selected as the final curriculum. These courses were categorized into five  
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39 modules, including General Knowledge, Methodology, Global Health Issues,  
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41 Intercultural Communication, Health Policy and Program Management.  
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44 **Conclusion:** This study established the first global health bachelor curriculum in  
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46 China. It will provide guidance for other educational institutions to develop similar  
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48 programs or curricula in the future.  
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50 **Keywords:** global health; bachelor; curriculum; Delphi  
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3 **1 Article Summary**

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5 **2 Strengths and limitations of this study**

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7 **3** ♦ This is the first study to develop a global health bachelor curriculum in China.  
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9 **4** ♦ This study take advantage of the Delphi methodology to gather expert opinions  
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11 and consensus on the curriculum.  
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13 **6** ♦ A pilot survey was completed by faculty members at Wuhan University to explore  
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15 the readability and feasibility of the questionnaire.  
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17 **8** ♦ A limitation of the study is that all of the international panel members were from  
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19 the U.S. with no experts from other foreign countries.  
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## 1 Introduction

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

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



1 middle-income countries.

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

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

## 19 **Methods**

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

1

## 2 ***Phase One***

### 3 *Generation of the Initial Draft and Questionnaire*

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

11 In March 2013, during a workshop on GH bachelor education, we held a  
12 brainstorming exercise to generate ideas on the potential courses to be included in the  
13 GH bachelor curriculum. To guide the workshop discussion, we adopted a widely  
14 cited GH definition: “GH is an area for study, research, and practice that places a  
15 priority on improving health and achieving equality in health for all people worldwide.  
16 GH emphasizes transnational health issues, determinates and solutions; involves many  
17 disciplines within and beyond the health sciences and promotes interdisciplinary  
18 collaboration; and is a synthesis of population-based prevention with individual-level  
19 clinical care”.<sup>19</sup> Nine GH educators, 12 public health educators, and 10  
20 multidisciplinary experts from Peking University, Fudan University and Wuhan  
21 University were invited. The courses that were generated were discussed in depth and  
22 categorized into six modules, including General Knowledge, Interdisciplinary  
23 Knowledge, Methodology, Global Health Issues, Intercultural Communication, Health  
24 Policy and Program Management.

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

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

## 5 6 ***Phase Two***

### 7 *Pilot Survey*

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

### 12 *Recruitment of Members in the Delphi Study*

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

## 19 20 ***Phase Three***

### 21 *Delphi Round One*

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

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

#### 4 *Delphi Round Two*

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

#### 11 *Data Analysis*

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

#### 21 *Participants and public involvement*

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

## 1 Results

### 2 *Demographics of the Delphi Panel members*

3 In Round one, 24 (85.7%) of the 28 invited experts participated. In Round two, 17  
4 (70.8%) of the 24 responded. Delphi panel members had different academic  
5 background and expertise, and worked in the following areas: nutrition, physiology,  
6 epidemiology, environmental health, and health policy. Five panel members from  
7 American universities (Duke, Florida, Hawaii and Tennessee) had been associated  
8 with Chinese universities and were familiar with Chinese GH education. Most  
9 participants were less than 50 years old, with more than 5 years of GH experience.  
10 There are no significant differences in the distributions of gender (Fisher's exact test  
11  $p=1.000$ ), age (Fisher's exact test  $p=0.433$ ), global health experience (Fisher's exact  
12 test  $p=1.000$ ) and organization (Pearson Chi-square  $p=0.680$ ) between the participants  
13 of the first and second rounds. The detailed demographic characteristics of the Delphi  
14 panel are shown in Table 1.

### 15 *Delphi Round One*

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

1 Global Health Organizations, and Global Health Promotion were incorporated into  
 2 Global Health Governance. Following feedback, the Interdisciplinary Knowledge  
 3 module was incorporated into the module of General Knowledge. Introduction to  
 4 Global Health was moved from the module of Global Health Issues to the module of  
 5 General Knowledge. As a result, the revised curriculum contained five modules and  
 6 32 courses.

### 7 ***Delphi Round Two***

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

12  
 13 **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 <sup>a</sup>	10 (41.7)	6 (35.3)

14 <sup>a</sup> Health administrative departments and NGOs.

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**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 <sup>b</sup>	
	Pathogenic Organisms	3.87±1.06 <sup>a</sup>	67 <sup>b</sup>	
	Basis of Computer Engineering	3.79±0.98 <sup>a</sup>	71 <sup>b</sup>	
	Medical History	3.54±1.06 <sup>a</sup>	58 <sup>b</sup>	
	Physiology	3.43±1.12 <sup>a</sup>	46 <sup>b</sup>	
	Human Anatomy	3.22±1.13 <sup>a</sup>	42 <sup>b</sup>	
	Biochemistry	3.09±0.90 <sup>a</sup>	25 <sup>b</sup>	
	Advanced Mathematics	3.04±1.04 <sup>a</sup>	21 <sup>b</sup>	
	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 <sup>a</sup>	46 <sup>b</sup>	

Module	Course	Mean±SD	Agreement(%)
Intercultural Communication	The Second Language (French)	3.42±0.83 <sup>a</sup>	58 <sup>b</sup>
	Global History	3.33±0.96 <sup>a</sup>	38 <sup>b</sup>
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 <sup>b</sup>

1 <sup>a</sup>Mean score < 4.0

2 <sup>b</sup>Percent agreement < 75%

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

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1 **Table 3. Recommended course name changes**

	<b>Original course name</b>	<b>Course name after renaming</b>
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

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1 **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 <sup>a</sup>	65 <sup>b</sup>
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

2 <sup>a</sup>Mean score < 4.03 <sup>b</sup>Percent agreement < 75%

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

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## 1 Discussion

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

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

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

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3 1 many colleges and universities in the US provided research method courses in their  
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5 2 GH bachelor curricula. For example, the University of Southern California offered  
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7 3 "core studies", as one of the required modules, which includes Health Behavior  
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9 4 Statistical Methods, Health Behavior Research Methods and Directed Research.<sup>9</sup> In  
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11 5 the review of GH bachelor education in the UK, research methods and epidemiology  
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13 6 were two of the most frequently offered courses, and they were emphasized in the  
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15 7 programs at University of Oxford and Kings College.<sup>6</sup> As the Global Health  
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17 8 Education Consortium has proposed the "Methods, Tools, and Skills" module in GH  
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19 9 undergraduate education,<sup>36</sup> we believe that research methods are essential in the GH  
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21 10 bachelor curriculum..

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24 11 Intercultural competency training is a challenge for the success of GH education  
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26 12 programs.<sup>35</sup> The most frequently mentioned core competency of GH for health care  
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28 13 professionals is 'be able to communicate with different populations and work under  
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30 14 various cultural environments and medical systems'.<sup>37 38</sup> This competency was also a  
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32 15 main focus of our GH bachelor program and was emphasized repeatedly by potential  
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34 16 employers of GH graduates of degrees. Sociocultural and political awareness is  
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36 17 needed by GH professionals to work effectively across diverse geographical and  
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38 18 cultural areas with a variety of populations and health policies.<sup>39 40</sup> The ability of  
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40 19 problem-solving in practical work should also be improved among GH professionals  
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42 20 to deal with health problems in different regions and healthcare systems.

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46 21 The module of Health Policy and Program Management comprises both domestic  
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48 22 and international internships. Prior studies have highlighted the benefits of GH  
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50 23 internships which include: (1) opening doors to applying the course theories in  
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52 24 settings of limited resources domestically and internationally and engaging in  
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54 25 collaborative research throughout the world;<sup>41</sup> (2) helping increase knowledge,

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3 1 develop skills and gain confidence and better cultural sensitivity;<sup>42 43</sup> (3) providing  
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5 2 opportunities for graduate programs and jobs.<sup>29</sup> Practicum or internship experiences  
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7 3 have been consistently emphasized in GH bachelor programs abroad. The five GH  
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9 4 bachelor programs in the US (Allegheny College, Arizona State University, Duke  
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11 5 University, New York University and University of California San Diego) require  
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13 6 students to have practicum experiences and another three (Arizona State University,  
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15 7 Mercer University and New York University) require students to have international  
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17 8 experiences.<sup>29</sup> These experiences are part of transformational learning components for  
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19 9 students and should be promoted and encouraged.  
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22 Our study was to identify the required GH major courses for a GH bachelor degree.  
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24 11 All of the 31 courses listed in the curriculum are required GH major courses without  
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26 12 elective courses, which are much more than the major courses required in the  
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28 13 American universities for a GH bachelor degree. In spite of this, the course contents  
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30 14 of our curriculum have much in common with those found in the Western countries.  
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32 15 They lay the foundation for Chinese GH students to study and work abroad in the  
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34 16 future. This curriculum was implemented in September 2013 and the first group of  
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36 17 students successfully completed the GH bachelor program in 2017. Tested in both  
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38 18 teaching and learning practices, the curriculum was proven to be practical. We would  
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40 19 like to summarize the previous research work during the development of the  
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42 20 curriculum to provide some information for future improvement of the curriculum.  
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44 21 Currently, the faculty members of School of Health Sciences at Wuhan University are  
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46 22 obtaining feedback from these graduates.  
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50 23 A limitation of this study is that all of the international panel members were from  
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52 24 the US. In the preparation phase, due to our limited professional network and financial  
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54 25 support to recruit Delphi participants, we were not able to seek opinions from any  
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1 academics and GH practitioners from other foreign countries. Five years later, with  
2 the development of GH education worldwide, we will continue to try to get feedback  
3 from those GH colleagues from more countries to share their experience on  
4 cultivation of GH undergraduates and discuss the proposed GH bachelor curriculum  
5 to identify areas of strength and weakness for further improvement.

## 6 7 **Conclusion**

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

14  
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19  
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21 drafted this manuscript with the help of SYL, YSL, XYL, FFL, ZFM, YAL and HX.  
22 All authors contributed to writing, revising and editing the manuscript. All authors  
23 read and approved the final version of the manuscript.

24  
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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.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data sharing statement** Data will be available from the corresponding author on request.

For peer review only

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# BMJ Open

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

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4 **1 Development of a Global Health Bachelor Curriculum in China: A**  
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7 **2 Delphi Study**  
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20 7 Word count: 2812  
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25 9 **Abstract**

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28 10 **Objective:** This study aimed to establish the first global health bachelor curriculum in  
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30 11 China.

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33 12 **Design:** The Delphi methodology was used to determine expert consensus on which  
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35 13 courses should be included in the global health bachelor curriculum. A literature  
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37 14 review and a workshop proceeding were performed to generate courses. Then a two-  
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39 15 round Delphi process was conducted with 28 invited experts from universities, health  
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41 16 administrative departments, and non-governmental organizations (NGOs) to rate  
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43 17 courses using a 5-point Likert scale. Additionally, the experts could alter, add or  
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45 18 delete courses as appropriate. Consensus was predefined as a mean score of 4 or  
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47 19 above and the percent agreement (proportion of panel members scoring ‘very  
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49 20 important’ or ‘important’) no less than 75%.

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54 21 **Results:** The responses in the two-round Delphi process were 85.7% and 70.8%,  
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56 22 respectively. In the first round, twelve courses did not meet the inclusion criteria and  
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1 were removed. Based on the participants' comments, 32 courses were included in  
2 Round two. In the second round, the consensus was reached on 31 courses which  
3 were selected as the final curriculum. These courses were categorized into five  
4 modules, including General Knowledge, Methodology, Global Health Issues,  
5 Intercultural Communication, Health Policy and Program Management.

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

9 **Keywords:** global health; bachelor; curriculum; Delphi

## 12 **Article Summary**

13 Strengths and limitations of this study

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

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For peer review only

## 1 Introduction

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

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

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

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

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

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## 21 **Methods**

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

1 questionnaires to determine the degree to which experts agree about the issue  
2 discussed.<sup>12</sup> There were three phases in this study. Ethical approval was obtained from  
3 the ethical committee of School of Health Sciences, Wuhan University.

#### 4 ***Phase One***

##### 6 *Generation of the Initial Draft and Questionnaire*

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

14 In March 2013, during a workshop on GH bachelor education, we held a  
15 brainstorming exercise to generate ideas on the potential courses to be included in the  
16 GH bachelor curriculum. To guide the workshop discussion, we adopted a widely  
17 cited GH definition: “GH is an area for study, research, and practice that places a  
18 priority on improving health and achieving equality in health for all people  
19 worldwide. GH emphasizes transnational health issues, determinates and solutions;  
20 involves many disciplines within and beyond the health sciences and promotes  
21 interdisciplinary collaboration; and is a synthesis of population-based prevention with  
22 individual-level clinical care”.<sup>19</sup> Nine GH educators, 12 public health educators, and  
23 10 multidisciplinary experts from Peking University, Fudan University and Wuhan

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

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

## 11 ***Phase Two***

### 12 *Pilot Survey*

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

### 17 *Recruitment of Members in the Delphi Study*

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

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3 1 recommendations for Delphi studies.<sup>20</sup>  
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9 3 ***Phase Three***  
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11 4 *Delphi Round One*  
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15 5 In the first round, all 28 panel members were sent an email with the questionnaire  
16 and the informed consent form. They were invited to rate the 52 courses on a 5-point  
17 Likert scale<sup>21</sup> from 1 (not important) to 5 (very important). In addition, they were  
18 asked to alter, add or delete courses as appropriate. The mean, standard deviation and  
19 percent agreement (scoring 'very important' or 'important') were calculated for each  
20 course. Complete data were collected from 24 of 28 panel members and the results  
21 were used to revise the questionnaire and establish a second version.  
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32 12 *Delphi Round Two*  
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36 13 The survey process for Round two followed that of Round one. The 24 panel  
37 members who had participated in Round one were invited to re-rate the selected  
38 courses. They were sent the second version of questionnaire, and 17 of them  
39 responded. Based on Diamond et al.<sup>20</sup>, Delbecq et al.<sup>22</sup>, and Ludwig<sup>23</sup>, this number is  
40 sufficient to conduct subsequent data analysis.  
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51 19 ***Data Analysis***  
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54 20 All statistical analyses were performed using IBM SPSS Statistics 19.0 to generate  
55 descriptive stats. The importance for each course was determined by the mean score.  
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1 The percent agreement of each course was the proportion of panel members rating the  
2 course as ‘very important’ and ‘important’. There have been no universally accepted  
3 criteria for consensus in a Delphi study.<sup>12</sup> Miller indicated that if a certain percentage  
4 of the votes fall into a predefined range, consensus can be achieved.<sup>24</sup> In this study,  
5 we define that a mean score is of 4.0 or above and the percent agreement is no less  
6 than 75%, the consensus is reached.<sup>20 25</sup>

### 8 ***Patients and public involvement***

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

## 15 **Results**

### 16 ***Demographics of the Delphi Panel members***

17 In Round one, 24 (85.7%) of the 28 invited experts participated. In Round two, 17  
18 (70.8%) of the 24 responded. Delphi panel members had different academic  
19 background and expertise, and worked in the following areas: nutrition, physiology,  
20 epidemiology, environmental health, and health policy. Five panel members from  
21 American universities (Duke, Florida, Hawaii and Tennessee) had been associated  
22 with Chinese universities and were familiar with Chinese GH education. Most



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

### 7 ***Delphi Round One***

8 Of the 52 courses rated by panel members, 12 courses did not meet the inclusion  
9 criteria and were removed (Table 2). One course (International Health Project  
10 Management) was added based on the recommendations of 4 panel members. Six  
11 courses were renamed (Table 3). In addition, Social Anthropology and Medical  
12 Anthropology were combined to form a course called Culture Anthropology.  
13 Principles and Application of GIS, Global Burden of Disease, and Behavior,  
14 Psychology, and Health were incorporated into Research Methods in Global Health,  
15 Epidemiology, and Mental Health, respectively. The course of Race, Culture and  
16 Health was incorporated into Health Social Determinants, which was then integrated  
17 into Introduction to Global Health. Comparative Health Systems, Introduction to  
18 Global Health Organizations, and Global Health Promotion were incorporated into  
19 Global Health Governance. Following feedback, the Interdisciplinary Knowledge  
20 module was incorporated into the module of General Knowledge. Introduction to  
21 Global Health was moved from the module of Global Health Issues to the module of  
22 General Knowledge. As a result, the revised curriculum contained five modules and  
23 32 courses.

## 1 *Delphi Round Two*

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

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7 **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 <sup>a</sup>	10 (41.7)	6 (35.3)

8 <sup>a</sup> Health administrative departments and NGOs.

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60**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 <sup>b</sup>		
	Pathogenic Organisms	3.87±1.06 <sup>a</sup>	67 <sup>b</sup>		
	Basis of Computer Engineering	3.79±0.98 <sup>a</sup>	71 <sup>b</sup>		
	Medical History	3.54±1.06 <sup>a</sup>	58 <sup>b</sup>		
	Physiology	3.43±1.12 <sup>a</sup>	46 <sup>b</sup>		
	Human Anatomy	3.22±1.13 <sup>a</sup>	42 <sup>b</sup>		
	Biochemistry	3.09±0.90 <sup>a</sup>	25 <sup>b</sup>		
	Advanced Mathematics	3.04±1.04 <sup>a</sup>	21 <sup>b</sup>		
	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	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	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 <sup>a</sup>	46 <sup>b</sup>
Module	Course	Mean±SD	Agreement(%)	
Intercultural	The Second Language (French)	3.42±0.83 <sup>a</sup>	58 <sup>b</sup>	
Communication	Global History	3.33±0.96 <sup>a</sup>	38 <sup>b</sup>	
Health Policy	Global Health Internship	4.42±0.72	88	
and Program	Comparative Health Systems	4.42±0.72	88	
Management	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	

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	Hygienic Managerialism	4.09±0.90	71 <sup>b</sup>
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- 1 <sup>a</sup>Mean score<4.0
- 2 <sup>b</sup>Percent agreement<75%
- 3 Likert scale: 1=not important, 2= somewhat important, 3= moderately important, 4= important, 5 = very important
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For peer review only

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3 **Table 3.** Recommended course name changes  
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	<b>Original course name</b>	<b>Course name after renaming</b>
6		
7	1 Global Health Economics	Health Economics
8	2 Maternal and Child Health	Introduction to Maternal and Child Health
9	3 Global Mental Health	Mental Health
10	4 Environment and Health	Environment and Global Health
11	5 International Law	International Health Law
12	6 Global Health Management	Global Health Governance
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For peer review only

1 **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 <sup>a</sup>	65 <sup>b</sup>
	Methodology	Epidemiology	4.70±0.47
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
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

1 <sup>a</sup>Mean score<4.0

2 <sup>b</sup>Percent agreement<75%

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

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## 9 **Discussion**

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

16 The module of General Knowledge comprises interdisciplinary courses covering



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3 1 psychological, social, economic, and philosophical dimensions. It is well accepted  
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5 2 that interdisciplinary knowledge is critical for GH undergraduates to recognize social,  
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7 3 political and economic factors of disease and understand the current and emerging GH  
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9 4 issues from different perspectives.<sup>19 26-28</sup> Most GH bachelor programs in the U.S.  
10  
11 5 encourage interdisciplinary coursework.<sup>29</sup> Allegheny College, Arizona State  
12  
13 6 University, Georgetown University, and the University of California San Diego all  
14  
15 7 offer interdisciplinary courses such as sociology, political sciences and economics  
16  
17 8 which, however, are set in elective modules.<sup>30-33</sup> In our GH bachelor program,  
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19 9 students are required to master interdisciplinary knowledge, which will ensure them to  
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21 10 successfully work in GH field.

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27 11 Through the web search of GH bachelor curricula abroad, we found that Kent State  
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29 12 University provided a special course on the application of GIS in health research.<sup>34</sup> As  
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31 13 the most efficient way for global spatial and geographic mapping,<sup>35</sup> GIS technology  
32  
33 14 should be included in the Methodology module. However, considering that it may be  
34  
35 15 difficult for students to understand the learning material, panel members suggested  
36  
37 16 incorporating GIS technology into Research Methods in Global Health and students  
38  
39 17 could choose this course as an elective one for further study. Also, we found that  
40  
41 18 many colleges and universities in the US provided research method courses in their  
42  
43 19 GH bachelor curricula. For example, the University of Southern California offered  
44  
45 20 "core studies", as one of the required modules, which includes Health Behavior  
46  
47 21 Statistical Methods, Health Behavior Research Methods and Directed Research.<sup>9</sup> In  
48  
49 22 the review of GH bachelor education in the UK, research methods and epidemiology  
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51 23 were two of the most frequently offered courses, and they were emphasized in the  
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53 24 programs at University of Oxford and Kings College.<sup>6</sup> As the Global Health

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3 1 Education Consortium has proposed the “Methods, Tools, and Skills” module in GH  
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5 2 undergraduate education,<sup>36</sup> we believe that research methods are essential in the GH  
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7 3 bachelor curriculum..  
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11 4 Intercultural competency training is a challenge for the success of GH education  
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13 5 programs.<sup>35</sup> The most frequently mentioned core competency of GH for health care  
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15 6 professionals is ‘be able to communicate with different populations and work under  
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17 7 various cultural environments and medical systems’.<sup>37 38</sup> This competency was also a  
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19 8 main focus of our GH bachelor program and was emphasized repeatedly by potential  
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21 9 employers of GH graduates of degrees. Sociocultural and political awareness is  
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23 10 needed by GH professionals to work effectively across diverse geographical and  
24  
25 11 cultural areas with a variety of populations and health policies.<sup>39 40</sup> The ability of  
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27 12 problem-solving in practical work should also be improved among GH professionals  
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29 13 to deal with health problems in different regions and healthcare systems.  
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35 14 The module of Health Policy and Program Management comprises both domestic  
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37 15 and international internships. Prior studies have highlighted the benefits of GH  
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39 16 internships which include: (1) opening doors to applying the course theories in  
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41 17 settings of limited resources domestically and internationally and engaging in  
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43 18 collaborative research throughout the world;<sup>41</sup> (2) helping increase knowledge,  
44  
45 19 develop skills and gain confidence and better cultural sensitivity;<sup>42 43</sup> (3) providing  
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47 20 opportunities for graduate programs and jobs.<sup>29</sup> Practicum or internship experiences  
48  
49 21 have been consistently emphasized in GH bachelor programs abroad. The five GH  
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51 22 bachelor programs in the US (Allegheny College, Arizona State University, Duke  
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53 23 University, New York University and University of California San Diego) require  
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55 24 students to have practicum experiences and another three (Arizona State University,  
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1 Mercer University and New York University) require students to have international  
2 experiences.<sup>29</sup> These experiences are part of transformational learning components for  
3 students and should be promoted and encouraged.

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

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

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3 1 GH workforce. Five years later, with the development of GH education worldwide,  
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5 2 we will continue to try to get feedback from those GH colleagues from low-income  
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7 3 countries to share their experience on cultivation of GH undergraduates and discuss  
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9 4 the proposed GH bachelor curriculum to identify areas of strength and weakness for  
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11 5 further improvement.  
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## 20 **Conclusion**

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22 8 In this study, the consensus was reached on five modules with 31 courses in the GH  
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24 9 bachelor curriculum among international experts after two rounds of a Delphi study.  
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26 10 This study broke new ground by developing the first GH bachelor curriculum in  
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28 11 China. We hope that our study will provide some guidelines and references for other  
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30 12 institutions to set up their GH programs or curricula. This may help facilitate GH  
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32 13 education in China as well as in other middle-income countries in the near future.  
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55 21 drafted this manuscript with the help of SYL, YSL, XYL, FFL, ZFM, YAL and HX.  
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3 1 All authors contributed to writing, revising and editing the manuscript. All authors  
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5 2 read and approved the final version of the manuscript.  
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18 6 **Competing interests** None declared.  
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24 8 **Ethical approval** This study was approved by the ethical committee of School of  
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26 9 Health Sciences at Wuhan University. Consent was obtained from all participants.  
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33 11 **Provenance and peer review** Not commissioned; externally peer reviewed.  
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39 13 **Data sharing statement** Data will be available from the corresponding author on  
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41 14 request.  
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