

THE ORTHOPAEDIC FORUM

Best Practices for Developing International Academic Partnerships in Orthopaedics

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Abstract: Traumatic and nontraumatic orthopaedic conditions are major contributors to global morbidity and account for the majority of life-years lived with disability worldwide. Additionally, the burden of musculoskeletal injuries has increased substantially over the past 3 decades. Unfortunately, in low and middle-income countries (LMICs), access to orthopaedic care is limited, leading to a disproportionate burden of disease. The Lancet Commission on Global Surgery has emphasized the urgent need for unified international commitment and research collaboration to achieve universal access to safe and affordable surgical care. However, conducting high-quality orthopaedic research in LMICs remains challenging as a result of disparities in training, access to resources, infrastructure, and equipment availability. Partnerships between high-income countries (HICs) and LMICs have emerged in recent decades as an effective approach to combatting some of these challenges. These partnerships aim to bridge the gaps by facilitating collaborative research and knowledge exchange. The establishment of successful partnerships requires a collaborative and reciprocal approach that starts with a clear understanding of mutual research aims and the availability of resources. Despite the potential benefits, various factors can make establishing such partnerships difficult. However, these partnerships can have a substantial impact in delivering quality orthopaedic education and research training, thus improving access to care in resource-limited environments. This paper represents the collaborative effort of multiple international academic orthopaedic surgeons with extensive experience in HIC-LMIC partnerships. Our aims were to outline the best practices for conducting orthopaedic research within these relationships and to provide guidance for future successful collaborations.

Traumatic and nontraumatic orthopaedic conditions are a substantial source of global morbidity and mortality, contributing to more global disability than HIV (human immunodeficiency virus), tuberculosis, and malaria combined¹⁻³. Musculoskeletal disorders account for the majority of life-years lived with dis-

ability (YLDs) worldwide, and an estimated 1 in 3 people need some form of rehabilitation in their lifetime⁴. Injury alone accounts for 10% of the global disease burden, and its share is increasing, with a 33% increase in fractures and fracture-related disability in the last 30 years⁵. The World Health

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Organization estimated in 2018 that 1.35 million deaths and 50 million nonfatal injuries occur each year because of road traffic accidents, making them the leading cause of death in people 5 to 29 years old⁶.

The disparity in access to orthopaedic care in low and middle-income countries (LMICs) further exacerbates the orthopaedic burden in those countries. For example, research has shown that 93% of deaths from road traffic accidents worldwide occur in LMICs⁶, in part due to the lack of infrastructure for pre-hospital care and a dearth of trained health-care personnel in these regions⁷. One study estimated that there is 1 trained surgeon per 100,000 people in LMICs, compared with 45 trained surgeons per 100,000 people in high-income countries (HICs)⁸. In January 2014, in order to address these surgical disparities, the Lancet Commission on Global Surgery was launched, which proclaimed that surgical care is an “indivisible, indispensable part of health care” and called for a unified, international commitment to global surgery research³.

Although a robust and growing body of literature exists to guide the treatment of orthopaedic disease in HICs, generalizing the results found in these studies to LMICs is challenging because of differences in the target populations and disparities in training, access, infrastructure, and equipment availability^{9,10}. Thus, high-quality orthopaedic research conducted in LMICs is necessary¹¹. However, it has been reported that only 13% of scientists worldwide are located in Africa, Latin America, and the Middle East¹². Although the number of clinical trials being conducted in developing countries has more than doubled since 1995, trials in orthopaedic surgery have not increased at the same rate^{13,14}. This is likely due to the excessive clinical workloads that exist for surgeons in these regions and the disparities mentioned above¹⁴. Thus, partners in HICs can become an indispensable resource to those in LMICs by helping to source funding, sharing clinical and research experience, and

providing research skills and resources to help start and support research in LMICs¹⁵.

In recent years, the global health movement has begun moving away from the semicolonial model of HIC-led research toward collaborative HIC-LMIC partnerships¹⁶. Such partnerships are founded on mutually beneficial relationships, with a commitment to develop and sustain research capacity and leadership within partnered institutions in LMICs^{15,17}. These HIC-LMIC academic partnerships have been implemented successfully across the globe in many fields of medicine and surgery¹⁸⁻²⁷. North American institutions conducting global orthopaedic research have implemented various models of HIC-LMIC international academic research partnerships, successfully transferring research skills that lead to improved research capacity^{15,28}. Importantly, existing literature has demonstrated that orthopaedic research conducted in the setting of an HIC-LMIC partnership is of greater quality and quantity than that conducted in settings where no such partnership exists^{29,30}. The purpose of this review was to outline how to effectively conduct orthopaedic research within the frame of an HIC-LMIC academic research partnership. A summary checklist to assist in implementation has been included in the Appendix.

Exploring Options for Partnerships

Establishing a successful research partnership starts with a commitment to a collaborative and reciprocal approach to relationship-building with LMIC investigators. A mutual interest in research may start through existing clinical, academic, or educational endeavors and involves clear understanding and communication of the specific aims for establishing the partnership. It is recommended that principal investigators, research staff, and institutional leaders meet to discuss, identify, and list what conditions and outcomes are of mutual interest. Although

TABLE 1 Common Society Events for Orthopaedic Partnership Networking*

Society	Event(s)
American Society for Surgery of the Hand	International guest society poster symposium
International Orthopaedic Trauma Association	Triennial meeting
The International Society for the Study of the Lumbar Spine	Annual meeting focus groups
International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine	Biennial congress
Limb Lengthening and Reconstruction Society	Annual meeting
North American Spine Society	International courses and annual summit
Orthopaedic Research Society	Annual meeting, international biennial meeting, and symposiums
Pediatric Orthopaedic Society of North America	Annual meeting
Ruth Jackson Orthopaedic Society	Annual meeting
Scoliosis Research Society	Annual meeting and worldwide courses

*Societies were identified from the AAOS list of orthopaedic societies. This table includes only events that explicitly mention an international session and/or focus. Multiple other societies organize events and meetings that can also be a networking opportunity even though it is not the focus of such gatherings. This table should not be considered a comprehensive list of all possible opportunities for networking.

TABLE II Societies Providing Fellowship and/or Observership Funding

Society	Fellowship/Observership Funding
American Association for Hand Surgery (AAHS)	International Reverse Surgery Fellowship
American Orthopaedic Society for Sports Medicine (AOSSM)	Traveling Fellowship Program
American Society for Reconstructive Microsurgery (ASRM)	MicroSurge Visiting Educator Opportunity
Arthroscopy Association of North America (AANA)	International Education Scholarship
The Hip Society	The Rothman-Ranawat Traveling Fellowship The Hip Society-British Hip Society Traveling Fellowship European Fellowship in Hip Reconstruction
The International Society for the Study of the Lumbar Spine (ISSLS)	ISSLS Clinical Travelling Fellowship
International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS)	ISAKOS Global Traveling Fellowship ISAKOS Knee Arthroplasty Traveling Fellowship ISAKOS Patellofemoral Traveling Fellowship International Sports Medicine Fellows Conference Scholarship The ISAKOS Young Investigator's Scholarship and Research Mentoring Program
The Knee Society	John N. Insall Traveling Fellowship
Limb Lengthening and Reconstruction Society (LLRS)	LLRS Traveling Fellowship
North American Spine Society (NASS)	Clinical Traveling Fellowship Research Traveling Fellowship
Orthopaedic Research Society (ORS)	ORS Collaborative Exchange Grant Orthoregeneration Network (ON)/ORS Education Grant ORS Spine Section Travel Fellowship ORS International Section of Fracture Repair (ISFR) Interdisciplinary Academic Exchange Grant
Orthopaedic Trauma Association (OTA)	Roy Sanders OTA Traveling Fellowship Center for Orthopaedic Trauma Advancement (COTA) grant
Pediatric Orthopaedic Society of North America (POSNA)	Pediatric Orthopaedic Global Outreach (POGO) Scholarship* Traveling Fellowship
Ruth Jackson Orthopaedic Society (RJOS)	Alexandra Kirkley, MD Academic Traveling Fellowship
Scoliosis Research Society (SRS)	SRS Traveling Fellowship Edgar Dawson Traveling Fellowship Eduardo R. Luque Memorial Scholarship Robert B. Winter Global Outreach Fellowship Global Outreach Program (GOP) Visiting Fellowship Global Outreach Program (GOP) Educational Scholarship SRS North American Meeting Scholarship for Residents and Fellows

*Formerly known as the COUR Scholarship.

likely an iterative process, these meetings should produce a clear research initiative that can be shared with potential partners.

Once a clear institutional initiative has been established, the next step is to identify potential partners. These partners should be actively sought out through multiple avenues, including personal connections, referrals, and networking through working groups, observerships, and orthopaedic societies and at organized meetings and events. Table I provides examples of events by specialty societies recognized by the American Academy of Orthopaedic Surgeons (AAOS) at which collaboration between high and low-resource partners is commonly encouraged and/or facilitated. Additionally, meetings sponsored by nongovernmental organiza-

tions and annual meetings led by LMICs such as the College of Surgeons of East, Central and Southern Africa and the West African College of Surgeons provide unique opportunities for HIC-LMIC collaboration and, perhaps more importantly, for LMIC-LMIC collaboration.

Fellowships and/or observerships present another, more expansive opportunity for both high and low-resource surgeons to establish a collaboration and to increase their level of clinical and cultural understanding. One recent study identified >100 unique observership opportunities in North America for international surgeons³¹. Table II lists common resources for orthopaedic observership and fellowship funding. Additionally, the

TABLE III Orthopaedic Society Grants for International Work

Society	Grant Name	Amount
American Academy for Cerebral Palsy and Developmental Medicine	International Development Grant	Up to \$5,000
American Association for Hand Surgery	Vargas International Hand Therapy Teaching Award	Up to \$5,000
Orthopaedic Trauma Association	OTA International Research Grant	Up to \$20,000
Pediatric Orthopaedic Society of North America	POSNA Micro Grant	Up to \$1,000

Ruth Jackson Orthopaedic Society maintains an updated list of upcoming orthopaedic traveling fellowships on their website (www.rjos.org).

Establishing a Relationship

Once both partners have been identified, it is imperative that representatives of the involved institutions meet to review their goals and resources openly. A thorough needs assessment should be presented to the high-resource partner, and that partner should assess their ability to meet those needs. Expectations from both the high and low-resource partners should be clearly outlined and discussed together. The final product of these meetings should be an affiliation agreement, frequently called a Memorandum of Understanding (MOU). The MOU should outline and summarize the expectations agreed upon by each institution, including, but not limited to, the quantity and forms of communication, the acquisition and distribution of funds, the contributions of team members, and the mechanism whereby academic credits are mutually agreed upon and assigned. Moreover, issues related to human subject protection, data transfer, local knowledge transfer and capacity building, and liability for potential harm may be addressed in the MOU. An example MOU is provided in the Appendix.

Care should be taken to ensure that differences in culture and resources are understood and respected. It has been shown that HIC partners often desire to collaborate with LMIC partners for personal reasons and that the needs of LMIC partners are rarely considered despite the negative consequences for LMICs³². Historically, it has been assumed that LMIC partners gain the most from these partnerships. However, the capacity of HIC partners is also enhanced as these partners learn how to navigate different cultural contexts and adapt research methods to low-resource settings. It is therefore imperative to ensure that all parties have an equal voice during the initial conversations and at every stage of the collaboration, including during the crafting of the MOU, to ensure that the relationship is truly in the best interests of all involved.

Beginning a Research Project

Once the investigators have been identified and the terms of the research partnership have been established in the MOU, the foundation for research activities can begin to be established. A strong research foundation requires choosing a mutually beneficial project, obtaining adequate funding and ethical approval, having a clear understanding of roles, and properly training research staff.

When choosing a project, ideas should be solicited from both partners to ensure that the research topic is relevant to both parties. The perspectives of allied health professionals (e.g., nurses, prosthetists, physiotherapists) and patients affected by the research or by its potential findings should be considered whenever possible. After a project has been decided on, funding should be applied for and obtained. Funding should cover all materials necessary for data collection and analysis. Additional funding considerations for partnerships conducting research in LMICs include local-staff salaries, technology (e.g., laptops, tablets, cell phones), site visits (bidirectional), transport reimbursement for study participants, and Wi-Fi or internet credits. Funding can be obtained from a variety of sources, including, but not limited to, philanthropic sources, private donors, departmental grants/scholarships, and grants from various professional societies such as the AO Foundation, the Orthopaedic Research and Education Foundation (OREF), the Pediatric Orthopaedic Society of North America (POSNA), and the Orthopaedic Trauma Association (OTA). Specific grants for international work are designated in Table III.

Ethical approval is another facet of the research project that should be secured prior to beginning the work. There are many examples of unethical clinical trials that tested products in impoverished communities for the sole benefit of higher-income patients³³⁻³⁵. For this reason, it is critical that the outcomes of the project will be immediately beneficial to the population participating in the study. Similarly, receiving true informed consent from research participants is important. Ensure that informed consent materials are written in the local language and can be understood by laypeople, regardless of their educational level. Obtaining ethical approval from both institutions is also necessary. This process varies greatly from country to country, with some countries requiring ethical approval at the national level for external collaborations. Additionally, in some countries, hospitals or academic centers may not have dedicated institutional review boards and thus the study team may need to obtain ethical approval at the level of a ministry of health.

The next step would be to build the rest of the research team and to organize roles. There should be team members from each institution in leadership positions. When attempting to distribute research roles between partners, play to the strengths of each institution. A common role distribution within HIC-LMIC partnerships has been for the LMIC partner to operate data collection, recruiting patients and maintaining data quality, and

for the HIC partner to analyze data and draft manuscripts. Although this model has historically been the most widely used, it is not the only way to distribute roles. We encourage the active transfer of research skills and capacity building between both teams at every stage of the project collaboration, including in data analysis and manuscript preparation. It is also important to have a conversation surrounding authorship early on during project planning and funding. Each partner and their respective institutions should have a clear understanding of the expectations for authorship, the authorship order, and any institutional incentives for publication.

It is imperative that all study personnel are aware of and comfortable with the study procedures. This may require a site visit in order to train research staff and troubleshoot issues that may arise. Having dedicated study staff who are solely dedicated to the research project can help to strengthen the research foundation. Research assistants have more time to dedicate to the project and can help organize it to ensure that it maintains forward momentum. Relying solely on physicians and trainees to do the research can often slow the progress of the project.

Conducting Research

Conducting a research project in a low-resource setting poses certain barriers that are not always present in high-income settings. Therefore, the study team should take care to ensure that these barriers are addressed ahead of time. Some of the barriers include inadequate research equipment, difficulty in participant recruitment and/or retention, and inconsistent communication. These barriers are further addressed below.

The study team should ensure that the study site has access to all necessary equipment. Partners should think about not only the actual equipment for the project, such as wet laboratory equipment or refrigeration for medications, but also the logistical equipment, such as internet access and reliable hardware. Limited access to the internet and technology is a commonly cited barrier among studies conducted in LMICs^{36,37}. Whenever possible, paper charts should be avoided and data should be collected prospectively and digitally. This means that the research team will need reliable internet or the ability to reliably collect data offline to be uploaded securely later. Data collection tools that provide this functionality exist and some are available free of charge. Prospective, digital data collection may require acquiring additional funding in order to cover the cost of internet credits and access to electronic data capture systems.

Recruitment and retention can be major barriers to conducting a research project in low-resource settings. For recruitment, ensure that all study materials, including informed consent

forms, are available in the local language and are written in a way that is understandable for laypeople. Strategies for maximizing in-person follow-up include creating a dedicated research day at the clinic and covering the costs of consultations, radiographs, laboratory investigations, and transport reimbursement for both patients and caregivers. Study teams can also consider a flat-rate incentive to encourage patient follow-up and to cover any miscellaneous costs or inconveniences related to participation in the study. If in-person follow-up is not possible, then the study team can consider utilizing telephone follow-ups as an alternative, provided that cell phones are prevalent among their patients. It is recommended that the study team collect at least 3 cell phone numbers (1 from the patient and 2 from family members) during enrollment. Such strategies can maximize the chances that the patient can be reached for follow-up³⁸.

Consistent communication is key to a successful research project. When choosing the method and frequency of communication, recognize that, although email may be the most widely utilized communication method in HICs, it may not be in LMICs. Consider providing funding for internet bundles and utilizing free messaging apps like WhatsApp, Viber (Rakuten), or Messenger (Meta) to maintain open lines of communication. In addition to communicating via messages, consider organizing video conferencing calls for more formal project check-ins.

Beyond Research

To sustain a research partnership beyond 1 research project, the partnership should ensure that all parties feel rewarded both personally and professionally by the project. Team members from both HICs and LMICs should be included in the author byline, with the authorship order guided by the amount of work completed by each person. It is important to consider that the academic rewards for publishing may not be equivalent between HIC and LMIC institutions; however, this should not prevent LMIC partners from taking leading roles in authorship. LMIC authors should be supported in presenting at conferences and meetings, particularly at regional and international conferences where the research findings are likely to be more applicable to the majority of participants. Other forms of support can include financial support, abstract writing guidance, and institutional assistance with obtaining the necessary visas or travel funding. Several North American orthopaedic professional societies fund grants and fellowships for LMIC investigators that can be used to support travel expenses and registration fees (Table IV).

Conference participation and research dissemination through publications can increase the impact of research, which can bring about substantial changes in surgical practice.

TABLE IV Orthopaedic Society Grants for International Travel to Academic Conferences

Society	Grant Name	Meeting	Observership
Orthopaedic Trauma Association	OTA Humanitarian Scholarship	OTA Annual Meeting	Yes
Pediatric Orthopaedic Society of North America	Pediatric Orthopaedic Global Outreach (POGO) International Educational Scholars Program	POSNA Annual Meeting	Yes


Nonetheless, although academic partnerships are frequently evaluated on the basis of their scholarly output, it is equally crucial to recognize the potential influence of the findings on broader systemic transformations. Achieving such transformations often necessitates active involvement of and collaboration with local stakeholders, including ministries of health and policymakers, who possess the power to implement evidence-based policies. These actions often require additional unsupported effort but can yield the perpetual culture of inquiry, health-care improvement, and public health policy improvements that these academic partnerships aim to foster.

Building institutional capacity also ensures the longevity of the academic partnership. This can be done through the creation of leadership-building and educational opportunities such as continuing education meetings, resident rotations and exchange programs, research staff training, and leadership training. One example of how educational opportunities can help to grow a research relationship is the partnership between the Institute of Global Orthopaedics and Traumatology at the University of California San Francisco and the Muhimbili Orthopaedic Institute. This academic partnership was established through a prospective cohort study begun in 2011. Since that time, these 2 institutions have created bidirectional resident-exchange rotations and have collectively organized continuing education courses³⁹. Over the past 10 years, the research relationship has grown, as has the research aptitude of the Tanzanian principal investigators, who serve as first authors on many of the study publications. More recently, a randomized clinical trial on local gentamicin use in open tibial fractures in Tanzania was initiated after garnering funding from both the OREF and the National Institutes of Health (NIH)^{40,41}. This collaboration is an example of how bidirectional partnerships can result in a culture of inquiry that becomes self-sustaining as it inspires young investigators on both sides to work together for mutual gains.

Conclusions

This article outlines the steps and considerations for establishing international academic partnerships within orthopaedics. International academic partnerships have the potential to be mutually beneficial and to improve the care of patients with musculoskeletal injuries worldwide. The critical ingredients of such partnerships are bidirectionality, shared decision-making, and clear communication.

Appendix

 Supporting material provided by the authors is posted with the online version of this article as a data supplement at [jbjs.org \(http://links.lww.com/JBJS/H724, http://links.lww.com/JBJS/H725\)](http://links.lww.com/JBJS/H724). ■

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