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Appendices

Appendix 1: Clinical Care

1.1 *Service Missions and Available Organizations*

Recently, there have been increasingly more opportunities for clinical educators to participate in global efforts, either through educational conferences or research societies. The AO Alliance Foundation has hosted more than 400 courses throughout Asia and Africa[1]; IGOT has designed a Surgical Management and Reconstructive Training (SMART) course to teach rotational flaps to orthopaedic surgeons in LMICs[2]; Haiti has created the Haitian Annual Conference on Orthopaedic Traumatology (Assemblée Annuelle Haitienne de Traumatologie Orthopédique; HAAOT) following the earthquake in 2010, connecting the island's surgeons and trainees with international faculty[3,4]; and the Asociación de Cirujanos Traumatólogos de las Américas (ACTUAR) provides Latin American orthopaedic trauma surgeons with opportunities for trauma-related clinical research and academic publication[5].

1.2 *Resident and Fellow Clinical Opportunities*

As global health interests grow among orthopaedic surgery residents and fellows, more training programs offer volunteer clinical work in LMICs[6-8]. These clinical opportunities have a plethora of educational benefits to both students and partners in LMICs. Overseas work in low-resource countries exposes orthopaedic trainees to a wide range of musculoskeletal pathology, often with unique or delayed presentations not regularly seen in their home institutions[6-8]. This emphasis on critical thinking and adaptability is valuable and often difficult to replicate in technologically advanced institutions[7-9]. Additionally, exposure to a population with different values, beliefs, and behaviors can foster greater cultural awareness - an indispensable skill for treating trainee's own increasingly diverse patient populations. Above all, overseas programs are intended to benefit the local patients and providers. Clinical work should aim to increase surgical capacity at the host institution through education, sharing of ideas, and development of local facilities and equipment.

1.3 *Trip Preparation: Pearls and Pitfalls*

When choosing an international opportunity, it may be useful to confer with physicians who have experience working in the considered regions. As LMICs each have unique clinical needs and resources, additional research can guide clinical expectations and help match volunteers with clinical work within their field of expertise. Most importantly, volunteers should act upon the principle of "first, do no harm". The urge to help can sometimes lead surgeons to perform procedures that are not appropriate given the local equipment or facilities. Prior to any procedure, surgeons need to confirm that follow-up care and secondary procedures are possible with the available local resources[10]. To avoid malpractice, one approach is to merely observe during the first visit to become conversant with the most common orthopaedic injuries, the available equipment, facilities, and typical care delivery[11]. A corollary is to perform the simplest procedures possible and ensure that treatment protocols and postoperative care can be managed prior to departure. Additionally, the cultural attitudes and behaviors are likely to differ from those at home, so visitors should be respectful and accept local customs[12].

Navigating the logistics associated with travel, lodging, documentation, and licensure may be difficult without institutional assistance. In fact, medical equipment can be delayed in

customs, which might leave volunteers without basic supplies for the duration of their trip. Most established organizations are well-equipped to expedite the procurement of customs or consular documentation and secure the most reliable route for transporting equipment.

Prior to travelling, volunteers should prepare for the trip, including obtaining the necessary vaccinations and visas, per the CDC (www.cdc.gov/travel) and U.S. travel guidelines (www.travel.state.gov). Important documents, medications, and a change of clothes should be packed in carry-on luggage, in case checked baggage is delayed. There should be appropriate plans for airport transfers and lodging arrangements. Travel insurance can help cover evacuation in the case of illness or conflict. Volunteers should also pack medication for HIV post-exposure prophylaxis, download reference books in electronic form in case of internet outages, and contact the host institution to determine if additional medical equipment or resources is required. It may also be practical to read about the local environment, culture, and history, and learn a few common phrases in the native language prior to travel.

Appendix 2: Clinical Research

2.1 *Rationale for Global Partnerships for Orthopaedic Clinical Research*

Regrettably, global orthopaedic research can also engender problematic power dynamics. The potential for exploitation is high in the vulnerable populations that volunteers seek to serve, making a rigorous adherence to an ethical research framework vital. Visitors must always aim to minimize patient risks, recruit subjects without coercion, seek appropriate informed consent, and obtain institutional approval[13]. Health literacy and cultural barriers among poor populations may also arise, so it is critical to work with local partners who can navigate context- and culture-specific challenges to ensure global orthopaedic research is conducted ethically and rigorously[14].

Before beginning a research project in a low-resource context, surgeons and researchers from high-resource settings must commit to building relationships of mutual respect and trust with local collaborators. They must recognize that collaborators from low- and high-resource settings stand to gain equally from these collaborations, in terms of knowledge and skills[15]. Horizontal partnerships are key to addressing the challenges relevant to local collaborators and patients[16]. Researchers in HICs should support partners in LMICs to build their institutions' research capacity by incorporating educational training into the research project and conducting adjunct courses, fellowships, and exchanges[17].

Global orthopaedic research can be used both as an evaluation tool and as a means of collaboration to foster an academic culture of inquiry. In addition to introducing important clinical skills, knowledge, and experience to a designated setting, clinical research projects can also indirectly enhance patient management. For example, clinical research focusing on patient outcomes may encourage local providers to follow-up more thoroughly with patients, ultimately leading to improved clinical processes, accountability, and patient care. Furthermore, research projects conducted in low-resource settings may also have much broader applicability, not only to other similar contexts, but also to high-resource settings where cost-effectiveness and delivery of equitable care can also be improved[18].

Perhaps most importantly, research on global orthopaedics is an essential tool for advocacy. Effective global orthopaedic partnerships must prioritize authentic communication of challenges and innovations, valuing local partners as co-investigators and co-authors. In this way, research gives voice to the struggles of marginalized patients and providers toiling in low-resource settings. Without recognition of musculoskeletal health inequities at the local and global levels, we simply cannot mobilize the resources necessary to effect change.

2.2 *Models of Global Research Partnerships*

Nearly two decades ago, Costello and Zumla called for the abandonment of HICs' semi-colonial approach to conducting research in LMICs[19]. Instead, they proposed that HICs foster cooperative research partnerships centered on mutual trust, shared decision-making, national ownership, translation of research findings into policy, and development of national research capacity. Many of these same recommendations were echoed in a recent empirical study suggesting an updated framework for developing sustainable, locally led clinical trials in LMICs. In this report, Franzen and colleagues outline four key strategies to improve health research capacity, including fostering a pro-research culture, appointing local clinical trial leaders and staff, providing a facilitative operational environment, and ensuring that trial research has local impact[20].

While the leading North American institutions conducting orthopaedic research in LMICs employ the strategies articulated by Costello and Franzen, the implementation of these principles has differed. Several common implementation models include one-to-one academic partnerships, large-scale international research consortia, professional society-associated working groups, and initiatives supported through non-governmental organizations (NGOs).

2.3 *Types of Research*

When considering the breadth of clinical and epidemiological tools needed by research partnerships, the assessment of formative work is equally as important as conducting an interventional trial. In fact, the latter cannot succeed without the former. Qualitative research aims to use the perspectives of stakeholders, including local health-care providers, patients, and community members, to delineate which problems matter most to those we are helping. Epidemiologic studies record the distribution, frequency, and burden of diseases in order to help identify conditions that warrant priority. This formative assessment is vital to determining if a particular research question can adequately provide feasible, novel, ethical and relevant answers[21].

The choice of study design is typically driven by practical and scientific considerations. When addressing questions about prognosis or strategies of intervention, observational studies often have fewer logistical and ethical constraints than an experimental design study. Prospective data collection can also evade many of the obstacles associated with retrospective data collection, including variable data quality, measurement bias, and difficulties obtaining medical records. Also, to achieve maximal improvements in global musculoskeletal health equity, research partners should strongly consider including economic analyses which help inform policy[22]. However, it is important to remember that regardless of a study's design, research should aim to generate high-quality inferences by mitigating any biases or confounding variables. The funding and organization of studies will invariably require careful planning and collaboration between academic partners[23].

2.4 *Practical Considerations*

When developing a research study budget, there are many financial aspects that require consideration. These often include participant sample size, number of sites involved, non-standard of care tests, equipment costs, and research personnel[24], with the latter requiring the majority of funding. In order to secure adequate funds and resources for a research study, it is vital that all possible costs are accounted for; failure to do so may lead to a poorly executed study, a funding shortage, or an early termination of the study protocol.

Another critical component of a successful research study is building a strong team. Typically, a research team consists of a principal investigator, co-investigators from relevant specialties, a statistician, and research coordinators. Each individual plays a significant role in the implementation of the study. The research coordinator is responsible for overseeing the everyday tasks of team members and serves as the central point of contact for the team. Ideally, the coordinator possesses the organizational and communication skills necessary to ensure the study operates according to protocol. Strong leadership from the principal investigator and open collaboration between team members will contribute to a successful study[25].

During the course of a study, data needs to be collected, reviewed, and verified with diligence and expedition. Electronic data capture systems are useful research tools providing automated support for data collection, query identification, and validation, among other

features[26]. The research coordinator, with oversight from the principal investigator, is typically responsible for ensuring that data is error-free, of reliably high-quality, and is statistically sound.

2.5 *Balancing Local-Visitor Expectations*

International research projects should be planned with careful consideration of both partners' expectations, especially with regards to the research findings. The goal is to disseminate research in a way that is both academically rigorous and easily accessible to the partnering institutional communities. One approach is to arrange for peer revisions prior to distribution or publication. Beyond this, there should be discussions on how the final research is shared within the local regions. For example, some groups have created regionally based conferences and organizations, like the Myanmar Orthopaedic Society and the Haitian Annual Conference on Orthopaedic Traumatology (HAAOT).

Appendix 3: Surgical Education

3.1 *Key Principles for Successful Orthopaedic Surgical Education Initiatives*

Reflecting on the successes and challenges of these initiatives, several principles have emerged that may be generalized into a useful template. To start, partnering with well-established orthopaedic surgery training programs is a highly effective means of advancing education in the less-resourced environments. By investing in the education of young orthopaedic residents and faculty, these programs are building the next generation of orthopaedic providers. As many of the trained orthopaedic residents become institutional faculty members themselves, the effects of these educational efforts are multiplied. This multifaceted approach, for example, has been notably adopted by the Pan African Academy of Christian Surgeons (PAACS), a multinational service organization created to address the need for surgical care in Africa. PAACS' comprehensive five-year surgical residency program trains African physicians to become surgeons. More specifically, PAACS offers an orthopaedic surgery subspecialty program that aims to generate a larger and more skilled African orthopaedic workforce. An analysis of the program's graduated surgeons reveal that its educational model achieves high retention rates among surgeons working in rural Africa compared to other programs[27]. This educational program demonstrates the importance of young generations of orthopaedic doctors in advancing the future of orthopaedic care.

In addition, educational programs should aim to equip orthopaedic trainees with specific knowledge on locally common cases, while also ensuring they receive a well-rounded, didactic education. A curriculum ideally exposes residents to all fields of orthopaedic surgery during their residency training. Although certain equipment may not be available for trainees to practice clinically, these subspecialty topics should still be covered. Hopefully, as more technology becomes available in the future, trainees will be better prepared to incorporate these tools into practice. In line with these principles, the American Society for Surgery of the Hand launched the Touching Hands Project (THP), a program providing free hand surgery and medical training to underserved communities worldwide. Their education program is particularly effective because their medical teams include hand surgeons, nurses, anesthesiologists, and occupational therapists. The inclusion of non-surgical staff allows the THP to deliver a more wholistic clinical education. Consequently, the team can guide a wider range of physicians through a complete course of treatment. After the visiting surgeons teach the host surgeons more complex surgical procedures, the nurses can effectively instruct the local nurses on post-operative patient care, and the therapists can jointly guide post-surgical physical therapy exercises. This program, which is now performed in 13 countries, highlights an effective method of teaching local physicians a combination of basic practices and advanced training.

In conjunction with a balanced education program, curricula should address the specific needs of the communities they are targeting; a training program will only be effective if the course material offered is relevant and applicable. One possible approach is for global health-care organizations to coordinate closely with their partnering hospitals to identify suitable learning priorities. This principle is clearly demonstrated by the HAAOT. Since its introduction in the spring of 2013, the annual conference provides a formal venue and occasion, gathering Haiti's community of orthopaedic surgeons, residency trainees, and visiting faculty from

overseas. Using an anonymous electronic audience response system, the HAAOT can identify the Haitian participants' self-perceived knowledge gaps and structure the presentations accordingly[28,29]. In past years, central themes have included the management of open fractures, treatment of delayed or neglected injury, osteomyelitis, and national disaster preparedness. This same response system also allows participants to answer poll questions confidentially, which helps the HAAOT assess participant understanding and retention in real time. Studies revealed that participants develop an immediate and sustained understanding of orthopaedic pathology and surgical management[29,30]. The HAAOT exemplifies one of the possible approaches to ensuring that orthopaedic education appropriately responds to the needs of the developing world.

Finally, it would be most effective to partner with an organization that already has strong relationships with surgeons in developing countries. Organizations with existing global partnerships can advance orthopaedic education beyond what individuals can accomplish by virtue of their vast network of connections. There are a myriad of advantages to such organizations, many of which are exemplified by the Institute for Global Orthopaedics and Traumatology (IGOT) at the University of California, San Francisco (UCSF)[31]. IGOT is a global health organization founded in 2006 that seeks to build capacity in musculoskeletal care through global academic partnerships in orthopaedic surgery. IGOT's educational programs include: Surgical Management and Reconstructive Training (SMART) courses, three-day didactic and hands-on lab programs on orthopaedic trauma and flap reconstruction given locally in San Francisco and in different countries around the world; the IGOT Portal, an online surgical education platform that supplements the SMART courses and offers additional resources and case discussions; and educational exchange programs[32]. IGOT's education model is carefully designed to leverage its extensive network of partnerships, helping to promote more sustainable solutions to complex problems. The global partnerships have significantly enhanced bidirectional educational exchange, providing more beneficial educational offerings to both UCSF members and LMIC partners. This exchange also allows for the incorporation of LMIC partners in the design and revision of educational initiatives. Such revisions could include teaching simpler clinical techniques with broader applications for participants working in low-resource settings. IGOT also partners with other large organizations to support and expand their educational mission. Ultimately, these synergistic collaborations amplify the effectiveness and sustainability of their training programs. Additionally, IGOT's partnerships facilitate the promotion of future academic leaders in LMICs by supporting leadership development and empowering the next generation of academic educators. Simply put, IGOT's education program continues to significantly advance education initiatives worldwide largely because of its emphasis on sustainable global academic partnerships.

Appendix 4: Disaster Response

4.1 *Disaster-Based Ethical Considerations*

Additionally, other areas of volunteer humanitarian activity have recently begun assessing strategies to deliver higher-quality care, although they queried whether or not credentials should be a requirement. In the disaster setting, surgeons often require support from other practitioners and agencies to deliver quality care. However, this coordination is complicated by the arrival of spontaneous unaffiliated volunteers ("SUVs"), civilians helping in mass-casualty events without credentials or logistical provisions for their safety, food, or shelter. While most SUVs are well-intentioned and able to assist, they must be managed appropriately.

Another important question to consider is whether surgeons in developing countries can conform to established professional standards of conduct. In order to improve humanitarian reform, there needs to be more predictability, accountability, and strengthening of partnerships between response agencies. In 1997, the organization Sphere (formerly known as Sphere Project) was created to develop a set of universal minimum standards in core areas of humanitarian response[33]. Through collaboration with NGOs, the Red Cross, the Red Crescent, and the United Nations, Sphere ultimately hopes to provide victims with dignified assistance and alleviate human suffering inflicted by disaster or conflict. Sphere regularly updates its guidelines to reflect appropriate response measures to emerging disasters (e.g. COVID-19) via their digital platform, which includes their handbook and other sets of humanitarian standards in various languages[34]. Furthermore, Sphere maintains that effective responses are based on humanitarian principles, including impartiality, neutrality, and respect for the individual, as well as rights to protection, security, and accountability for the larger communities. Many of Sphere's same objectives were later echoed in the 2011 Humanitarian Action Summit, where the Working Group on Surgical Issues within the Humanitarian Space established similar minimum standards regarding the capabilities of responders and response teams[35]. One of the main principles cited was the need for more comprehensive planning, record-keeping, and monitoring of germane responder motivations.

4.2 *International Humanitarian Organizations*

In most low-resource countries, health care is sustained by either regional organizations, NGOs, or international non-governmental organizations (INGOs). These organizations have often been operating in LMICs for prolonged periods to provide nationals with profound local knowledge and to develop an extensive network of diversified partnerships[36]. This external support becomes especially important in response to mass-casualty events. LMICs are particularly vulnerable to natural disasters, where the burden of casualties frequently overwhelms the local health-care system[31]. Following a mass-casualty incident, the immediate response measures are conducted according to the existing regional disaster response plan. Generally, international responders appear after this initial state of emergency. While NGOs typically utilize their well-connected networks to facilitate communications, logistics, security, and transportation, INGOs offer additional human, material, technical, and financial resources. All of which are essential to delivering an effective response, both in the acute phase and in the subsequent weeks. Strong collaboration and communication between national and foreign organizations is key to optimizing the quality of the disaster response[37]. However, efficient

coordination has historically been difficult, as each NGO and INGO has its own political agenda[38]. The World Health Organization is currently working to remedy this situation.

A prospective international volunteer should always proceed through the framework of an accredited NGO or INGO, rather than acting as an SUV[39]. In addition to the various INGOs associated with orthopaedic-related disaster response, like Médecins Sans Frontières (Doctors Without Borders), Médecins du Monde, The International Committee of the Red Cross (ICRC), and EMERGENCY, many other international organizations, societies, and academic institutions exist as well. All of these organizations share similar needs - healthy volunteers who are adaptable, collaborative, resourceful, culturally sensitive, and without agenda. However, the length of assignment and necessary requirements for experience and skills may vary with each organization.

4.3 *Resident Electives*

Over the past decade, there has been an increasing trend among orthopaedic residency programs to offer global health electives in underserved countries. Recent studies have revealed that 20-32% of responding U.S. orthopaedic surgery training programs currently offer formal international health electives[7,40,41]. The majority of the program directors and trainees agree that there are invaluable experiences and skills to be learned from working in a multicultural environment with limited resources[40,42,43]. The most commonly cited skills are cultural awareness, professionalism, leadership, and improved improvisation, both within and beyond the operating room[8,40,42,44]. Similarly, the unique skills acquired from international electives may help prepare orthopaedic surgeons for unpredictable scenarios back home. Disaster management situations can frequently replicate international health-care scenarios, where a normally resource-abundant environment quickly becomes one of temporization and improvisation. For example, the 2013 Boston Marathon Bombings required a coordinated multispecialty response to provide immediate surgical care (e.g. extremity amputations, shrapnel extraction, and damage-control orthopaedics) until additional resources became available to assist with the surge of patients[45,46]. Many surgeons involved in the immediate aftermath of the bombings stressed the importance of having prior experience treating trauma patients. Several of them specifically cited their experience in low-resource countries, like South Africa and Haiti, as being crucial for their ability to respond effectively[45].

Increasing the availability of global health electives to meet the documented interest among residents will inevitably create an orthopaedic workforce that is better equipped to respond to mass-casualty events, domestic and abroad.

Additionally, surgeons who served as humanitarian workers in disaster-response often develop long-term relationships with the country where they first volunteered. For example, a group sponsored by the Foundation for Orthopaedic Trauma (FOT) has returned to Haiti every year since the catastrophic 2010 earthquake to deliver surgical care and train Haitian orthopaedic doctors[47]. Consequently, early involvement in volunteer clinical work can drastically improve present and future disaster response efforts.

4.4 *Military Trauma Care*

Surgeons with military training can offer valuable instruction on how humanitarian efforts should respond to natural disasters and mass-casualty terrorist attacks. It has become a priority to harness the skills that military surgeons have acquired from combat and cross-train

their civilian counterparts. Despite the widespread tragedy, each war has contributed to medical advancements in trauma care that have since been applied to civilian practice[48,49].

Under the current Overseas Contingency Operations funding (formerly known as the Global War on Terror), the Military Health System has significantly improved combat trauma care and currently records the highest rates of survival in modern history[50]. However, the lessons learned from combat casualty care have historically been slow to transfer to the civilian sector[51]. For the most part, the civilian trauma systems continue to struggle to provide consistent, high-quality care[52]. Furthermore, as the casualties from current wartime operations continue to decline, the Military Health System is at risk of losing the institutional knowledge and skills developed over that time. In 2016, the Military Trauma Committee of the National Academies of Sciences, Engineering and Medicine (NASEM) proposed a series of federal policies to reduce preventable trauma deaths and to standardize trauma care for U.S. service members and civilians[53]. Cooperation between civilian and military trauma systems may mutually benefit from the expertise acquired in combat and help preserve these skills in the inter-war periods.

However, there are marked differences between the injury patterns seen in military wartime and in civilian centers[54,55]. For example, the 2017 Las Vegas Shooting demonstrates that civilian, low-velocity gunshot wounds differ in severity and pattern than military, high-velocity gunshot wounds[56]. Similarly, while bomb blast injuries seen in military trauma are relatively well-characterized, civilian bombings are not as well understood, despite multiple civilian mass-casualty events, including the Boston Marathon and Austin Serial Bombings[57,58]. Military and civilian medical teams will likely have to continue treating blast injuries sustained in domestic terror events, natural disasters, and industrial accidents in the years to come. Therefore, it is important that all technological or medical advancements in military or civilian settings are appropriately translated to humanitarian-based activity.

Appendix 5: Advocacy

5.1 *Educational Advocacy*

Over the past two decades, both the AAOS and OTA have made significant efforts to increase awareness of orthopaedic management challenges in developing countries. In 2005, the AAOS initiated the annual Guest Nation Program to improve recognition of contributions made by international orthopaedic surgeons. Since 2011, the OTA has been exhibiting the most successful research, academic presentations, clinical treatment plans, and collaborations of various countries abroad[59]. Although these forums do not focus exclusively on LMICs, they do encourage surgeons from every nation to participate. Perhaps most importantly, they give surgeons around the world the opportunity to interact with North American surgeons and foster international relationships. Ultimately, these efforts are intended to cultivate strong multinational collaboration and create a sustainable health-care community through the exchange of ideas, technologies, and methodologies.

Long-term relationships with organizations and private industry partners could be pivotal in increasing the visibility of global health and orthopaedics. In the past, several organizations have been successful in recruiting industry support in the form of implants, supplies, and research funding. SIGN Fracture Care International, for example, uses the resources acquired from their corporate partners to provide surgeons in LMICs with the knowledge and medical equipment needed to perform surgery. However, given that the majority of existing partnerships are small-scale, there are vast opportunities for larger industry partnerships. There are many strategies to achieve such partnerships, like the creation of virtual educational resources or the co-branding of existing educational materials. Both the OTA and AAOS have pioneered these efforts to bring orthopaedics to the global stage. By incorporating international education into their annual meetings, they have successfully increased awareness of global orthopaedics among North American surgeons. Their annual forums give them leverage to increase private donations and fund educational and research endeavors. Additional financial support from large national and international organizations, like the OTA and AAOS, will be key to sustaining these advocacy efforts.

5.2 *Funding*

Philanthropic support through foundations, such as the Wyss Medical Foundation, have provided critical support funding for outreach efforts. While most health-care non-profits rely on external entities for steady funding, there are many organizations that have developed strategies to generate internal revenue streams. Internal funding is particularly beneficial for the long-term viability of non-profit missions, as they will not be at risk of disappearing if external funding dwindles. The most efficient method to generate internal revenue will depend on the organization's mission. If the organization could combine their mission of providing education and training with a low-cost and efficient care delivery system, then the revenue generated from their work in local hospitals and larger for-profit entities could support the organization's mission. The Aravind Eye Care System, for example, is a non-profit network of hospitals in India, established to provide high-quality eye care for all. Aravind offers free eye care to the majority of its patients, which is subsidized by a subset of patients who can pay the full-service fees. An alternative strategy is to provide training in regions that can afford these services and use the generated revenue from that location to fund the rest of the mission.

The allocation of funds will depend on both the organization's mission and the needs of each individual low-resource country. For missions that provide education to the local surgeons, funding often covers the travel expenses of visiting surgeons and educational teams or the production of virtual educational materials. However, funding could also be used for the provision of medical supplies, like implants and surgical equipment, or for computers and flash drives with predownloaded educational content for surgeons without high-speed internet access.

References

1. Alliance AO. help us heal more than broken bones. AO Alliance. Accessed June 13, 2020. https://ao-alliance.org/
2. Challa S, Conway D, Wu HH, Bisht R, Sherchan B, Lamichhane A, Shearer DW, Terry M, Gillenwater J. Can a 2-Day Course Teach Orthopaedic Surgeons Rotational Flap Procedures? An Evaluation of Data From the Nepal SMART Course Over 2 years. J Orthop Trauma. 2018 Oct;32(Suppl 7):S38-42.
3. Dyer GSM. Haitian Annual Conference on Orthopaedic Traumatology: Building Surgical Capacity Through Academic Collaboration. J Orthop Trauma. 2018 Oct;32(Suppl 7):S16-7.
4. Furey A, O'Hara NN, Marshall E, Pollak AN. Practical Guide to Delivering Surgical Skills Courses in a Low-Income Country: Knowledge Gained From a Surgical Education Partnership in Haiti. J Orthop Trauma. 2018 Oct;32(Suppl 7):S18-20.
5. Miclau T, MacKechnie MC, Shearer DW; ACTUAR group. Asociación de Cirujanos Traumatólogos de las Américas: Development of a Latin American Research Consortium. J Orthop Trauma. 2018 Oct;32(Suppl 7):S8-11.
6. Dormans JP. Orthopaedic surgery in the developing world—can orthopaedic residents help? J Bone Joint Surg Am. 2002 Jun;84(6):1086-94.
7. Shultz PA, Kamal RN, Daniels AH, DiGiovanni CW, Akelman E. International health electives in orthopaedic surgery residency training. J Bone Joint Surg Am. 2015 Feb 4;97(3):e15.
8. Disston AR, Martinez-Diaz GJ, Raju S, Rosales M, Berry WC, Coughlin RR. The international orthopaedic health elective at the University of California at San Francisco: the eight-year experience. J Bone Joint Surg Am. 2009 Dec;91(12):2999-3004.
9. Henry JA, Groen RS, Price RR, Nwomeh BC, Kingham TP, Hardy MA, Kushner AL. The benefits of international rotations to resource-limited settings for U.S. surgery residents. Surgery. 2013 Apr;153(4):445-54.
10. Welling DR, Ryan JM, Burris DG, Rich NM. Seven sins of humanitarian medicine. World J Surg. 2010 Mar;34(3):466-70.
11. Interview with Professor Christopher Lavy. Orthop Res UK. 2017. https://www.youtube.com/watch?v=eCejgGXmqVI
12. Rinsky L. Personal experiences with overseas volunteerism. Clin Orthop Relat Res. 2002 Mar;(396):89-97.
13. Adhikari B, Pell C, Cheah PY. Community engagement and ethical global health research. Glob Bioeth. 2019 Dec 20;31(1):1-12.
14. Stapleton G, Schröder-Bäck P, Laaser U, Meershoek A, Popa D. Global health ethics: an introduction to prominent theories and relevant topics. Glob Health Action. 2014 Feb 13;7:23569.
15. Ahmad AA. What's Important: Recognizing Local Power in Global Surgery. J Bone Joint Surg Am. 2019 Nov 6;101(21):1974-5.
16. Krishnaswami S, Stephens CQ, Yang GP, Nwomeh BC, Swaroop M, Nadler EP, Holterman AX, Simeone DM, Kingham TP, Merchant N, Orloff SL. An academic career in global surgery: a position paper from the Society of University Surgeons Committee on Academic Global Surgery. Surgery. 2018 Apr;163(4):954-60.
17. Institute of Medicine (US) Committee on the US Commitment to Global Health. The US Commitment to Global Health: Recommendations for the Public and Private Sectors. Washington (DC): National Academies Press (US); 2009.
18. Babu JM, Cruz A, Patel SA, Born CT, Akelman E. Global Volunteering in Orthopaedics: Availability and Implementation Considerations. J Am Acad Orthop Surg. 2021 Feb 15;29(4):139-47.
19. Costello A, Zumla A. Moving to research partnerships in developing countries. BMJ. 2000 Sep 30;321(7264):827-9.
20. Franzen SRP, Chandler C, Siribaddana S, Atashili J, Angus B, Lang T. Strategies for developing sustainable health research capacity in low and middle-income countries: a prospective, qualitative study investigating the barriers and enablers to locally led clinical trial conduct in Ethiopia, Cameroon and Sri Lanka. BMJ Open. 2017 Oct 13;7(10):e017246.
21. Hulley S, Newman T, Cummings S. Getting Started: The anatomy and physiology of clinical research. In: *Designing Clinical Research*. 3rd ed. Lippincott, Williams and Wilkins; 2007:3-16.
22. Ali SH, Albright P, Morshed S, Gosselin RA, Shearer DW. Orthopaedic Trauma in Low-resource Settings: Measuring Value. J Orthop Trauma. 2019 Nov;33(Suppl 7):S11-5.
23. Ibrahim J, Liu M, Yusi K, Haonga B, Eliezer E, Shearer DW, Morshed S. Conducting a Randomized Controlled Trial in Tanzania: Institute for Global Orthopaedics and Traumatology and the Muhimbili Orthopaedic Institute. J Orthop Trauma. 2018 Oct;32(Suppl 7):S47-51.
24. Roffey D, Dobransky J. Dollars and "Sense": A Guide to Research Finances. In: *The Coordination of Clinical Research: A Handbook for Research Coordinators*. Thieme; 2020.
25. Dwyer H. Leadership and Management: The Principal Investigator and Research Coordinator. In: *The Coordination of Clinical Research: A Handbook for Research Coordinators*. Thieme; 2020.
26. El Emam K, Jonker E, Sampson M, Krleza-Jerić K, Neisa A. The use of electronic data capture tools in clinical trials: Web-survey of 259 Canadian trials. J Med Internet Res. 2009 Mar 9;11(1):e8.
27. Van Essen C, Steffes BC, Thelander K, Akinyi B, Li HF, Tarpley MJ. Increasing and Retaining African Surgeons Working in Rural Hospitals: An Analysis of PAACS Surgeons with Twenty-Year Program Follow-Up. World J Surg. 2019 Jan;43(1):75-86.
28. Qudsi RA, Roberts HJ, Bhashyam AR, Losina E, Bae DS, Alexis F, Dyer GS. A Self-Reported Needs Assessment Survey of Pediatric Orthopaedic Education in Haiti. J Surg Educ. 2018 Jan - Feb;75(1):140-6.

29. Bhashyam AR, Fils J, Lowell J, Meara JG, Dyer GS. A novel approach for needs assessment to build global orthopedic surgical capacity in a low-income country. J Surg Educ. 2015 Jul-Aug;72(4):e2-8.
30. Fils J, Bhashyam AR, Pierre Pierre JB, Meara JG, Dyer GS. Short-Term Performance Improvement of a Continuing Medical Education Program in a Low-Income Country. World J Surg. 2015 Oct;39(10):2407-12.
31. Alvarado O, Trelles M, Tayler-Smith K, Joseph H, Gesline R, Wilna TE, Mohammad Omar MK, Faiz Mohammad NM, Muhima Mastaki J, Chingumwa Buhu R, Caluwaerts A, Dominguez L. Orthopaedic surgery in natural disaster and conflict settings: how can quality care be ensured? Int Orthop. 2015 Oct;39(10):1901-8.
32. Chu KM, Trelles M, Ford NP. Quality of care in humanitarian surgery. World J Surg. 2011 Jun;35(6):1169-72, discussion :1173-4.
33. Sphere. *The Sphere Handbook 2018*. Accessed August 30, 2020. https://spherestandards.org/handbook-2018/
34. *The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response*. 3rd ed. Rugby: Practical Action Publishing; 2011.
35. Chackungal S, Nickerson JW, Knowlton LM, Black L, Burkle FM Jr, Casey K, Crandell D, Demey D, Di Giacomo L, Dohlman L, Goldstein J, Gosney JE Jr, Ikeda K, Linden A, Mullaly CM, O'Connell C, Redmond AD, Richards A, Rufsvold R, Santos AL, Skelton T, McQueen K. Best practice guidelines on surgical response in disasters and humanitarian emergencies: report of the 2011 Humanitarian Action Summit Working Group on Surgical Issues within the Humanitarian Space. Prehosp Disaster Med. 2011 Dec;26(6):429-37.
36. Herard P, Boillot F. Quality orthopaedic care in sudden-onset disasters: suggestions from Médecins Sans Frontières-France. Int Orthop. 2016 Mar;40(3):435-8.
37. Trelles Centurion M, Crestani R, Dominguez L, Caluwaerts A, Benedetti G. Surgery with limited resources in natural disasters: what is the minimum standard of care? Curr Trauma Rep. 2018;4(2):89-95.
38. Pfeiffer J, Johnson W, Fort M, Shakow A, Hagopian A, Gloyd S, Gimbel-Sherr K. Strengthening health systems in poor countries: a code of conduct for nongovernmental organizations. Am J Public Health. 2008 Dec;98(12):2134-40.
39. Gosselin RA. War injuries, trauma, and disaster relief. Tech Orthop. 2005;20(2):97-108.
40. Fan B, Zhao C, Sabharwal S. International elective during orthopaedic residency in North America: perceived barriers and opportunities. J Bone Joint Surg Am. 2015 Jan 7;97(1):e1-8.
41. Clement RC, Ha YP, Clagett B, Holt GE, Dormans JP. What is the current status of global health activities and opportunities in US orthopaedic residency programs? Clin Orthop Relat Res. 2013 Nov;471(11):3689-98.
42. Yeomans D, Le G, Pandit H, Lavy C. Is overseas volunteering beneficial to the NHS? The analysis of volunteers' responses to a feedback questionnaire following experiences in low-income and middle-income countries. BMJ Open. 2017 Oct 16;7(10):e017517-017517.
43. Matar WY, Trottier DC, Balaa F, Fairful-Smith R, Moroz P. Surgical residency training and international volunteerism: a national survey of residents from 2 surgical specialties. Can J Surg. 2012 Aug;55(4)(Suppl 2):S191-9.
44. Zehir S, Zehir R, Şahin E, Akgül T, Zehir S, Subaşı M. Bonesetter interventions and consequences. Acta Orthop Traumatol Turc. 2015;49(4):416-20.
45. Surgeons put planning, preparation, past experience to work in efforts to save Boston Marathon bombing victims. *The Bulletin*. Published online 2013. Accessed June 8, 2020. https://bulletin.facs.org/2013/09/save-boston-marathon-bombing-victims/
46. Tobert D, von Keudell A, Rodriguez EK. Lessons from the boston marathon bombing: An orthopaedic perspective on preparing for high-volume trauma in an urban academic center. J Orthop Trauma. 2015 Oct;29(Suppl 10):S7-10.
47. Rosenwasser MP. Personal Communication. *Dep Orthop Surg Columbia Univ Med Cent N Y City*. Published online September 8, 2020.
48. Baker MS. Casualties of the Global War on Terror and their future impact on health care and society: a looming public health crisis. Mil Med. 2014 Apr;179(4):348-55.
49. Noe A. Extremity injury in war: a brief history. J Am Acad Orthop Surg. 2006;14(10 Spec No.):S1-6.
50. Eastridge BJ, Hardin M, Cantrell J, Oetjen-Gerdes L, Zubko T, Mallak C, Wade CE, Simmons J, Mace J, Mabry R, Bolenbaucher R, Blackbourne LH. Died of wounds on the battlefield: causation and implications for improving combat casualty care. J Trauma. 2011 Jul;71(1)(Suppl):S4-8.
51. Cancio LC, Rasmussen TE, Cannon JW, Dubick MA. The vital civilian-military link in combat casualty care research: Impact of attendance at scientific conferences. J Trauma Acute Care Surg. 2015 Oct;79(4)(Suppl 2):S221-6.
52. Stinner DJ, Johnson AE, Pollak A, MacKenzie E, Ficke JR, Mabry RL, Czarnik J, Schmidt A. "Zero Preventable Deaths and Minimizing Disability"-The Challenge Set Forth by the National Academies of Sciences, Engineering, and Medicine. J Orthop Trauma. 2017 Apr;31(4):e110-5.
53. Berwick DM, Downey AS, Cornett EA. A National Trauma Care System to Achieve Zero Preventable Deaths After Injury: Recommendations From a National Academies of Sciences, Engineering, and Medicine Report. JAMA. 2016 Sep 6;316(9):927-8.
54. Rignault DP. Is war surgery a specialty? Part I. Mil Med. 1990 Mar;155(3):91-7.
55. Rignault DP. How to train war surgery specialists: Part II. Mil Med. 1990 Apr;155(4):143-7.

56. Woody C. A Nevada hospital calls in Air Force Surgeons to deal with wounds from the Las Vegas shooting. *Bus Insid Internet*. Published online 2017. https://www.businessinsider.com/hospital-called-air-force-surgeons-over-las-vegas-shooting-wounds-2017-10
57. Belmont PJ, Schoenfeld AJ, Goodman G. Epidemiology of combat wounds in Operation Iraqi Freedom and Operation Enduring Freedom: orthopaedic burden of disease. J Surg Orthop Adv. 2010 Spring;19(1):2-7.
58. Kapur GB, Hutson HR, Davis MA, Rice PL. The United States twenty-year experience with bombing incidents: implications for terrorism preparedness and medical response. J Trauma. 2005 Dec;59(6):1436-44.
59. Leighton R. Leading by example: the role of international trauma organizations in global trauma initiatives. J Orthop Trauma. 2014;28(Suppl 1):S22-5.