A Global Health Capstone: An Innovative Educational Approach in a Global Health Competency-Based Curriculum

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Abstract

Background Global health educational programs for medical and public health professionals have grown substantially in recent years. The University of Illinois Chicago College of Medicine (UICOM) began a global medicine (GMED) program for selected students in 2012 and has since graduated four classes. As part of the four-year curriculum, students complete a longitudinal global health capstone project. This paper describes the global health capstone project with the aims of understanding whether longitudinal capstone projects are feasible, how mentorship of capstones could be strengthened, and how participation in a capstone might contribute to students’ attainment of global health competencies.

Methods The authors reviewed the final capstone projects for 35 graduates to assess features of the capstones including whether the projects were longitudinal, faculty-mentored, or involved original research. In addition, the authors assessed the attainment of each of 11 global health competency domains identified by the Consortium of Universities for Global Health (CUGH). Student reflection papers were reviewed for themes related to capstone completion. Results Of the 35 capstones, 19 (54%) were longitudinal, and 21 (60%) had subject matter-focused faculty mentorship. Twenty-six projects involved original research (74%) and 25 involved international travel (71%). Nine projects led to a conference abstract/presentation (26%) while five led to a publication (14%). Overall, capstone projects addressed 9 out of 11 (82%) CUGH competency domains. In their reflection papers, students identified factors that facilitated capstone completion (e.g. strong mentorship), barriers to capstone completion (e.g. difficulty identifying a capstone project), and key benefits of the capstone process (e.g. strengthened research skills). Conclusions A longitudinal capstone model is feasible, provides an impactful opportunity for research and career mentorship, and can teach targeted global health competencies. Further refinement of the capstone process is needed to strengthen mentorship and target more global health competencies, and additional assessment tools are needed.

Background

Participation in global health activities by U.S. medical students has grown substantially in recent decades.1 Although global health interest has grown, many schools still do not offer structured global health curricula, and there is little standardization for didactic, clinical, scholarly, and cultural components across programs.2,3 Many programs also lack well-defined competencies outlining critical skills for global health practitioners, although the past decade saw the development of essential competencies to guide global health curricular development.4-10

A current challenge in global health education is identifying methods to teach students to become successful global health practitioners. Aspects of various curricula have been published. Some describe didactic curricula focused on topics such as cultural competency and communication.11 Others describe educational formats such as e-learning or simulation-based learning to teach competencies such as ethics or professional practice in low-resource settings.12-14 Many programs involve international electives or service-learning experiences, and best practice approaches have been proposed to help students in short-term global health experiences build skills in cross-cultural effectiveness, capacity building, and collaboration while addressing the needs of host communities and partners.15-18

Part of the challenge of teaching global health is designing educational methods that address competencies that include skills building and attitude formation.4 Particularly in resource-limited settings involving different cultures, political climates, and power dynamics, competencies required of effective global practitioners extend far beyond clinical knowledge and include the effective practice of cultural humility, interprofessional collaboration, ethical conduct, and promotion of health equity. The Consortium of Universities for Global Health (CUGH) formed in 2008 to support academic institutions to improve global health. In 2013, CUGH formed a Global Health Competency Subcommittee to develop a standardized set of global health competencies to guide institutions developing curricula. An interdisciplinary expert panel published this list of 39 competencies across 11 domains in 2015; however, methods for teaching these competencies are still being developed.4

Although there are some published descriptions of global health capstones for pharmacy and bioengineering students, we are not aware of other published descriptions of global health capstones as part of an educational curriculum for medical students.19,20 This paper describes our experience with the first 35 graduates of the Global Medicine (GMED) program at the University of Illinois Chicago College of Medicine (UICOM).

The GMED program was developed in response to increased interest in global health at the UICOM. Completion of a longitudinal capstone project is required as part of the GMED program. The objective of this paper is to review student capstone projects as well as student reflection papers to identify strengths and weaknesses of the GMED capstone and examine the following:
• Is a longitudinal model of a global health capstone project feasible as part of a global health curriculum for U.S. medical students?
• What mentorship is required to assist students in developing and completing their capstone projects?
• Are global health capstone projects a suitable method for teaching CUGH-identified competencies?

Using a global health capstone project as an educational method for medical students is a novel construct. This assessment will inform future modifications to the UICOM GMED program and may be valuable to global health educators who wish to develop or strengthen their global health training programs for health professions students.

GMED Program
The UICOM GMED Program recruited its first class in 2012 and has since graduated four classes. GMED is a track for 12 selected students per year that spans the four-year medical school curriculum and is completed in addition to standard required coursework. The program's goal is to improve the health of populations worldwide by training the next generation of global health leaders. The curriculum includes didactic instruction, colloquia, skills-building workshops, and individual longitudinal capstone projects. The initial curriculum included didactic sessions modeled after the Global Health Education Consortium's 2010 guidelines. Curricular adaptations were made in 2018 to address an expanded list of global health competencies. Programming also includes exposure to supplementary content (e.g. cultural competency, economic perspectives of global aid, ethics of volunteerism) as well as alternative interactive learning formats including film reviews, book club discussions, and simulation-based cases. Each student in the track must develop, implement, and present a capstone project to successfully complete the program.

Capstone projects
The capstone requirement is a longitudinal scholarly work culminating in a presentation and reflection paper at the end of the final year of medical school. Although capstones are reported in other disciplines, they have not been routinely incorporated into global health medical student programs. Other fields found capstones beneficial because they allow students to:

• Become involved in sustainable impact-oriented research.
• Build skills in scholarship and professionalism including writing, presenting, and integrating "core theoretical concepts to form a broad view of professionalism.”
• Develop research mentorships and relationships with faculty.

The capstone allows students to acquire skills through project planning and implementation. Specific deliverables are required throughout the four years of medical school. During the first year, each student identifies a specific global health issue, performs a literature review, and delivers a presentation on the topic along with a written paper. In the second year, each student identifies a specific project, defines his/her role in that project, establishes methods and a timeline for project completion, and prepares a scientific poster. In the third and fourth years, students focus on capstone project implementation and evaluation, culminating in oral presentations summarizing their work. A written scholarly paper was added as a requirement for 2019 graduates (whose work is not included in this paper). Projects should be completed under the guidance of faculty mentors who are identified by the student.

Capstone projects can vary in structure and content depending on students' interests. Projects can focus on original global health research or on curriculum design, programmatic implementation, field practicums, or meta-analyses. Although the capstone format may vary, all students must demonstrate an understanding and integration of relevant global health core competencies. All students are also provided with formal faculty advising that gives overall guidance for capstone completion but may not provide content-specific mentorship.

Graduating students also submit a self-reflection paper. In the reflection papers, students identify lessons learned during the capstone process, potential implications of their projects, and the anticipated impact completing the program will have on their future careers. This paper encourages
students to reflect on their accomplishments, articulate the challenges and successes of their projects, and internalize their experiences to translate knowledge acquired to their personal and professional growth.

**Methods**

We performed a retrospective review of graduating medical student capstone projects from the first three GMED cohorts (2016-2018). Each of 35 graduating students presented a capstone PowerPoint presentation, and 33 submitted a written self-reflection paper. Each student’s capstone products were assessed by two independent faculty reviewers using a structured tool to evaluate achievement of some degree of competency in each of the 11 CUGH competency domains. A pilot trial for inter-rater reliability of reviewers was conducted to standardize the review process. In cases of discrepancy, a third independent reviewer reviewed the capstone materials to achieve concordance. Other key components of the capstone were assessed, including whether the student received dedicated faculty capstone project mentorship and whether the project was longitudinal in nature.

Self-reflection papers were reviewed by a single reviewer who used Braun & Clark’s 6-step framework to complete a thematic analysis to identify, analyze, and report common ideas among students’ reported experiences.\(^2\) Important statements were identified and coded. These codes were further organized and developed into themes and subthemes.

**Results**

**Capstones**

The capstone is designed to enhance students’ scholarly skills. As noted, students were given some flexibility as to the capstone structure and format. Of the initial 35 program graduates, 26 (74%) completed capstones involving original research. Of those, ten (39%) used mixed methods, ten (39%) used quantitative methods, and six (23%) used qualitative methods. Twenty-six percent presented capstone-related abstracts or presentations at conferences, and five (14%) authored peer-reviewed publications related to their capstones. (Table 1)

While all students had faculty advisors, 21 capstones (60%) involved projects where students had additional dedicated faculty mentorship, meaning they worked with a faculty member who possessed subject matter expertise and guided the capstone development and implementation. The remaining 14 projects (40%) were implemented in a more independent manner. Nineteen capstones (54%) were longitudinal in nature, with students spending at least two of the four years of medical school focused on a single project. (Table 1)

Medical specialty areas identified were varied, with the largest percentage of projects focused on emergency medicine (29%), obstetrics/gynecology (17%), and primary care (14%). Other projects focused on internal medicine (9%), psychiatry (6%), neurology (3%), ophthalmology (3%), and pediatrics (3%). In addition, six projects (17%) did not concentrate on a medical specialty area and instead focused on topics including environmental health, medical ethics, health systems, medical education, and mHealth. Eighteen students (51%) completed capstones related to their ultimate medical residency specialty.

Capstones included projects in 14 different countries; eight additional projects had a transnational global health focus, and four projects focused on domestic and/or refugee populations in the U.S. (Table 2) Twenty-five capstones (71%) involved an international field experience.

Of the 11 CUGH global health competency domains, students demonstrated a high rate of competency in Collaboration, Partnering, and Communication (77%); Social and Environmental Determinants of Health (74%); Sociocultural and Political Awareness (74%); Global Burden of Disease (71%); Professional Practice (66%); and Health Equity and Social Justice (66%). Students had moderate and low rates of competency in other domains. (Figure 1 CUGH Global Health Competency Domains and Demonstration of Attainment of Competency from Global Health Capstones)

**Reflection papers**
Reflection papers were reviewed to gain a better understanding of students' experiences with the capstone project and GMED program. The main themes of the papers were categorized within three thematic areas: factors that facilitated capstone completion, challenges to capstone completion, and key benefits of the process. (Table 3)

Students valued strong faculty capstone project mentorship to help guide capstone development and completion, especially those students with limited research experience. One student wrote "without the always supportive and occasionally stern guidance of [my mentor], I could not have completed [my capstone]." Personal interest in the focus area was noted as a facilitator given competing demands on students' time with regular medical school responsibilities. Students also expressed that adaptability and flexibility on their behalf and within the program were essential.

One common challenge was identifying a capstone project in the students' desired topic area or with a particular population (e.g. Spanish-speaking or refugee populations). Students also noted the challenge of developing a methodologically sound and feasible research project given limited past research experience. One student wrote "I admit I frankly did not know what I was getting into when I proposed a brand-new research project and willingly took on the task of doing much of the legwork." Another challenge was a lack of both financial and human resources to facilitate capstone project completion.

By the conclusion of the capstone process, students felt their research skills were strengthened, and they possessed a better understanding of all aspects of the research process including planning, implementation, and analysis. They also noted improvement in their approach to clinical practice, with one student drawing parallels between global health and providing care in the U.S.: "We can take lessons, such as working with limited resources, understanding cultural influence, and respecting traditional healers from the global front and bring them back to our domestic communities." Finally, students valued both peer and mentor relationships and felt those relationships enhanced their understanding of global health.

Discussion

A longitudinal global health capstone model is feasible.

We found that a longitudinal capstone model is feasible; however, the individual steps in the longitudinal process are more important than having a single long-term project. Slightly more than half of the student projects were longitudinal in nature (spanning two years or more). Although many of the specific projects were not longitudinal, all students went through the same four-year process with defined deliverables during each year of medical school. We found this focus on process important to provide a continuum of mentorship and opportunity to build cross-disciplinary skills, while allowing the students flexibility to change their specific final project focus.

Students report personal and professional growth through facing challenges in project planning and implementation. The obstacles faced by our students reflect real world challenges of global health work and provide student learning opportunities. The longitudinal capstone model allows students to progress while meeting challenges inherent in any given project including mentor identification, Institutional Review Board (IRB) approval, data collection delays, and lack of student availability at times due to competing priorities of exams and clerkships.

Giving students the flexibility to change their final project focus over time enables students to pursue meaningful scholarship related to their future specialties as their career interests evolve. In addition, it allows some students to participate in different aspects of serial short-term projects. Challenges noted by students in identifying projects may be mitigated by directing students to focus on building translatable skills rather than focusing on specific geographic project locations, patient populations, or narrow topical areas.

Capstones create an opportunity for dedicated mentorship.

Rather than assigning project mentors, students are encouraged to pursue global health capstone projects with mentors they align with. Although every student is assigned an advisor to provide support for program completion, these advisors are not necessarily content experts in the student's research area of interest. Student reflection papers highlighted the value of mentor relationships and often cited mentorship as a key component of successful capstone project completion. That being said, many students reported some challenges with finding mentors. Forty percent of GMED graduates ultimately completed a capstone project where they did not receive dedicated faculty mentorship.
The mentorship process can be improved within the GMED program to support student capstone development and scholarship. Moving forward, every student should have capstone mentorship to improve the quality of their experiences as well as to create a stronger final product. We found that 26% of students presented capstone-related abstracts at conferences, and 14% were able to publish work related to their capstones. With dedicated project mentorship for every student, we aim to increase the number of students producing quality global health scholarship.

In addition, GMED must expand its pool of mentors to cover more medical specialty areas. When the program was founded, emergency medicine had strong representation among program faculty, which may explain why almost a third of student capstones were in that specialty area. GMED is restructuring its mentorship program to provide wider faculty representation and to create a more structured mentorship environment, to ensure that students are provided necessary support and guidance.

**The capstone is synergistic with other modalities for teaching CUGH competencies.**

Our review suggests that a majority of students demonstrated some level of competency in nine of the eleven CUGH competency domains. Competency in Capacity Strengthening and Program Management was not demonstrated by a majority of students. Alternate methods may be better suited to address certain competencies, and it is important to consider the global health capstone as part of a larger curriculum using multiple educational modalities.

In 2012, when our original curriculum was designed, didactic sessions targeted previously established competencies, not the 39 competencies in 11 domains published in 2015. To address additional competencies, in 2018, we integrated supplemental curricular content in the form of skills-based workshops that focus on community engagement, global health research and scholarship, and global health policy and advocacy.

It is interesting to note that many students were able to complete global health capstones that did not require international travel. Considering personal and financial restrictions that may affect students’ ability to travel, the global health capstone reinforces the view that global health can focus on transnational health issues addressing health equity, and one need not always be in an international context to participate in effective global health work.

**Limitations**

Our review was based on final presentations and written reflection papers of graduating fourth year students, which may not be representative of students’ earlier capstone work (e.g. presentations delivered in the first year and posters presented as second year students). In particular, the first year presentation requires students to research the global burden of disease and identify relevant social determinants for a defined global health issue. Had these products been considered, it is likely more students would have demonstrated achievement in those particular competency domains.

Our study was also limited to a retrospective review of the global health capstone to determine how this unique component of our program might contribute to global health competency-based education. However, as noted previously, the capstone is one part of a broader curriculum, and it may be more reasonable to consider competency development throughout the course of the entire GMED program rather than only through final capstone products.

This paper aims to evaluate the global health capstone as part of a global health competency-based curriculum, but we have not yet developed structured assessment tools to evaluate student attainment of competencies. Although capstone products were reviewed to identify “some” level of competency in the 11 CUGH competency domains, we did not assess whether students attained each of the 39 sub-competencies and to what degree. Numerous challenges have been identified in assessment of global health competencies. Attempts have been made to develop tools such as surveys, structured instruments, and self-assessments in order to objectively assess global health competencies, but more research is needed in this area, including validated tools to assess global health capstones.
Conclusions

As the bar is raised on global health education beyond just international electives, students need integrated and formalized programming that enables them to develop skills and the ability to apply concepts in impactful global health endeavors. A structured global health capstone is one method to teach global health competencies and prepare students for careers as global health practitioners and leaders. The longitudinal global health capstone appears feasible and shows promise in demonstrating student understanding of most of the essential global health core competencies. Improved mentorship is essential for successful capstone and program completion. Further refinement of the capstone may also target additional competency domains while enhancing scholarship and research skills for global health students.

Declarations

Ethics approval and consent to participate
Not applicable

Consent for publication
Not applicable

Availability of data and material
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests
Not applicable

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Authors’ contributions
SC contributed to the study design, data analysis, and writing of the manuscript.
NG contributed to the study design, data analysis, and writing of the manuscript.
VD contributed to the study design, data analysis, and editing/revision of the manuscript.
ME contributed to the study design, data analysis, and editing/revision of the manuscript.
JL contributed to the study design, data analysis, and editing/revision of the manuscript.
SW contributed to the study design and editing/revision of the manuscript.
All authors read and approved the final manuscript.

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Tables

Table 1 Features of Capstones

| Feature                                      | n (%)     |
|----------------------------------------------|-----------|
| Original Research                            | 26 (74%)  |
| **Mixed Methods**                            |           |
| Quantitative                                 | 10 (39%)  |
| Qualitative                                  | 10 (39%)  |
| Faculty-mentored project                     | 6 (23%)   |
| Final capstone longitudinal                  | 21 (60%)  |
| International travel                         | 25 (71%)  |
| Project related to residency specialty       | 17 (49%)  |
| Led to abstract/presentation                 | 9 (26%)   |
| Led to publication                           | 5 (14%)   |

Table 2 Capstone Locations
### Countries (Number of Projects Completed)

| Country         | Number of Projects |
|-----------------|--------------------|
| Colombia        | 1                  |
| Mexico          | 1                  |
| New Zealand     | 1                  |
| Nicaragua       | 1                  |
| Palestine       | 1                  |
| Peru            | 1                  |
| Senegal         | 1                  |
| Sierra Leone    | 1                  |
| Uganda          | 1                  |
| Dominican Republic | 2            |
| Mongolia        | 2                  |
| Kenya           | 3                  |
| South Africa    | 3                  |
| Ghana           | 4                  |
| United States   | 4                  |

### Table 3 Student Reflection Paper Themes

| Facilitators for Capstone Completion                                                                 |
|------------------------------------------------------------------------------------------------------|
| Receiving faculty mentorship                                                                     |
| “I was extremely fortunate to have mentors that were dedicated to helping me.”                     |
| Having personal interest in focus area                                                              |
| “If I had not been as personally invested in the topic and the community, I might have given up.”   |
| Being adaptable and flexible                                                                        |
| “The need for flexibility and patience was further highlighted as I encountered other obstacles to smooth project progression.” |

| Challenges to Capstone Completion                                                                 |
|---------------------------------------------------------------------------------------------------|
| Identifying a capstone project                                                                    |
| “After two years of searching for a suitable capstone project, I was stumped...as a lowly, lone medical student, I did not find much enthusiasm or support. After this setback, I was discouraged and briefly abandoned the idea of working with [population of interest].” |
| Developing a research project                                                                     |
| “The experience included many bumpy rides. Some of the reasons [include] poor experience in research design on my end.” |
| Lacking financial and human resources                                                              |
| “This quickly proved to be very difficult with significantly less manpower and funding available. This realization showed me that I had to tackle a smaller part of the problem at hand.” |

| Key Benefits                                                                                       |
|---------------------------------------------------------------------------------------------------|
| Strengthening research skills                                                                     |
| “I now have a better understanding of the process it takes to conduct a research project and the patience and perseverance it takes to keep a project going.” |
| Improving approach to clinical practice                                                            |
| “As time went on [in the LMIC], I learned an incredible amount...my medical knowledge definitely grew during this time.” |
| Developing faculty and peer relationships                                                          |
| “The greatest and most valuable thing I've gained through the GMED program is without a doubt the relationships I've formed with classmates and faculty members.” |

### Figures
Figure 1

CUGH Global Health Competency Domains and Demonstration of Attainment of Competency from Global Health Capstones