



The extent of pediatric orthopaedic research in low- and middle-income countries and the impact of academic collaboration on research quality: a scoping review

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Accepted: 2 November 2018 / Published online: 9 November 2018
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Abstract

Introduction This review aims to (1) assess the breadth of pediatric orthopaedic research in low- and middle-income countries (LMICs) and (2) determine the impact of academic collaboration (an LMIC and a non-LMIC investigator) in published LMIC research.

Methods Pediatric orthopaedic clinical studies conducted in LMICs from 2004 to 2014 were extracted from Embase, Cochrane, and Pubmed databases. Of 22,714 searched studies, 129 met inclusion criteria.

Results 85% generated low-quality evidence (level IV or lower). 21% were collaborative, and these were more likely than non-collaborative papers to generate level III evidence or higher (25% vs 13%, $p = 0.141$).

Discussion Pediatric orthopaedic research produced by LMICs rarely achieves level I–III evidence, but collaborative studies are associated with higher levels of evidence.

Level of evidence: N/A.

Keywords Pediatrics · Global surgery · Orthopaedics · Low- and middle-income countries · Academic collaboration · Scoping review

Introduction

In the developing world, musculoskeletal disease is common and represents a significant burden for patients, their family, and the healthcare economy. Disease etiologies include traumatic injury, congenital, infectious, idiopathic, neoplastic, and degenerative, with traumatic injuries accounting for the largest portion of disease [1]. Musculoskeletal diseases have a significant impact on affected patients' function and

quality of life and are a common culprit of chronic disability [2]. Internationally, orthopaedic diseases in pediatric patients require additional attention. As these patients are in a phase of dynamic growth, management of musculoskeletal disease has long-term implications and requires consideration of several factors such as age, classification of disease, and patient finances [3–6].

In an effort to quantify the burden of certain diseases, the Global Burden of Disease (GBD) Study by the World Bank and the World Health Organization examined the impact of several specific diseases on the years of life lost and the years lived with disability to calculate disability-adjusted life years (DALYs) for numerous diseases [1, 7, 8]. According to the GBD study, injuries accounted for 11% of total DALYs and musculoskeletal disorders accounted for an additional 6.8% [1]. Consideration of the financial burden of musculoskeletal disease includes both the direct healthcare costs and the indirect costs of lost or decreased work [9–11]. In a 2005 case study of one middle-income nation, Colombia, direct costs of musculoskeletal disease totaled \$63 million,

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and after estimating indirect costs, a total cost of \$171 million [12].

As healthcare slowly improves among developing nations, childhood mortality and communicable diseases are decreasing [7, 13, 14]. This, in conjunction with an increase in road traffic accidents, further adds to the burden of musculoskeletal disease [7, 13]. Despite the high burden of pediatric orthopaedic disease in low-and-middle income countries (LMICs), little is known about the research efforts to address this burden. The oft-cited 10/90 gap refers to the observation that only 10% of global medical research investment addresses 90% of the world population in LMICs [15]. The vastly differing demographics, resources, and healthcare systems between developed and developing nations often renders Western research inapplicable to LMICs, necessitating the need for developing nations to conduct their own research [16]. Wu et al. [17] addressed this issue in a scoping review of clinical orthopaedic research studies in LMICs. The review illustrated that there is very little research emanating from LMICs, but that both quality and quantity of research increases with academic collaboration between LMICs and non-LMICs through mentorship and financial support [18]. This investigation aims to further this work by focusing specifically on clinical orthopaedic research in LMICs in the pediatric population and assessing the effect of academic collaboration.

The goal of this scoping review is to (1) assess the breadth of published pediatric orthopaedic research conducted in LMICs and (2) determine the prevalence of academic collaboration in published LMIC research and the effect of collaboration on research quality.

Methods

This scoping review follows the protocol as described by Wu et al. [17] using the Arksey and O'Malley framework with modifications from Levac et al. and Daudt et al. [19–21]. Five authors sought and assessed orthopaedic studies conducted in LMICs that were published between June 2004 and June 2014. The LMICs were defined as any country listed as a “Low-income” or “Lower-middle-income” economy according to the 2014 World Bank classification [22]. Eighty-two countries met our study's definition of LMIC (Table 1). The studies were identified by comprehensive textwords and MeSH-based electronic searches of PubMed/MEDLINE, EMBASE and Cochrane library that was developed with assistance from a research librarian. Our search strategy combined terms for orthopaedic surgery, LMICs, musculoskeletal injury, musculoskeletal anatomy and human studies to be as inclusive as possible (“Appendix”).

Full-text articles were assessed for eligibility in the order of title, abstract and manuscript. Included studies (1)

deal primarily with a low- or lower-middle-income country (LMIC), (2) pertain to orthopaedic surgery, (3) enroll humans and (4) were original peer-reviewed publications. Studies that reported three cases or fewer, were non-English and pertained to a high-income country (HIC) at war, animals, biomechanics or laboratory values were excluded. Each included study was read in its entirety and a RED-Cap survey for data extraction was created that identified the study location, author's academic affiliation and study quality. Study location and author affiliations were categorized into seven World Bank regions: East Asia and Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, North America, South Asia, and Sub-Saharan Africa (Table 1). Collaboration was determined by the investigator country affiliation and defined as LMIC only, multicenter (LMIC with LMIC investigator), collaborative (LMIC with non-LMIC investigator) and non-LMIC (e.g., upper-middle or high-income country investigators) only. Academic partnerships were defined as a study where the authors from both LMICs and non-LMICs were affiliated with an academic institution.

Finally, for quantitative studies the study quality was assessed by the levels of evidence (LOE), presence of control group, prospective or retrospective design, and use of randomization. Due to the heterogeneity of study design in the global orthopaedic literature, which includes qualitative and epidemiologic studies that cannot be categorized with the LOE scale, no other quality assessment tools were utilized. To determine the level of evidence of each study, we used the 2015 scale adopted by the Journal of Bone and Joint Surgery and derived from recommendations given by the Centre for Evidence-Based Medicine in Oxford, United Kingdom [23, 24]. The LOE scale divides studies into four categories: diagnostic, prognostic, therapeutic, and economic and decision analyses.

Each category can then be subdivided into level 1–5 evidence, with each level having its own definition [23]. Level 1, 2, and 3 studies were considered high levels of evidence, while those of level 4, and 5 were considered low levels of evidence. This cutoff was selected as levels 1–3 usually include a comparative group and thus can have a greater impact on influencing surgeon practice. Studies that had no levels of evidence, such as epidemiologic or qualitative studies, were also noted. LOE was used as the primary indicator of study quality due to its ubiquitous use as a validated measure of study strength [25–29]. In addition, studies that do include control groups, collect data prospectively and randomize interventions have been shown to produce higher quality evidence than studies that do not [30, 31].

Descriptive statistics were used to summarize all data. Discrete variables were summarized as counts or proportions. Fisher's exact test was used to determine the

Table 1 Countries by World Bank region

Europe and Central Asia, <i>n</i> =57	Latin America and the Caribbean, <i>n</i> =41	Middle East and North Africa, <i>n</i> =21	Sub-Saharan Africa, <i>n</i> =48
Albania	Antigua and Barbuda	Algeria	Angola
Andorra	Argentina	Bahrain	Benin ^a
Armenia ^b	Aruba	Djibouti ^b	Botswana
Austria	Bahamas	Egypt, Arab Rep. ^b	Burkina Faso ^a
Azerbaijan	Barbados	Iran, Islamic Rep.	Burundi ^a
Belarus	Belize	Iraq	Cabo Verde ^b
Belgium	Bolivia ^b	Israel	Cameroon ^b
Bosnia and Herzegovina	Brazil	Jordan	Central African Republic ^a
Bulgaria	Cayman Islands	Kuwait	Chad ^a
Channel Islands	Chile	Lebanon	Comoros ^a
Croatia	Colombia	Libya	Congo, Dem. Rep. ^a
Cyprus	Costa Rica	Malta	Congo, Rep. ^b
Czech Republic	Cuba	Morocco ^b	Côte d'Ivoire ^b
Denmark	Curacao	Oman	Equatorial Guinea
Estonia	Dominica	Qatar	Eritrea ^a
Faeroe Islands	Dominican Republic	Saudi Arabia	Ethiopia ^a
Finland	Ecuador	Syrian Arab Republic ^b	Gabon
France	El Salvador ^b	Tunisia	Gambia ^a
Georgia ^b	Grenada	United Arab Emirates	Ghana ^b
Germany	Guatemala ^b	West Bank and Gaza ^b	Guinea ^a
Greece	Guyana ^b	Yemen, Rep. ^b	Guinea-Bissau ^a
Greenland	Haiti ^a		Kenya ^b
Hungary	Honduras ^b		Lesotho ^b
Iceland	Jamaica	East Asia and Pacific, <i>n</i> =37	Liberia ^a
Ireland	Mexico	American Samoa	Madagascar ^a
Isle of Man	Nicaragua ^b	Australia	Malawi ^a
Italy	Panama	Brunei Darussalam ^b	Mali ^a
Kazakhstan	Paraguay	Cambodia ^a	Mauritania ^b
Kosovo ^b	Peru	China	Mauritius
Kyrgyz Republic ^b	Puerto Rico	Fiji	Mozambique ^a
Latvia	Sint Maarten (Dutch part)	French Polynesia	Namibia
Liechtenstein	St. Kitts and Nevis	Guam	Niger ^a
Lithuania	St. Lucia	Hong Kong SAR, China	Nigeria ^b
Luxembourg	St. Martin (French part)	Indonesia ^b	Rwanda ^a
Macedonia, FYR	St. Vincent and the Grenadines	Japan	São Tomé and Príncipe ^b
Moldova	Suriname	Kiribati ^b	Senegal ^b
Monaco	Trinidad and Tobago	Korea, Dem. Rep. ^a	Seychelles
Montenegro	Turks and Caicos Islands	Korea, Rep.	Sierra Leone ^a
Netherlands	Uruguay	Lao PDR	Somalia ^a
Norway	Venezuela, RB	Macao SAR, China	South Africa
Poland	Virgin Islands (U.S.)	Malaysia	South Sudan ^a
Portugal		Marshall Islands	Sudan ^b
Romania		Micronesia, Fed. Sts. ^b	Swaziland ^b
Russian Federation	North America, <i>n</i> =3	Mongolia ^b	Tanzania ^a
San Marino	Bermuda	Myanmar ^b	Togo ^a
Serbia	Canada	New Caledonia	Uganda ^a
Slovak Republic	United States	New Zealand ^b	Zambia ^b
Slovenia		Northern Mariana Islands	Zimbabwe ^{aa}
Spain		Palau	
Sweden	South Asia, <i>n</i> =8	Papua New Guinea ^b	

Table 1 (continued)

Europe and Central Asia, <i>n</i> = 57	Latin America and the Caribbean, <i>n</i> = 41	Middle East and North Africa, <i>n</i> = 21	Sub-Saharan Africa, <i>n</i> = 48
Switzerland	Afghanistan ^a	Philippines ^b	
Tajikistan ^b	Bangladesh ^b	Samoa ^b	
Turkey	Bhutan ^b	Singapore	
Turkmenistan	India ^b	Solomon Islands ^b	
Ukraine ^b	Maldives	Taiwan, China	
United Kingdom	Nepal ^a	Thailand	
Uzbekistan ^b	Pakistan ^b	TimorVLeste ^b	
	Sri Lanka ^b	Tonga	
		Tuvalu	
		Vanuatu ^b	
		Vietnam ^b	

GNI Gross National Income

^aLow-income economies(GNIpercapita\$1045orless) (*n* = 31).

^bLow-middle-income economies(GNIpercapita\$1046–\$4125) (*n* = 51)

association between categorical variables, with a two-tailed *p* value. Significance was set at *p* < 0.05.

Results

Out of 22,714 unique articles assessed, 129 met all inclusion criteria (Fig. 1). From 2004 to 2014 (Fig. 2), 38 (29.5%) of the 129 included pediatric clinical orthopaedic research studies conducted in LMICs were epidemiologic or qualitative and had no LOE. Of the clinical studies that could be assessed with levels of evidence, only 15.5% were level I–III and 84.5% generated low-quality evidence (level IV or lower) (Table 2). There were only two level 1 studies. Only 18 (14%) of all studies had a control group, only 3 (2%) underwent randomization, and 23 (18%) discussed study limitations. There was a nearly equal number of retrospective (49.6%) and prospective (50.4%) studies. Most studies were therapeutic (55%), followed by epidemiological (26%), qualitative (7.0%), diagnostic (6.2%), prognostic (4.7%), and systematic review/meta-analysis/scoping review (0.8%). The distribution of study designs was retrospective case series (30.2%), prospective case series (22.5%), prospective cohort series (10.9%), cross-sectional studies (7.0%), retrospective cohort series (2.3%), randomized control trials (1.6%), or other design (25.6%).

The majority of the studies were conducted in South Asia (31.9%) and Sub-Saharan Africa (40.4%). Of the 20 studies with LOE I–III, 50% took place in South Asia and another 20% in Sub-Saharan Africa (Fig. 3). There was no statistically significant correlation between study location and level of evidence produced.

The most frequently studied disease etiologies were traumatic (37%) and congenital (36%) (Fig. 4). Congenital

papers primarily focused on clubfoot (43%) and hip dysplasia (15%). There were a similar number of studies found that investigated infectious (9 studies), idiopathic (8), and neoplastic (8) etiologies.

Among the trauma papers, only 29.4% were published in a trauma or orthopaedics journal. Supracondylar fractures (29%) and non-specific orthopaedic trauma (23%) were the most commonly studied topics. The remainder (21%) focused on various topics including femoral (15%), spine (6%), tibia (4%), elbow (4%), and forearm (4%) trauma. The average sample size of non-epidemiological trauma papers was 61 ± 62 (range 10–374) patients; epidemiological studies had on average 3731 ± 4561 (range 41–16,060) participants included in the analysis.

Of the 129 included studies, 28 (21%) were collaborative between an LMIC and a high-income country (HIC), and 5% were multicenter studies between two or more LMICs. In 10 (7.8%) of the included studies, all authors were affiliated with a different country than where the study took place. The majority (72.9%) of the 129 studies took place in academically affiliated institutions. Collaborative papers were more likely than non-collaborative papers to generate level III evidence or higher (25% versus 13%, respectively), but this value was not statistically significant (*p* = 0.141) (Table 3).

Discussion

The high prevalence of musculoskeletal disease in developing nations starkly contrasts with the lack of quality research to address these diseases, and is especially evident in the subspecialty of pediatric orthopaedics. Our scoping review sought to better explore the extent of orthopaedic research

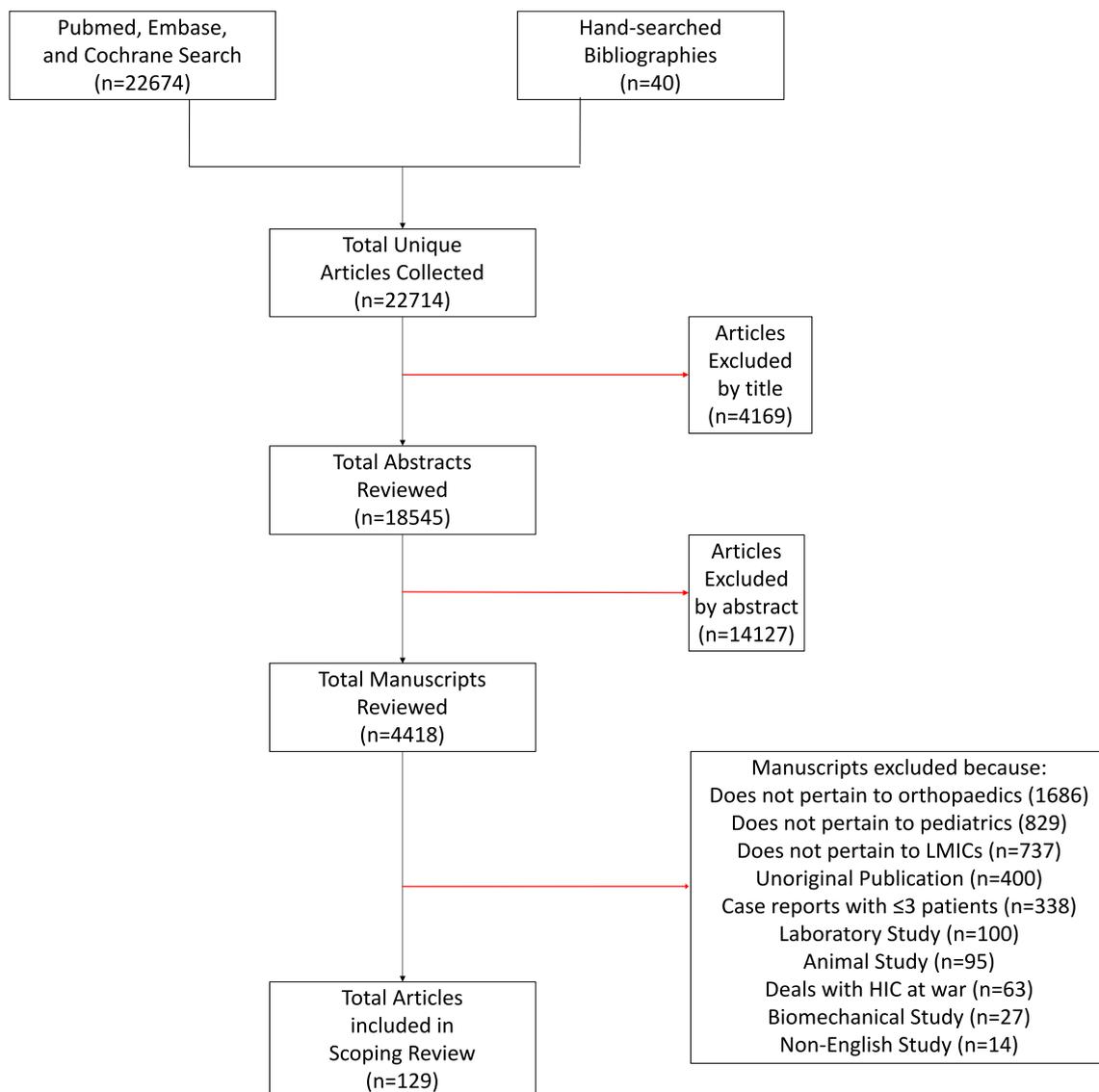


Fig. 1 Flowchart illustrating process of study search, exclusion, and inclusion

in LMICs and the impact of academic collaboration on research quality.

The major strength of this study is the systematic approach to screening the literature on this topic in LMICs, which is unprecedented. However, there are several limitations of our study and potential improvements for further work. First, the nature of a scoping review can only provide information on the breadth of the literature and associations between academic collaboration and higher research quality, but cannot show causation. Second, the heterogeneous nature of selected articles limited our quality metric primarily to LOE. Although LOE is a reputable, validated measure of study quality, it is a crude metric, and we were unable to include other standardized quality assessment tools that may have provided a more specific and complete picture of

individual study quality. Third, our study was limited to one decade of research articles. Although expanding our criteria to a larger timeframe would have yielded more studies, our current study captures a sufficient sample of the recent literature to assess trends and draw meaningful conclusions. Lastly, excluding non-English publications may have excluded a large body of research from non-English speaking regions, such as Latin America. As such, conclusions regarding relative productivity by region are limited.

Our study found that there are a limited number of high-quality research studies in pediatric orthopaedics produced by developing countries. Higher quality studies were associated with academic collaboration and were more likely to be produced in South Asia and Sub-Saharan Africa. The geographic preference, however, more likely reflects the higher

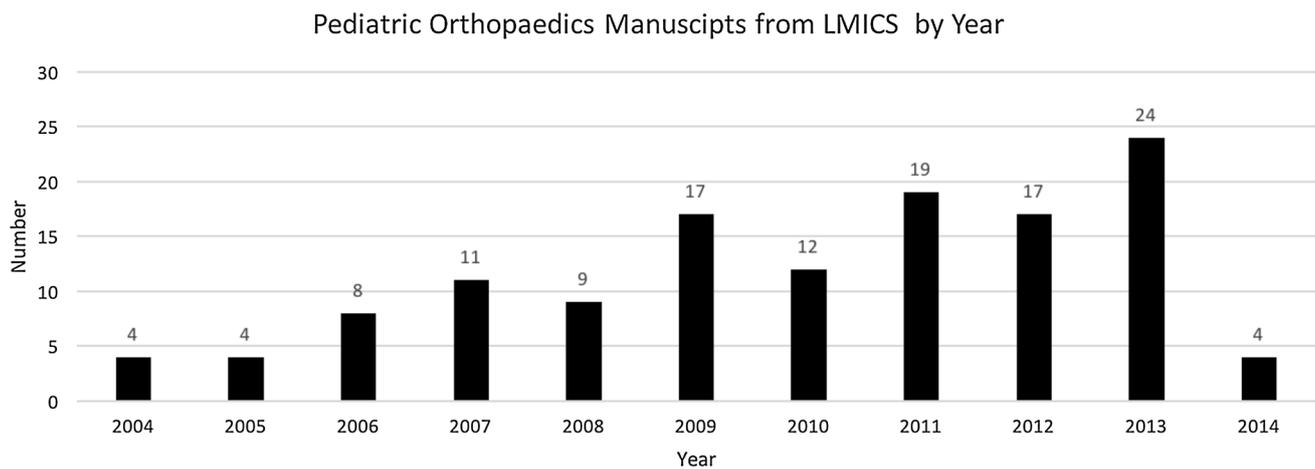


Fig. 2 Global pediatric orthopaedic manuscripts from low- and middle-income countries by year, from June 2004 to June 2014

Table 2 Number of studies and corresponding LOE

Level of evidence	Number of studies (n=129)
I	2
II	13
III	5
IV	69
V	2
None	38

number of LMICs in Sub-Saharan Africa, as this region represents 42 of the 84 LMICs. South Asia, by comparison, only represents seven LMICs, suggesting greater productivity of high-quality research compared to other regions. Reasons for this disparity are unknown and warrant further study. Additionally, academic institutions may have more research funding available, allowing for more rigorous, higher quality studies that ultimately produce higher levels of evidence. As such, the degree of funding may significantly impact the level of evidence that is ultimately produced. Funding data was not specifically analyzed here and offers a topic for future study.

Even more noticeable is the disparity between the LOE of research produced by LMICs and HICs. While our data showed that studies with level I–III evidence comprised 16% of LMIC research, a 2013 review of LOE for trauma papers from high-impact orthopaedic trauma journals revealed Level I–III evidence in 60% of studies [32]. Furthermore, quality research from LMICs is rarely found in high impact journals. Reich et al. reviewed 7 years of publications from *The Journal of Bone and Joint Surgery* and found that of the 38 publications that were level I or II evidence, only one was from an LMIC. Additionally, the

majority of studies found in this scoping review focused on traumatic and congenital diseases.

This study examined the role of international collaborations, between LMICs and HICs. The goal of this type of partnership is to provide mentorship so that the LMIC institution can build research capacity and move towards research independence. In a review of literature focused on research capacity development, Franzen et al. noted that international partnerships continue to struggle with building local capacity [33]. One comparison that has not been studied is between international collaborations and local collaborations. Examining the differences between the traditional international partnership of an LMIC with a HIC and the less studied LMIC–LMIC multi-institutional partnership is an important area of future research.

Our study shows an association, although not statistically significant, between academic collaboration of LMIC and non-LMIC researchers and the production of higher levels of evidence publications. One form of collaboration described by Morshed et al. [18] is the Institute for Global Orthopaedics and Traumatology (IGOT) at the University of California, San Francisco (UCSF), where faculty and residents partner with international hospitals to improve surgical education, research, and clinical care. The advantages of this type of academic partnership—and potential reasons for producing higher quality research—include additional funding support from these institutions and better study design from experienced mentors. A change in study design can improve the study quality, as Obrebsky et al. [34] noted that simply by adding a control group, a case series can become a cohort study with level II or III evidence. We believe this review should encourage investigators in high-income countries to consider research partnership as a tool for outreach with academic pediatric orthopaedic surgeons in LMICs.

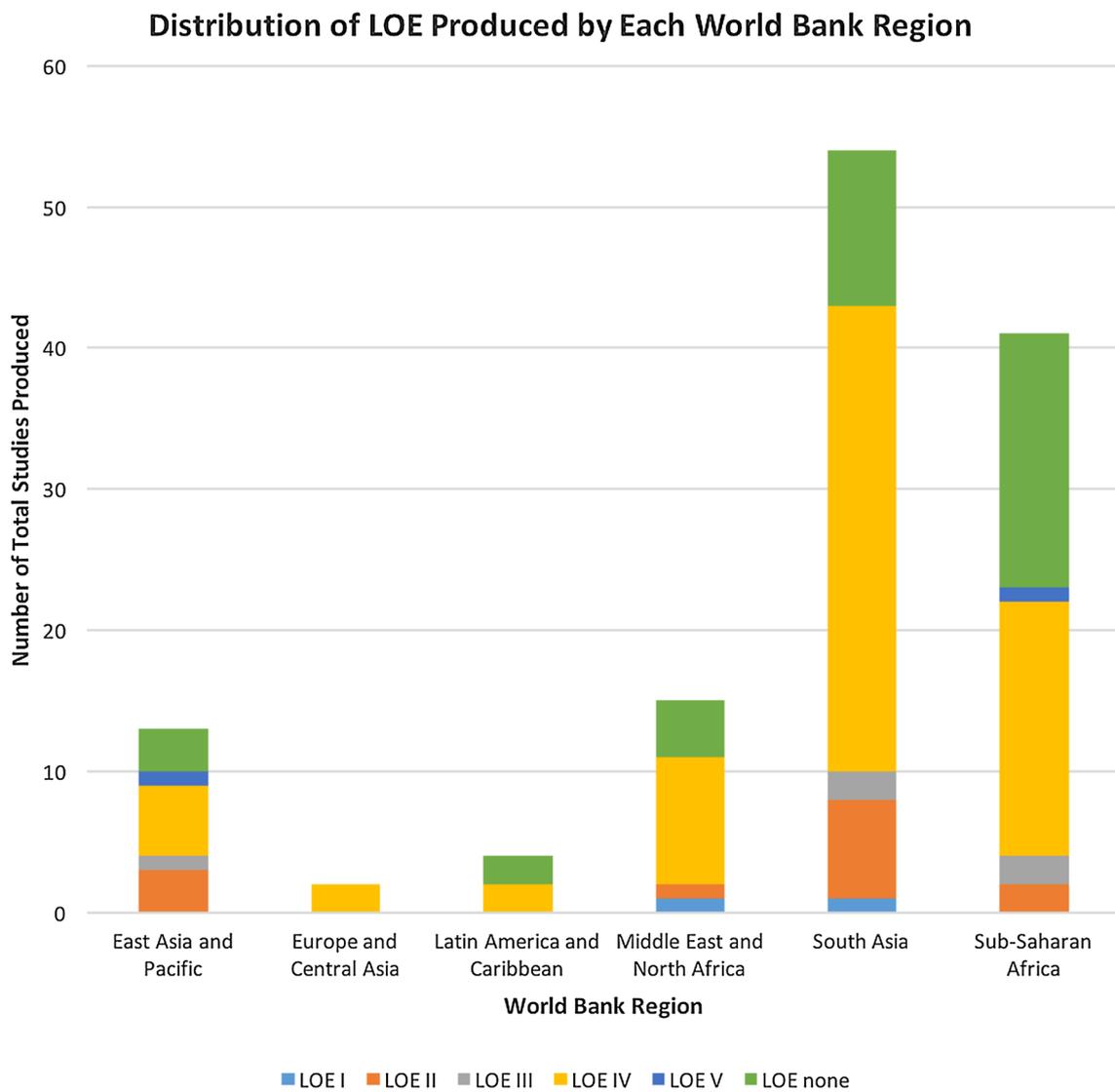


Fig. 3 Distribution of the levels of evidence of global pediatric orthopaedic studies from low- and middle-income countries from June 2004 to June 2014, organized by World Bank region

Conclusion

The volume of high-quality pediatric orthopaedic research produced from developing countries is low and presents a major problem since these nations bear a large burden of musculoskeletal disease. The main barriers to this problem are thought to be scarcity of funding, training, and time devoted to research. We found an association between academic collaboration with LMICs and a higher level of research evidence, offering a potential solution in which researchers from HICs help foster research programs in LMICs and address barriers to pediatric orthopaedic research. More research is needed to assess the impact of partnerships like these and also to develop other potential solutions to improve research internationally.

Acknowledgements The authors wish to thank Dr. Edmund Eliezer and Dr. Billy Haonga from the Muhimbili Orthopaedic Institute, Dar es Salaam, Tanzania, and Dr. Jeremie Larouche, and Dr. Brian Cunningham for their support and contributions to this study.

Funding This study did not receive any sources of funding.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest. Each author certifies that he or she has no commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Fig. 4 Etiological focus of global pediatric orthopaedic studies from low- and middle-income countries from June 2004 to June 2014

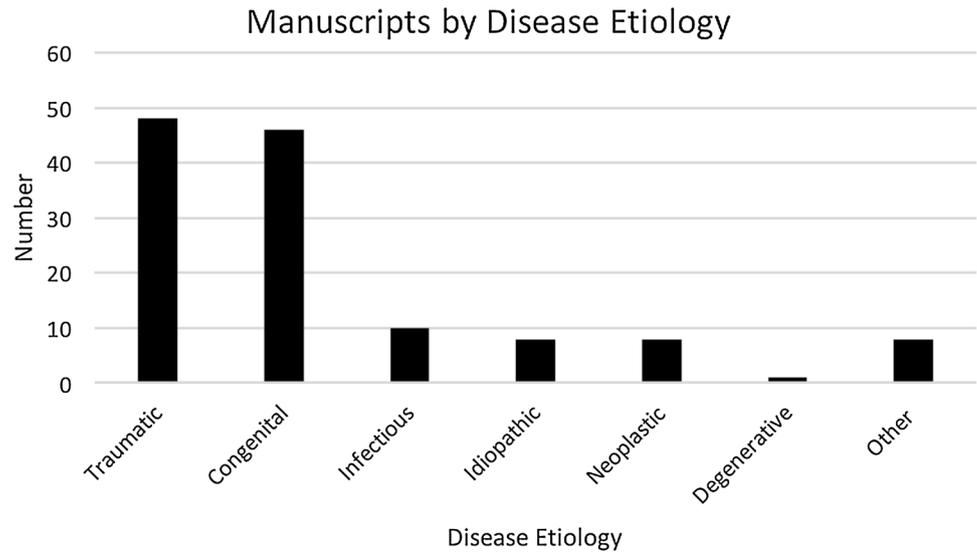


Table 3 Characteristics of collaborative and non-collaborative global pediatric orthopaedic studies from 2004 to 2014

Quality of study	Collaborative (<i>n</i> = 28) Number of studies [<i>n</i> (%)]	Non-collaborative (<i>n</i> = 101) Number of studies [<i>n</i> (%)]	
Levels I–III	7 (25%)	13 (12.9%)	<i>p</i> = 0.1412
Level I	0	2 (7.1%)	
Level II	5 (17.2%)	8 (7.9%)	
Level III	2 (7.1%)	3 (3.0%)	
Levels IV–none	21 (75%)	88 (87.1%)	
Level IV	8 (7.9%)	61 (60.4%)	
Level V	2 (7.1%)	0	
None	11 (39.3%)	27 (26.7%)	
Controls	5 (17.2%)	13 (12.9%)	<i>p</i> = 0.5405

Appendix

Search strategy

1. orthopedics[mh] OR orthopedic procedures[mh] OR fractures, bone[mh] OR musculoskeletal diseases[mh:noexp] OR bone diseases[mh] OR cartilage diseases[mh:noexp] OR chondromalacia patellae[mh] OR osteochondritis[mh] OR polychondritis, relapsing[mh] OR foot deformities[mh] OR foot diseases[mh] OR hand deformities[mh] OR joint diseases[mh] OR muscular diseases[mh:noexp] OR arthrogryposis[mh] OR compartment syndromes[mh] OR contracture[mh] OR medial tibial stress syndrome[mh] OR musculoskeletal pain[mh] OR tendinopathy[mh] OR musculoskeletal abnormalities[mh:noexp] OR campomelic dysplasia[mh] OR hip dislocation, congenital[mh] OR klippelfeilsyndrom[mh] OR limb deformities, congenital[mh] OR synostosis[mh] OR rheumatic diseases[mh:noexp] OR osteoarthritis[mh] OR tennis elbow[mh] OR amputation, traumatic[mh] OR arm injuries[mh] OR back injuries[mh] OR craniocerebral trauma[mh:noexp] OR dislocations[mh] OR fractures, cartilage[mh] OR hand injuries[mh] OR hip injuries[mh] OR leg injuries[mh] OR ligaments, articular[majr] OR limb salvage[mh] OR muscle, skeletal[majr] OR musculoskeletal system[mh:noexp] OR orthopedic equipment[mh] OR skeleton/injuries[mh] OR skeleton/surgery[mh] OR spinal injuries[mh] OR spine/injuries[mh] OR tendon injuries[mh] OR tendons[majr]
2. amput*[tiab] OR dislocation*[tiab] OR fracture[tiab] OR fractures[tiab] OR musculoskeletal*[tiab] OR orthoped*[tiab] OR orthopaed*[tiab]
3. accidents[mh] OR accident*[tiab] OR injur*[tiab] OR polytrauma*[tiab] OR “wounds and injuries”[majr:noexp] OR wounds, gunshot[mh] OR blast injuries[mh]

4. bone[tiab] OR bones[tiab] OR humerus[tiab] OR humeri[tiab] OR ulna[tiab] OR ulnas[tiab] OR ulnae [tiab] OR scaphoid[tiab] OR scaphoids[tiab] OR vertebra*[tiab] OR spine[tiab] OR spines[tiab] OR pelvis* [tiab] OR pelves[tiab] OR femur[tiab] OR femurs[tiab] OR tibia[tiab] OR tibias[tiab] OR fibula[tiab] OR fibulas[tiab] OR talus[tiab] OR tali[tiab] OR calcaneus[tiab] OR calcanei[tiab] OR calcanea[tiab] OR shoulder[tiab] OR shoulders[tiab] OR elbow[tiab] OR elbows[tiab] OR wrist[tiab] OR wrists[tiab] OR hip[tiab] OR hips[tiab] OR knee[tiab] OR knees[tiab] OR ankle[tiab] OR ankles[tiab] OR extremity[tiab] OR extremities[tiab] OR “open injury”[tiab] OR “open injuries”[tiab]
5. 3 AND 4
6. 1 OR 2 OR 5
7. Afghanistan[Mesh] OR Bangladesh[Mesh] OR Benin [Mesh] OR Burkina Faso[Mesh] OR Burundi[Mesh] OR Cambodia[Mesh] OR Central African Republic[Mesh] OR Chad[Mesh] OR Comoros[Mesh] OR Democratic Republic of the Congo[Mesh] OR Eritrea [Mesh] OR Ethiopia[Mesh] OR Gambia[Mesh] OR Guinea[Mesh] OR Guinea-Bissau[Mesh] OR Haiti[Mesh] OR Kenya[Mesh] OR Democratic People’s Republic of Korea[Mesh] OR Kyrgyzstan[Mesh] OR Liberia[Mesh] OR Madagascar[Mesh] OR Malawi [Mesh] OR Mali[mh] OR Mozambique[Mesh] OR Myanmar[Mesh] OR Nepal[Mesh] OR Niger[Mesh] OR Rwanda[Mesh] OR Sierra Leone[Mesh] OR Somalia[Mesh] OR Sudan[Mesh] OR Tajikistan[Mesh] OR Tanzania[Mesh] OR Togo[Mesh] OR Uganda[Mesh] OR Zimbabwe[Mesh]
8. Armenia[Mesh] OR Bhutan[Mesh] OR Bolivia[Mesh] OR Cameroon[Mesh] OR Cape Verde[Mesh] OR Congo[Mesh] OR Cote d’Ivoire[Mesh] OR Djibouti[Mesh] OR Egypt[Mesh] OR El Salvador[Mesh] OR “Georgia (Republic)”[Mesh] OR Ghana[Mesh] OR Guatemala [Mesh] OR Guyana[Mesh] OR Honduras[Mesh] OR Indonesia[Mesh] OR India[Mesh] OR Kosovo[Mesh] OR Laos[Mesh] OR Lesotho[Mesh] OR Mauritania[Mesh] OR Moldova[Mesh] OR Mongolia[Mesh] OR Morocco[Mesh] OR Nicaragua[Mesh] OR Nigeria[Mesh] OR Pakistan[Mesh] OR Papua New Guinea[Mesh] OR Paraguay[Mesh] OR Philippines[Mesh] OR Samoa[Mesh:noexp] OR Independent State of Samoa[mh] OR Senegal[Mesh] OR Sri Lanka[Mesh] OR Sudan[Mesh] OR Swaziland[Mesh] OR Syria[Mesh] OR East Timor[Mesh] OR Ukraine[Mesh] OR Uzbekistan[Mesh] OR Vanuatu[Mesh] OR (Vietnam[Mesh] NOT veteran*) OR Yemen[Mesh] OR Zambia[Mesh]
9. Afghani*[tiab] OR Bangladesh*[tiab] OR Benin[tiab] OR “Burkina Faso”[tiab] OR Burundi*[tiab] OR Cambodia*[tiab] OR “Central African Republic”[tiab] OR Chad[tiab] OR Comoros[tiab] OR (Congo[tiab] NOT “congo red”) OR Congolese[tiab] OR Zaire[tiab] OR Eritrea*[tiab] OR Ethiopia*[tiab] OR Gambia*[tiab] OR (Guinea*[tiab] NOT (guinea fowl* OR guinea pig* OR “new guinea”)) OR “Guinea-Bissau”[tiab] OR Haiti*[tiab] OR Kenya*[tiab] OR “Democratic People’s Republic of Korea”[tiab] OR “North Korea”[tiab] OR North Korean*[tiab] OR Kyrgyz*[tiab] OR Liberia* [tiab] OR Madagascar[tiab] OR Malawi[tiab] OR Malawian*[tiab] OR Mali[tiab] OR Mozambique[tiab] OR Myanmar[tiab] OR Burma[tiab] OR Burmese[tiab] OR Nepal[tiab] OR Nepalese[tiab] OR Niger[tiab] OR Rwanda*[tiab] OR “Sierra Leone”[tiab] OR Somalia [tiab] OR Somali[tiab] OR Somalis[tiab] OR “South Sudan”[tiab] OR Tajikistan*[tiab] OR Tadjikistan*[tiab] OR Tanzania*[tiab] OR Zanzibar*[tiab] OR Tanganyika[tiab] OR Togo[tiab] OR Togolese[tiab] OR Uganda*[tiab] OR Zimbabwe*[tiab] OR (Rhodesia[tiab] NOT “Rhodesian ridgeback”)
10. Armenia*[tiab] OR Bhutan*[tiab] OR Bolivia*[tiab] OR Cameroon*[tiab] OR “Cape Verde”[tiab] OR “Cote d’Ivoire”[tiab] OR “Ivory Coast”[tiab] OR Djibouti* [tiab] OR Egypt*[tiab] OR El Salvador*[tiab] OR “Georgia Republic”[tiab] OR “Republic of Georgia” [tiab] OR Ghana*[tiab] OR Guatemala*[tiab] OR Guyana[tiab] OR Guyanese[tiab] OR “British Guiana” [tiab] OR Hondur*[tiab] OR (India[tiab] NOT (“india ink” OR “indian ink”)) OR “Asian Indian”[tiab] OR “Asian Indians”[tiab] OR Indonesia*[tiab] OR Kiribati[tiab] OR Kosovo[tiab] OR Kosovan*[tiab] OR Kosovar*[tiab] OR Laos[tiab] OR “Lao PDR” OR “LAO People’s Democratic Republic”[tiab] OR Laotian*[tiab] OR Lesotho*[tiab] OR Mauritania*[tiab] OR (Micronesia*[tiab] AND “Federated States”[tiab]) OR Moldova*[tiab] OR Mongolia*[tiab] OR Morocc*[tiab] OR Nicaragua*[tiab] OR Nigeria*[tiab] OR Pakistan* [tiab] OR “Papua New Guinea”[tiab] OR Paraguay[tiab] OR Paraguayan*[tiab] OR Philippines[tiab] OR (Filipino*[tiab] OR Filipina*[tiab] NOT (Filipino American* OR United States[mh])) OR (Samoa*[tiab] NOT American Samoa*) OR “Sao Tome”[tiab] OR Senegal[tiab] OR Senegalese[tiab] OR Solomon Island*[tiab] OR “Sri Lanka”[tiab] OR Sri Lankan* [tiab] OR Ceylon[tiab] OR Sudan*[tiab] OR Swaziland [tiab] OR Syria*[tiab] OR “Timor-Leste”[tiab] OR “East Timor”[tiab] OR Ukrain*[tiab] OR Uzbekistan*

- [tiab] OR Vanuatu*[tiab] OR (Vietnam*[tiab] NOT veteran*) OR “West Bank”[tiab] OR Gaza[tiab] OR Palestin*[tiab] OR Yemen*[tiab] OR Zambia*[tiab]
11. developing countries[mh] OR “developing country”[tiab] OR “developing countries”[tiab] OR LMIC[tiab] OR LMICs[tiab] OR “low income countries”[tiab] OR “low income country”[tiab] OR “low and middle income countries”[tiab] OR “low and middle income country”[tiab] OR “lower middle income countries”[tiab] OR “lower middle income country”[tiab] OR “developing nation”[tiab] OR “developing nations”[tiab] OR “developing world”[tiab] OR “developing economy”[tiab] OR “developing economies”[tiab] OR “transitional country”[tiab] OR “transitional countries”[tiab] OR “global burden”[tiab] OR “global health”[tiab] OR global orthop*[tiab] OR “global outreach”[tiab] OR “global public health”[tiab] OR (global[ti] AND watch[ti]) OR “international health”[tiab] OR “international public health”[tiab] OR world health[majr] OR international cooperation [majr] OR “resource poor”[tiab] OR austere environment*[tiab] OR “third world”[tiab]
 12. Africa[mh:noexp] OR Africa, Central[mh:noexp] OR Africa, Eastern[mh:noexp] OR Africa, Northern[mh:noexp] OR Africa South of the Sahara[mh:noexp] OR Africa, Southern[mh:noexp] OR Africa, Western[mh:noexp] OR central Africa*[ti] OR east Africa*[ti] OR eastern Africa*[ti] OR north Africa*[ti] OR northern Africa*[ti] OR southern Africa*[ti] OR west africa*[ti] OR western africa*[ti] OR sahara*[ti] OR subsahara*[ti] OR (Asia[mh:noexp] NOT (china[mh] OR japan[mh] OR Singapore[mh] OR south korea[mh])) OR Asia, Central[mh:noexp] OR Asia, Southeastern[mh:noexp] OR Asia, Western[mh:noexp] OR central asia*[ti] OR south asia*[ti] OR south asia*[ti] OR southeast asia*[ti] OR southeastern asia*[ti] OR southern asia*[ti] OR west asia*[tiab] OR western asia*[ti] OR Central America[mh:noexp] OR central America*[ti] OR Europe, Eastern[mh:noexp] OR eastern Europe*[ti] OR South America[mh:noexp] OR South America*[ti] OR Caribbean Region[mh:noexp] OR Caribbean[ti] OR Middle East[mh:noexp]
 13. 7 OR 8 OR 9 OR 10 OR 11 OR 12
 14. 7 OR 8 OR 9 OR 10 OR 11 OR 12 NOT (animals[mh] NOT humans[mh]) NOT Dental journals[sb] NOT News[pt] NOT (mummies OR mummy OR history, ancient[mh] OR paleoanthro* OR paleoepidem* OR paleopath* OR paleont* OR archeolog* OR ancient egypt* OR dynast* OR fossil* OR forensic anthropology[mh] OR history of medicine[mh])
 15. 14 AND (“2004”[Date Publication]: “3000”[Date Publication])

16. 14 AND (“2004”[Date Publication]: “3000”[Date Publication]) AND English[Language]

Pubmed and Cochrane Search (June 1, 2014)

(orthopedics[mh] OR orthopedic procedures[mh] OR fractures, bone[mh] OR musculoskeletal diseases[mh:noexp] OR bone diseases[mh] OR cartilage diseases[mh:noexp] OR chondromalacia patellae[mh] OR osteochondritis[mh] OR polychondritis, relapsing[mh] OR foot deformities[mh] OR foot diseases[mh] OR hand deformities[mh] OR joint diseases[mh] OR muscular diseases[mh:noexp] OR arthrogryposis[mh] OR compartment syndromes[mh] OR contracture[mh] OR medial tibial stress syndrome[mh] OR musculoskeletal pain[mh] OR tendinopathy[mh] OR musculoskeletal abnormalities[mh:noexp] OR campomelic dysplasia[mh] OR hip dislocation, congenital[mh] OR klip-pel-feil syndrome[mh] OR limb deformities, congenital[mh] OR synostosis[mh] OR rheumatic diseases[mh:noexp] OR osteoarthritis[mh] OR tennis elbow[mh] OR amputation, traumatic[mh] OR arm injuries[mh] OR back injuries[mh] OR craniocerebral trauma [mh:noexp] OR dislocations[mh] OR fractures, cartilage[mh] OR hand injuries[mh] OR hip injuries[mh] OR leg injuries[mh] OR ligaments, articular[majr] OR limb salvage[mh] OR muscle, skeletal[majr] OR musculoskeletal system[mh:noexp] OR orthopedic equipment[mh] OR skeleton/injuries[mh] OR skeleton/surgery[mh] OR spinal injuries[mh] OR spine/injuries[mh] OR tendon injuries[mh] OR tendons[majr] OR amput*[tiab] OR dislocation*[tiab] OR fracture[tiab] OR fractures[tiab] OR musculoskeletal*[tiab] OR orthoped*[tiab] OR orthopaed*[tiab] OR ((accidents[mh] OR accident*[tiab] OR injur*[tiab] OR polytrauma*[tiab] OR “wounds and injuries”[majr:noexp] OR wounds, gunshot[mh] OR blast injuries[mh]) AND (bone[tiab] OR bones[tiab] OR humerus[tiab] OR humeri[tiab] OR ulna[tiab] OR ulnas[tiab] OR ulnae[tiab] OR scaphoid[tiab] OR scaphoids[tiab] OR vertebra*[tiab] OR spine[tiab] OR spines[tiab] OR pelvis*[tiab] OR pelves [tiab] OR femur[tiab] OR femurs[tiab] OR tibia[tiab] OR tibias[tiab] OR fibula[tiab] OR fibulas[tiab] OR talus[tiab] OR tali[tiab] OR calcaneus[tiab] OR calcanei[tiab] OR calcanea[tiab] OR shoulder[tiab] OR shoulders[tiab] OR elbow[tiab] OR elbows[tiab] OR wrist[tiab] OR wrists[tiab] OR hip[tiab] OR hips[tiab] OR knee[tiab] OR knees[tiab] OR ankle[tiab] OR ankles[tiab] OR extremity[tiab] OR extremities[tiab] OR “open injury”[tiab] OR “open injuries”[tiab])))) AND ((Afghanistan[Mesh] OR Bangladesh[Mesh] OR Benin[Mesh] OR Burkina Faso[Mesh] OR Burundi[Mesh] OR Cambodia[Mesh] OR Central African Republic[Mesh] OR Chad[Mesh] OR Comoros[Mesh] OR Democratic Republic of the Congo[Mesh] OR Eritrea[Mesh] OR Ethiopia[Mesh] OR Gambia[Mesh] OR Guinea[Mesh] OR

Guinea-Bissau[Mesh] OR Haiti[Mesh] OR Kenya[Mesh] OR Democratic People’s Republic of Korea [Mesh] OR Kyrgyzstan[Mesh] OR Liberia[Mesh] OR Madagascar[Mesh] OR Malawi[Mesh] OR Mali[mh] OR Mozambique[Mesh] OR Myanmar[Mesh] OR Nepal[Mesh] OR Niger[Mesh] OR Rwanda[Mesh] OR Sierra Leone[Mesh] OR Somalia[Mesh] OR Sudan[Mesh] OR Tajikistan[Mesh] OR Tanzania[Mesh] OR Togo[Mesh] OR Uganda[Mesh] OR Zimbabwe[Mesh] OR Armenia[Mesh] OR Bhutan[Mesh] OR Bolivia[Mesh] OR Cameroon[Mesh] OR Cape Verde[Mesh] OR Congo[Mesh] OR Cote d’Ivoire[Mesh] OR Djibouti [Mesh] OR Egypt[Mesh] OR El Salvador[Mesh] OR “Georgia (Republic)”[Mesh] OR Ghana[Mesh] OR Guatemala[Mesh] OR Guyana[Mesh] OR Honduras[Mesh] OR Indonesia[Mesh] OR India[Mesh] OR Kosovo[Mesh] OR Laos[Mesh] OR Lesotho[Mesh] OR Mauritania[Mesh] OR Moldova[Mesh] OR Mongolia[Mesh] OR Morocco[Mesh] OR Nicaragua [Mesh] OR Nigeria[Mesh] OR Pakistan[Mesh] OR Papua New Guinea[Mesh] OR Paraguay[Mesh] OR Philippines[Mesh] OR Samoa[Mesh:noexp] OR Independent State of Samoa[mh] OR Senegal[Mesh] OR Sri Lanka[Mesh] OR Sudan[Mesh] OR Swaziland[Mesh] OR Syria[Mesh] OR East Timor[Mesh] OR Ukraine[Mesh] OR Uzbekistan[Mesh] OR Vanuatu[Mesh] OR (Vietnam[Mesh] NOT veteran*) OR Yemen[Mesh] OR Zambia[Mesh] OR Afghani*[tiab] OR Bangladesh*[tiab] OR Benin[tiab] OR “Burkina Faso”[tiab] OR Burundi*[tiab] OR Cambodia*[tiab] OR “Central African Republic”[tiab] OR Chad[tiab] OR Comoros[tiab] OR (Congo[tiab] NOT “congo red”) OR Congolese[tiab] OR Zaire[tiab] OR Eritrea*[tiab] OR Ethiopia*[tiab] OR Gambia*[tiab] OR (Guinea*[tiab] NOT (guinea fowl* OR guinea pig* OR “new guinea”)) OR “Guinea-Bissau”[tiab] OR Haiti*[tiab] OR Kenya*[tiab] OR “Democratic People’s Republic of Korea”[tiab] OR “North Korea”[tiab] OR North Korean*[tiab] OR Kyrgyz*[tiab] OR Liberia*[tiab] OR Madagascar[tiab] OR Malawi[tiab] OR Malawian*[tiab] OR Mali [tiab] OR Mozambique[tiab] OR Myanmar[tiab] OR Burma[tiab] OR Burmese[tiab] OR Nepal[tiab] OR Nepalese[tiab] OR Niger[tiab] OR Rwanda*[tiab] OR “Sierra Leone”[tiab] OR Somalia[tiab] OR Somali[tiab] OR Somalis[tiab] OR “South Sudan”[tiab] OR Tajikistan*[tiab] OR Tadjikistan*[tiab] OR Tanzania*[tiab] OR Zanzibar*[tiab] OR Tanganyika[tiab] OR Togo[tiab] OR Togolese[tiab] OR Uganda*[tiab] OR Zimbabw*[tiab] OR (Rhodesia[tiab] NOT “Rhodesian ridgeback”) OR Armenia*[tiab] OR Bhutan*[tiab] OR Bolivia*[tiab] OR Cameroon*[tiab] OR “Cape Verde”[tiab] OR “Cote d’Ivoire”[tiab] OR “Ivory Coast”[tiab] OR Djibouti*[tiab] OR Egypt*[tiab] OR El Salvador*[tiab] OR “Georgia Republic”[tiab] OR “Republic of Georgia”[tiab] OR Ghana*[tiab] OR Guatemal*[tiab] OR Guyana[tiab] OR

Guyanese[tiab] OR “British Guiana”[tiab] OR Hondur*[tiab] OR (India[tiab] NOT (“india ink” OR “indian ink”)) OR “Asian Indian”[tiab] OR “Asian Indians”[tiab] OR Indonesia*[tiab] OR Kiribati [tiab] OR Kosovo[tiab] OR Kosovan*[tiab] OR Kosovar*[tiab] OR Laos[tiab] OR “Lao PDR” OR “LAO People’s Democratic Republic”[tiab] OR Laotian*[tiab] OR Lesotho*[tiab] OR Mauritania*[tiab] OR (Micronesia*[tiab] AND “Federated States”[tiab]) OR Moldova*[tiab] OR Mongolia*[tiab] OR Morocc*[tiab] OR Nicaragua*[tiab] OR Nigeria*[tiab] OR Pakistan*[tiab] OR “Papua New Guinea”[tiab] OR Paraguay [tiab] OR Paraguayan*[tiab] OR Philippines[tiab] OR (Filipino*[tiab] OR Filipina*[tiab] NOT (Filipino American* OR United States[mh])) OR (Samoa*[tiab] NOT American Samoa*) OR “Sao Tome”[tiab] OR Senegal[tiab] OR Senegalese[tiab] OR Solomon Island*[tiab] OR “Sri Lanka”[tiab] OR Sri Lankan*[tiab] OR Ceylon[tiab] OR Sudan*[tiab] OR Swaziland[tiab] OR Syria*[tiab] OR “Timor-Leste”[tiab] OR “East Timor”[tiab] OR Ukrain*[tiab] OR Uzbekistan*[tiab] OR Vanuatu*[tiab] OR (Vietnam*[tiab] NOT veteran*) OR “West Bank”[tiab] OR Gaza[tiab] OR Palestin*[tiab] OR Yemen*[tiab] OR Zambia*[tiab] OR (developing countries[mh] OR “developing country”[tiab] OR “developing countries”[tiab] OR LMIC[tiab] OR LMICs[tiab] OR “low income countries”[tiab] OR “low income country”[tiab] OR “low and middle income countries”[tiab] OR “low and middle income country”[tiab] OR “lower middle income countries” [tiab] OR “lower middle income country”[tiab] OR “developing nation”[tiab] OR “developing nations”[tiab] OR “developing world”[tiab] OR “developing economy”[tiab] OR “developing economies”[tiab] OR “transitional country”[tiab] OR “transitional countries”[tiab] OR “global burden”[tiab] OR “global health”[tiab] OR global orthop*[tiab] OR “global outreach”[tiab] OR “global public health”[tiab] OR (global[ti] AND watch[ti]) OR “international health”[tiab] OR “international public health”[tiab] OR world health[majr] OR international cooperation[majr] OR “resource poor”[tiab] OR austere environment*[tiab] OR “third world”[tiab]) OR (Africa[mh:noexp] OR Africa, Central[mh:noexp] OR Africa, Eastern[mh:noexp] OR Africa, Northern[mh:noexp] OR Africa South of the Sahara[mh:noexp] OR Africa, Southern[mh: noexp] OR Africa, Western[mh:noexp] OR central Africa*[ti] OR east Africa*[ti] OR eastern Africa*[ti] OR north Africa*[ti] OR northern Africa*[ti] OR southern Africa*[ti] OR west africa*[ti] OR western africa*[ti] OR sahara*[ti] OR subsahara*[ti] OR (Asia[mh:noexp] NOT (china[mh] OR japan[mh] OR Singapore[mh] OR south korea[mh])) OR Asia, Central[mh:noexp] OR Asia, Southeastern[mh:noexp] OR Asia, Western[mh:noexp] OR central asia*[ti] OR south asia*[ti] OR south asia*[ti] OR southeast asia*[ti] OR south-eastern asia*[ti] OR southern asia*[ti] OR west asia*[tiab]

OR western asia*[ti] OR Central America[mh:noexp] OR central America*[ti] OR Europe, Eastern[mh:noexp] OR eastern Europe*[ti] OR South America[mh:noexp] OR South America*[ti] OR Caribbean Region[mh:noexp] OR Caribbean[ti] OR Middle East[mh:noexp])) NOT (animals[mh] NOT humans[mh]) NOT Dental journals[sb] NOT News[pt] NOT (mummies OR mummy OR history, ancient[mh] OR paleoanthro* OR paleoepidem* OR paleopath* OR paleont* OR archeolog* OR ancient egypt* OR dynast* OR fossil* OR forensic anthropology[mh] OR history of medicine[mh]) AND (“2004”[Date Publication]: “3000”[Date Publication]) AND English[Language].

Embase search (June 1, 2014)

‘orthopedics’/de OR ‘orthopedic surgery’/exp OR ‘fracture’/exp OR ‘musculoskeletal disease’/de OR ‘arthropathy’/exp OR ‘bone disease’/exp OR ‘chondropathy’/exp OR ‘compartment syndrome’/exp OR ‘contracture’/mj OR ‘flexion contracture’/de OR ‘hip contracture’/de OR ‘joint contracture’/de OR ‘muscle contracture’/de OR ‘tendon contracture’/de OR ‘dupuytren contracture’/de OR ‘enthesopathy’/exp OR ‘limb disease’/de OR ‘arm disease’/exp OR ‘leg disease’/exp OR ‘limb defect’/de OR ‘limb deformity’/de OR ‘limb injury’/exp OR ‘limb malformation’/exp OR ‘limb pain’/de OR ‘limb tumor’/de OR ‘muscle disease’/mj OR ‘musculoskeletal injury’/exp OR ‘musculoskeletal pain’/exp OR ‘musculoskeletal system malformation’/exp/mj OR ‘rheumatic disease’/de OR ‘tendinitis’/exp OR ‘ligament’/exp/mj OR ‘musculoskeletal system’/mj OR ‘orthopedic equipment’/exp/mj OR ‘pelvis injury’/exp OR ‘skeletal muscle’/exp/mj OR ‘tendon’/exp/mj OR amput*:ab,ti OR back NEAR/3 injur* OR dislocation*:ab,ti OR fracture:ab,ti OR fractures:ab,ti OR musculoskelet*:ab,ti OR orthopedi*:ab,ti OR orthopaedi*:ab,ti OR (‘accident’/exp OR ‘accidental injury’/de OR accident*:ab,ti OR injur*:ab,ti OR polytrauma*:ab,ti OR ‘injury’/mj OR ‘blunt trauma’/exp OR ‘crush trauma’/de OR ‘multiple trauma’/de AND (bone:ab,ti OR bones:ab,ti OR humerus:ab,ti OR humeri:ab,ti OR ulna:ab,ti OR ulnas:ab,ti OR ulnae:ab,ti OR scaphoid:ab,ti OR scaphoids:ab,ti OR vertebra*:ab,ti OR spine:ab,ti OR spines:ab,ti OR pelvis*:ab,ti OR pelves:ab,ti OR femur:ab,ti OR femurs:ab,ti OR tibia:ab,ti OR tibias:ab,ti OR fibula:ab,ti OR fibulas:ab,ti OR talus:ab,ti OR tali:ab,ti OR calcaneus:ab,ti OR calcanei:ab,ti OR calcanea:ab,ti OR shoulder:ab,ti OR shoulders:ab,ti OR elbow:it,ab OR elbows:ab,ti OR wrist:ab,ti OR wrists:ab,ti OR hip:ab,ti OR hips:ab,ti OR knee:ab,ti OR knees:ab,ti OR ankle:ab,ti OR ankles:ab,ti OR extremity:ab,ti OR extremities:ab,ti OR ‘open injury’:ab,ti OR ‘open injuries’:ab,ti)) AND (‘afghanistan’/de OR ‘bangladesh’/de OR ‘benin’/de OR ‘burkina faso’/de OR ‘burundi’/de OR ‘cambodia’/de OR ‘central african republic’/de OR ‘chad’/ de OR ‘comoros’/de OR

‘democratic republic congo’/de OR ‘eritrea’/de OR ‘ethiopia’/de OR ‘gambia’/de OR ‘guinea’/de OR ‘guinea-bissau’/de OR ‘haiti’/de OR ‘kenya’/de OR ‘north korea’/de OR ‘kyrgyzstan’/de OR ‘liberia’/de OR ‘madagascar’/de OR ‘malawi’/de OR ‘mali’/de OR ‘mozambique’/de OR ‘myanmar’/de OR ‘nepal’/de OR ‘niger’/de OR ‘rwanda’/de OR ‘sierra leone’/de OR ‘somalia’/de OR ‘tajikistan’/de OR ‘tanzania’/de OR ‘togo’/de OR ‘uganda’/de OR ‘zimbabwe’/de OR ‘armenia’/de OR ‘bhutan’/de OR ‘bolivia’/de OR ‘cameroon’/de OR ‘cape verde’/de OR ‘congo’/ de OR cote d’ivoire’/exp OR ‘djibouti’/de OR ‘egypt’/de OR ‘el salvador’/de OR ‘georgia (republic)’/de OR ‘ghana’/ de OR ‘guatemala’/de OR ‘guyana’/de OR ‘honduras’/de OR ‘indonesia’/de OR ‘india’/de OR ‘kosovo’/de OR ‘laos’/de OR ‘lesotho’/de OR ‘mauritania’/de OR ‘federated states of micronesia’/de OR ‘moldova’/de OR ‘mongolia’/de OR ‘morocco’/de OR ‘nicaragua’/de OR ‘nigeria’/de OR ‘pakistan’/de OR ‘papua new guinea’/de OR ‘paraguay’/de OR ‘philippines’/de OR ‘samoa’/de OR ‘sao tome and principe’/de OR ‘senegal’/de OR ‘solomon islands’/de OR ‘sri lanka’/de OR ‘sudan’/de OR ‘swaziland’/de OR ‘syrian arab republic’/de OR ‘timor-leste’/de OR ‘ukraine’/de OR ‘uzbekistan’/de OR ‘vanuatu’/de OR (‘vietnam’/de NOT veteran*) OR ‘palestine’/de OR ‘yemen’/de OR ‘zambia’/de OR afghani*:ab,ti OR bangladesh*:ab,ti OR benin:ab,ti OR ‘burkina faso’:ab,ti OR burundi*:ab,ti OR cambodia*:ab,ti OR ‘central african republic’:ab,ti OR chad:ab,ti OR comoros:ab,ti OR (congo:ab,ti NOT ‘congo red’) OR congolese:ab,ti OR zaire:ab,ti OR eritrea*:ab,ti OR ethiopia*:ab,ti OR gambia*:ab,ti OR (guinea*:ab,ti NOT (guinea NEXT/1 fowl* OR guinea NEXT/1 pig* OR ‘guinea pig’/exp OR ‘new guinea’)) OR ‘guinea-bissau’:ab,ti OR haiti*:ab,ti OR kenya*:ab,ti OR ‘north korea’:ab,ti OR ‘north korean’:ab,ti OR ‘north koreans’:ab,ti OR ‘kyrgyz republic’:ab,ti OR kyrgyzstan*:ab,ti OR liberia*:ab,ti OR madagascar:ab,ti OR malawi:ab,ti OR mali:ab,ti OR mozambique:ab,ti OR myanmar:ab,ti OR burma:ab,ti OR burmese:ab,ti OR nepal:ab,ti OR nepalese:ab,ti OR niger:ab,ti OR rwanda*:ab,ti OR ‘sierra leone’:ab,ti OR somalia:ab,ti OR somali:ab,ti OR somalis:ab,ti OR ‘south sudan’:ab,ti OR tajikistan*:ab,ti OR tadjikistan*:ab,ti OR tanzania*:ab,ti OR zanzibar*:ab,ti OR tanganyika:ab,ti OR togo:ab,ti OR togolese:ab,ti OR uganda*:ab,ti OR zimbabwe*:ab,ti OR (rhodesia:ab,ti NOT ‘rhodesian ridgeback’) OR armenia*:ab,ti OR bhutan*:ab,ti OR bolivia*:ab,ti OR cameroon*:ab,ti OR ‘cape verde’:ab,ti OR ‘cote d ivoire’:ab,ti OR ‘ivory coast’:ab,ti OR djibouti*:ab,ti OR egypt*:ab,ti OR ‘el salvador’:ab,ti OR ‘el salvadoran’:ab,ti OR ‘el salvadorans’:ab,ti OR ‘georgia republic’:ab,ti OR ‘republic of georgia’:ab,ti OR ghana*:ab,ti OR guatemal*:ab,ti OR guyana:ab,ti OR guyanese:ab,ti OR ‘british guiana’:ab,ti OR hondur*:ab,ti OR (india:ab,ti NOT (‘india ink’ OR ‘indian ink’)) OR

'asian indian':ab,ti OR 'asian indians':ab,ti OR indonesia*:ab,ti OR kiribati:ab,ti OR kosovo:ab,ti OR laos:ab,ti OR 'lao pdr' OR laotian*:ab,ti OR lesotho*:ab,ti OR mauritania*:ab,ti OR (micronesia:ab,ti AND 'federated states') OR moldova:ab,ti OR mongolia*:ab,ti OR morocc*:ab,ti OR nicaragua*:ab,ti OR nigeria*:ab,ti OR pakistan*:ab,ti OR 'papua new guinea':ab,ti OR paraguay:ab,ti OR philippines:ab,ti OR (filipino*:ab,ti OR filipina*:ab,ti NOT ('filipino american' OR 'filipino americans' OR 'filipina american' OR 'filipina americans' OR 'united states'/exp)) OR (samoa:ab,ti OR samoan*:ab,ti NOT american NEXT/1 samoa*) OR 'sao tome':ab,ti OR senegal:ab,ti OR senegalese:ab,ti OR 'solomon island':ab,ti OR 'solomon islands':ab,ti OR 'sri lanka':ab,ti OR 'sri lankan':ab,ti OR 'sri lankans':ab,ti OR ceylon:ab,ti OR sudan*:ab,ti OR swaziland:ab,ti OR syria*:ab,ti OR 'timor-leste':ab,ti OR 'east timor':ab,ti OR ukraine*:ab,ti OR uzbekistan*:ab,ti OR vanuatu*:ab,ti OR (vietnam*:ab,ti NOT veteran*) OR 'west bank':ab,ti OR gaza:ab,ti OR palestin*:ab,ti OR yemen*:ab,ti OR zambia*:ab,ti OR 'developing country'/de OR 'developing country':ab,ti OR 'developing countries':ab,ti OR lmic:ab,ti OR lmic:ab,ti OR 'low income countries':ab,ti OR 'low income country':ab,ti OR 'low and middle income countries':ab,ti OR 'low and middle income country':ab,ti OR 'lower middle income countries':ab,ti OR 'lower middle income country':ab,ti OR 'developing nation':ab,ti OR 'developing nations':ab,ti OR 'developing world':ab,ti OR 'developing economy':ab,ti OR 'developing economies':ab,ti OR 'transitional country':ab,ti OR 'transitional countries':ab,ti OR 'global burden':ab,ti OR 'global health':ab,ti OR (global NEXT/1 orthop*):ab,ti OR 'global outreach':ab,ti OR 'global public health':ab,ti OR 'global watch':ab,ti OR 'international health':ab,ti OR 'international public health':ab,ti OR 'international cooperation'/mj OR 'resource poor':ab,ti OR 'austere environment':ab,ti OR 'third world':ab,ti OR 'africa'/de OR 'central africa'/de OR 'north africa'/de OR 'africa south of the sahara'/de OR (central NEXT/1 africa*):ti OR (east NEXT/1 africa*):ti OR (eastern NEXT/1 africa*):ti OR (north NEXT/1 africa*):ti OR (northern NEXT/1 africa*):ti OR (southern NEXT/1 africa*):ti OR sahara*:ti OR subsahara*:ti OR (west NEXT/1 africa*):ti OR (western NEXT/1 africa*):ti OR ('asia'/mj NOT ('china'/de OR 'japan'/de OR 'singapore'/de OR 'south korea'/de)) OR 'south asia'/de OR 'southeastern asia' OR (central NEXT/1 asia*):ti OR (south NEXT/1 asia*):ti OR (southeast* NEXT/1 asia*):ti OR (southern NEXT/1 asia*):ti OR (west NEXT/1 asia*):ti OR (western NEXT/1 asia*):ti OR 'central america'/de OR (central NEXT/1 america*):ti OR 'eastern europe'/de OR (eastern NEXT/1 europe*):ti OR 'south america'/de OR 'south and central america'/de OR (south NEXT/1 america*):ti OR 'caribbean islands'/de OR caribbean:ti OR 'middle east'/de

NOT ([animals]/lim NOT ([humans]/lim OR 'patient'/exp)) NOT ('mummies'/exp OR 'mummy'/exp OR 'ancient history' OR paleo* OR archeolog* OR ancient NEXT/1 egypt* OR dynast* OR 'forensic anthropology'/exp OR 'history of medicine'/exp OR 'history'/exp) AND [english]/lim AND [2004–2014]/py.

Cochrane library search (June 1, 2014)

orthop* or fracture* or musculoskeletal or amput* or dislocat* or extremity or extremities or bone or bones or ankle or calcaneus or elbow or femur or fibula or femur or foot or hand or hip or humerus or knee or leg or pelvis or scaphoid or shoulder or spine or talus or tibia or ulna or vertebrae or wrist or open next injur*:ti,ab,kw and Afghani* or Bangladesh* or Benin or "Burkina Faso" or Burundi* or Cambodia* or "Central African Republic" or Chad or Comoros or (Congo* not "congo red") or Zaire or Eritrea* or Ethiopia* or Gambia* or (Guinea not (guinea next fowl* or guinea next pig* or "new guinea")) or "Guinea-Bissau" or Haiti* or Kenya* or (Democratic next People* and "Republic of Korea") or North next Korea* or Kyrgyz* or Liberia or Madagascar or Malawi* or Mali or Mozambique or Myanmar or Burma or Burmese or Nepal or Nepalese or Niger or Rwanda* or "Sierra Leone" or Somali* or "South Sudan" or Tajikistan* or Tadjikistan* or Tanzania* or Zanzibar* or Tanganyika or Togo or Togolese or Uganda* or Zimbaw* or (Rhodesia* not "Rhodesian ridgeback") or Armenia* or Bhutan* or Bolivia* or Cameroon* or "Cape Verde" or "Cote d'Ivoire" or "Ivory Coast" or Djibouti* or El next Salvador* or "Georgia Republic" or "Republic of Georgia" or Ghana* or Guatemala* or Guyana or Guyanese or Hondur* or Indonesia* or Kiribati or Kosovo* or Kosovar* or Laos or "Lao PDR" or LAO next People* or Laotian* or Lesotho* or Mauritania* or "Federated States of Micronesia" or Moldova* or Mongolia* or Morocco* or Nicaragua* or Nigeria* or Pakistan* or "Papua New Guinea" or Paraguay* or Philippines or (Filipino* or Filipina* not (Filipino next American* or "United States")) or (Samoa* not "American Samoa") or "Sao Tome" or Senegal* or Solomon next Island* or Sri next Lanka* or Ceylon or Sudan* or Swaziland or Syria* or "Timor-Leste" or "East Timor" or Ukrain* or Uzbekistan* or Vanuatu* or (Vietnam* not veteran*) or "West Bank" or "Gaza" or Palestin* or Yemen* or Zambia* or developing next countr* or LMIC or LMICs or "low income countries" or "low income country" or "low and middle income countries" or "low and middle income country" or "lower middle income countries" or "lower middle income country" or developing next nation* or developing next world or "developing economy" or "developing economies" or transitional next countr* or "global burden" or "global health" or global next orthop* or "global outreach" or "global public health" or global next watch or "international health" or

“international public health” “world health” or “resource poor” or austere environment* or “third world” or central next Africa* or east next Africa* or eastern next Africa* or north next Africa* or northern next Africa* or southern next Africa* or west next africa* or western next africa* or sahara* or subsahara* or central next asia* or south next asia* or south next asia* or southeast next asia* or south-eastern next asia* or southern next asia* or west next asia* or western next asia* or central next America* or eastern next Europe* or South next America* Publication Date from 2004 to 2014 (Word variations have been searched).

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