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BASIC RESEARCH

What Factors Influence the Production of Orthopaedic Research in East Africa? A Qualitative Analysis of Interviews

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Abstract

Background Research addressing the burden of musculoskeletal disease in low- and middle-income countries does not reflect the magnitude of the epidemic in these countries as only 9% of the world's biomedical resources are devoted to addressing problems that affect the health of 90% of the world's population. Little is known regarding the barriers to and drivers of orthopaedic surgery research in such resource-poor settings, the knowledge of which would help direct specific interventions for increasing research capacity and help surgeons from high-income countries support the efforts of our colleagues in low- and middle-income countries.

Purpose We sought to identify through surveying academic orthopaedic surgeons in East Africa: (1) barriers impeding research, (2) factors that support or drive research, and (3) factors that were identified by some surgeons as barriers and others as drivers (what we term barrier-driver overlap) as they considered the production of clinical research in resource-poor environments.

Materials Semistructured interviews were conducted with 21 orthopaedic surgeon faculty members at four academic medical centers in Ethiopia, Kenya, Tanzania, and Uganda. Qualitative content analysis of the interviews was conducted using methods based in grounded theory. Grounded theory begins with qualitative data, such as interview transcripts, and analyzes the data for repeated ideas or concepts which then are coded and grouped into categories which allow for identification of subjects or problems that may not have been apparent previously to the interviewer.

Results We identified and quantified 19 barriers to and 21 drivers of orthopaedic surgery research (mentioned n = 1688 and n = 1729, respectively). Resource, research process, and institutional domains were identified to

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This study was performed at The University of California at San Francisco, San Francisco, CA, USA; Makerere University Hospital, Kampala, Uganda; Black Lion Hospital, Addis Ababa, Ethiopia; Muhimbili Orthopaedic Institute, Dar es Salaam, Tanzania; and Moi Teaching and Referral Hospital, Eldoret, Kenya.

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categorize the barriers (n = 7, n = 5, n = 7, respectively) and drivers (n = 7, n = 8, n = 6, respectively). Resource barriers (46%) were discussed more often by interview subjects compared with the research process (26%) and institutional barriers (28%). Drivers of research discussed at least once were proportionally similar across the three domains. Some themes such as research ethics boards, technology, and literature access occurred with similar frequency as barriers to and drivers of orthopaedic surgery research.

Conclusions The barriers we identified most often among East African academic orthopaedic faculty members focused on resources to accomplish research, followed by institutional barriers, and method or process barriers. Drivers to be fostered included a desire to effect change, collaboration with colleagues, and mentorship opportunities. The identified barriers and drivers of research in East Africa provide a targeted framework for interventions and collaborations with surgeons and organizations from high-resource settings looking to be involved in global health.

Introduction

The large and increasing burden of musculoskeletal disease in low- and middle-income countries is poorly documented and largely neglected by the global health community [5, 8, 21, 37]. Injury underlies 11.2% of all disability adjusted life years as reported by the Global Burden of Disease Study 2010 [29], with musculoskeletal injury estimated to account for 70% to 80% of reported injuries in one developing country (Sierra Leone) [39]. Nontraumatic musculoskeletal problems account for 6.8% of all disability adjusted life years worldwide [29].

Despite the strain of increasing incidence globally of musculoskeletal disease, there is a paucity of clinical research in orthopaedic surgery emerging from developing countries [2, 38]. Research originating in developing countries is necessary to address questions that are of importance specifically to low-resource settings. To a certain extent, hospitals in these low-resource settings can use the literature that is available from high-income countries, but much may not apply as there are substantial differences in the clinical settings such as population differences, implant availability differences, organism differences, and health system differences (ie, availability of physical therapy, splinting materials, support staff of various clinical specialties, long-term nursing care, or others). For example, how does the availability of specific resources such as physical therapy or prosthetic development affect patient outcomes and what are the implications for targeting resource allocation in a given low- or middle-income country?

The WHO and others have recognized that development of healthcare infrastructure is partly dependent on locally produced research [27, 31], but less than 10% of global research resources and funding are dedicated to the population experiencing 90% of health problems worldwide—the 10/90 gap [13, 31]. This skewed resource allocation is particularly pronounced in the orthopaedic literature where increased global musculoskeletal disease and trauma in the developing world have not been met with a concomitant increase in attention or funding [2, 17, 30]. Research is a way to contribute lasting change in a low-resource setting and is as important as research performed in a high-resource setting. By fostering research programs in developing countries, orthopaedic surgeons and institutions from high-income countries can help surgeons in low- and middle-income countries start development through research programs at home.

The importance of musculoskeletal research driven by low- and middle-income countries is clear; however, considerable barriers to conducting research exist in these austere settings. In nonsurgical specialties, barriers to sustainable research capacity including lack of protected research time, research training, human resources and expertise, and adequate financing in developing and developed countries have been documented [16, 23, 35]; however, assessments of surgical research capacity in low- and middle-income countries using similar methods remain to be performed.

To develop informed research partnerships with academic orthopaedic surgeons in low- and middle-income countries, an understanding of the complex and numerous barriers to and drivers of research experienced by surgeons in these countries is required. Qualitative research methods are designed to expose context, complex relationships, and decision-making processes which can be useful in determining factors that affect research in resource-poor settings [4]. We therefore sought to identify through a survey of academic orthopaedic surgeons in East Africa: (1) the barriers impeding research; (2) the factors that support or drive research; and (3) factors that were identified by some surgeons as barriers and others as drivers (what we term barrier-driver overlap), as they considered the production of clinical research in the resource-poor environment of East Africa.

Materials and Methods

Study participants (n = 21) were affiliated with academic medical centers in four East African countries including Makerere University Hospital in Uganda, Black Lion Hospital in Ethiopia, Muhimbili Orthopaedic Institute in Tanzania, and Moi Teaching and Referral Hospital in

Table 1. Participant demographics

Participant demographics	Mean	SD	Number of training programs
Age (years)	45.8	7.4	
Sex			
Male, n (%)	20 (95)		
Female, n (%)	1 (5)		
Interview duration (minutes)	38.3	14.5	
Country			
Ethiopia, n (%)	2 (10)		1
Kenya, n (%)	6 (29)		2
Tanzania, n (%)	7 (33)		2
Uganda, n (%)	6 (29)		1
Years in practice	10.8	8.4	

Kenya. The orthopaedic departments at each of the centers have a memorandum of understanding with the University of California, San Francisco (UCSF), Department of Orthopaedic Surgery, through the Institute for Global Orthopaedics and Traumatology (IGOT). It is unknown how many orthopaedic surgeons were practicing in each of these countries at the time of the interviews. All faculty members from each institution were approached to be interviewed and all agreed to be interviewed (21 interviewed of 21 asked). All 21 interviewed study participants were orthopaedic surgeon faculty members (Table 1) with levels of experience ranging from junior to senior faculty (mean years in practice, 10.8 years; SD, 8.4 years). Local institutional review board (IRB) approval was obtained at each of the interview sites and ethics approval also was secured from UCSF. Informed consent was obtained from all interview subjects before participation.

Interviews were conducted by the same research assistant (SA) during site visits conducted between July and August 2011 at each of the academic centers. Individual interviews were designed to be semistructured to best explore, in depth, the individual experiences of each study participant [41]. The interview questions were open-ended and oriented to the personal and cultural attitudes, barriers, drivers of research, and research needs of the individual participant. The interview questions were developed by several of the authors (AC, RRC, RAG) in a discussion after reviewing evaluations of the IGOT Soft Tissue Flap Course. Several open-ended questions were added to these evaluations to gauge interest in a course on research methods to be held in conjunction with the soft tissue flap course. Interviews were conducted in English (mean interview duration, 38.3 minutes; SD, 14.5 minutes), which then were transcribed verbatim for qualitative analysis.

Qualitative data analysis was conducted with a quantitative component. For the qualitative analysis, elements of grounded theory and content analysis were incorporated in the transcript analysis [4, 9–11, 36, 45]. This type of qualitative method has been seen in the arthroplasty literature [4, 7, 18], and used to identify the needs and perspectives of a study group in a given context as performed by Clark et al. [7] in their analysis of decision making in patients with arthritis before or instead of joint replacement. Grounded theory stems from the social sciences and originated to examine problems in a population by asking that population, "what is the problem" in an open-ended manner, and subsequently systematically analyzing transcripts of their discussed responses [4]. The grounded-theory approach involves analysts reading transcripts of an open-ended interview and coding or labeling key themes that arise throughout the discussion. The grounded-theory analysis requires iterative comparison of emerging codes with previously defined codes. Throughout the process, the codes are organized into author-determined meaningful categories or domains. Two coauthors (DBS, ASS) conducted the analysis to ensure agreement [6]. When codes differed, consensus was reached between the two authors. The analysis was conducted until saturation or the point at which no new themes emerged.

Based on content analysis, the overall frequency of each coded barrier or driver was calculated in addition to its relative frequency for the orthopaedic surgeons from each of the four academic centers. The number of interview subjects and the proportion who discussed the barriers and drivers at least once were calculated with 95% CIs for each of the identified domains [36]. Atlas.ti® 6.2 (Scientific Software Development, Berlin, Germany), a qualitative research software package, provided a conceptual framework based on grounded theory to assist with our transcript analysis and data output. Data were analyzed using Microsoft® Excel (Microsoft Corp, Redmond, WA, USA).

Results

Barriers

All interviewed surgeons expressed an interest in performing research. Nineteen barriers to research were identified (Table 2), coded, and quantified in a frequency distribution (n = 1688; Fig. 1). Three domains—resource constraints (n = 7 barriers), research process (n = 5 barriers), and institutional (n = 7 barriers)—were identified from the 19 barriers. The proportion of barrier domains discussed at least once by interview subjects was 46% (91 of 198) for resource constraints, 26% (51 of 198) for

Table 2. Categorized domains for barriers to orthopaedic surgery research

Barriers	Interview subjects (number)*	Proportion of total subjects (%)	95% CI
Resource constraints	91	46	39–53
Funding	20	95	76–100
Protected research time	19	90	70–99
Private practice	17	81	58–95
Literature access	12	57	34–78
Technology	10	48	26–70
Human resources	9	43	22–66
Hospital infrastructure	4	19	5–42
Research process	51	26	20–32
Research training	19	90	70–99
Recordkeeping and data management	15	71	48–89
Publication/dissemination	8	38	18–62
IRB/ethics	5	24	8–47
Mentoring	4	19	5–42
Institutional	56	28	22–35
Research culture	18	86	64–97
Trauma burden recognition	9	43	22–66
Collaboration	8	38	18–62
Affecting change	7	33	15–57
Research requirement	7	33	15–57
Regional forum	5	24	8–47
Value of local research	2	10	1–30

* Number of interview subjects who discussed each barrier and driver at least once; IRB = institutional review board.

research process, and 28% (56 of 198) for institutional barriers.

Of the resource constraint barriers, funding was discussed by 95% (20 of 21 participants, 278 occurrences). Clinical responsibilities and a lack of protected research time often were discussed as a resource constraint barrier to research (218 occurrences; 19 of 21 participants, 90%). Many surgeons also reported prioritizing responsibilities from their private practices (91 occurrences; 18 of 21 participants, 81%) as a barrier.

Research process barriers such as lack of research training or education (169 occurrences; 19 of 21 participants, 90%) were frequently cited. Data management (174 occurrences; 15 of 21 participants, 71%) was an often-discussed research process barrier owing to cumbersome paper charts.

In terms of institutional barriers, faculty reported that their hospitals rarely acknowledged the infrastructure required to conduct research, a factor many interviewees equated with an overall lack of institutional support. The absence of a research culture was an institutional barrier prevalent throughout the interviews (199 occurrences; 18 of 21 participants, 86%). Several participants cited a current institutional focus on research related to infectious disease (69 occurrences; nine of 21 participants, 43%) rather than orthopaedic research as a barrier.

Drivers

Analysis of the interview transcripts resulted in identification of drivers of research (n = 21) which were coded (n = 1729), and their frequencies quantified (Fig. 2). The drivers were categorized into one of the three identified domains: resource constraints (n = 7), research process (n = 8), or institutional (n = 6). The proportional representation of resource constraints (31%), research process (35%), and institutional (34%) drivers discussed at least once was similar among the domains (Table 3). The presence of certain resources drove research. For example, the volume of musculoskeletal trauma (114 occurrences; 19 of 21 participants, 90%) seen at the associated hospitals of the study participants provided a substantial clinical pool of patients and therefore was an often-discussed driver of research. The Surgical Implant Generation Network (SIGN, now known as SIGN Fracture Care International)

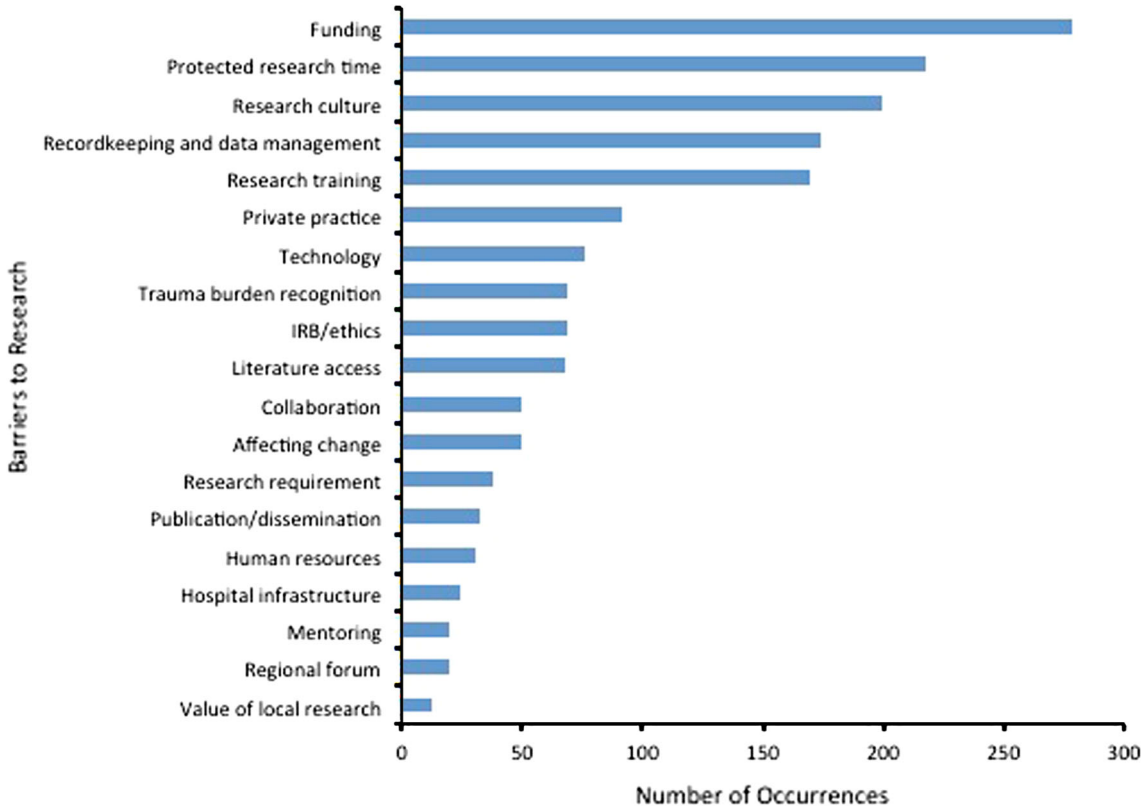

Fig. 1 The coding frequency of barriers to orthopaedic surgery research among interviewed subjects is shown. IRB = Institutional review board.

was identified as a resource driver (66 occurrences; 10 of 21 participants, 48%) because of the implant provisioning and database resources provided to the academic centers.

Research process drivers, such as the presence of local and regional East African journals, were discussed as a driver of research and publication (138 occurrences; 14 of 21 participants, 67%). Mentoring (108 occurrences; 17 of 21 participants, 81%) residents and medical students by orthopaedic faculty was discussed by many participants as an important facet of research at their respective medical centers.

With respect to institutional drivers, affecting change in medical practice for the benefit of patients and society was discussed by all interview subjects as a driver of research (198 occurrences; 21 of 21 participants, 100%). To realize this goal, many participants cited the importance of institutional collaboration in driving research (180 occurrences; 18 of 21 participants, 86%). Interview subjects discussed the merits of international collaborations which cultivate mentoring relationships, facilitate information exchange, and encourage higher-quality research with greater funding potential. Maintaining a research requirement (121 occurrences; 18 of 21 participants, 86%) for resident graduation and faculty promotion proved to be customary at the four East African academic hospitals.

Barrier and Driver Overlap

Many identified codes were discussed by some interview subjects as barriers and by others as drivers (n = 15; Fig. 3). Technology, IRB/ethics, and literature access occurred with similar frequency as barriers (76, 69, and 68 occurrences, respectively) and drivers (74, 67, and 81 occurrences, respectively). Funding and recordkeeping and data management more often were discussed as barriers (278 and 174 occurrences, respectively) than drivers (83 and 17 occurrences, respectively). Collaboration and effecting change were discussed with greater frequency as drivers (180 and 198 occurrences, respectively) than as barriers (50 and 50 occurrences, respectively).

Discussion

Research is an integral part of asking and answering questions relevant to caring for patients, and the specific questions that surgeons in low-resource settings ask are not necessarily the same as the questions generated in high-resource settings. The barriers and drivers of orthopaedic research in these low-resource settings need to be better

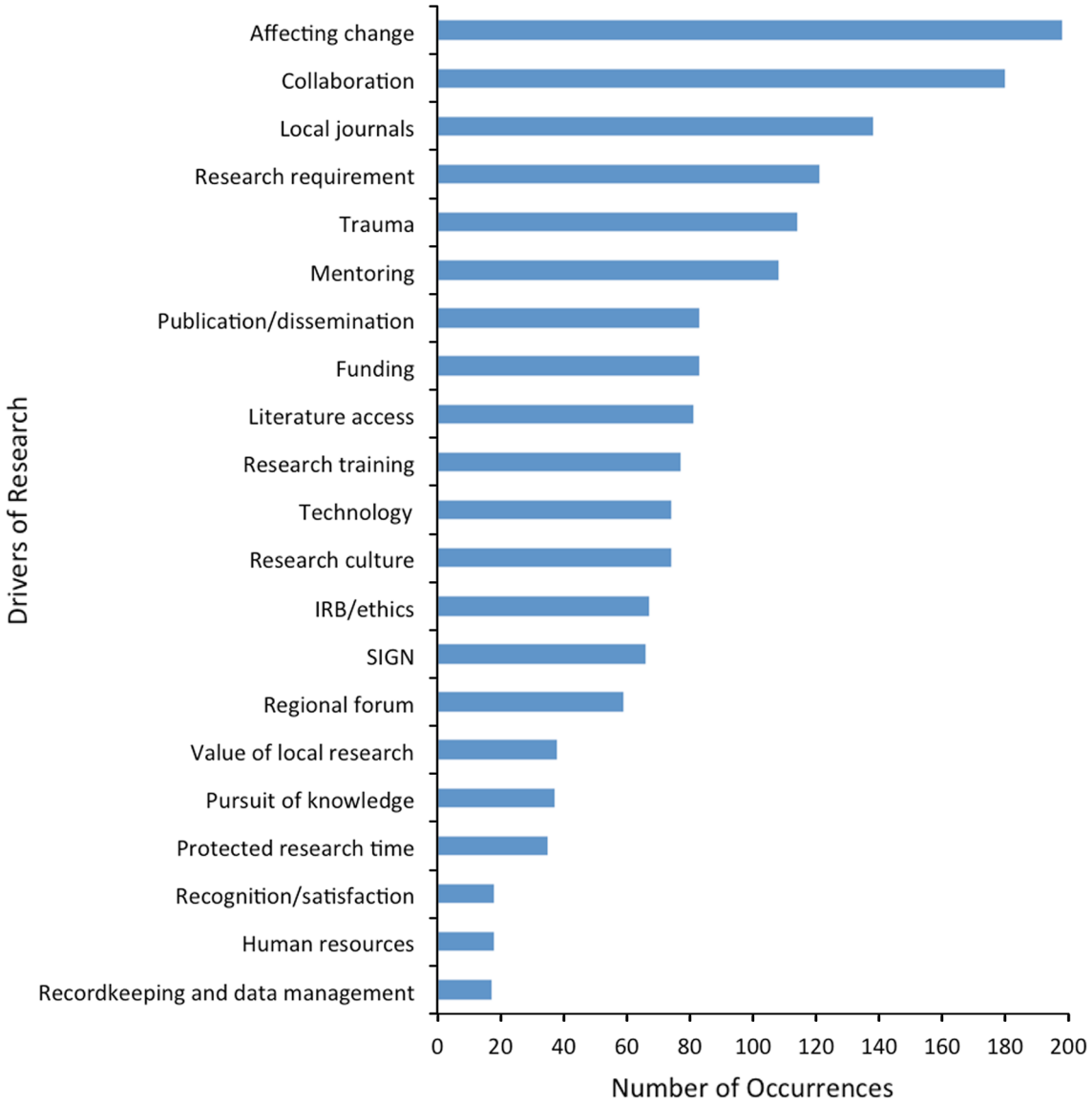

Fig. 2 The coding frequency of drivers to orthopaedic surgery research among interviewed subjects is shown. IRB = Institutional review board; SIGN = Surgical Implant Generation Network, now known as SIGN Fracture Care International.

understood to provide a framework for allocating resources and supporting existing clinical leaders in the development of sustainable research centers. An understanding of the barriers and drivers of research in low-resource East African academic centers can provide a guide for developing research programs and partnerships regionally and globally. The major (1) barriers impeding research, (2) drivers of research, and (3) overlap between factors identified as barriers and drivers are defined here through qualitative interviews with academic orthopaedic surgeons from four major East African hospitals.

Our study has several important limitations. Participants from only four academic institutions were enrolled in the study. Although multiple participants were recruited to participate in our study, generalizing our outcome data beyond the participant institutions and beyond academic centers should be done with caution, as none of our interviewees practice in a community hospital setting. We also do not know how many orthopaedic surgeons are actually practicing in each of these countries. The lack of information regarding the total number of surgeons in each of these countries and lack of inclusion of surgeons from community practices prevents conclusions from being drawn regarding what barriers and drivers of research are most important to community surgeons. The surgeons we interviewed all work at academic centers, and as shown in the drivers section, have incentive to pursue research. Surgeons in community practices there may not have much

Table 3. Categorized domains for drivers of orthopaedic surgery research

Drivers	Interview subjects† (number)	Proportion of total subjects (%)	95% CI
Resource constraints	86	31	25–37
Trauma	19	90	70–99
Technology	17	81	58–95
Literature access	14	67	43–85
Funding	12	57	34–78
SIGN Fracture Care International	10	48	26–70
Human resources	9	43	22–66
Protected research time	5	24	8–47
Research process	97	35	30–41
Publication/dissemination	17	81	58–95
Mentoring	17	81	58–95
Research training	14	67	43–85
Local journals	14	67	43–85
Pursuit of knowledge	13	62	38–82
Recognition/satisfaction	10	48	26–70
IRB/ethics	8	38	18–62
Recordkeeping and data management	4	19	5–42
Institutional	93	34	28–40
Affecting change	21	100	84–100
Collaboration	18	86	64–97
Research requirement	18	86	64–97
Research culture	17	81	58–95
Regional forum	12	57	34–78
Value of local research	7	33	15–57

† Number of interview subjects who discussed each barrier and driver at least once; IRB = institutional review board; SIGN = Surgical Implant Generation Network.

incentive to pursue research although conclusions are not possible with the information we have. Another limitation is the lack of depth of information regarding the private practices of each of the interviewees. It is not clear how much time per day they contribute to their private practice. In addition, qualitative analysis is limited by the knowledge and experiences of the text analysts. Although two reviewers performed the reviews and came to consensus on disagreements, there may be an inherent bias given that both were representing the same organization, a group focused on building research partnerships between academic institutions from low- and middle-income countries and UCSF. There is a risk of bias in the interview as the questions were formulated by analysis of feedback gleaned from a surgical skills and research course hosted by IGOT in San Francisco for orthopaedic surgeons from low- and middle-income countries. These question prompts were intended to foster open-ended discussion suitable for grounded theory analysis but it is difficult to determine whether they completely achieved their goal. Because new themes did not emerge when nearing the termination of the grounded theory analysis of the interviews indicates that there are unlikely to be additional major barriers or drivers to research performed in these particular institutions from low- and middle-income countries. We also do not have numerous publications from each of the interviewees therefore we have not quantified how involved in research they were before. Finally, grounded theory and qualitative research methods are designed to focus on a rich description of an issue rather than focus on generalizability or predictive value of the results. The strength of this study lies in identification of the specific barriers and drivers but it cannot predict for an unstudied location which of the defined barriers and drivers will be most significant.

The most often-cited barrier to conducting research was scarcity of funding, which also has been cited as a barrier to orthopaedic research in the United States [1]. Musculoskeletal disease receives little public health recognition compared with infectious disease research [19, 28, 32], which may have an effect on the reported lack of institutional support for orthopaedic research and devaluation of the burden of trauma. Research productivity also is limited

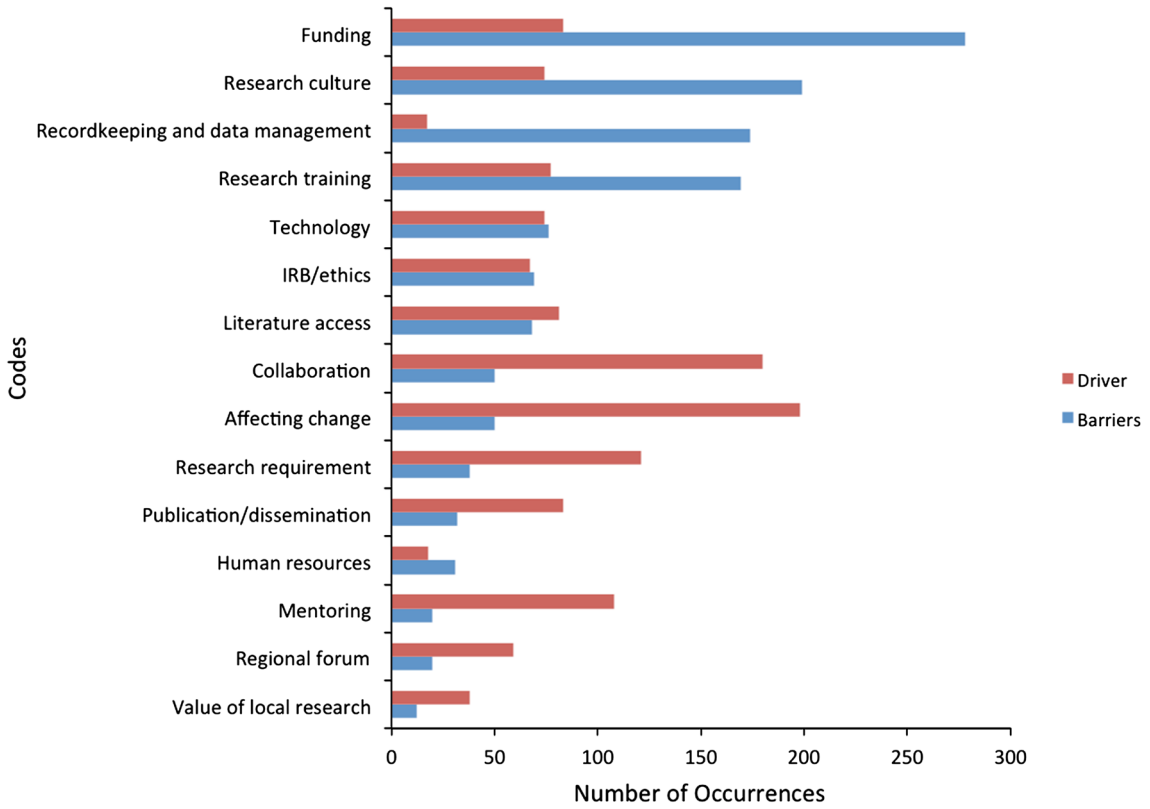

Fig. 3 A comparison of the coding frequencies characterized as barriers and drivers is shown.

by the volume of clinical work performed by participants and the associated lack of protected research time for these clinicians. These mirror barriers also have been identified in the United States, with increasing pressure to be clinically productive in the face of waning reimbursements [34]. The interviewed surgeons also typically had private practices outside their academic appointments which supplemented their academic salaries. Private practices provide income to surgeons but take focus away from other potential pursuits such as research. Incentives and rewards based on defined goals for academic productivity might encourage research among orthopaedic surgeons in low- and middle-income countries, as it has in the United States [14]. Alternatives to direct financial support for surgeons might include financial support for research personnel to aid in the logistics of doing research projects, such as protocol generation, patient enrollment, data management, and analysis to alleviate some of the time burden of performing research from the academic surgeon. Lack of research training was a hurdle echoed by interview subjects. Now widespread in undergraduate and postgraduate medical training, research training is essential to build research capacity in low- and middle-income countries [3, 22], with even short-term clinical training programs having success in building capacity in resource-poor settings [12, 24, 43]. Short-term courses, such as the IGOT research symposium, could have numerous benefits, including the development of mentoring relationships and collaborations, a frequently discussed driver of orthopaedic research and an important aspect of international research partnerships to address the infectious disease threat [15, 25, 26]. Improved data management could overcome an often-cited hindrance to research and publication—poor patient tracking. Electronic medical records systems have great potential to improve data management and quality in low- and middle-income countries [42, 44]. Other electronic systems for data capture, such as REDCap™ (Research Electronic Data Capture; Vanderbilt University, Nashville, TN, USA), offer a method for alleviating the cumbersome nature of paper data capture and make international collaboration easier.

Regional presentation and publication of research was seen as a driver to perform clinical research by participants. Recognizing the relevance of local journals when collaborating with orthopaedic surgeons in low- and middle-income countries may play an important role in translating knowledge and changing local practice effectively [8, 20, 33, 40]. In addition, the inclusion of high-quality publications in regional medical journals may elevate the importance of the journals in the minds of nonacademic

surgeons thereby increasing the effect of local research on medical practice. Augmenting the production, distribution, or quality of publication of local and regional journals could be an effective method for driving increased research, and this could be achieved via partnerships between journals in high-resource settings and journals in low-resource settings or via editor to editor mentorship opportunities. Cross-institutional collaboration was described as a major driver of research. Collaborative projects and relationships allow opening lines of communication that can lead to research mentorship, increased opportunity for funding, and sharing the workload of performing research, the most obvious examples of which are SIGN Fracture Care International and IGOT. Faculty and orthopaedic surgery residents from UCSF and other institutions have collaborated on multiple research projects with institutions in Ghana and Tanzania that now have been presented at regional and international meetings, showing the utility of these collaborations. Surgeons who use the SIGN implants across the globe present their research at an annual conference. Research awards hosted by institutions from high-income countries also may be a low-cost way to elevate the status of research in institutions from low- and middle-income countries and counteract the barrier of lack of institutional support for research. Most importantly, the desire to effect change was universally cited as a driver of research. Academic surgeons in the studied East African hospitals want to improve the care that they are able to provide and research is one tool to help them accomplish this.

Codes that overlapped as barriers and drivers warrant further discussion (Fig. 3). Technology and literature access were codes discussed as barriers and drivers by many with the reasons for these differences being unclear. Many locations in hospitals have access to the Internet on various devices yet surgeons still experience access barriers. With respect to literature access, there seems to be underutilization of existing tools such as the Health InterNetwork Access to Research Initiative (HINARI). Ultimately, these likely are related to the individual hospital locations and infrastructures, which raises interesting possibilities for regional exchanges. If a code is discussed more frequently as a barrier in one location and as a driver in another, what would these surgeons learn from visiting each other's institutions?

A substantial number of barriers and drivers of orthopaedic surgery research exist in the resource, research process, and institutional domains for orthopaedic faculty in East Africa. Additionally, drivers that appear to cultivate orthopaedic research, such as collaborations and mentorship, merit continued investment of time and money from academic centers and professional organizations in high-income countries. An open education model curricula with a focus on surgical research would be a valuable tool to breaking down process barriers and could be developed as a collaboration between orthopaedic research and educational organizations such as AO, the Orthopaedic Research Society, IGOT, and the Orthopaedic Trauma Association. Contributions for research infrastructure can come from academic partnerships with institutions in the high-resource settings, such as UCSF and the University of Utah have had at Komfo Anokye Teaching Hospital in Kumasi, Ghana, and Muhimbili Orthopaedic Institute in Dar Es Salaam, Tanzania through their support for research staff. Organizations such as SIGN, IGOT, and Orthopaedics Overseas provide frameworks for surgeons from low- and middle-income countries to connect with surgeons from high-income countries with the hope of initiating some of the previously mentioned interactions. Further investigation of the barriers and drivers at individual institutions will help elucidate the goals and metrics for research capacity-building partnerships in the future. Our study begins to provide the data needed to create an initial framework for international partnerships that aim to build sustainable orthopaedic research capacity in resource-poor settings.

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