ORIGINAL RESEARCH

Consensus on global health competencies for Korean medical students using a modified Delphi method

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Purpose: This study aimed to reach a consensus among experts on the global health competencies for medical students in Korea.
Methods: A global health competency model was developed to identify domains and competencies for medical education, and a three-round modified Delphi method was used to reach consensus among 21 experts on the essential global health competencies. The degree of convergence, degree of consensus, and content validity ratio of the model were used to reach a consensus.
Results: A list of 52 competencies in 12 domains were identified according to a literature review. In the first-round Delphi survey, the global health competencies were refined to 30 competencies in eight domains. In the second round, the competencies were reduced to 24. In the final round, consensus was reached among the expert panel members, and the competencies were finalized. The global health competency domains for medical students include global burden of disease (three items), globalization of health and healthcare (five items), determinants of health (two items), healthcare in low-resource settings (two items), global health governance (three items), health as a human right (four items), cultural diversity and health (three items), and participation in global health activities (two items).
Conclusion: The group of experts in global health achieved a consensus that 24 global health competencies in eight domains were essential for undergraduate medical education in Korea. The domains and competencies identified herein can be used to develop an undergraduate medical education curriculum in global health.

Key Words: Delphi technique, Global health, Education, Medical students

Introduction

In 2020, the world experienced an unprecedented crisis due to the coronavirus disease 2019 (COVID-19) pandemic. The world realized not only that failure to effectively deal with the infectious-disease-induced healthcare crisis would have a detrimental impact on the healthcare system but also that one country's healthcare problems were not limited to that country because of the rapid spread of the virus across continents. There are no boundaries between countries in terms of diseases, and interstate or global cooperation is important to manage such diseases, which is one of the reasons for the emphasis on global health education (GHE) [1,2]. Since the COVID-19 outbreak, joint response and quick and effective cooperation among countries to prevent the spread of the virus have become more necessary than ever for medical

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personnel [3]. The participation of doctors in international organizations is significant not only in terms of contribution to the international community but also in protecting the rights and interests of patients by identifying medical policy trends in the international community. Doctors can share each country's experiences and expertise and participate in establishing medical systems and policies in underdeveloped countries. International exchange and cooperation also provide an opportunity to contribute to developing medicine and healthcare systems both at home and abroad. After the COVID-19 pandemic, there may be an increasing demand for doctors who can protect global health and contribute to the international community [4]. Global health competency is one of the social constructs for understanding social trends and changes, adapting to the changes in the medical environment, and contributing to the healthcare of the international community [5]. To promote the health of mankind, it is necessary to not only know what policy strategies and cooperation systems are in place but also develop a global sense in the medical field. It has been reported that students who have experienced GHE better understand disease patterns, perform more comprehensive clinical skills, have excellent cultural sensitivity, and are more likely to choose a career in global health after graduation and practice medicine in diverse cultural environments [6]. Moreover, medical students consider global health to be essential for working in a globalized world [7]. Therefore, sufficient understanding and education about global health problems are required for medical students to actively fulfill their roles in global health.

A competency-based approach is important in developing GHE curriculums. Competency-based education is intended for learners to successfully apply the knowledge, skills, and attitudes required in certain specialized fields to actual worksites, which is why it is accepted as a more important concept in healthcare, including in medical education. A competency-based education model would provide a more complete picture of GHE in medical school curriculums. For the smooth progress of these curriculums, a series of essential global health competencies are needed to prepare for various global health issues that medical students may face. Thus, continued efforts have been made to determine or integrate global health competencies in various studies. Notably, 14 competencies were derived after reviewing 32 domestic and international works on global health competencies and GHE: skills to better interface with different populations, cultures, and healthcare systems; an understanding of immigrant health; primary care within diverse cultural settings; understanding healthcare disparities between countries; an understanding of the burden of global disease; an understanding of travel medicine; developing a sense of social responsibility; appreciating contrasts in healthcare delivery systems and expectations; humanism; scientific and societal consequences of global change; evolving global governance issues; cost of global environmental change; taking adequate patient histories and physical examinations in resource-poor settings; and using physical diagnosis without high technological support [8]. Another study argues that the core components of GHE are fostering the ability to be engaged in interdisciplinary teams and work with all global health practitioners in a respectful and collaborative manner and developing equitable partnerships with shared leadership and stated, common goals [9]. According to the graduation competencies related to global health suggested by the General Medical Council in 2018, graduates must have knowledge and skills in areas such as population health; improvement and development of health; equity and sustainable healthcare; health service policy and economics; and ecological, environmental, and occupational hazards in ill health and their mitigation [10]. As such,

with the increasing diversity of contents and methods addressed in global health and the growing demand for the standardization process, a subcommittee of the Consortium of Universities for Global Health (CUGH) in 2013 began to publish and regularly revise a tool kit that includes 38 competencies in 11 domains [11,12]. This toolkit specifically provides the competencies that must be developed in 11 domains: namely, global burden of disease; globalization of health and healthcare; social and environmental determinants of health; capacity strengthening; collaboration; partnering and communication; ethics, professional practice, health equity, and social justice; program management; sociocultural and political awareness; and strategic analysis.

Meanwhile, the core competencies of global health for nursing students have been defined in healthcare in Korea [13]. Further, 24 competencies were derived in six domains; global burden of disease; health implications of migration, travel, and displacement; social and environmental determinants of health; globalization of health and healthcare; healthcare in low-resource settings; and health as a human right and development resource. However, no research has been conducted thus far on global health competencies in medical education. In medical school education, global health is defined in the "2014 Korean Doctor's Role" as the role and competency that medical students must have as social accountability [14]; the Basic Medical Education Accreditation Standards of KIMEE 2019 (ASK2019) [15] also recommend medical schools to include content related to global health and healthcare in their mission (H.1.1.1) and graduation outcomes (H.1.3.1). Consequently, global health is one of the fields that must be addressed to achieve graduation outcomes in medical education. To this end, global health competencies must be derived before developing a GHE program. Reaching a consensus on global health competencies would help all medical students be exposed to similar basic levels of education. Medical schools seeking to establish GHE programs and activities must start by defining the desired competencies. However, even though it is important to integrate international competencies into GHE for medical students, finding sources or studies with consensus on specific global health competencies that must be included in medical education is difficult. Therefore, this study aims to define the global health competencies of medical students in Korea through consensus among experts.

Methods

1. Research design

This is a cross-sectional study that applies a modified three-round Delphi method to develop global health competencies for medical students.

2. Research subjects

This study selected 13 experts (61.9%) who have majored in global health, have experience related to GHE, or are affiliated with institutions or organizations related to global health, as well as eight medical education experts

Table 1. Demographic Characteristics of the Respondents

Characteristic	Frequency (%)
Affiliation	
Medical school	17 (81.0)
Non-medical school (institution related to global health)	4 (19.0)
Gender	
Male	10 (47.6)
Female	11 (52.4)
Age (yr)	
40 and under	1 (4.8)
50 and under	11 (52.4)
Over 50	9 (42.9)
Areas	
Global health	13 (61.9)
Medical education	8 (38.1)

in medical schools (38.1%) as the panel of experts for the Delphi survey (Table 1). The total number of panel members was 21, and they all participated in every round without dropping out.

3. Data collection

Data were collected using the Delphi method from October to December 2022. Copies of the research guide and consent for panel participation were distributed to global health and medical education expert. The experts who agreed to participate were recruited as panel members. The Delphi survey was conducted three times via email, and a consensus was reached by not only providing feedback on the response results from each round but also receiving additional opinions. All data were anonymized in the data analysis process. This study was approved by the Gil Medical Center Institutional Review Board of Gachon University (approval no., GBIRB2022-284).

The following research procedures were conducted to reach a consensus on global health competencies. The first draft of the items for global health competencies was developed using the modified Delphi method. While the classic Delphi method involves exploring and converging survey items using an unstructured questionnaire before commencing the actual survey, the modified Delphi method first develops items by reviewing the related literature instead of going through the aforementioned process [16]. The researchers came up with the global health competencies for medical students through discussions based on various sources, such as 38 competencies in 11 domains announced by the CUGH [11,12], Canadian global health core competencies in undergraduate medical education [17], 21 competencies in six domains announced by the Global Health Learning Outcomes Working Group [18], and core global health competencies for nursing students in Korea [13]. Moreover, 52 competencies in 12 domains were extracted as the Delphi survey items. These included global burden of disease (seven items), globalization of health and healthcare (three items), determinants of health (three items), healthcare in low-resource settings (six items), global health governance (four items), human rights and ethics (10 items), global migration and health (three items), collaboration and communication (two items), cultural diversity and health (five items), professional practice (three items), global health research (four items), and program development and management (two items).

For the first round, a questionnaire was sent to a panel of 21 experts. They were asked to evaluate the validity (5-point scale) of 52 global health competencies in 12 domains and to write their opinions on whether each competency could be integrated with others, excluded, or must be modified. In the second round, the experts were to evaluate the validity (5-point scale) of 30 competencies in eight domains derived according to the results of the first round and to write down their opinions regarding modification. In the third round, the experts were asked to indicate their final agreement on 24 competencies in eight domains derived according to responses to the second-round survey.

4. Analysis method

To determine the adequacy of the panel members' evaluation of validity for the competencies in each domain, this study analyzed the mean, standard deviation, degree of convergence, degree of consensus, and content validity ratio (CVR).

The degree of convergence is an index that represents whether the response results obtained through the Delphi survey are converging [19]. The degree of convergence increases when it is closer to 0; when it is between 0 and 0.5, the opinions of experts (the panel) are considered to be converging. The formula is (Q3-Q1)/2 (Q3: 3rd quartile coefficient, Q1: 1st quartile coefficient) [20].

The degree of consensus increases when it is closer to 1; when it is 0.75 or higher, the opinions of experts are considered to have reached a consensus. The formula is 1-(Q3-Q1)/Mdn [20].

CVR is the value that quantifies the opinions about importance that reach a consensus [21].

$$CVR=(ne-N/2)/(N/2)$$

where "ne" denotes the number of panel members indicating that an item is "essential," which in this study is the number of respondents who rate an item as "essential (4 points)" and "very essential (5 points)" on a 5-point Likert scale; N denotes the number of panel members.

For CVR, only the items with a higher value than the minimum for the number of panel members are considered to have content validity [21]. As 21 panel members participated in the Delphi survey, the items with a CVR of 0.37 or higher were considered to have content validity. However, the items that were considered important were still included in the survey even if they had a low CVR.

Results

1. Results of the first-round Delphi survey

The results of the first-round Delphi survey were analyzed according to the CVR threshold (0.37 or higher), degree of convergence (0-0.5), and degree of consensus (0.75 or higher); descriptive opinions such as integration or exclusion of each competency were all reflected (Table 2). Thus, 52 competencies in 12 domains were restructured to 30 competencies in eight domains.

Specifically, "globalization of health and healthcare" and "global migration and health" were integrated into "globalization of health and healthcare," and "collaboration and communication" was integrated into "cultural diversity and health." Meanwhile, three domains—"professional practice," "global health research," and "program development and management"—were excluded, and some competencies in these domains were modified and included in other domains. Moreover, "participation in global health activities" related to participation in global health programs was newly added.

In "global burden of disease," two out of seven competencies were excluded, and one competency was integrated, and thereby it was modified into a total of four competencies. "Globalization of health and healthcare" had three competencies but was modified into five. One competency was excluded from the initial three, and two competencies that had been incorporated in "global migration and health" were included in this domain. In addition, "can explain global trends and efforts at national and regional levels to achieve health-related Sustainable Development Goals (SDGs)" was added as the new competency. "Determinants of health" had three competencies, but two of them were integrated into one competency, and one other competency was added, ultimately becoming modified into three competencies. The competency added was "can explain the concepts and levels (micro, macro, and so forth) of determinants of health."

"Healthcare in low-resource settings" had six competencies, but three were excluded, two were integrated into one, and one was added, ultimately becoming modified into a total of three competencies. The competency added was "can see epidemiological situations in low-resource settings and apply them to diagnosis." "Global health governance" had four competencies, but one was excluded, and thus it was modified into three competencies.

"Human rights and ethics" had 10 competencies, but four were excluded, and thus it was modified into six competencies. "Cultural diversity and health" had five competencies, but three were excluded. As it was integrated

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Table 2. Content Validation Index of the Global Health Competencies and Experts' Consensus in the First Round

Domain	Competency	Mean ± SD	Degree of convergence	Degree of consensus	CVR	Experts' consensus
Global burden of disease	1. Explain the main causes of morbidity and mortality rates worldwide and the differences in disease risk by region.	4.62 ± 0.59	0.50	0.80	0.90	Included
	2. Discuss the causes and control of infectious diseases worldwide.	4.05 ± 0.86	0.50	0.75	0.52	Modified and included
	3. Explain the interconnection between domestic healthcare and healthcare in other parts of the world.	3.86 ± 0.91	0.50	0.75	0.43	Included
	4. Explain public health activities and efforts to reduce global health disparities.	4.43 ± 0.68	0.50	0.80	0.81	Modified and included
	5. Check population health status using health-related data.	4.19 ± 0.87	0.50	0.75	0.62	Excluded (integrated with Competency 1)
	6. Express opinions on the distribution and funding of global medical services.	3.71 ± 1.06	1.00	0.33	−0.05	Excluded
	7. Explain the latest knowledge on global burden of disease.	3.86 ± 1.01	1.00	0.50	0.33	Excluded
Globalization of health and healthcare	1. Compare healthcare systems between countries.	4.24 ± 0.70	0.50	0.75	0.71	Included
	2. Explain how globalization of health and healthcare internationally affects the quality and use of health and healthcare.	3.95 ± 0.92	1.00	0.50	0.33	Modified and included
	3. Explain the general trends and impacts of international employment and migration of medical personnel.	2.95 ± 1.07	1.00	0.33	−0.43	Excluded
Determinants of health	1. Explain the impacts of major social and economic determinants of health on differences in morbidity, mortality, and life expectancy within and between countries.	4.38 ± 0.74	0.50	0.80	0.71	Modified and included
	2. Explain the impacts of political, economic, social, and environmental factors on accessibility to health and medical services.	4.38 ± 0.67	0.50	0.75	0.81	Excluded
	3. Explain the relationship of the environment, such as sanitation, food, air, and drinking water, with individual and population health at the global level.	4.33 ± 0.80	0.50	0.80	0.62	Modified and included
Healthcare in low-resource settings	1. Explain the barriers to health and medical benefits in low-resource settings both domestically and internationally.	4.24 ± 0.89	0.50	0.75	0.81	Modified and included
	2. Check the symptoms and signs of the disease required for treatment when it is difficult to perform diagnostic tests on major diseases in low-resource settings both domestically and internationally.	3.48 ± 1.03	0.50	0.67	-0.05	Excluded
	3. Provide opinions on resource allocation and priorities for scarce resources to achieve balance according to community demands.	3.90 ± 1.04	1.00	0.50	0.43	Excluded (integrated with Competency 4)
	4. Provide strategies to contribute to reducing health disparities and improving health in the community.	4.33 ± 0.80	0.50	0.75	0.81	Included
	5. Discuss the possibility of unintended outcomes (both positive and negative) when working in low-resource settings.	3.57 ± 1.21	1.00	0.50	0.05	Excluded
	6. Explain interventions and strategies to prevent diseases and promote health in low-resource settings, such as vaccinations and maternal and child health programs.	4.00 ± 0.86	0.63	0.69	0.43	Excluded
Global health governance	1. Explain the concept and history of global health.	4.14 ± 0.91	0.50	0.75	0.52	Included
	2. Explain the complexity of global health governance.	3.76 ± 1.00	0.50	0.75	0.33	Excluded
	3. Explain the roles and relationships of major actors in global health and development.	4.05 ± 0.80	1.00	0.50	0.43	Included
	4. Explain the role of World Health Organization as a leading international organization for health.	4.14 ± 0.79	0.50	0.75	0.52	Modified and included

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Table 2. (Continued)

Domain	Competency	Mean ± SD	Degree of convergence	Degree of consensus	CVR	Experts' consensus
Human rights and ethics	1. Explain the concept of rights to health.	4.62 ± 0.59	0.50	0.80	0.90	Included
	2. Explain the relationship between health, human rights, and international inequality.	4.52 ± 0.68	0.50	0.80	0.81	Included
	3. Apply human rights principles to solving global health problems.	4.29 ± 0.78	0.50	0.75	0.62	Excluded (integrated with competency 4)
	4. Explain the Universal Declaration of Human Rights and the Declaration of Helsinki in association with health as a human right.	4.33 ± 0.66	0.50	0.75	0.81	Included
	5. Show the attitude of respecting the rights and equal values of all people without discrimination.	4.19 ± 0.93	0.50	0.75	0.52	Included
	6. Explain the special healthcare needs of vulnerable populations.	4.10 ± 1.00	0.50	0.75	0.52	Included
	7. Find services available for vulnerable populations (immigrants, refugees, homeless people, patients with mental diseases, and so forth).	3.86 ± 1.01	1.00	0.50	0.24	Excluded
	8. Establish strategies to involve neglected and vulnerable populations in making decisions that affect health and welfare.	3.76 ± 0.94	1.00	0.50	0.05	Excluded
	9. Explain cultural and ethical issues in practice for vulnerable populations.	3.76 ± 1.00	1.00	0.50	0.14	Excluded
	10. Suggest ways to solve ethical problems that occur when working in various economic, political, and cultural contexts.	4.05 ± 0.80	0.50	0.75	0.62	Included
Global migration and health	1. Explain how overseas travel or global migration affects health, such as the spread of infectious diseases and chronic illnesses.	4.29 ± 0.72	0.50	0.75	0.71	Modified and included (moved to "globalization of health and healthcare")
	2. Explain countries with a high risk for diseases such as acquired immunodeficiency syndrome, malaria, multidrug-resistant tuberculosis, and Ebola virus, as well as activities to be aware of when traveling.	4.00 ± 1.03	0.50	0.75	0.52	Modified and included (moved to "globalization of health and healthcare")
	3. Describe approaches to management and evaluation of health problems encountered in international clinical settings, such as travel, health of immigrants and refugees, and overseas clinical practice.	3.76 ± 0.94	1.00	0.50	0.05	Excluded
Collaboration and communication	1. Communicate to show respect for and acknowledge the cultures, values, roles and responsibilities, and expertise of other experts and groups working in global health.	4.05 ± 1.12	0.50	0.75	0.52	Modified and included (moved to "cultural diversity and health")
	2. Demonstrate the leadership necessary for collaboration and team effectiveness in various cultural contexts.	4.05 ± 1.07	0.50	0.75	0.62	Modified and included (moved to "cultural diversity and health")

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Table 2. (Continued)

Domain	Competency	Mean ± SD	Degree of convergence	Degree of consensus	CVR	Experts' consensus
Cultural diversity and health	1. Inspect one's own prejudice and bias that people from certain sociocultural groups will behave in certain ways.	4.00 ± 0.95	1.00	0.50	0.33	Included
	2. Induce the health problems and interests of subjects by considering individual cultural backgrounds.	3.45 ± 1.10	0.50	0.67	−0.14	Excluded
	3. Communicate effectively with colleagues, patients, and families from different cultural backgrounds (racial, religious, and social backgrounds).	4.00 ± 1.10	1.00	0.50	0.43	Included
	4. Collaborate efficiently with colleagues from different cultural backgrounds (racial, religious, and social backgrounds).	3.86 ± 1.11	1.00	0.50	0.24	Excluded (integrated with competency 3)
	5. Show cultural competencies, including the concepts of cultural safety, humility, and sensitivity.	3.35 ± 1.04	0.50	0.67	−0.24	Excluded
Professional practice	1. Show integrity, care, and respect for others as an expert in low-resource settings both domestically and internationally.	3.76 ± 1.00	0.50	0.75	0.33	Excluded
	2. Demonstrate clinical skills or performance in low-resource settings both domestically and internationally.	3.62 ± 1.07	0.50	0.75	0.14	Excluded
	3. Practice the importance of self-management, introspection, and personal well-being in low-resource settings both domestically and internationally.	3.14 ± 1.06	0.50	0.67	−0.14	Excluded
Global health research	1. Set priorities for global health research.	3.86 ± 1.01	1.00	0.50	0.43	Excluded
	2. Explain the impact of imbalance in research funding that addresses the burden of disease in poor and wealthy groups by critically evaluating global health research.	3.52 ± 0.81	0.50	0.75	0.05	Excluded
	3. Explain how health-related research is conducted and managed worldwide.	3.57 ± 0.81	0.50	0.67	−0.05	Excluded
	4. Explain the ethical principles of clinical and translational research in low-resource settings.	3.71 ± 1.10	1.00	0.50	0.05	Excluded
Global health program development and management	1. Plan, implement, monitor, and evaluate global health programs.	3.81 ± 1.17	1.00	0.50	0.24	Excluded
	2. Apply project management skills to global health programs.	3.15 ± 1.14	1.00	0.33	−0.33	Excluded

SD: Standard deviation, CVR: Content validity ratio.

with the "collaboration and communication" domain, two competencies were included; thus, it was modified into four competencies in total.

Finally, "participation in global health activities" was added as a new domain with two competencies. The competencies that were added included "can identify the status of global health activities at home and abroad using all kinds of data" and "can perform one's role by participating in global health programs at home and abroad."

2. Results of the second-round Delphi survey

The responses from the second-round Delphi survey showed that no competencies met the standards (Table 3). However, the competencies were modified according to the descriptive opinions of the panel members about each competency; as a result, 30 competencies in eight domains were restructured into 24 competencies.

"Global burden of disease" was modified into three competencies, while the remaining competency was integrated into "globalization of health and healthcare," which maintained five competencies with some changes to clarify the meanings of the competencies. "Determinants of health" was modified into two competencies, and competency 3 was integrated with competency 2. "Healthcare in low-resource settings" was modified into two competencies, and competency 3 was integrated with competency 2.

"Global health governance" maintained three competencies with some changes to clarify the meanings of the competencies. "Human rights and ethics" was renamed "Health as a human right" and modified into four competencies. "Cultural diversity and health" was modified into three competencies, integrating the ones with redundant meanings and making some changes to clarify the meanings of the competencies. "Participation in global health activities" maintained two competencies with some changes to clarify the meanings of the competencies.

3. Results of the third-round Delphi survey

The results of the third-round Delphi survey were analyzed in light of the agreement and additional opinions on global health competencies organized according to the results of the second round. The panel members agreed on the final version of global health competencies and provided a few opinions on modification. Words or texts in four competencies (competency 5 in "globalization of health and healthcare," competencies 1, 2, and 3 in "cultural diversity and health") to clarify their meanings. The global health domains and competencies for medical students were finalized through this consensus process (Table 4, Appendix 1).

Discussion

Health problems are occurring increasingly beyond national borders. Notably, GHE is becoming more important in solving these problems. Korea has not yet reached a consensus on global health competencies that can be potential resources for medical schools in developing their own GHE programs. This study was the first in Korea to derive global health competencies that must be included in undergraduate medical curriculums using a Delphi method for medical students to obtain global health competencies.

Accordingly, 52 competencies in 12 domains summarized in previous studies [11-13,17,18] were finalized into 24 competencies in eight domains after three rounds of the panel consensus process. Out of the eight domains in this study, "global burden of disease," "determinants of health," and "health as a human right" were among those that had also been commonly suggested in previous studies. "Global burden of disease" was most frequently mentioned in the literature review on global health competencies [8]

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Table 3. Content Validation Index of the Global Health Competencies and Experts' Consensus in the Second Round

Domain	Competency	Mean±SD	Degree of convergence	Degree of consensus	CVR	Experts' consensus
Global burden of disease	1. Explain the main causes of morbidity and mortality rates worldwide and the differences in disease risk by region.	4.95±0.22	0.00	1.00	1.00	Included
	2. Discuss the causes and prevention of major global epidemics.	4.52±0.60	0.50	0.80	0.90	Modified and included
	3. Explain the interconnection between domestic healthcare and healthcare in other parts of the world.	4.00±0.63	0.00	1.00	0.81	Excluded (integrated with competency 1 in "globalization of health and healthcare")
	4. Explain public health activities and efforts to reduce global health disparities between countries as well as domestic health disparities within the country.	4.67±0.58	0.50	0.80	0.90	Modified and included
Globalization of health and healthcare	1. Compare healthcare systems between countries.	4.33±0.48	0.50	0.75	0.95	Included
	2. Explain how globalization of health and healthcare affects the quality and use of health and healthcare services.	4.29±0.56	0.50	0.75	0.90	Modified and included
	3. Explain global trends and efforts at national and regional levels to achieve health-related Sustainable Development Goals.	4.29±0.85	0.50	0.75	0.86	Modified and included
	4. Explain how global migration (overseas travel or trade, and so forth) affects health, such as changes in the prevalence of major infectious diseases or chronic illnesses.	4.38±0.67	0.50	0.75	0.86	Included
	5. Explain countries with a high risk for diseases such as acquired immunodeficiency syndrome, malaria, multidrug-resistant tuberculosis, Ebola virus, and viral infections, as well as activities to be aware of when traveling.	4.00±0.55	0.00	1.00	0.81	Modified and included
Determinants of health	1. Explain the concepts and levels (micro, macro, and so forth) of determinants of health.	4.48±0.68	0.50	0.80	0.86	Modified and included
	2. Explain the impacts of social, economic, and environmental determinants of health on morbidity, mortality, life expectancy, and medical service accessibility within and between countries.	4.85±0.37	0.00	1.00	0.90	Included
	3. Explain the relationship of the environment, such as sanitation, food, air, and drinking water, with individual and population health.	4.62±0.50	0.50	0.80	0.95	Excluded (integrated with competency 2)
Healthcare in low-resource settings	1. Explain the impact of low-resource settings on health and medical benefits both domestically and internationally.	4.48±0.51	0.50	0.75	0.95	Included
	2. Provide strategies on resource allocation and priorities to contribute to reducing health disparities and promoting health in the community.	4.71±0.46	0.50	0.80	0.95	Modified and included
	3. Observe epidemiological situations in low-resource settings and apply them to diagnosis.	3.95±0.59	0.00	1.00	0.76	Excluded (integrated with competency 2)
Global health governance	1. Explain the concept and history of global health.	4.48±0.60	0.50	0.80	0.90	Included
	2. Explain the roles and relationships of major actors in global health and development.	4.43±0.60	0.50	0.75	0.90	Included
	3. Explain the typical examples and roles of governments, intergovernmental organizations, and non-governmental organizations in global health.	4.43±0.51	0.50	0.75	0.95	Modified and included

(Continued on next page)

Table 3. (Continued)

Domain	Competency	Mean±SD	Degree of convergence	Degree of consensus	CVR	Experts' consensus
Health as a human right	1. Explain the concept of rights to health.	5.00±0.00	0.00	1.00	0.95	Included
	2. Explain the relationship between health, human rights, and international inequality.	4.90±0.30	0.00	1.00	0.95	Excluded (integrated with competency 3)
	3. Explain the Universal Declaration of Human Rights and the Declaration of Helsinki in association with health as a human right.	4.52±0.51	0.50	0.80	0.95	Included
	4. Show the attitude of respecting the rights and equal values of all people without discrimination.	4.52±0.51	0.50	0.80	0.95	Excluded (added by integrating competencies 4 and 5)
	5. Explain the special healthcare needs of vulnerable populations.	4.52±0.51	0.50	0.80	0.95	Excluded (added by integrating competencies 4 and 5)
	6. Suggest ways to solve ethical problems that occur when working in various economic, political, and cultural contexts.	4.24±0.62	0.50	0.75	0.90	Modified and included
Cultural diversity and health	1. Reflect on one's own prejudice and bias against people with certain sociocultural backgrounds.	4.38±0.67	0.50	0.75	0.86	Modified and included
	2. Express respect for the cultures, values, roles and responsibilities, and expertise of other experts or groups working in global health.	4.57±0.51	0.50	0.80	0.95	Modified and included
	3. Communicate effectively with colleagues, patients, and families from different cultural backgrounds (racial, religious, social backgrounds).	4.45±0.60	0.50	0.78	0.86	Modified and included
	4. Perform the role of a team member necessary for collaboration and team effectiveness in various cultural contexts.	4.67±0.48	0.50	0.80	0.95	Excluded (integrated with competency 3)
Participation in global health activities	1. Identify the status of global health activities at home and abroad using all kinds of data.	4.25±0.55	0.50	0.75	0.86	Modified and included
	2. Perform one's role by participating in global health programs at home and abroad.	4.05±0.83	0.50	0.75	0.71	Modified and included

SD: Standard deviation, CVR: Content validity ratio.

Table 4. Final Consensus of Global Health Domains and Competencies for Medical Students

Domain	Competency	Experts' final consensus
Global burden of disease	1. Explain the main causes of morbidity and mortality rates worldwide and the differences in disease risk by region.	Included
	2. Explain how to prevent based on the causes of major global epidemics.	Included
	3. Explain public health activities to reduce global health disparities between countries as well as domestic health disparities within the country.	Included
Globalization of health and healthcare	1. Compare healthcare systems between countries.	Included
	2. Explain how globalization of health and healthcare affects the quality and use of health and healthcare services.	Included
	3. Explain global trends and efforts at national and regional levels to achieve health-related SustainableDevelopmentGoals.	Included
	4. Explain how global migration (overseas travel or trade, and so forth) affects health, such as changes in the prevalence of major infectious diseases or chronic illnesses.	Included
	5. Explain things to be aware of when traveling to countries with a high risk of diseases	Modified and included
Determinants of health	1. Explain the determinants of health.	Included
	2. Explain the impacts of social, economic, and environmental determinants of health on morbidity, mortality, life expectancy, and medical service accessibility within and between countries.	Included
Healthcare in low-resource settings	1. Explain the impact of low-resource settings on health and medical benefits both domestically and internationally.	Included
	2. Provide strategies on resource allocation and priorities to contribute to reducing health disparities and promoting health in the community.	Included
Global health governance	1. Explain the concept and history of global health.	Included
	2. Explain the roles and relationships of major actors in global health and development.	Included
	3. Explain the typical examples and roles of governments, intergovernmental organizations, and non-governmental organizations in global health.	Included
Health as a human right	1. Explain the concept of rights to health.	Included
	2. Explain the Universal Declaration of Human Rights and the Declaration of Helsinki in association with health as a human right.	Included
	3. Explain the relationship between health and human rights.	Included
	4. Discuss the ethical issues in global health.	Included
Cultural diversity and health	1. Reflect on one's own prejudice and bias against people from different backgrounds (racial, religious, social, cultural, gender)	Modified and included
	2. Treat people from different backgrounds (racial, religious, social, cultural, gender) with respect and without any form of discrimination.	Modified and included
	3. Communicate effectively with people from different backgrounds (racial, religious, social, cultural, gender).	Modified and included
Participation in global health activities	1. Explore the information needed for global health activities.	Included
	2. Participate in relevant programs at home and abroad for global health activities.	Included

and was proposed as one of the three major global health competencies that medical students must have [22]. This indicates that it is an important basic domain of competencies in global health. In "global burden of disease," medical students must know the burden of disease, risk factors for that burden, and how these things vary across populations to understand and solve global health problems. They must also understand the indicators explaining health status and how they vary by region or country.

As "determinants of health" has been reported as the most valid global health domain for not only medical

students but also nursing students [13], it is an essential domain of competency required for all students in medical and health departments. The competencies included in this domain identify the social, economic, and environmental factors (determinants) of health and how they affect the key health status indicators, such as the prevalence of diseases, mortality, and life expectancy. These competencies are required to resolve health disparities and gaps in quality of life, as well as to encourage action to achieve health equity [23]. "Health as a human right" also showed the highest ratio of consensus vis-à-vis having the most important competencies in health and healthcare [13]. The SDGs set by the United Nations also emphasize that health is a mandatory requirement of development resources, as well as a basic human right [24]. Therefore, medical students must be able to comprehend the relevance of health as a human right and present their own views on various ethical issues related to global health. If medical students can use GHE as a learning venue for medical ethics education so that they can cognize human rights and health inequalities and gain ethical and philosophical perspectives on healthcare [25], students' competencies can be cultivated in this domain.

"Globalization of health and healthcare" and "global migration and health" were integrated into "globalization of health and healthcare," ultimately deriving five competencies. This domain consisted of competencies related to the impact of changes incurred by the globalization in progress and the common migration between countries on global health and healthcare. The competency to understand and analyze the relevance between globalization and healthcare is so important that it is suggested as one of the 11 common competencies of global health for medical personnel [11,12]. Changes in healthcare in each country due to globalization are also factors affecting population health problems [26]. In a study on nursing students in Korea, "globalization of health and healthcare" showed relatively low validity. This study also revealed that this domain had the lowest validity among eight domains, except for "participation in global health activities." In other words, this domain has global health competencies required for medical personnel and yet shows relatively lower validity compared with other domains.

"Collaboration and communication" was integrated into "cultural diversity and health." Global health initiatives recommend medical students to have cultural sensitivity to provide holistic and comprehensive care for the gradually increasing immigrant population [22]. The aforementioned CUGH also includes communication skills and cultural awareness at the global citizen level as competencies [11,12]. The number of foreign residents and patients is also increasing in Korea [27]. Medical students must be able to interact effectively with people from different cultures and have the cultural competency to respect and respond to the health beliefs and cultural needs of diverse populations [28]. Medical students must identify their own beliefs and cultural identities about people or patients from diverse backgrounds and introspect and have critical self-awareness.

Meanwhile, "professional practice," "global health research," and "program development and management" were excluded in the first-round Delphi survey. The panel members did not include these competencies because they were not related to those at the medical student level and were a burden on medical school curriculums. In the process of reaching a consensus on competencies, the CUGH assigned the competency levels according to the intent of education to the global health citizen level, which is the basic preparation level for pursuing and contemplating a future in any field related to global health, and the basic operational program-oriented level, which is the discipline-specific level for a career in global health. The basic operational program-oriented level has 38

competencies in 11 domains, which include the global citizen level with 13 competencies in eight domains [11,12]. This shows that discipline-specific level domains and competencies beyond the medical student level are also excluded in this study. This might be because the competencies at the basic operational program-oriented level were also included when initially developing the Delphi survey items. Other studies have also claimed that policy development, analysis, and program management are global health competencies for specific professional groups, which are included within the scope of competencies at the postgraduate education level [29]. For this reason, this study added a new domain called "participation in global health activities." This domain has competencies at the medical student level, which include searching for information necessary for global health activities and voluntarily participating in various global health programs.

As in previous studies, "global burden of disease," "determinants of health," and "health as a human right" emerged as core competencies. Unlike previous studies, "global health research" and "program development and management" were not included as competencies in Korea. Even if these competencies are limited at the undergraduate level, they should be considered as necessary competencies for students considering majors or careers in global health. Furthermore, cultural competency should be emphasized in the future in the Korean context, where population migration and globalization are accelerating and the patient population from different cultures is increasing.

The limitations of this study are as follows: as the items for the first-round Delphi survey were developed on the basis of the review of a few representative works in the literature, this study might not include all domains and competencies. The adequate levels of CVR, degree of convergence, and degree of consensus were all considered in the analysis process, but as the additional opinions described by the panel members were also reflected, this might have unintentionally affected the results in a subjective manner. Therefore, it is necessary to verify and supplement the validity of the current competency framework on the basis of continuous research. Global health competencies in this study are limited to only those at the medical school level, thus underscoring the importance of establishing a competency framework in each step by expanding to the postgraduate education level. Moreover, it will be possible to expand the scope of application by conducting a follow-up study that establishes a guide to reach each competency, such as the content and method of education, and evaluation.

Notwithstanding the growing demand for global health competencies as graduation outcomes, there is still a lack of consensus on global health competencies that must be acquired by medical students in Korea. This study is significant in terms of reaching a consensus among experts in this situation. The results of this study are expected to be used as the basic data for the development of GHE programs for medical students in the future.

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Appendix 1. Korean Version of Global Health Domains and Competencies for Medical Students

영역	역량
전 세계 질병부담	1. 전 세계 높은 유병률과 사망률의 주요 원인과 지역별 질병위험의 차이를 설명할 수 있다.
	2. 전 세계적으로 유행하는 주요 감염병의 원인에 따라 예방방법을 제안할 수 있다.
	3. 전 세계 각 국가들 간 건강격차와 각국의 국내 건강격차를 줄이기 위한 공중보건활동을 설명할 수 있다.
보건의료의 세계화	1. 국가 간 보건의료시스템을 비교할 수 있다.
	2. 보건의료 세계화가 전 세계 보건의료의 질에 미치는 영향을 설명할 수 있다.
	3. 건강 관련 지속가능발전목표(SDGs) 달성을 위한 세계적 흐름과 SDGs에 대한 국가 및 지역수준의 노력을 설명할 수 있다.
	4. 국제적 이동(해외여행, 무역 등)이 주요 전염병의 발생률 변화 등 건강에 미치는 영향을 설명할 수 있다.
	5. 전염병이 발생할 위험성이 높은 나라를 여행할 때 주의해야 할 점에 대해 설명할 수 있다.
건강의 결정요인	1. 건강을 결정하는 요인이 무엇인지 설명할 수 있다.
	2. 건강에 대한 사회, 경제, 환경적 결정요인이 국내 및 국가 간 질병의 유병률과 사망률, 기대 수명, 보건의료서비스 접근성에 미치는 영향을 설명할 수 있다.
자원이 부족한 환경의 보건의료	1. 국내·외적으로 자원이 부족한 환경이 건강과 의료혜택에 미치는 영향을 설명할 수 있다.
	2. 지역사회의 건강 격차 감소와 건강증진에 기여하기 위한 자원 할당, 우선순위 결정 등 전략을 제시할 수 있다.
국제보건 거버넌스	1. 국제보건의 개념과 역사를 설명할 수 있다.
	2. 국제보건과 개발에 영향을 미치는 주요 주체들의 역할과 관계를 설명할 수 있다.
	3. 국제보건에서 정부, 정부 간 기구(IGO), 비정부기구(NGO)의 역할과 기능, 대표적 사례를 설명할 수 있다.
건강과 인권	1. 건강에 대한 권리의 개념을 설명할 수 있다.
	2. 건강과 인권을 연계하는 세계인권선언, 헬싱키선언 등을 설명할 수 있다.
	3. 건강과 인권의 관계를 설명할 수 있다.
	4. 국제보건 관련 윤리적 문제에 의견을 제시할 수 있다.
문화적 다양성	1. 다양한 배경(인종, 종교, 사회, 문화, 성별)을 가진 사람에 대한 편향이 있는지 성찰할 수 있다.
	2. 다양한 배경(인종, 종교, 사회, 문화, 성별)을 가진 사람을 존중하여 차별 없이 대할 수 있다.
	3. 다양한 배경(인종, 종교, 사회, 문화, 성별)을 가진 사람과 효과적으로 의사소통 할 수 있다.
국제보건활동 참여	1. 국제보건활동을 위해 필요한 정보를 탐색할 수 있다.
	2. 국제보건활동을 위해 국내 · 외 국제보건프로그램에 참여할 수 있다.

SDGs: Sustainable Development Goals, IGO: Intergovernmental Organizations, NGO: Non-Governmental Organizations.