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Title
Developing a Longitudinal Case-Based Global Health Curriculum for the Medical Student Clerkship Year

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Educational Objectives
By the end of this activity, learners will be able to:
1. Discuss challenges faced by patients in low-resource settings and disparities in access to care globally
2. Understand social determinants of health and its effects on patients domestically and internationally
3. Apply new skills in history, physical exam, diagnosis, and treatment to patient care

Abstract
Introduction
Although over 20% of U.S. medical students express interest in global health (GH), only 39% of medical schools offer formal GH education. We designed a longitudinal case-based curriculum for the core clerkships to incorporate GH into clinical education, increase awareness of barriers to care globally, and create opportunities for students to meet GH faculty.

Methods
We conducted an institution-wide survey to determine baseline GH interest. We then developed three case-based sessions incorporated into medicine, surgery, and pediatrics clerkships at Harvard Medical School. The cases included clinical learning targeted to each clerkship while exploring fundamental GH concepts. Cases were developed with GH faculty, and the pilot was implemented from October to December 2019 with 55 students. We used pre- and post-didactic surveys to assess interest in GH and plans to pursue GH, and to elicit qualitative feedback. A follow-up survey assessed students' understanding of GH and barriers to care relevant to their patients domestically.

Results
Students felt clinical management, physical exam skills, epidemiology, and social determinants of health were strengths of the sessions, and felt they were able to apply more critical thinking skills and cultural humility to their patients afterwards. Students felt that simulation would be a great addition to the curriculum, and wanted both more time per session and more sessions overall.

Discussion
Integrating GH didactics into the core clerkships has potential to address gaps in GH education and to help students make connections between clinical learning and GH, enhancing their care of patients both domestically and in future GH work.

Introduction

It is increasingly important for medical schools to incorporate global health (GH) into their curricula, both to satisfy the interests of their student body and to foster deeper learning of the social determinants of health (SDH) and the historical determinants of health inequities, both major contributors to disparities in healthcare globally. A significant percentage of students who enter medical school in the United States have an interest in GH, increasing from 6.4% in 1984 to 23.1% in 2007.[1] Additionally, students are engaging in international experiences prior to medical school, and 20-30% of medical students will take part in an international clinical elective during their training.[2-4] However, it is not just students who have interest in GH who should be exposed to GH education. Domestic physician practice increasingly requires an understanding of the many social, cultural, and economic factors that affect patient outcomes,[5] and there are a number of benefits to formally incorporating these concepts into medical education.[6] GH education can help increase awareness of the role of public health in medicine, as well as the structural barriers to healthcare.[7,8] Exposure to GH in medical school can also increase the chance of future practice in underserved areas of the U.S. and careers in primary care.[9-12]

A consensus statement in *Academic Medicine* concluded that medical school GH curricula vary significantly and that the majority of GH experiences for medical students are international rotations.[3] While medical schools offer pre-clerkship GH courses and post-clerkship international electives, this leaves a significant gap during the core clinical year and is a missed opportunity to connect the social determinants of health to students' foundational clinical education. Existing GH curricular offerings are also often optional, which deepens learning for those who are interested, but leaves many medical students without exposure to GH. To address the gap in GH coursework during the clerkship year, we developed a clinically-focused case-based GH curriculum spread longitudinally throughout the medical student core clerkships.[13-14] Cases were chosen from different WHO regions internationally, while also addressing domestic concepts (i.e. refugee care, homeless populations, rural healthcare, indigenous health, etc.). The cases were intended to encourage students to think creatively, draw upon fundamental clinical knowledge and skills, connect historical processes with current health realities, and recognize the significant structural barriers for patients in underserved regions internationally and domestically.[15,16] We also hoped to increase interest in GH and to expose students to GH faculty mentors throughout the clerkship year.

In *MedEdPORTAL*, the Clinical Topics in Global Health course is an optional pre-clinical elective.[17] Unique to our curriculum is that it spans the clerkship year and is required for all students. Our case-based approach to GH also directly engages students in critical thinking and allows them to apply their growing body of clinical knowledge to resource-limited settings.[18] In *MedEdPORTAL*, Fredrick discusses implementation of a single GH case that addresses health disparities, health systems, and SDH.[18] We build on this case model, expanding to several cases across the core clerkships, with a greater focus on clinical learning, and highlighting not only international, but also domestic issues. With this curriculum, we hope to facilitate the development of a socially conscious generation of physicians, who will look beyond their patients' physical symptoms and work to understand health and well-being in the greater context of their patients' lives.

Methods

Curricular Context

We implemented this curriculum in the didactic portion of three of the core clerkships for Harvard Medical School (HMS) students based at Brigham & Women's Hospital (BWH) and Boston Children's Hospital (BCH). The curriculum consisted of one-hour sessions in medicine, surgery, and pediatrics, and attendance was required for clerkship students. At our institution, the medicine clerkship is 12 weeks long with didactics included throughout. The surgery clerkship is 12 weeks long, with didactics scheduled in blocks every Wednesday morning. The pediatrics clerkship is 6 weeks long with didactics scheduled throughout.

To advocate for the implementation of this curriculum, we sent out an interest survey to all Harvard medical students from May 12 to June 15, 2019, and then conducted a review of the GH course offerings at HMS. At the end of June 2019, this information was presented to the clerkship directors at BWH and BCH. We then met with the medicine, surgery, pediatrics, and Ob/Gyn clerkship directors throughout July 2019 to discuss moving forward with piloting the curriculum. We received approval from medicine, surgery, and pediatrics. Due to time constraints in the Ob/Gyn clerkship, we did not receive approval, and this was deferred for the purposes of the pilot study. We then contacted GH faculty in medicine, surgery, and pediatrics to begin developing the cases. This included a series of independent meetings throughout August and September 2019 to understand gaps in the current clerkship didactics, to discuss potential topics for the cases, and to begin outlining each session.

For pediatrics, there were no didactics on diarrheal disease and fluid management, so we elected to move forward with the topic of "diarrhea, dehydration, and malnutrition," based in a Syrian refugee camp. For surgery, we saw that there were no didactics on burn care, and decided on the topic of "burns, plastic surgery, and vulnerable populations," based in rural Rwanda. For internal medicine, we engaged residents and faculty in the BWH Global Health Equity residency, who chose a case on "pneumonia, air pollution, and forced displacement," based in a Palestinian community in Israel. As the cases were being developed, we worked with the clerkship directors and coordinators to schedule the sessions. For the study pilot period from October through December 2019, we scheduled one session for medicine, one session for surgery, and two sessions for pediatrics.

Survey Design and Administration

To assess the impact of this educational innovation, we administered pre- and post-intervention surveys to explore student interest in GH, desire for increased GH education opportunities, likelihood to seek out GH experiences in medical school and residency, and likelihood to pursue a career in GH. We used 5-point Likert scales (1=least, 5=most) to assess these student perspective items. We also gathered demographic data and feedback on each session. The pre-intervention survey was administered during orientation (first day) for each clerkship. The post-intervention survey was administered to students immediately after each didactic session. We also administered a brief follow-up survey with free-form questions two weeks after each session to assess how the cases impacted students' views of their patients, whether they noticed any similarities or differences in their clinical experiences, and any additional reflections.

Per agreement with the clerkship directors, the surveys were only administered during the pilot period from October to December 2019. The total potential sample size during that time was 55 (14 students on internal medicine, 14 students on surgery, and a total of 27 students divided between two pediatrics blocks). The Harvard Medical School / School of Public Health IRB determined that the study was exempt from IRB review.

Data Analysis

We used counts and percentages to describe categorical variables, and means and standard deviations to describe continuous variables. Likert responses were analyzed as continuous variables. Qualitative data was analyzed via a grounded theory approach to identify themes on the educational experience, methods for improving implementation in the future, and impact of the curriculum on students' views of patient care and the challenges their patients faced here in Boston. Student data was analyzed collectively in the pre-intervention and post-intervention responses, rather than being paired for direct comparison. It was determined that pairing would be challenging with limited time, creates issues with student confidentiality, and would result in lost data for students who may not have filled out one survey or the other. All analyses were conducted using Microsoft Excel.

Results

A total of 98 of 660 students (15%) participated in the school-wide global health (GH) interest survey. Students from each class responded to the survey (28% MS1s, 27% MS2s, 31% MS3s, and 15% MS4s). Most students had an interest in internal medicine (36%), surgery (28%), or pediatrics (16%). A majority of respondents (69%) had prior experience in GH. Most students were extremely or very interested in GH (53%); were extremely or somewhat dissatisfied with the current GH curriculum at HMS (55%); and were extremely or very interested in having a GH curriculum during the clerkships (57%). Student comments included not feeling prepared for GH work, desire to gain clinical knowledge applicable to resource-limited settings, and desire to interact with GH faculty.

For piloting the curriculum, pre-intervention surveys were administered to 55 students who were in the medicine, surgery, or pediatrics clerkships at BWH and BCH. Fifty-one of the 55 students (93%) filled out this survey. The majority of students in the pilot were in their MS2 year (73%), were MD only (78%), and had an interest in internal medicine (63%), followed by pediatrics (49%), surgery (39%), and Ob/Gyn (29%). Additional demographic data from the pre-didactic survey is included in Table 1. In the pre-didactic survey, 45% of students were extremely or very interested in GH; 53% were extremely or somewhat likely to pursue GH experiences in medical school and 41% during residency; and 51% said they were extremely or somewhat likely to incorporate GH into their future career.

Table 1: Pre-Didactic Survey – Demographics (*N*=51)

Characteristic	# of Students
Number	51
Gender	
Male	23 (45.1%)
Female	26 (51%)
Non-Binary	1 (2%)
Prefer not to say	1 (2%)
Degree	
MD	40 (78.4%)
MD/PhD	11 (21.6%)
Year	
MS2 (c/o 2022)	37 (72.5%)
MS3 (c/o 2021)	14 (27.5%)
Fields of Interest	
Internal Medicine	32 (62.7%)
Pediatrics	25 (49%)
Surgery	20 (39.2%)
Ob/Gyn	15 (29.4%)
Neurology	5 (9.8%)
Psychiatry	5 (9.8%)
Radiology	5 (9.8%)
Have you done global health work or research in the past?	
Yes	22 (43.1%)
No	29 (56.9%)

The post-didactic survey was administered directly after each global health didactic session. Forty of the 55 students (73%) filled out the post-didactic survey. In the post-didactic survey, 50% of students were extremely or very interested in GH; 53% were extremely or somewhat likely to pursue GH experiences in medical school and 50% during residency; and 60% were extremely or somewhat likely to incorporate GH into their future career. The majority of students were extremely or very interested in having more GH didactics during the clerkships (55%) and were extremely or very interested in having more GH education during medical school overall (55%). Averages and standard deviations from the pre- and post-didactic surveys are reflected in Table 2.

Table 2: Pre- and Post-Didactic Survey – Quantitative Results (Likert Scale: 1=Not at All, 5=Extremely)

Question	Pre-Survey (*N*=51)		Post-Survey (*N*=40)	
	Mean	Std Dev	Mean	Std Dev
Interest in global health	3.43	1.12	3.53	1.06
Likelihood to seek out a global health experience during medical school	3.55	1.32	3.48	1.41
Likelihood to seek out a global health experience during residency	3.24	1.26	3.53	1.32
Likelihood to incorporate global health into your future medical career	3.51	1.32	3.68	1.25

The post-didactic survey also included several qualitative questions to allow students to review the session and provide specific feedback. Students found clinical management, physical exam skills, epidemiology, creative approaches to care, and social determinants of health to be key educational strengths of the sessions. Similarly students wanted to see more clinical knowledge and epidemiology, more time to go through the cases in depth, and an even broader focus on global health concepts. Additional feedback indicated that students wanted more didactics such as these embedded throughout the clerkship year. These results are summarized in Table 3.

Table 3: Post-Didactic Survey – Qualitative Results (*N*=40)

Theme	**Quote**
Please name at least one aspect of this global health didactic session that you found helpful.	
Clinical Management	"I think learning about practical diagnostics and interventions in low resource environments is super helpful to apply even on the wards." "Clinical management of a global and domestic pediatric health problem, knowing what the 'highest yield' tests and instruments are." "Differential of diarrhea. How to assess this in low-resource settings." "Burn care in a low-resource setting." "I found it very helpful to ground the didactic in a concrete clinical case."
Epidemiology	"History of Palestine/Israel and how that has influenced the environment & burden of disease." "Discussing the different epidemiology of disease in different countries."
Creative Solutions	"Discussion of creative solutions to [resource challenges in] low-resource settings." "Providing care in resource-limited settings, implementing creative solutions for systems problems."
Social Determinants of Health	"Discussing importance of social determinants vs. healthcare quality and access in improving human health."
Physical Exam	"Learning physical exam findings of dehydration." "The hands-on experience with the thread, though small, was very powerful and evocative" "The string [representing MUAC for severe malnutrition] was particularly powerful. I brought that home and showed all my medical student roommates so they too would be aware."
Please name at least one aspect of this global health didactic session that you would improve.	
Broader Global Health Topics	"In the future, it might be helpful to have a 5-10 minute discussion on specific principles of engaging in global health work that are applicable in the didactic case. It would also be helpful to increase the time of the didactic to allow for a more thorough discussion of global health ethics, pathophysiology, and general clinical pearls." "Discussing any actions we can take to help."
More Epidemiology	"I'd love to know some other illnesses that specifically impacted children living in that specific setting."
Clinical Knowledge	"Talking about how to actually make ORS and more about why it's so good." "More about etiology of malnutrition in this setting (how long it develops, typical nutrition access for refugees)."
Real Life Examples	"I was wondering if it would be possible to use a real example next time. A contrived example helps us visualize what is going on, but seeing a real example is always more impactful." "How are resources actually allocated? How do we decide how to divide medical supplies amongst children?"
More Sessions	"More often please! The lecture was very educational."

More Time	"We needed more time to get through this content!" "Duration - leave more time for questions." "Would be better earlier in the rotation."
If you have additional feedback, please feel free to include below:	
"Great experience, I'm far more likely to seek out global health work as a direct result of these talks."	
"I appreciated how the burn lecture combined reviewing content (treatment of burns) and global health concepts."	
"I would love to see more such sessions embedded throughout the pre-clinical and clinical curriculum. In fact, I feel this should be an essential component of every clerkship and/or perhaps embedded into a longitudinal clerkship elective track."	

The final follow-up survey was administered two weeks after each global health didactic session. Seventeen of the 55 students (31%) filled out the follow-up survey. When discussing influence of the sessions, students mentioned increased critical thinking skills, cultural humility, interest in GH, and understanding of SDH. They noticed similarities in healthcare access challenges abroad and with vulnerable populations here in the U.S. Many students provided feedback that simulation would be a great addition to the curriculum; that rural health should be further incorporated; and that they wanted more GH in the overall medical school curriculum. These results are summarized in Table 4.

Table 4: Follow-Up Survey – Qualitative Results (*N*=17)

Theme	**Quote**
How did the global health didactic session influence your view of taking care of patients here in Boston?	
Critical Thinking	"To think more critically about creative solutions when people say something can't be done."
Cultural Humility	"The didactic session encouraged me to approach care with an emphasis on contextually-informed and culturally-competent care. In doing so, care will be higher quality and more patient-centered."
Increased Interest	"Increased interest in working within resource poor settings."
New Clinical Knowledge	"Helpful to be exposed to problems that are common elsewhere but not often seen here."
Resource Disparities	"It made me understand how privileged we are in Boston to have many resources to tackle problems."
Social Determinants of Health	"Think more about [a patient's] background, pay more attention to other hx besides medical hx."
What similarities did you notice between issues in the global health didactic session and challenges your patients here in Boston have faced?	
Access to Care	"Compliance and access to care are issues prevalent everywhere." "Barriers that delay healthcare treatment [are similar]."
Resource Disparities	"It made me wonder which of our technologies actually improve outcomes and whether the cost of such interventions is always worth it in relation to lower tech options (financial harm is a real burden on patients following hospital care too)."

Vulnerable Populations	"There's overlap between global health challenges and those faced by underserved and immigrant populations."
Social Determinants of Health	"Every patient has a unique story and health history (with social, personal, biological influences); if these are ignored or minimized, we are doing a huge dis-service to our patients and likely unable to effectively target the root of their illness." "A lot of the social determinants of health and barriers to care were unfortunately very similar."
Do you have any other reflections on this PCE global health curriculum initiative or the global health curriculum at HMS overall? If so, please include them below:	
Add Simulation	“I think that simulations would be the best way to learn. For example, have us do a trauma case with a patient with tools available in Boston versus tools available in LMIC. This would force us to think about what challenges others face.”
More Global Health Sessions	"I would love to see such sessions embedded more longitudinally across the curriculum at HMS, especially in each of the clinical clerkships. Thank you for organizing this!" "Could expand on global health related cases at noon/morning conferences in [the clerkships]." "It would be great to have more global health--it also helps us think about social determinants of health more broadly."
Rural Health	"I would love to learn more about parallels between rural health in the U.S. and rural health abroad.”

Discussion

Increasing numbers of students enter medical school with an interest in GH, but not enough schools offer formal didactic GH education, and those that do often have a gap in GH education during the clerkship year. As globalization progresses, it is important for medical students to understand issues faced by patients both in their own locality and around the world. There are many demands on medical students’ time, and we see our GH curriculum as a way to incorporate GH into didactic sessions that address universally relevant clinical topics for the core clerkships. It is important for medical students to be exposed to this material during their clinical training, to demonstrate that GH concepts can enhance medical skills and professionalism for all students.

Each case in our curriculum uniquely intertwines clinical topics that students need for patient care (history, physical exam, diagnostics, treatment, etc.) with the challenges faced by patients in low- and middle-income countries, while also addressing SDH and barriers for patients in the U.S. As these sessions use a case-based approach, students are able to creatively engage with the issues presented in the case and draw upon their growing repertoire of clinical knowledge while learning about GH. This was clearly stated in the post-survey responses by students who felt they gained clinical diagnosis and management skills as well as knowledge on epidemiology and SDH.

There are several limitations both in the curriculum and our approach to evaluation. Given the limited time allotted for piloting the curriculum, the sample size was small, representing only a subset of all students in their clerkship year at only two of the Harvard-affiliated hospitals. In addition, because of the three-month time-frame, students were evaluated after only one didactic session, while the curriculum is intended to be spread longitudinally throughout multiple clerkships. Another challenge we faced was the survey response rate. While almost all students filled out the pre-didactic survey, the response rate decreased for the post-didactic survey and dropped off significantly for the follow-up survey. This made it challenging to conduct a true quantitative pre- and post-comparison of interest in pursuing GH and incorporating GH experiences into future training. However, we were able to gain significant insight from the qualitative data that showed meaningful gains for students who experienced the case-based GH didactic. We were unable to include the Ob/Gyn didactic session due to time constraints in the Ob/Gyn clerkship schedule, and we were unable to actively pursue the other core clerkships (neurology, psychiatry, and radiology) for a similar reason. Given the positive student feedback we received for the pilot, we are equipped to re-evaluate the current clinical didactic offerings in those clerkships and to incorporate similar GH cases and content.

There are a number of exciting opportunities ahead based on this work. Expanding the case series to include the other core clerkships is an important first step. We may also consider developing subspecialty cases, for use in 3rd/4th year medical student electives or for residents. To address generalizability and support institutions with less GH faculty, we have included detailed notes for each case and slidedeck such that they can be directly taught by faculty or residents at other institutions. However, we also hope that the general structure we have created for these cases allows other institutions to adapt and expand the cases to cover topics that may fit better into their current curricular offerings and that may address more locally relevant content. At HMS specifically, we hope to expand to all of the other major clinical sites (Massachusetts General Hospital, Beth Israel Deaconess Medical Center, and Cambridge Health Alliance). We also hope to ensure sustainable inclusion of the cases beyond the pilot. Ideally, the curriculum could then be re-evaluated over the course of a year, after students have been exposed to all of the GH didactic sessions across the different clerkships.

Overall, we believe that this unique case-based approach makes GH education more accessible, interesting, and relevant to clerkship students, whether or not they plan to pursue GH during their careers. This currululum meaningfully includes GH education in medical school in a way that integrates both clinical learning and a greater understanding of the multidimensional factors that affect health outcomes. Ultimately, we envision that such cases will facilitate the development of a thoughtful and socially conscious generation of physicians, who go beyond their immediate vicinity and engage with the broader context of their patients both in front of them and around the world.

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