Development of a Novel Global Surgery Course for Medical Schools

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OBJECTIVE: We endeavored to create a comprehensive course in global surgery involving multinational exchange.

DESIGN: The course involved 2 weeks of didactics, 2 weeks of clinical rotations in a low-resource setting and 1 week for a capstone project. We evaluated our success through knowledge tests, surveys of the students, and surveys of our Zimbabwean hosts.

SETTING: The didactic portions were held in Sweden, and the clinical portion was primarily in Harare with hospitals affiliated with the University of Zimbabwe.

PARTICIPANTS: Final year medical students from Lund University in Sweden, Harvard Medical School in the USA and the University of Zimbabwe all participated in didactics in Sweden. The Swedish and American students then traveled to Zimbabwe for clinical work. The Zimbabwean students remained in Sweden for a clinical experience.

RESULTS: The course has been taught for 3 consecutive years and is an established part of the curriculum at Lund University, with regular participation from Harvard Medical School and the University of Zimbabwe. Participants report significant improvements in their physical exam skills and their appreciation of the needs of underserved populations, as well as confidence with global surgical concepts. Our Zimbabwean hosts thought the visitors integrated well into the clinical teams, added value to their own students' experience and believe that the exchange should continue despite the burden associated with hosting visiting students.

CONCLUSIONS: Here we detail the development of a course in global surgery for medical students that integrates didactic as well as clinical experiences in a low-resource setting. The course includes a true multilateral exchange with students from Sweden, the United States and Zimbabwe participating regularly. We hope that this course might serve as a model for other medical schools looking to establish courses in this burgeoning field. (J Surg Ed 76:469−479. © 2018 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: global surgery, curriculum development, Sweden, Zimbabwe, low- and middle-income countries (LMIC's)

COMPETENCIES: Systems-Based Practice, Professionalism, Interpersonal and Communication Skills

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INTRODUCTION[1]

The global health community is increasingly aware of the critical need for, and impact of, surgical services in health systems. In 2015, multiple publications highlighted the vital role of surgery in global health and described specific interventions necessary for surgical capacity building, with a focus on low and middle-income countries (LMICs).[1-3] Interest in the field of global health and global surgery among medical students and residents has never been higher.[4-6] Therefore, it is important to emphasize the development of novel educational strategies to foster this interest.

Global surgery is poised to address several current problems in surgical education. Surgical residency directors have noted a lack of basic skills among graduating medical students.[7,8] Deficits have been noted in technical skills, physical exam techniques, and patient interactions.[9] Additionally, medical students are increasingly fast-tracking into surgical subspecialties directly out of medical school.[10-16] The number of surgical residents going into subspecialties is at all-time high of over 80%.[17] These figures have prompted leaders in surgery to raise the alarm about the coming critical shortage of true general surgeons.[18] A focus on education in global surgery is one potential remedy to this looming significant deficiency. It has been pointed out that global surgery is a field that attracts surgeons with the broadest range of skills.[19]

Previous research has demonstrated that students and institutions that participate in global health experiences derive numerous benefits.[6,20-23] These benefits include, but are not limited to, increased: clinical experience, cultural competence, and awareness of the importance of public health.[6] Students interested in global health are often driven by a desire to use their skills to work in the places where they are needed the most. These students also have a deeper understanding of the social determinants of health, including economic, racial, gender, and social disparities. If this surge of student interest in global health can be channeled, it has the potential to create a new generation of surgeons with broad training, who are also committed to serving in places of greatest need.

Despite the rising tide of interest among medical students,[4-6] and the clear benefits that these experiences can have on both partners in the global surgery exchange,[6,20-23] very few courses dedicated to global surgery exist. Of the courses that do exist, few include both classroom didactics and supervised international experience. When global surgery educational interventions are well designed, they involve a bilateral exchange of ideas, experiences and resources. Unfortunately, there are many examples of poorly conceived global health experiences that negatively impacted the host institution by burdening strained local health care providers and harming patients.[7,24] No courses that we are aware of include provision for students from LMICs to participate in a bilateral exchange with their counterparts from high-income countries.

Through Lund University's partnership with Harvard and the University of Zimbabwe, there was a unique opportunity to develop a robust and engaging course for medical students interested in the field of global surgery with the support of a grant from the Swedish Foundation for International Cooperation in Research and Higher Education (STINT). This paper describes our experience in creating such a course and assesses the effect of introducing this course to the participating students and institutions.

MATERIALS AND METHODS

Study Setting

This course involved faculty and students from Lund University, Harvard University, and the University of Zimbabwe. There were numerous student applications for participation from each institution, and 15 to 20 students were ultimately chosen to participate each year.

Curriculum Design and Course Development

Curriculum development began with a search of literature on global surgery and surgical education using the search terms "global surgery," "global health," "education," and "curriculum design" (PubMed and Google). There were numerous examples of global surgery courses but the most robust courses we discovered that were specific to surgery, medical students and included extensive didactic components were from King's College London, the University of British Columbia and Unite for Sight.[20,24,25] We reached out to these institutions to obtain and examine their curricula. Many other institutions had organized experiences in global surgery, but these were either limited to clinical rotations in LMICs or were focused solely on surgical residents.[26-29]

Course Structure

We designed our course to fit within Lund's existing elective framework of full-time course work for 5-week periods. The course was structured as 2 weeks of didactic course work, a 2-week international field experience and a final week for a capstone project. During the initial 2-week period, students participated in lectures and small group discussions in Sweden. For the Swedish and American students, the subsequent 2 weeks were spent

[1] LMIC (low and middle-income country), HIC (high-income country), STINT (Swedish Foundation for International Cooperation in Research and Higher Education)

in Harare, Zimbabwe participating in a clinical experience. After returning from Zimbabwe, the students had a fifth week to finalize and present their capstone project. Concurrently, students from Zimbabwe traveled to Sweden to participate in a 5-week surgery elective, which included both didactics and clinical work. During the didactic components, the students from Zimbabwe learned alongside the students from Sweden and the USA. This interaction allowed for deeply meaningful and informed exchange of ideas and experiences. All of these components were designed to foster an understanding of global health and global surgery while developing students' clinical skills, knowledge, and cultural competency (Fig. 1). The course was developed according to the constructive alignment framework of Biggs, which triangulates[1] the goals and expected learning outcomes,[2] the learning activities, and[3] the assessment and observed learning outcomes, in order to align and create synergy among these 3 course components.[30]

Didactic Component

We saw this course as an opportunity to bring together some of the thought leaders in global surgery. Over the 3 years that the course has run, 20 international guest lecturers from 10 countries have participated. We chose lecturers for their expertise in topics on which we wished to focus during the course or for their demonstrated experience and leadership in the field of global surgery (Fig. 2). Furthermore, we shared the curriculum with the invited lecturers and requested their input and subsequent feedback. The majority of the lectures were taught in person, with additional video streaming from international sites. We also used Lund's medical simulation center to conduct a surgical skills curriculum with a focus on skills applicable to the low-resource environment.

Developing the International Experience

The signature piece of the course was the 2-week international clinical experience. At the time of our initial course development, Lund University was expanding its partnership with the University of Zimbabwe. We were given the opportunity to offer this course as one of the first tangible products of this partnership. In collaboration with Zimbabwean colleagues, plans were made for the international clinical experience. Swedish and American students joined surgical, Ob/Gyn and anesthesia teams for variable amounts of time over a 2-week period at Parirenyatwa Hospital and Harare Central Hospital. In the second and third iterations of the course, we added a dedicated pediatric track, as well as a district hospital and home visit experiences. In addition to these activities, the students had the opportunity to participate in a number of other related experiences, such as meeting with the Swedish ambassador and visiting the World Health Organization country office. The students were accompanied by instructors and administrative support from Lund and Harvard University and had personal introductions on the first day of their rotations.

Capstone Project

The capstone project was designed to synthesize the experience and expand the knowledge on a specific topic in global surgery. In the first year of the course, students researched a particular clinical topic relating to surgery, anesthesia or Ob/Gyn in LMICs. In the second year, students focused on a specific challenge to care delivery in LMIC's and proposed solutions involving advocacy through social media campaigns. In the most recent year, each group wrote a grant proposal to address a challenge in global surgery.

Funding and Course Implementation

Funding for the course came from a number of sources including: an initial grant from STINT; student travel reimbursements by Lund University, assistance with faculty travel expenses by Harvard; and a grant for innovative courses administered by Lund University. Lund continues to fund the course with support from the Linnaeus-Palme partnership grant through the Swedish International Development Cooperation Agency. This grant has a provision to fund travel and room-and-board for Zimbabwean students and faculty who participate in clinical teaching in Sweden, as well as for Swedish medical students while in Zimbabwe.

Feedback

From the beginning, this course was designed to change to fit the needs of the students. At the end of each day, we solicited feedback from the students. Course instructors met daily to go over this feedback and to make changes to the course in real time. During the international clinical experience, there were daily sessions for sharing, feedback and reflection. Focus was placed upon the comparison between the theoretical knowledge discussed in Lund and the practical experience gained in Harare. In addition to the daily feedback, there also was a summative feedback session at the completion of the course. The course was adjusted in the second and third years based on student feedback, such as the addition of the rotation at a district hospital to allow for a broader picture of the health care system.

Knowledge Test, Attitude Survey, and Host Survey Development and Administration

We used the goals and objectives set for each of the lectures throughout the course to create pre-and postcourse

Themes	Programs	Learning Activities	Evaluation
Global Health	History of Global Health Key Stakeholders in Global Health Health Policy, Metrics and the Millenium Development Goals	Lectures Case Studies Group Discussion	Attendance Participation in group discussion, case studies, and field work Instructor Observation Group Project Quality and Participation
Surgery as a key global health issue	Global Burden of Surgical Disease Infrastructural Limitations in LMICs Human Resource Challenges in LMICs	Lectures Case Studies Group Discussion	
Clinical Skills and Knowledge: Surgery OB/Gyn Anesthesia	The Trauma Pandemic OB/Gyn Considerations in LMICs Anesthetic Considerations in LMICs Humanitarian Disaster Response Career Pathways in Global Surgery Skills Lab: Surgery, OB/Gyn, Anesthesia	Lectures Case Studies Group Discussion Skills Lab Field Experience	
Cultural Competency	Cultural Awareness in LMICs Ethics Field Work in a low resource setting	Lectures Case Studies Group Discussion Skills Lab Field Experience	

FIGURE 1. Course concept.

History of global health	Surgery in the context of global health	Lancet Commission on Global Surgery	Short term mission trips	Barriers to access
Workforce issues	Investing in surgery for LMIC's	Trauma as a global health issue	Humanitarian and natural disasters	Mobile surgery
Blood banking	Cardiothoracic surgery in LMIC's	Critical care in resource limited settings	Surgical oncology in global health	Global surgery metrics
Case study: Sierra Leone	Role of schools of public health	Careers in global surgery	Pediatric global surgery	Female genital mutilation
Task shifting/sharing	Perioperative nursing in global health	Radiology in LMIC's	Orthopedic surgery in LMIC's	Urology in LMIC's
Introduction to your hosts: Zimbabwe				

FIGURE 2. Lecture topics.

multiple-choice knowledge tests. After performing a literature search and several rounds of evaluations from a panel of experts in the field of global surgery, we developed precourse and postcourse questionnaires. We piloted this questionnaire on a group of medical students from both Sweden and the United States for further validation and refinement. We then administered the survey tool to all course participants to determine change in knowledge and attitudes measured on a 5-point Likert scale (ranging from "strongly disagree" to "strongly agree"). Finally, we developed a survey to measure our host's attitudes toward our course. This was adapted from a survey by Elobu et al., used to gauge the attitudes of healthcare workers in LMIC's toward visiting medical teams.[20] Knowledge test, attitude survey, and host survey were administered from the first and third years of the course.

Data Analysis

We compared scores on pre- and postcourse knowledge tests using 2-sided 2-way paired t-tests. We compared scores on the attitude surveys using a Wilcoxon Rank Sum test. We performed all statistical analyses using STATA 14 (College Station, Tx) and defined statistical significance as $p < 0.05$.

RESULTS

A total of 50 students participated in the course over the 3-year period. In 2015, there were 14 students, followed by 18 in 2016 and in 2017, respectively. Among these students, 42 were from Sweden, 4 from the United States and 4 from Zimbabwe. Students averaged 26.2 years of age. Results from the knowledge test, attitude survey, and host survey results are presented below. Most students had no previous formal global health experience (60.0%), whereas 6 (20.0%) had less than 1 month, 5 (16.7%) had between 1 month and a year, and only 1 (3.3%) had more than 1 year of experience.

Participants' knowledge of global surgery improved during the course. Before participating in the course, students scored an average of 62.8% ± 13.9% on the knowledge test, which improved to 80.9% ± 7.0% after the course. In a 2-tailed paired t-test analysis, this was a statistically significant increase in score ($p < 0.001$).

Participants' attitudes also evolved during the course (Table 1 and Fig. 3). Student self-perceived confidence in physical exam skills improved from the pre- to the postattitude survey ($p = 0.01$). Students noted high levels of agreement with the following statement: "I understand the challenges faced by the underserved when attempting to access the healthcare system", with a significant increase in agreement from the pre- to postattitude survey ($p = 0.002$). Students' impression of their

TABLE 1. Pre- and Postcourse Attitude Survey

Question	PrecourseMedian (IQR)	PostcourseMedian (IQR)	p value
I plan to pursue a career in academic medicine or surgery	4 (2)	4 (2)	0.1663
I have a good understanding of global health	3 (2)	4 (1)	0.0006*
I have a good understanding of global surgery	2 (1)	4 (1)	0.0002*
As a physician/surgeon I can make a real difference in someone's life	5 (1)	5 (0.5)	0.3239
As a physician/surgeon I can make a real difference in healthcare systems	4 (2)	4 (1.5)	0.9936
I plan to pursue surgery as a career	3 (2)	3.5 (3)	0.5803
I plan to get a secondary degree in global health including but not limited to public health or public policy	3 (2)	3 (2)	0.7693
I understand the challenges faced by the underserved when attempting to access the healthcare system	3 (1)	4 (0)	0.0024*
I plan to go on international medical/surgical trips regularly during my career	4 (2)	4 (1)	0.4906
In the future, the focus of my work will primarily be towards caring for underserved populations	3 (0)	3 (2)	0.7433
I would feel comfortable working as a physician or surgeon in a low-resource setting for a year	4 (2)	4 (1.5)	0.1999
I am confident in my physical examination skills in making a diagnosis	3 (0.5)	4 (1)	0.015*
Surgery is an 'indivisible, indispensable' part of primary healthcare	4 (2)	5 (1)	0.0124*

All answers reported as medians from a 5-point Likert scale (from "strongly disagree 1" to "strongly agree 5").
*denotes statistically significant difference.

understanding of global health also improved during the course ($p < 0.001$). At the end of the course, the majority of students (69.0%) strongly agreed with the statement that "surgery is an indivisible, indispensable part of healthcare," compared with one third (34.5%) before the course ($p = 0.01$).

A total of 51 participants completed the host surveys, 14 in 2015 and 37 in 2017 (Fig. 4). There was a broad representative sample of respondents: 25 (49.0%) were residents/house officers, 12 (23.5%) were nurses, 8 (15.7%) were consultants, 1 (2.0%) was a student, and 5 (9.8%) were administrators or "other". Almost all respondents agreed that hosting the students was an enjoyable experience (98.0%), that hosting was valuable to Zimbabwean students (74.0%), that the students acted in a culturally appropriate fashion (96.1%), and integrated well into the host medical teams (96.1%), and that the institution should continue to host visiting students from this program (96.1%). However, despite one accompanying international faculty for every 4 international students, a total of 40 respondents (80.0%) agreed or strongly agreed with the statement: "visiting students added a considerable burden to the hospital staff." There was no statistically significant difference in responses among the different categories of respondents.

DISCUSSION

We developed and implemented a global surgery course for medical students that includes a didactic component, a clinical rotation in a low resource setting and a capstone project for students and faculty from Sweden and the USA. As part of the multilateral exchange portion of this course students and faculty from Zimbabwe also participated in the didactics and did a clinical rotation in Sweden. While a few other courses dedicated to global surgery exist around the world, to the best of our knowledge, the format of this course and the multilateral exchange of students make this course truly unique.

After taking the course, the students' knowledge of global surgery improved, as did their comfort with physical exam skills and their appreciation of the needs of underserved populations. These results are similar to other studies, which demonstrated that students who participate in global health electives show improvement in their physical exam skills, their understanding of the social determinates of health, and in their desire to care for the underserved and work with multicultural populations.[6,21] We do not yet have data for the impact of this course on long-term career plans, but other studies have shown that students who participate in global health work are less likely to sub-specialize and are more likely to work in public service.[6]

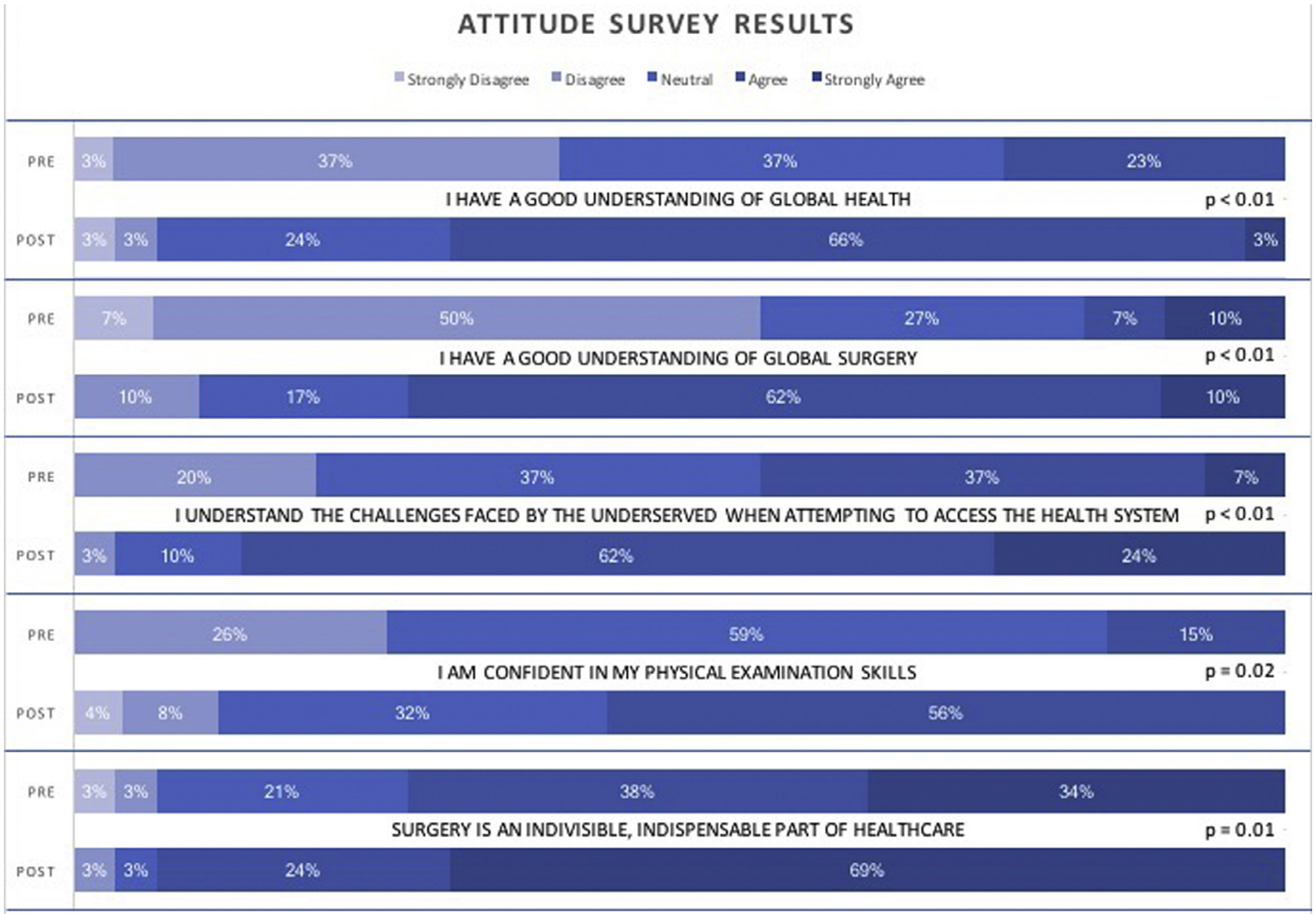

FIGURE 3. Pre- and postcourse student attitude survey results. Reported as percentage of students who answered each option on a 5-point Likert scale from strongly disagree to strongly agree. P-values comparing precourse and postcourse answers are provided.

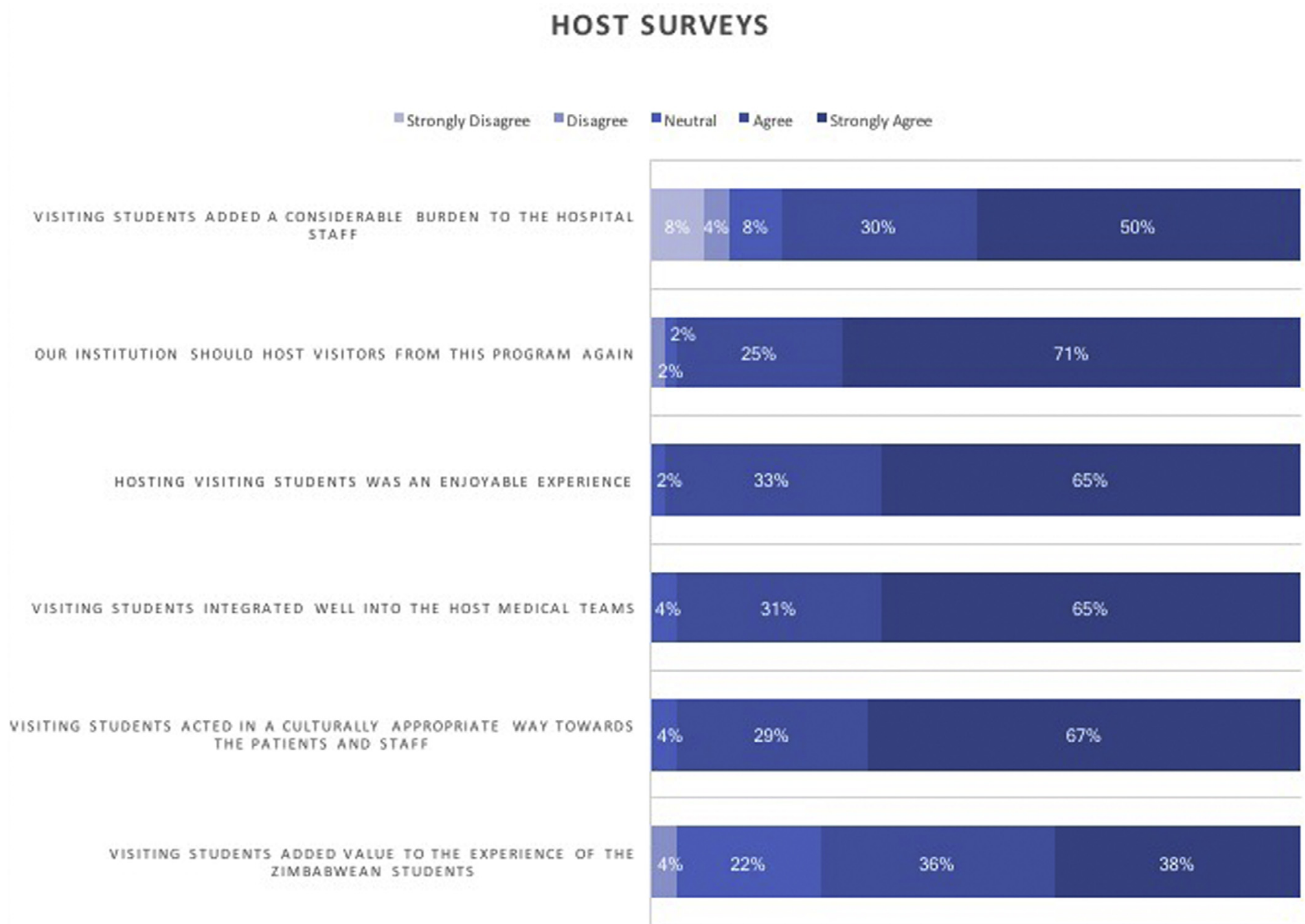

FIGURE 4. Zimbabwean host attitude survey results. Reported as percentage of respondents who answered each option on a 5-point Likert scale from strongly disagree to strongly agree.

Importantly, our Zimbabwean hosts thought the visitors integrated well into the clinical teams, added value to their own students' experience; and believe that the exchange should continue. Indeed, the students from both sides appeared to relish the experience. The visiting and host students even set up events outside the clinical rotations to share experiences and to socialize; and they have continued to stay in touch via social media. Despite this comradery, our Zimbabwean hosts acknowledged that the presence of the visitors did place a significant burden on their staff. Our results are comparable to other studies that have looked at host attitudes toward visiting medical providers.[24,31] These studies also showed largely positive receptivity to visiting medical teams, while acknowledging the burden placed upon them by having to serve as hosts.[24] We were sensitive to these risks and made every attempt to mitigate this burden by keeping the visiting students in small groups dispersed over several teams and by traveling with our own faculty and administrative support.

Medical schools around the world recognize the presence of massive disparities in levels of care and are increasingly looking for ways to incorporate these concepts into their curricula.[32-34] The reasons for these disparities are complex; and a sophisticated understanding of the social determinants of health is critical for clinicians who practice in any setting. Those with training in global health likely have a more profound understanding of concepts like poverty, inequality and structural violence. Exposure and skill development through this course equip these students to serve patients from a variety of cultures and in a range of different settings.

Each year the course has been oversubscribed and has received overwhelmingly positive feedback from all participants. This course is now fully integrated into the curricula of the 3 institutions and has been run for 3 consecutive years. The faculty members at Lund, Harvard, and the University of Zimbabwe have expressed a commitment to continue to run this course as an investment in the future of global surgery.

There are future opportunities to expand the course to be even more multilateral. Identified next steps include: (1) allowing areas of focused specialization for the international clinical experience; (2) increasing the number of Zimbabwean students who are able to travel to Sweden each year; (3) continued expansion of the district hospital and home-visit component of the course to highlight the critical role of the health systems; and (4) iterative development of the curriculum.

The design and implementation of this course along with our results had several limitations. The overarching course design of 2 weeks in Sweden, 2 weeks in Zimbabwe and a final week in Sweden was largely dictated by the elective course time-limit of Lund University. Our conclusions with regard to the benefits of this course are limited to measurement of written knowledge and attitudes. We do not yet have objective data on how this course might influence career trajectories and choice in practice setting. While we demonstrate effective knowledge transfer and shifts in attitudes, the effects of this course on more objective parameters such as physical exam skills have not been studied. Ongoing longitudinal assessment of student participants over time would be an ideal method to measure course impact on a larger scale. Additionally, this course has only been conducted for 3 years with 14 to 18 students in each class, which limited our sample size. The majority of the participants are from Sweden. The number of students from Zimbabwe and the United States has increased each year but is limited by funding. Finally, currently available funding limits the possibility of course expansion to other institutions.

CONCLUSION

Global surgery is an indivisible, indispensable part of healthcare. Participation in this course has been personally and professionally gratifying for the participants as well as the authors. We plan to continue this course on an annual basis and will continue to refine the experience. This course's deliberate multilateral design involving didactic, practical, and summative components has facilitated its success. With student interest in global surgery at an all-time high, we hope that this course will serve as a model for other institutions that wish to design such an experience for their own students.

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