Review Article

The landscape of academic global surgery: a rapid review

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Abstract: Interest in academic global surgery, which comprises clinical, educational, and research collaborations to improve surgical care between academic surgeons in high-income countries and low- and middle-income countries (LMICs) and their corresponding academic institutions, has grown over the years. However, there is no collective knowledge of academic global surgery. Thus, this review aims to understand the current landscape of academic global surgery and discuss future directions. A rapid review, a streamlined approach, was conducted to identify and summarize emerging studies systematically. The keywords applied in the search strategy were "global surgery" and "academic programs". The total number of retrieved articles in PubMed was 390, and after the investigation, 20 articles were extensively reviewed for the result section. According to the results, this study provided findings regarding: (I) perceptions of residents, faculty, and surgical program directors toward academic global surgery programs, (II) key program characteristics of implemented academic global surgery programs, and (III) evaluation results of available academic global surgery programs. We also drew lessons and challenges for a useful guide for future academic global surgery research and the development of optimal educational programs. This review identified a small but rich set of information on academic global surgery. Further research and discussion are needed on how to successfully incorporate the academic global surgery program into medical institutions.

Keywords: Global health; global surgery; academic global surgery; low- and middle-income country; medical education

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Introduction

After the 2015 publication of the Lancet Commission on Global Surgery, universal access to surgical care emerged as a global priority. In low- and middle-income countries (LMICs), 9 out of 10 individuals lack access to safe and affordable surgical care (1). The Lancet Commission on Global Surgery's follow-up report calls for a larger academic priority for global surgery while emphasizing the need for training programs for future surgeons, obstetricians, and anesthesiologists in LMIC (2).

A large portion of global surgery work involves clinical and educational activities by volunteer medical missions, non-governmental organizations (NGOs), and short-term medical trips. The role of academic institutions, however, has not been documented as much (3). Although academic institutions' role in global surgery has been restricted: consisting of short-term volunteerism during

surgeons' spare time, it is noted that academic surgical culture, innovation, teaching, and service can significantly contribute to unmet needs in global surgery (4). Moreover, academic institutions can bring global partnerships together and offer surgical training to ensure reliable and consistent delivery of care.

Notably, the demand for surgical residency education in HICs has increased. For instance, approximately 87% (n=61) of residents in a surgery department at Yale's New Haven Hospital responded that they were interested in pursuing international surgery activities (5). In addition, 76% of residents plan to incorporate global surgery into their future careers, according to a survey of 74 residents in the United States (6). However, studies on academic global surgery programs (AGSPs) have been limited. Thus, this rapid review aimed to provide a current landscape of the available evidence of AGSPs by categorizing and summarizing the evidence. This study will also shed light on future directions and opportunities for AGSPs.

Methods

A rapid review is a form of systematic review that is streamlined and accelerated, to fast-track knowledge synthesis (1). We conducted this rapid review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis checklist (2) (Supplementary).

Eligibility criteria

Academic global surgery (AGS) has been defined as "the exchange of clinical, teaching, or research resources between two academic institutions" (7). Based on this definition, we focused on collaboration and bilateral education between HICs and LMIC institutions in which official training programs served the surgical needs of the international community.

We conducted database searches on PubMed (Medline) using the search terms "global surgery" and "academic programs", without a specific period to include all the searchable articles. This database was selected following discussion with experts in the field, and a preliminary search. We included articles that were: (I) published in English, (II) published in a peer-reviewed journal, and (III) published in an original article form. Of the articles meeting the inclusion criteria, we excluded studies that were not related to AGSPs and/or targeted the wrong population.

Study selection

A total of 390 articles were obtained from the PubMed search. Electronic search results were downloaded and uploaded to the Rayyan system (http://rayyan.qcri.org/), a free web-enabled application for health care professionals to conduct systematic reviews (3). First, we excluded seven articles as duplicates. Then, two reviewers (JY and ML) independently screened all identified articles (n=383) based on the inclusion and exclusion criteria. Of those articles, 324 were excluded based on the eligibility criteria. The remaining 59 texts were then examined in detail, and 29 were excluded because they were not original research articles. Of the 30 remaining articles, eight were excluded because they did not include AGSPs. A report on an invitational education program that focused on training HIC students was excluded. Finally, another article was excluded because it was published in a language other than English, leaving 20 articles for the final analysis (*Figure 1*). Any disagreement between the two reviewers during the screening process was discussed until a consensus was reached. Other reviewers (SC, JH) also joined the discussion to resolve any disagreements.

Data extraction and data synthesis

The following characteristics were extracted from the 20 studies (also presented in *Table 1*): author(s), year of publication, study location, study sample, study objectives, and outcome measures. Considering our study aim and the heterogeneity of study designs, measures, and settings, we synthesized the studies descriptively, as opposed to performing a formal meta-analysis.

First, we categorized the eight studies that examined the needs of the AGSPs. This was achieved by studying participants or stakeholders' perceptions of AGSPs, according to the study population and the assessment results. The study population was divided according to professional titles (residents, faculty, and program directors). We focused on measures of interest, perceived benefits, and the needs of AGSPs. All the identified study results were descriptively summarized. Next, we extracted the following elements from the nine studies on AGSPs implementation: program type, program length, specialty (other than general surgery), funding, program delivery, program provider, program location, number of accumulated program participants, participant criteria, and program years. If programs were published more than once

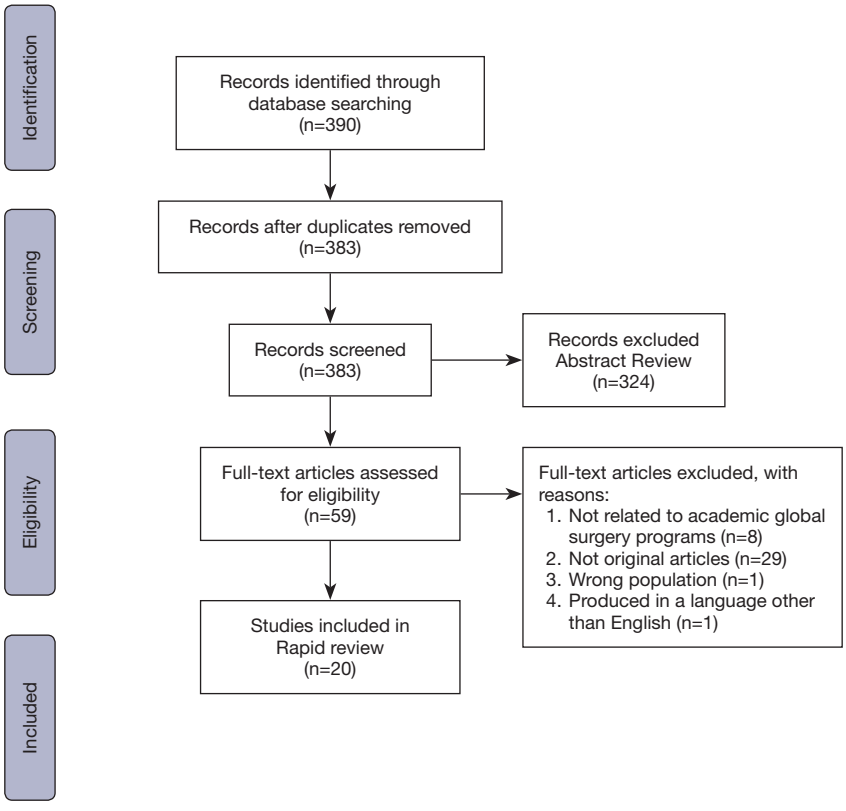

Figure 1 Flow chart of the literature search and screening process.

(12,18), they were grouped together in the table. However, if programs adopted different program delivery methods or different countries, studies were separated. Program type was categorized according to different types of training sessions, which were indicated as official training sessions in the curriculum. Program delivery was also categorized according to different education delivery methods.

Notably, six of the nine studies not only described their own program delivery experiences, they also furnished evaluations of their programs. The following key characteristics of AGSPs evaluations were extracted: program name, sample size, evaluation method, and evaluation results.

Results

Characteristics of the selected studies

Table 1 illustrates the characteristics of the 20 studies included in the review. The selected studies were published in the last ten years, between 2008 and 2018. Among them, 15 studies (15/20, 75%) were completed in HICs, including the United States and Canada (5,6,8-12,14-17,22-25), while five were conducted in other LMICs, including Ethiopia, Tanzania, Uganda, and Ghana (13,18-21). Of the 20 selected studies, eight explored the need for AGSPs by investigating faculty and student perceptions of AGSPs (5,6,9,14,19,20,22,24). Nine studies examined the delivery of AGSPs (8,11,12,15,16,21,25), and three surveyed residencies with global health training programs (10,17,23). Studies also reached diverse groups, including HIC trainees (8/20, 40%) (5,6,8,9,11,12,15,16), LMIC trainees (5/20, 25%) (13,18-21), HIC faculty (3/20, 15%) (5,12,15), LMIC faculty (1/20, 5%) (18) and program directors (2/20, 10%) (14,24). Most were cross-sectional studies (19/20, 95%) (5,6,8-19,21-25); they included a variety of data sources, like surveys (15/19, 100%) (5,6,8-12,14-16,18,19,21,23,24), qualitative data (2/19, 10.5%) (9,12), and case studies (3/19, 5.2%) (17,22,25). Two mixed-method study designs are also featured in the selected literature (2/20, 10%) (11,12). Other study methods are longitudinal studies, including a pre- and post-survey (1/20, 5%) (13) and one initial and follow-up survey (1/20, 5%) (18).

Table 1 Data extracted from studies included in this review (n=20)

First author, year	Research study design	Research location	Research sample	Research objectives	Outcome measures
LeCompte *et al.*, 2018 (8)	Descriptive cross-sectional survey, retrospective review	USA	78 HIC general surgery residents, 17 HIC participant residents	Evaluate the perceptions of the residents who participated in the rotation, to assess the effectiveness of the rotation	Attitudes toward global surgery; experience; strengths of the rotation
Rickard *et al.*, 2018 (9)	Descriptive cross-sectional survey, qualitative data	USA	36 US academic global surgeons	Evaluate the state of the AGS field, and determine the output of US academic global surgeons	Time commitment; salary model; benefits to home country (i.e., professionalism, education, funding)
Cheung *et al.*, 2018 (5)	Descriptive cross-sectional survey	USA	61 HIC general surgery residents and 29 HIC faculty	Assess interests in global surgery and in the development of a global surgery elective. Assess perceived barriers to developing these opportunities and examine whether exposure to a global experience led to repeated engagement	Students: prior experience and current interest; barriers to participation; desired experience. Faculty: prior experience; interest in the development of an international surgical elective; need for departmental support
Johnston *et al.*, 2018 (6)	Descriptive cross-sectional survey	USA	74 HIC general surgery residents	Understand the growing interest in, and desires for, global surgery experience among residents	Level of interest in global surgery and reasons for said interest; prior global health experience; preferred training opportunities; specific post-residency plans in the field of global surgery
Trivedi *et al.*, 2018 (10)	Observational and cross-sectional study	USA	245 U.S. accredited obstetrics and gynecology residencies, and 200 respondents	Compile a listing of global health training programs and describe the program type, the global distribution of work, as well as effect and reciprocity within programs	Characteristics of training programs; publications about global health training
Esquibel *et al.*, 2018 (11)	Mixed-method study (cross-sectional survey and interview), retrospective review	USA	14 HIC general surgery residents and resident case logs	Compare operative volumes and types of cases to those obtained at the home institution and evaluate the impact of these experiences on our residents and graduates	Program factors (i.e., location, duration, ABS/ACGME approval, partnering organization, weekly case volume, and case categories); pre-residency goals; international exposure prior to residency; overall experience; current or anticipated involvement
Graf *et al.*, 2018 (12)	Mixed-method study (cross-sectional survey and interview)	USA	12 HIC surgical educators, 9 HIC residents (qualitative), 6 HIC residents (quantitative)	Assess the effect of surgical program rotation on the HIC surgery residents accompanying volunteer HIC surgery faculty members	Positive and/or negative comments from resident blogs and interviews; experiences of participants; medical knowledge

Table 1 (*continued*)

Table 1 (*contiuned*)

First author, year	Research study design	Research location	Research sample	Research objectives	Outcome measures
Gauger *et al.*, 2018 (13)	Pre- and post-survey	Ethiopia	12 Ethiopian anesthesia residents	Assess the impact of the novel Cricothyroidotomy Skills Maintenance Program (CSMP) on the needle cricothyroidotomy knowledge and skills of resource-poor healthcare trainees, using a high fidelity, low cost laryngotracheal model produced by Computer-Aided Design (CAD) and 3D printing	Confidence; knowledge; procedural time; checklist ratings; inter-rater reliability
Medoff *et al.*, 2016 (14)	Descriptive cross-sectional survey	USA, Canada	21 HIC surgical program directors	Assess whether cooperation between surgical mission trips can lead to operational efficiency and identify obstacles to cooperation	Existence of global surgery program at the institutions; interest in cooperating with programs at other institutions; barriers to cooperating with humanitarian organizations
Chao *et al.*, 2015 (15)	Descriptive cross-sectional survey	USA	43 HIC attending physicians, 4 HIC fellows, 26 HIC residents (a total of 73 participants)	Identify steps that were critical to transform volunteer and mission-based global surgery efforts into an educational experience in surgical systems strengthening	Interest; experience
Hoehn *et al.*, 2015 (16)	Descriptive cross-sectional survey	USA	21 HIC residents	Develop a global surgery elective based on a synergistic partnership between American universities and the developing world	Interest in global health; experience; variety of cases observed during the rotation; cost
Wackerbarth *et al.*, 2015 (17)	Descriptive case report	USA	239 surgical residencies	Assess surgical department websites to determine if international programs were profiled and what kinds of opportunities are advertised	Existence of information on global surgery programs; accessibility of information
Cook *et al.*, 2015 (18)	Descriptive cross-sectional survey	Tanzania	Initial survey: 7 Tanzanian faculty, 5 Tanzanian residents. Follow-up survey: 15 Tanzanian faculty and 22 Tanzanian residents	Assess the educational (clinical training) needs of MUHAS and the Muhimbili National Hospital surgeons in Tanzania. Assess the educational value of the Alliance project	Perceptions of clinical care; impact of the Alliance project
Elobu *et al.*, 2014 (19)	Descriptive cross-sectional survey	Uganda	20 Ugandan surgical trainees and 13 Ugandan anesthesia trainees (a total of 33 participants)	Capture the perspectives of Ugandan surgical and anesthesia trainees regarding the perceived benefits and shortcomings of international collaborations	Skills improvement; impact on patient care; priority areas of research projects; ethics of clinical decisions

Table 1 (*contiuned*)

Table 1 (*continued*)

First author, year	Research study design	Research location	Research sample	Research objectives	Outcome measures
Cadotte *et al.*, 2014 (20)	Qualitative study	Ethiopia	14 Ethiopian neurosurgeons, and 7 visiting neurosurgeons	Explore the perspectives of Ethiopian and international neurosurgeons regarding the development of a sustainable academic neurosurgery teaching unit in Addis Ababa, Ethiopia	Development of long-term friendship and trust; poor communication between professional groups; development of an educational infrastructure and a longitudinal assessment program; lack of structured morbidity and mortality discussion; effective data collection strategies
Abedini *et al.*, 2014 (21)	Descriptive cross-sectional survey	Ghana	51 Ghanaian medical students	Assess the value and impact of UMMS rotation, according to Ghanaian medical students	Perceptions of value and impact; impact of participation; knowledge improvement; attitude shift
Grigorian *et al.*, 2014 (22)	Descriptive case report	USA	N/A	Outline the steps needed to bring IE to an institution. Describe how general surgery residency programs can help bridge the gap between surgeons in developed countries and the surgical needs of the international community	The trainee (motivation and list of program sources); the role of the mentors and program directors; capacity of the local surgical team; challenges for both the trainees and host institutions
Nelson *et al.*, 2012 (23)	Descriptive cross-sectional survey	USA	80 global health fellowship programs	Identify and describe all global health fellowship opportunities currently available in the United States	Program characteristics; specific features
Mitchell *et al.*, 2011 (24)	Descriptive cross-sectional survey	USA	56 HIC surgical program directors	Gain in-depth information from program directors about the features of existing international electives at their institution, to ascertain interest in national collaboration	Level of interest; characteristics of formal rotations (length, location, type of hospital, curriculum, evaluation, supervision, budget and funding); characteristics of informal rotations; barriers to establishing an international surgery rotation; domestic and specialty opportunities and exchange programs; consortium and database
Ozgediz *et al.*, 2008 (25)	Descriptive case report	USA	N/A	Demonstrate that global health can be more effectively incorporated into general surgery resident training with clinical electives, as well as structured didactics and research	All global health-related activities; benefits; changes

Table 2 Perceptions of residents, faculty, and program directors toward global surgery program (n=8)

Articles	Categorized	Respondents	Results
Cheung *et al*., 2018 (5), Johnston *et al*., 2018 (6), Medoff *et al*., 2016 (14), Mitchell *et al*., 2011 (24), Grigorian *et al*., 2014 (22)	Assessed interest	HIC residents	Interest in an international elective was observed among different study populations: (I) individuals who had previously engaged in global surgery/health activity programs (5,6,22), (II) individuals who had never engaged in global surgery/health activity programs (5,6); interested in post-residency plans for global surgery (individuals who had previously engaged in global surgery/health activity programs) (6); interested in incorporating international surgery into their future careers (22)
		HIC faculty	86% of respondents from surgical departments expressed interest (5)
		HIC program director	Interested in the international electives (22,24); interested in how the RRC or ABS would recognize the rotation and its U.S. equivalency (24); interested in all assistance that could be provided to the program director (24); interested in a consortium that would allow residents from other U.S. residency programs to participate in their overseas electives (24); interested in developing an international health track (2 years in the global health 'lab') (24); interested in cooperation with programs at other institutions (14)
Rickard *et al*., 2018 (9), Elobu *et al*., 2014 (19), Cadotte *et al*., 2014 (20), Grigorian *et al*., 2014 (22)	Perceived benefits	LMIC residents	The program improves their training (19,20); the program promises mentorship and friendship (20,22); visiting surgeons are instrumental to educating residents, given that the resident-to-faculty ratio is very uneven (20); visiting surgeons encourage the development of data collection, monitoring, and evaluation strategies (20)
		HIC faculty	Contributes to society at both the local and global level (9); globally expands institutional reputations (9); brings in funding (from departmental, philanthropic, federal sources); (9) supports institutional reputation building for smaller institutions (9)
Rickard *et al*., 2018 (9), Cheung *et al*., 2018 (5), Medoff *et al*., 2016 (14), Grigorian *et al*., 2014 (22), Mitchell *et al*., 2011 (24)	Perceived barrier	HIC residents	Lack of funding to defray their personal expenses (5,22); scheduling is difficult (5); lack of information and resources (22)
		HIC faculty	Most respondents reported that their department does not use specific metrics for global surgery productivity (9); protected time as the most important mechanism of departmental support (9); lack of promotion credit for global surgery work (9); need to develop different compensation plans for those engaging in AGS (9)
		HIC program director	Credentialing and credit for training experience (14,24); mismatch of logistic support (14,24); lack of an organized structure through which to share information (14,24); funding models (24)

RRC, the Residency Review Committee; ABS, American Board of Surgery.

Perceptions of AGSPs

Assessing interests in AGSPs

Of eight articles focusing on perceptions toward AGSPs, three articles revealed a strong interest in AGSPs among HIC residents who had previously engaged in global health activities (*Table 2*). Studies generally asked the residents on interests in international electives and post-residency plans for global surgery, and a majority responded positively. Furthermore, Johnston *et al.* noted that 93% (n=27) of residents expressed interest in commitment to global surgery after residency, and of those residents, 65% preferred international electives during their training (6). Two articles assessed residents without prior global health activities, and the level of interest was high. However, Cheung *et al.* indicated that many residents were uncertain about how to integrate global surgery into their careers (5). One study measured the HIC faculty's interest in involvement with AGSPs. Cheung and the research team assessed the interest of HIC faculty from all surgical departments and discovered that a majority (86%, n=29) expressed interest in AGSPs (5). Three studies identified the surgical program directors' interest in AGSPs. The program directors showed a strong interest in the academic international programs, went on further by showing interest in how the authorization groups would recognize the rotation. They were interested in developing an international health track, which would be two years of the

global health course. The majority of program directors showed interest in participating in designing databases to facilitate the standardization of international electives and educational exchange (24).

Perceived benefits of the AGSPs

Four studies reviewed the perceived benefits of global surgery activities in academic medical institutions. All studies mentioned that implementing an international elective as part of the curriculum is essential because these activities improve the clinical skills of the local surgical team. Moreover, Grigorian *et al.* and Cadotte *et al.* pointed out that local hospitals took advantage of mentorship, balanced ratio with respect to residents and faculty, and developed data collection, monitoring, and evaluation skills (20,22). Discussing the benefits of the AGSPs, Rickard *et al.* asserted that, by working across cultures, participants might be more adaptable, cost sensitive, and have a greater impact on their home institutions (9).

Perceived barriers

A number of studies have reported the perceived need for assistance with AGSPs. There is some evidence that HIC surgical residents felt a lack of funding sources and information for formal international electives. It is also noteworthy that HIC faculty expressed the need for protected time, promotion credit, and different compensation plans for those engaging in AGS. Medoff *et al.* and Mitchell *et al.* discovered that credentialing and credit for training experience is important as well as an organized structure through which to share the training experience (14,24).

Implementation of AGSPs

Program characteristics: types, length, specialties, and funding

First, three different program types were identified: clinical training, research training, and cultural training (*Table 3*). All eight reviewed programs included clinical training (100%), while four also included research training (50%), and only one explicitly included cultural training for cultural preparation (12.5%). Only one program studied by LeCompte *et al.* included all three training sessions (8).

Meanwhile, reported program lengths ranged from two weeks to one year. Five out of eight (62.5%), except the one without information, provided a 4-week program. A program studied by Ozgediz *et al.* was the only program that delivered a program for more than a month (12.5%) (25). Information regarding the specialty other than general surgery has rarely been reported. Only two programs marked specialty surgical education, in anesthesia (13) and obstetrics and gynecology (OBGY) (21), respectively. Regarding funding, most programs were financially supported by HIC provider institutions.

Program delivery

Programs were delivered in two different ways. Seven programs (87.5%) were delivered by sending HIC residents or faculty members to LMIC settings (HIC-LMIC). In contrast, only one program (12.5%) adopted a bilateral method, which means that there was an exchange of residents between HIC and LMIC (21). It was found that sending HIC residents to LMIC settings (HIC-LMIC) usually takes a form of elective residency rotation in the university, and most of the participants require eligibility criteria such as a PGY of 3 or higher. Meanwhile, one program sent both residents and faculty members (7,24), while 5 programs sent residents only (8,11,15,16,25) and one program sent the faculty only (13).

Program locations

Notably, all of the programs were initiated by academic institutions in the US or an alliance of those institutions. At the same time, there was heterogeneity in the locations of each program including not the only US but Kenya (8), Dominican Republic (11), Ecuador (11), Ethiopia (11), Nicaragua (11), Tanzania (12,18), Uganda (15,25), Malawi (16), and Ghana (21). Among these different locations, six were African countries, and the other three were Caribbean, South American, and Central American countries. Unlike others, a program provided by Gundersen Health System, University of Wisconsin College of Medicine (11), took a one-to-many approach. It was conducted in four different countries, accounting for two-thirds of all identified program locations. Meanwhile, only one program that accepted LMIC residents as a part of bilateral exchange had been partly conducted in the US (21).

AGSPs evaluations

Six studies evaluated AGSPs, and we identified the strength and limitations of AGSPs by analyzing the evaluation results. Details of the assessment for each study are provided in *Table 4*.

Table 3 Characteristics of Academic Global Surgery Program (AGSP) delivery (n=9)

First author, year (program name)	Program type	Program delivery	Program provider (country)	Program location (country)	Number of accumulated participants	Participants criteria	Program years	Program length	Specialty other than general surgery	Funding
LeCompte *et al*., 2018 (Vanderbilt International Surgery Elective Rotation) (8)	Clinical training, research training, cultural training	Sending residents from HIC to LMIC (HIC-LMIC)	Vanderbilt University (USA)	Academic hospital in Kijabe (Kenya)	17 HIC residents	PGY4, PGY3*	2006–2016	4 weeks	N/A	Donations
Esquibel *et al*., 2018 (Gundersen Medical Foundation, Global Partners) (11)	Clinical training	Sending residents from HIC to LMIC (HIC-LMIC)	Gundersen Health System, (University of Wisconsin College of Medicine, USA)	Academic Medical Centers (Dominican Republic, Ecuador, Ethiopia, and Nicaragua)	14 HIC residents	PGY4, PGY3	2008–2017	1–4 weeks (mostly 2 weeks)	N/A	Gundersen Medical Foundation
Graf *et al*., 2018 (Alliance for Global Clinical Training) (12)	Clinical training, research training	Sending residents and faculty from HIC to LMIC (HIC-LMIC)	The Alliance for Global Clinical Training (USA)	Muhimbili University of Health and Allied Sciences and Muhimbili National Hospital (Tanzania)	11 HIC residents	Residents in research year	2012–2017	4 weeks	N/A	Pacific Coast Surgical Association, volunteer surgeons and residents as well as the Alliance Board members
Cook *et al*., 2015 (Alliance for Global Clinical Training, pilot) (18)	Clinical training, research training	Sending faculty and resident teams from HIC to LMIC (HIC-LMIC)	The Alliance for Global Clinical Training (USA)	Muhimbili University of Health and Allied Sciences and Muhimbili National Hospital (Tanzania)	N/A	Resident research years (completed 3 clinical years)	2013–2014	4 weeks	N/A	N/A
Gauger *et al*., 2018 (Global Reach) (13)	Clinical training	Sending a faculty from HIC to LMIC (HIC-LMIC)	University of Michigan, Medicine (USA)	Academic Hospital in Addis Ababa (Ethiopia)	12 LIC residents	PGY 1,2 in LMIC	N/A	N/A	Anesthesia	University of Michigan
Chao *et al*., 2015 (MGH Global Surgery Initiative) (15)	Clinical training, research training	Sending residents from HIC to LMIC (HIC-LMIC)	Massachusetts General Hospital (MGH, USA)	Mbarara University of Science and Technology, Mbarara Regional Referral Hospital (Uganda)	N/A	PGY 2–4 in HIC	2013	4 weeks	N/A	MGH Surgery Department

Table 3 (*continued*)

Table 3 (*continued*)

First author, year (program name)	Program type	Program delivery	Program provider (country)	Program location (country)	Number of accumulated participants	Participants criteria	Program years	Program length	Specialty other than general surgery	Funding
Hoehn *et al*., 2015 (pilot) (16)	Clinical training	Sending residents from HIC to LMIC (HIC-LMIC)	University of Cincinnati (USA)	Mzuzu Central Hospital (Malawai)	1 resident	PGY 3 in HIC	N/A	4 weeks	General surgery	University of Cincinnati (program host)
Abedini *et al*., 2014 (Global Reach) (21)	Clinical training	Exchanging residents between LMIC and HIC (HIC = LMIC)	University of Michigan Medicine (USA)	University of Ghana Medical School (Ghana) and the Kwame Nkrumah University of Science and Technology School of Medical Sciences (Ghana)	73 residents from Ghana, 33 residents from the U.S.	4 in their 5th year of a six-year medical school curriculum in Ghana-residents in HIC	2008–2010	3–4 weeks	Obstetrics and gynecology (OBGY)	Ghanaian students receive a 300$ stipend from the UMMS department, but they are responsible for financing almost all incidentals
Ozgediz *et al*., 2008 (A UCSF postgraduate surgical training program at MU) (25)	Clinical training, research training	Sending residents from HIC to LMIC (HIC-LMIC)	University of California (USA)	Makerere University in Kampala (Uganda)	10 residents	PGY 4 in HIC (who have completed 3 clinical year)	2003–2008	1–3 months	General surgery	N/A

Table 4 Evaluations of delivered Academic Global Surgery Program (AGSP) (n=6)

First author, year	Program name	Sample size (n)	Evaluation method	Evaluation results	Recommendations
LeCompte *et al*., 2018 (8)	Vanderbilt International Surgery Elective Rotation	17 HIC residents	Post-rotation surveys	Strengths: 76% of the participants reported high satisfaction with the rotation. Global surgery interest increased among participants; 33% of the participants reported ongoing global health activity in their current practices; interest in global surgery following participation in the rotation ranged from 10 to 100, with a mean of 82.2; the most reported benefit of the rotation was improvements in the residents' teaching skills (n=10, 59%). Limitations: N/A	Commitment of institutions to international involvement (i.e., funding and academic incentives); incentivize institutions, further resources, and attention; academic advancement and academic career models in global surgery required

Table 4 (*continued*)

Table 4 (*continued*)

First author, year	Program name	Sample size (n)	Evaluation method	Evaluation results	Recommendations
Esquibel *et al*., 2018 (11)	Gundersen Medical Foundation, Global Partners	14 HIC residents	Cross-sectional survey: open-ended questions	Strengths: all 14 residents stated that their IE had a positive impact on their personal commitment to serve in an international setting after graduation; nine residents (64%) reported that they would not, or may not, have participated in international surgical service during residency had established opportunities not already been available through the residency program; the most common operations performed for the first time by residents on IEs included open cholecystectomy, open gynecologic procedures open prostatectomy, thyroidectomy for goiter, and open appendectomy. Limitations: difficulty finding time, and family responsibilities; financial constraints	2-week rotation is recommended; 4-week criteria is a barrier to participation; secured funding
Graf *et al*., 2018 (12)	Alliance for Global Clinical Training	11 HIC residents	Retrospective qualitative analysis, cross-sectional survey	Strengths: HIC surgery residents joined the MUHAS/MNH Department of Surgery, made significant teaching contributions, and performed a variety of "open procedures" (including hand-sewn intestinal anastomoses); all of the residents stated that it was a maturing and challenging clinical rotation, due to the complexity of the cases, the limited resources available, and the ethical and emotional challenges; some HIC residents developed close relationships with their Tanzanian colleagues, which continued after they returned home. Limitations: an environment lacking in English language proficiency; the stress, frustration, and emotional challenges of dealing with preventable death and disability, due to resource constraints; the poor quality of anesthesia care, as well as preoperative and postoperative care; taking cases away from their Tanzanian colleagues	Defined curriculum or specific body of knowledge for residents to master during the rotation; students accompanied by a faculty member from the same institution are preferred

Table 4 (*continued*)

Table 4 (*contiuned*)

First author, year	Program name	Sample size (n)	Evaluation method	Evaluation results	Recommendations
Cook *et al.*, 2015 (18)and improving surgical care requires local capacity building. Single-institution partnerships and surgical missions are logistically limited. The Alliance for Global Clinical Training (hereafter the Alliance	Alliance for Global Clinical Training	15 Tanzanian faculty and 22 Tanzanian residents	Follow-up survey and free-text comments	Strengths: an established relationship/ mentorship relationship with at least 1 of the Alliance surgeons on a 5-point Likert-type scale ranging with a median of 4.0 for both faculty and residents; the partnership with the Alliance has improved residents' ability to learn on a 5-point scale, with a median of 3.5 for faculty and 4.0 for residents. Limitations: N/A	More teaching coverage, equitably distribute educational support among all LMIC surgeons; collaboratively develop a formal surgical curriculum; secured funding
Gauger *et al.*, 2018 (13)Ethiopia suffers from a severe shortage of adequately trained health professionals. Academic partnerships can support sustainable training programs and build capacity for low-resource settings. 3D modeling and simulation-based training provide necessary tools, especially for rarely-encountered clinical situations, such as needle cricothyroidotomy. Methods: Departments of Anesthesiology, Otolaryngology, and Learning Health Sciences collaborated to develop a low-cost, high-fidelity simulator and Cricothryoidotomy Skills Maintenance Program (CSMP	Global Reach	12 Ethiopian anesthesia residents	Pre-post-assessment: self-reported learner confidence scored on 5-point rating scale, the knowledge test (7 multiple choice questions), the CSMP Global Rating Scale, the CSMP Checklist	Strengths: improvements were identified in all areas, including residents' knowledge, measured by mean summed test scores (Mpre =3.31, Mpost =4.46, P=0.003), time to perform cricothyroidotomy (Mpre =96.64, Mpost =72.82, P=0.12), residents' performance quality, measured by overall mean global ratings (Mpre =0.20; Mpost =0.70) with improvements identified at the item-level, P=0.001 with moderate-large effect sizes, and residents' ability to complete tasks, measured by mean checklist ratings (Mpre =0.51, Mpost =0.90, with item-level improvements observed, P≤0.01, with small-large effect sizes. Limitations: N/A	The multidisciplinary nature of the project is essential
Abedini *et al*., 2014 (21)students from the University of Michigan Medical School (UMMS	Global Reach	51 Ghanaian medical students	Online survey	Strengths: students reported (I) improved medical knowledge (37/40; 93%), (II) greater appreciation for evidence-based medicine (34/36; 94%), (III) increased comfort searching medical literature (39/40; 98%), and (IV) improved knowledge of U.S. medical care (38/39; 97%); most participants (32/35; 91%) said that the UMMS experience changed their perspectives on their careers. Limitations: felt more interested in pursuing a career abroad than they did before their rotation; having less hands-on experience during their rotation than would be expected of a typical U.S. clinical student; must have financial resources to travel to the U.S.	A system to properly orient trainees to the local language, culture, and medical environment before their arrival the host institution; considerations while scouting a local institution (i.e., safety, case volume and distribution of local hospitals, funding)

Strengths of AGSPs

The findings were almost all positive, reporting qualitative changes in knowledge and patterns of thought. The AGSPs with the host institution made both HIC and LMIC residents more confident in their learning (11-13,18), brought evidence-based medicine, and maturing clinical rotations due to the complexity of the cases. Residents valued experiencing global surgery by participating in the rotation, and the majority of participants described that their participation in the program positively changed their attitude and perception towards a future career in global surgery (12,21). Some HIC participants felt that the program improved their teaching skills and helped them establish a close relationship with their colleagues at the host institution (8).

Limitations of AGSPs

One of the limitations of AGSPs is the communication barrier due to language differences. In addition, a study revealed that the HIC residents faced emotional challenges from dealing with preventable death and disability due to resource constraints, poor clinical practice, and concerns about taking cases away from the host institution colleagues (12). Another limitation was that LMIC residents had less chance to experience hands-on training than did residents in the US (21). Furthermore, a study indicated that the LMIC residents changed their attitudes toward their future careers; most LMIC residents felt more inclined to pursue careers outside their home country than before the rotation, which contradicted the aim of the exchange program (ibid).

Recommendations by current AGSPs

Table 4 also outlines recommendations from the AGSPs that are worth noting. These recommendations include securing funding, pursuing collaborative curriculum development, adding accreditation, including a pre-elective program, and offering academic incentives. The most commonly reported recommendations in all studies were securing funding. Five studies (83.3%) reported that financial support is necessary to create a sustainable AGSPs (8,11,12,18,21). Three studies (50%) insisted that home institutions ought to work collaboratively with the host institution on curriculum development, including clinical teaching, patient care, and research (12,13,18). While collaboratively supporting the work for surgical residency course advancement, one study stressed that accrediting the AGSPs by a responsible body would alleviate barriers for residents' participation in global surgery activities (25). Two studies (25%) stated that offering a standardized pre-elective program as a part of an AGSPs was helpful for residents to prepare for cultural differences, clinical skills, and anticipated safety issues (8,12). One study indicated that academic incentives should be provided to surgeons who use their vacation or personal time to participate in global surgery (8).

Discussion

Academic collaboration between HICs and LMICs is a potential avenue to address the global surgical need by enhancing knowledge in global surgery. In this rapid review, we identified 20 studies to systematically organize the needs described by participants and stakeholders of AGSPs, key program characteristics of AGSPs, and their evaluation results.

Overall, studies have shown that institutional interests in AGSPs remain high among surgical residents, faculty, and program directors. It must also be noted that many programs have been implemented in the past ten years and were still very much focused in a few countries. Most studied the implementation of general surgery courses, but a few of them were limited to those of surgical subspecialties. Various elements of AGSPs implementation were identified in this rapid review, including: funding, collaborative curriculum, accreditation, pre-elective programs, and academic incentives. Furthermore, the reviewed studies have shown that the participants in AGSPs among HIC residents improved their clinical practice and knowledge, research skills, and career aspirations. However, the reviewed studies do not capture the effects on LMIC surgical residents' motivation and learning.

Critical components of AGSPs and bilateral academic collaborations

Cultural training

One of the critical components of AGSPs is related to cultural training. Academic medical institutions should plan to integrate pre-departure sessions focused on cultural awareness into the curriculum to help students prepare for language and cultural differences. Social relationships are one of the key factors that affect the effectiveness of the surgical skill transfers from HIC residents and faculty to LMIC trainees (26). However, in our study, we discovered that a few programs included cultural training to properly orient trainees to the local language, culture, and medical environment before arriving at the host institutions.

Structured preparation can provide HIC residents and faculty with cultural specificities and expectations for their international experience, political, environmental, or health crises, and overall measures required while working clinically abroad.

Building trust and relationships

Another core component for fostering bilateral partnerships is building trust and relationships that drive local empowerment and shape equitable partnerships (27). The evaluation study of a ten-year team-based collaborative capacity-building program for pediatric cardiac surgery in Uzbekistan examined that a team-based approach, in which everyone holds equal responsibility for processes and outcomes of surgery, results in a trustworthy relationship (28). Nevertheless, in our study, only one program measures the development of long-term relationships and trust as the program's outcomes. Therefore, the academic medical institutions should consider complementing the AGSPs with the team-based approach to promote self-sustainability for surgical care.

Using a theory of change (TOC) frameworks for AGSPs

Developing a TOC is the first prerequisite for constructing and implementing program models and assessing program effects (29). TOC can explicate how a program works and achieve the intended outcomes based on describing pathways of set preconditions (steps) that lead to the outcomes (30). For example, in the case of AGSPs, the TOC mapping process can identify preconditions necessary to achieve the long-term outcomes which can be to increase safe surgeries. One of the preconditions will be to build the capacity of LMIC surgeons using hands-on training. Likewise, the TOC can help to establish potential causal pathways between the AGSPs' inputs and the expected outcomes and help identify effective interventions. However, TOCs were rarely described in the papers that we reviewed. We propose that future AGSP research should share the TOC and explicitly state the factors that cause the outcomes and why in the evaluation.

Increased LMIC participation in monitoring and evaluation and research

We suggest that the AGSPs must carefully review and continue evaluations of the bilateral education model by using the appropriate TOC. Our review showed that the AGSP's delivery was considerably skewed in favor of the HIC residents. Skewed participation and data collection do not provide a complete picture of the entire AGS landscape. It may also jeopardize the sustainability of the programs (8). Considering that partnership building is a crucial factor in implementing AGSPs, securing trust and maintaining the interests of LMIC institutions in AGSPs is also important. For instance, the bilateral method that balances reciprocal advantages, by inviting more LMIC trainees to HICs, will allow both sides to gain exposure to both resource-limited to resource-abundant settings. Collecting appropriate data from the participants and stakeholders in LMICs will provide greater insight. Moreover, this balanced delivery will provide more opportunities for collaborative research, resulting in a synergistic and sustainable partnership between LMIC and HIC institutions (8). Hence, future bilateral methods for AGSPs should be extended: inviting LMIC trainees to HICs, and these programs must include rigorous monitoring and evaluation in both HIC and LMIC contexts. In addition, we recommend research training programs as a global surgery program bonds with a major partner in an LMIC. Building research capacity will stimulate locally relevant research and strengthen partnerships of both trainers and trainees from HIC and LMIC.

Developing the standardized metrics of outcomes

Our review found that most studies looked at initial outcomes (i.e., attitude toward global surgery training, evaluation of the training program), excluding the long-term impact of the program evaluations. We believe that having a thorough TOC will greatly help in developing metrics to monitor and evaluate the AGSPs with an increased focus on sustainability measures. Similarly, Rickard and the team mentioned that academic institutions fail to use standardized AGS metrics to measure social impact, equity, and access (9). The standardization process can also help measures to be quick and easy to administer across institutions. Accordingly, a collaborative effort is necessary to develop principles for establishing standardized metrics to evaluate both short-term and long-term outcomes of AGSPs across institutions and countries.

Study limitations

Our study may be limited by publication bias. This study did not include non-peer-reviewed articles, such as gray literature or program reports, and articles written in languages other than English. Additionally, the conclusions

of this scoping review are limited to interventions that focused on HIC residents, as we did not find many AGSPs publications that focused on training LMIC students.

Conclusions

Our findings can serve as a foundation for further development of AGSPs in academic medical institutions. With interest in global surgery increasing among residents, faculty, and program directors, future research would be best served by producing reliable and contextually relevant data, and ultimately developing a robust global surgery educational program to increase access to safe and affordable surgical care.

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Footnote

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Supplementary

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	3
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	n/a
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	4
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	n/a
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	4
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	4-5
Data collection process	10	Describe method of data .	4
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5-6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	n/a
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	n/a
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	5

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Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	n/a
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n/a
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	6
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	n/a
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	7-11
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	n/a
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	n/a
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	12
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	14
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	14
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	n/a

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