THE ORTHOPAEDIC FORUM

A Conceptual Model for the Evaluation of Surgical Missions

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Background: Medical missions to low and middle-income countries are increasingly frequent, with an estimated 6,000 trips sponsored by U.S. organizations accounting for approximately 200,000 surgical cases and \$250 million in costs annually. However, these missions have received little critical evaluation. This paper describes the research program Operation Walk (Op-Walk) Boston, and proposes an evaluation model for similar surgical missions.

Methods: We propose an evaluation model, borrowing from the work of Donabedian and enriched by evidence from our research program. The model calls for evaluation of the salient contextual factors (culture and beliefs), system management (structure, process, and outcomes), and sustainability of the program's interventions. We used these domains to present findings from the quantitative and qualitative research work of Op-Walk Boston.

Results: Op-Walk's qualitative research findings demonstrated that cultural factors are important determinants of patients' perceptions of arthritis etiology, physical activity patterns, and treatment preferences. Quantitative assessments documented that Dominican patients had worse lower-extremity functional status (mean Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC] function score of 33.6) and pain preoperatively than patients undergoing total hip or knee replacement in the U.S. (WOMAC function score of 43.3 to 54), yet they achieved excellent outcomes (50-point improvement), comparable to those of their U.S. counterparts. Assessments of the quality and sustainability of the Op-Walk program showed that the quality of care provided by Op-Walk Boston meets Blue Cross Blue Shield Centers of Excellence (Blue Distinction) criteria, and that sustainable changes were transferred to the host hospital.

Conclusions: Our proposed model offers a method for formal assessment of medical missions that addresses the call for evidence of their merit. We suggest that surgical missions adopt quantitative and qualitative strategies to document their impact, identify areas of improvement, and justify program continuation, growth, and support.

Arthritis affects the lives of hundreds of millions of people worldwide; osteoarthritis caused the loss of >17 million disability-adjusted life years worldwide in 2010¹⁻³. The preva-

lence of osteoarthritis is growing rapidly in low and middle-income countries, whose populations are surviving longer and reporting higher rates of obesity, a key osteoarthritis risk factor^{4,5}.

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Additionally, patients in low and middle-income countries with inflammatory arthritis frequently develop advanced structural damage because biologic therapies are seldom available⁶.

Total joint arthroplasty (TJA) provides pain relief and functional improvement in persons with end-stage arthritis^{7,8}. In response to the growing burden of joint disease in low and middle-income countries, international medical missions offer TJA programs in these countries. Delivery of care through medical missions has increased, with U.S. organizations sponsoring 6,000 trips per year^{9,10}, resulting in estimated annual expenditures of \$250 million⁹. The cost of these missions has prompted questions about their sustainability, cost-effectiveness, and quality of care^{9,11-14}. Notably, in a literature review of mission trips, Martiniuk et al. found that only 5.7% of articles had any theoretical or conceptual analysis, with the majority being descriptive and implementation-focused¹⁵. Additionally, Sykes found that even though approximately 200,000 surgeries were performed annually on mission trips as of 2013, there were only 13 published studies on the long-term (≥ 8 days posttreatment) outcomes of these interventions¹⁶.

Operation Walk (Op-Walk) Boston has conducted yearly 1-week trips to the Dominican Republic since 2008 to provide free total hip and knee replacement surgeries to economically disadvantaged patients. Op-Walk Boston is 1 of 14 Operation Walk programs. Operation Walk provides TJAs internationally, and is one of the few missions that provides elective procedures rather than trauma care¹⁷. Op-Walk Boston is affiliated with an academic health center, and numerous team members have roles in research and quality improvement. Reflecting these roots, Op-Walk Boston has instituted a robust research program evaluating multiple aspects of the program¹⁸⁻³⁰. Given the rising popularity of global mission trips and the lack of an evaluative framework for these endeavors, 1 aim of this investigation is to introduce a conceptual evaluation model for short-term surgical missions. Another aim is to describe the research approach of Op-Walk Boston using this proposed evaluation model.

Methods

Setting

The Dominican Republic occupies the eastern two-thirds of the Caribbean island of Hispaniola. Roughly 41% of the 10.5 million Dominicans live below the international poverty line. The economy is largely agricultural and service-based, yielding a per capita gross national income of \$13,570, roughly 24% of that in the U.S.³¹. Although the basic health needs of most citizens are covered by a public health-care system, advanced treatments such as TJA are generally not accessible to the poor. In 2008, Op-Walk Boston partnered with Hospital General de la Plaza de la Salud (HGPS) in Santo Domingo, and has been providing pro bono TJAs yearly. HGPS is a private hospital with over 2,200 employees, 12 operating rooms, and 3 orthopaedic surgeons who perform TJA. Prior to 2008, they collectively performed < 20 TJAs annually. During the yearly 1-week trips, Op-Walk Boston has performed TJAs on 380 patients with advanced hip or knee arthritis and limited financial resources. Patients are recruited via media announcements and screened

for surgical indications, medical contraindications, and financial need by HGPS and U.S. staff. The patients who receive surgery come from almost all of the cities in the country (Fig. 1). The operational program costs are about \$150,000, with donated implants and surgical supplies totaling about \$600,000.

Evaluation Model

We conducted a literature review in order to identify review papers describing medical missions and evaluation models for missions. We searched the Cochrane Database, Embase, and MEDLINE. The search strategy used MeSH (medical subject heading) terms and words from the title or abstract, including “international mission,” “surgical mission,” and “volunteer.” Reviewers manually traced the studies’ bibliographies for any citations missed by the search algorithm.

We identified review papers by Sykes¹⁶ and Martiniuk et al.¹⁵, and an assessment tool by Maki et al.⁹. These authors identified the following domains used to assess mission trips: patient outcomes, quality and effectiveness of care, perspectives of health-care professionals and patients, sustainability, cost-effectiveness, and education. We grouped these domains into 3 themes: quality of care, sustainability, and personal perspectives. We used these themes as a starting point for shaping our evaluation model because they aligned with previous research conducted by Op-Walk Boston. However, given that quality of care is the most common theme in mission trip research, we felt that we needed to further clarify how to evaluate quality. Therefore, we searched for a conceptual framework for health-care quality assessment to incorporate into our model, and chose Donabedian’s structure, process, and outcome framework because of its long-standing prominence in quality improvement literature³².

While quality of care and sustainability often are used to assess mission trip impact, a multilevel approach is needed to capture the perspective of clinicians and patients participating in these missions. Maki et al. include patient perspectives in their model using surveys, which limit a patient’s ability to discuss cultural beliefs⁹. We felt that a thorough assessment of patient perspectives should be included in the evaluation model because this can delineate the social determinants of health in the host country. As discussed by Braveman and Gottlieb, social determinants can have synergistic or antagonistic relationships with medical care³³. Given the influence of social determinants on health, we propose that missions evaluate contextual factors, such as culture and beliefs, in order to better understand the people whom they are serving.

Using the information gathered from the literature and Op-Walk Boston’s 10 years of experience, we propose an evaluation model based on 3 major domains: contextual factors, system management (structure, process, and outcomes), and sustainability (Fig. 2).

Contextual Factors

The health literacy and health-related beliefs of the population can be critical to understanding patterns of utilization

Fig. 1
Distribution of patients among Dominican cities.

and outcome. Specifically, a patient's views on the etiology of the disease, the need for treatment, and medication practices can influence management recommendations. Furthermore, the host institution's treatment guidelines, such as preferred medication regimens, and health-care delivery system should be understood in order to develop appropriate management strategies.

System Management

The system management domain is further stratified into 3 assessment categories: structure, process, and outcome. Structure includes the physical structures where care is delivered, the clinical and nonclinical staff, and financial and administrative support. Process focuses on care processes, such as medical and financial screening, perioperative evaluation, intraoperative management, and postoperative care. Both the structure and the process of the mission trip organization and the host institution should be assessed using standard guidelines. The results of these analyses are essential to improving the care provided by the mission since many of the factors, such as screening protocols, can be adjusted quickly.

The outcome category refers to the clinical outcomes of the treatments. In order to evaluate the success of the treatments supplied by the mission, it is important to quantify the initial disease severity in patients, as well as the outcomes, using standardized, validated measures. This allows for the assessment of long-term outcomes and comparison with cohorts in other locations, which helps to quantify the impact of the mission.

Sustainability

For multiyear partnerships, the sustainability and cost-effectiveness of the missions should be assessed. Evaluation of host organization

practices and work culture prior to and after forming a relationship with the mission organization can reveal if any changes have occurred and whether they were due to knowledge transfer. Furthermore, cost-effectiveness analyses can determine if the ratio of incremental costs to health benefits of the programs compares favorably with other programs that compete for resources in these developing countries.

Brief Overview of Prior Op-Walk Boston Research Methods

The Op-Walk Boston research program has used quantitative and qualitative methods that are appropriate to the research question. All study procedures were approved by the institutional review boards at both the Brigham and Women's Hospital in Boston and HGPS in Santo Domingo.

Fig. 2

In the evaluation model, contextual factors create the background in which system management and sustainability factors interact to produce mission outcomes and impact.

Quantitative Methods

The Op-Walk Boston research program obtains patients' preoperative and postoperative data, creating a longitudinal database. All patients, with the help of a research assistant, complete a baseline survey that consists of several reliable and validated measures of health-related quality of life, as well as demographic questions and patient expectations of surgery^{34,35}. We documented the reliability of these measures in this Dominican cohort^{22,36}. From 2009 to 2016, 91.4% of patients completed the baseline survey. Additionally, patient-reported outcomes are collected for up to 2 years from the date of surgery. Of patients operated on between 2009 and 2015, 77.5% completed at least one 1-year or 2-year follow-up survey.

Qualitative Methods

Investigators utilized structured one-on-one interviews to elicit patient and staff member beliefs and practices. Moderator's guides were created by multidisciplinary teams, including experienced qualitative researchers. Interviews, conducted in Spanish, were digitally recorded and later translated into English. Transcripts were analyzed using content analysis to identify themes³⁷, which were then converted into a set of content area codes³⁸. An investigator then used this coding scheme to go back through and code each transcript. The interrater reliability of coding for themes and content was assessed by having an additional investigator code a subset of transcripts.

Results

Op-Walk Boston has conducted several research studies in the Dominican Republic during its partnership with HGPS, and these were used to inform our proposed model. Below we provide a brief overview of the results of these investigations, stratified by the 3 evaluation domains.

Contextual Factors

Several qualitative studies were conducted to understand how culture influences patients' experience with disease, as well as physicians' practice patterns. Niu et al. investigated patients' understanding of arthritis, and found that patients used religious and environmental theories to explain their disease. For example, they stated that their arthritis had been caused by God or through contact with water²³. Patients also were interviewed about their arthritis treatment prior to total knee arthroplasty. They reported a reliance on nonpharmacologic therapies, as well as family and religious support. They had limited knowledge of opioids, and trusted God and their doctors to cure their pain²⁸.

In order to better understand the analgesic prescription culture at HGPS and compare that to the practices of Op-Walk staff, Devine et al. interviewed American and Dominican providers about their prescription patterns and decision-making frameworks²⁷. Dominican surgeons rarely prescribed opioids because of limited availability, and adhered to a standardized pain protocol. This contrasted with American surgeons who subscribed to a shared decision-making model for analgesic prescribing, and prescribed various medications, including opioids.

System Management

Blue Cross Blue Shield developed criteria for designating Centers of Excellence (Blue Distinction) for total hip and knee replacement surgery in the U.S.³⁹, which involve a combination of structural elements, processes of care, and outcomes. Using the Centers of Excellence criteria, a study found that Op-Walk Boston scored 71 points of a possible 100; a score of 60 qualifies as a Center of Excellence²¹. Op-Walk Boston was especially successful in satisfying process-based criteria, reflecting the capacity of the organization to collaborate with HGPS to implement high-quality processes of care, even in a resource-constrained environment.

Research on surgical outcomes has yielded several important findings (Table I). First, the functional status of patients undergoing TJA in the Op-Walk sample is considerably worse, on average, than that of patients undergoing these procedures in high-income countries (baseline Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC] function score of 33.6 compared with 43.3 to 54, respectively, using a 0 to 100 scale, where 100 is best), reflecting more advanced disease at the time of presentation²². Nevertheless, Dominican patients improve considerably following TJA and reach average pain and function scores at 1 year (50-point improvement) that are comparable with patients who present with higher preoperative function²⁰. Additionally, to assess physical activity among TJA recipients, the research team developed and validated a Spanish translation of the Yale Physical Activity Survey^{25,40}. Only 43% of patients who were assessed 1 to 4 years after TJA did enough physical activity to satisfy Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO) recommendations. Patients who were older, those who lived alone, and those who were more pessimistic about the outcomes of surgery were less likely to be physically active²⁹. A related study of patients' postoperative experiences showed that patients generally resumed obligatory activities (those required to fulfill their social roles), but did not resume or try new discretionary activities¹⁸.

Sustainability

We studied how the Op-Walk partnership had influenced the structure and process of care at HGPS or at the home institutions of the Op-Walk Boston staff²⁶. This study utilized interviews with various American and Dominican personnel, including surgeons, nurses, and administrative staff. Study participants noted sustainable changes that occurred in the way care is delivered at HGPS as a result of the technical knowledge transfer and managerial examples provided by Op-Walk Boston staff. Examples included improved infection control and documentation of care. Additionally, HGPS staff attributed an evolution in nursing care to interactions with Op-Walk Boston nurses, who introduced a culture of greater independence in decision-making for nurses and the desire for continued education. U.S. staff noted gaining a better appreciation for different providers' roles and greater cost-consciousness. This study also helped identify barriers to knowledge transfer in this setting, such as language and organizational hierarchy.

TABLE I Summary of Operation Walk Boston Publications*

Authors, Year	Article Title	Study Type	Research Focus	Summary/Conclusions
Niu et al., 2011 ²³	Patient Disease Perceptions and Coping Strategies for Arthritis in a Developing Nation: A Qualitative Study	Qualitative	Patient perceptions	Semi-structured interviews with patients with advanced arthritis in the Dominican Republic revealed that patients invoke religious and environmental theories of disease etiology. Social effects of arthritis are sex-specific
Niu et al., 2011 ²²	Pre-operative Status and Quality of Life Following Total Joint Replacement in a Developing Country: A Prospective Pilot Study	Quantitative	Pain and functional status	Patient-reported WOMAC pain and function scores were poor preoperatively, but improved significantly after total joint TJR, indicating that TJR was effective in relieving pain and restoring function
Niu et al., 2011 ²⁴	Singing Intervention for Preoperative Hypertension Prior to Total Joint Replacement: A Case Report	Qualitative	Preoperative therapy	A 76-year-old woman with chronic stable hypertension experienced severely elevated blood pressure prior to total knee replacement. The blood pressure dropped dramatically when she sang several religious songs. This case highlights the possible therapeutic effects of singing and the value of culturally sensitive care
Nwachukwu et al., 2013 ¹⁹	Obesity & Hypertension Are Determinants of Poor Hemodynamic Control During Total Joint Arthroplasty: A Retrospective Review	Quantitative	Intraoperative management	Retrospective cohort analysis identified hypertension and obesity as substantial risk factors for poor hemodynamic control during TJR surgery. Hypertensive and/or obese patients warrant further attention and optimization prior to TJR
Dempsey et al., 2013 ²⁰	Associations Between Preoperative Functional Status and Functional Outcomes of Total Joint Replacement in the Dominican Republic	Quantitative	Functional status	Dominican patients with poor preoperative WOMAC and SF-36 functional scores had greater improvement but similar 12-month functional outcomes compared with patients who had a higher level of function before surgery
Dempsey et al., 2013 ²¹	Enhancing the Quality of International Orthopedic Medical Mission Trips Using the Blue Distinction Criteria for Knee and Hip Replacement Centers	Qualitative	Quality of care	The Op-Walk Boston 2012 medical mission was evaluated using Blue Cross Blue Shield's Center of Excellence (Blue Distinction) criteria and received 71 of 100 possible points, qualifying it as a Blue Distinction center, validating the high quality of care being delivered through the program in the Dominican Republic
Katz et al., 2014 ²⁵	Development and Validation of a Spanish Translation of the Yale Activity Survey	Translation validation	Physical activity	We developed a new Spanish translation of the Yale Physical Activity Survey and administered it to 107 Dominican subjects with advanced knee or hip arthritis just prior to or 1-4 years after TJR. The translation demonstrated convergent validity and appears well accepted and valid

continued

TABLE I Continued

Authors, Year	Article Title	Study Type	Research Focus	Summary/Conclusions
Stenquist et al., 2015 ¹⁸	Physical Activity and Experience of Total Joint Replacement in Patients One to Four Years Postsurgery in the Dominican Republic: A Qualitative Study	Qualitative	Physical activity	Semi-structured interviews with patients with advanced arthritis revealed that TJR allowed most patients to regain previous levels of physical activity, while a few were limited by continued pain or other comorbidities. Even with remaining limitations to physical activity, many patients felt that the improved mobility that TJR afforded was life-changing
Elman et al., 2014 ²⁹	Participation in Physical Activity in Patients 1-4 Years Post Total Joint Replacement in the Dominican Republic	Quantitative	Physical activity	Compared with an age-matched, nonpostoperative population in the U.S., postoperative Dominican patients participate in less physical activity, as measured by the Yale Physical Activity Survey
Bido et al., 2015 ²⁶	Sustainability Assessment of a Short-Term International Medical Mission	Qualitative	Sustainability	Interviews with Dominican and American staff revealed multiple sustainable changes, such as technical skills and nursing culture evolution. Cultural norms and organizational structure are important determinants of program sustainability
Devine et al., 2016 ²⁷	Postoperative Pain Management Among Dominican and American Health-Care Providers: A Qualitative Analysis	Qualitative	Pain management	There were differences in Dominican vs. American provider practices in regards to patient-provider relationship, pain medication prescribing variability, and access to medications. Dominican providers described less opioid availability and thus fewer prescriptions than American providers
Yu et al., 2016 ²⁸	Pain Management Among Dominican Patients with Advanced Osteoarthritis: A Qualitative Study	Qualitative	Pain management	Patients reported relying on nonpharmacologic therapies as well as family and religion to cope with their pain. They reported modest use of pain medications, with limited use or knowledge of opioids
Bido et al., 2017 ³⁰	Predictors of Patient-Reported Outcomes of Total Joint Arthroplasty in a Developing Country	Quantitative	Pain and functional status	The predictors of follow-up pain and function outcomes in the Dominican Republic were not the same as those seen in the U.S. Worse preoperative pain and function in the Dominican patients, as well as bilateral surgery, were associated with greater improvement in function
*WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index, TJR = total joint replacement, and SF-36 = 36-Item Short-Form Health Survey.				

Discussion

The number of medical mission trips and the financial investment in these endeavors has steadily increased over the years⁹, prompting demands for proof of their value^{12,13}. As Sykes stated in a recent systematic review, “there is a need for comprehen-

sive data collection and outcome assessment to justify, quantify, and verify the impact of MSTs [mission trips].”¹⁶ In this paper, we offer a comprehensive evaluation model for mission trips and use the work of Op-Walk Boston as an example of its implementation.

We have presented a new evaluation model that assesses mission quality across 3 domains: contextual factors, system management, and sustainability. This allows for a better understanding of both the patient population and the host institution in order to adapt mission practices in a culturally sensitive manner. This, in turn, may improve the medical results that are quantified with standardized outcome measures. Additionally, the sustainability assessment can help verify and justify the impact that the mission has had on the host institution.

Op-Walk Boston's implementation of this comprehensive tool illustrates the value it can provide to a mission trip. Notably, Op-Walk Boston's use of qualitative studies allowed for an increased understanding of the differences in medical practices, catalyzed adaptation to cultural norms, and identified needed interventions. For example, studies on patient opioid use and physician opinions on prescription medications showed that HGPS physicians rarely prescribed opioids, and patients had limited experience with them^{27,28}. These observations prompted the Op-Walk clinical leaders to reduce the role of opioids in the postoperative pain management protocols for the program, as well as to evaluate the reasoning for their prescription practices at their home institutions. Additionally, studies showing patients' limited understanding of arthritis etiology and recommended activity levels following TJA have prompted increased patient education efforts^{18,23}.

To formally document the merits of the mission trip and its impact on HGPS, the research program used the Blue Cross Blue Shield criteria for Centers of Excellence and found that the mission met the Centers of Excellence requirements. Additionally, various studies on postoperative outcome have demonstrated that despite worse preoperative pain and function, Op-Walk patients achieved levels of functional status at 1 to 2 years postsurgery comparable to those observed in U.S. cohorts^{20,22}. In fact, patients in the worst tertile of preoperative pain and function improved so drastically after TJA that at the 1-year follow-up, there were no differences between those patients and those who had started with the least preoperative limitations¹⁸. These data suggest that even though TJA recipients in developing countries such as the Dominican Republic are likely to be substantially limited preoperatively, they can achieve excellent outcomes and should not be denied surgery because of advanced functional limitations.

Given the multiyear partnership between Op-Walk Boston and HGPS, a sustainability analysis was conducted to look at the technical and managerial skills that had been conveyed, while asking what inhibited additional knowledge transfer²⁶. This study highlighted the procedural and cultural evolution that occurred at HGPS, as well as the continual obstacles created by language barriers. This investigation provided insight into areas for improvement. Specifically, future research could collect annual educational metrics and cost data to evaluate how changes in systems management have made the mission more cost-effective and sustainable. Additionally, it is critically important that each mission program incorporate patient financial means assessments so that the provision of free care

does not harm the developing provider community within the partnering institutions.

Conducting program evaluation in the developing world has several challenges. The infrastructure needed to conduct follow-up assessment of postoperative outcomes may be lacking. For example, the lack of reliable postal service in the Dominican Republic requires that follow-up evaluations be done in person or by telephone, but not by mail. Additionally, it may be difficult for patients to return to the original site of treatment if they have traveled far for the surgery. Despite these difficulties, Op-Walk Boston has collected follow-up assessments for 77.5% of patients, which is largely attributed to the patients' gratitude and loyalty to the program. Additional challenges include limited education and literacy in the patient population, as well as the generalizability of individual study findings.

In summary, our proposed evaluation model offers a new method for the formal assessment of medical mission trips. Specifically, establishing a system for the assessment of long-term patient outcomes helps to quantify the impact of the program on patient lives. Qualitative studies that are focused on program evaluation help document the impact of the mission on patients and the host institution. Additionally, these studies can identify local cultural factors that may influence outcomes, and point out opportunities for better adaptation to the customs of host countries. This evaluation model can help global mission trips implement a comprehensive research approach to document their impact and justify their endeavors. ■

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References

- March L, Smith EU, Hoy DG, Cross MJ, Sanchez-Riera L, Blyth F, Buchbinder R, Vos T, Woolf AD. Burden of disability due to musculoskeletal (MSK) disorders. *Best Pract Res Clin Rheumatol*. 2014 Jun;28(3):353-66. Epub 2014 Nov 18.
- Murray CJL, Lopez AD. Measuring the global burden of disease. *N Engl J Med*. 2013 Aug 1;369(5):448-57.
- Murray CJL, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, Ezzati M, Shibuya K, Salomon JA, Abdalla S, Aboyans V, Abraham J, Ackerman I, Aggarwal R, Ahn SY, Ali MK, Alvarado M, Anderson HR, Anderson LM, Andrews KG, Atkinson C, Baddour LM, Bahalim AN, Barker-Collo S, Barrero LH, Bartels DH, Basáñez MG, Baxter A, Bell ML, Benjamin EJ, Bennett D, Bernabé E, Bhalla K, Bhandari B, Bikbov B, Bin Abdulhak A, Birbeck G, Black JA, Blencowe H, Blore JD, Blyth F, Bolliger I, Bonaventure A, Boufous S, Bourne R, Boussinesq M, Braithwaite T, Brayne C, Bridgett L, Brooker S, Brooks P, Brugha TS, Bryan-Hancock C, Bucello C, Buchbinder R, Buckle G, Budke CM, Burch M, Burney P, Burstein R, Calabria B, Campbell B, Canter CE, Carabin H, Carapetis J, Carmona L, Cella C, Charlson F, Chen H, Cheng AT, Chou D, Chugh SS, Coffeng LE, Colan SD, Colquhoun S, Colson KE, Condon J, Connor MD, Cooper LT, Corriere M, Cortinovis M, de Vaccaro KC, Couser W, Cowie BC, Cripps MH, Cross M, Dabhadkar KC, Dahiya M, Dahodwala N, Damsere-Derry J, Danaei G, Davis A, De Leo D, Degenhardt L, Dellavalle R, Delos-santos A, Denenberg J, Derrett S, Des Jarlais DC, Dharmaratne SD, Dherani M, Diaz-Torne C, Dolk H, Dorsey ER, Driscoll T, Duber H, Ebel B, Edmond K, Elbaz A, Ali SE, Erskine H, Erwin PJ, Espindola P, Ewigogbokhan SE, Farzadfar F, Feigin V, Felson DT, Ferrari A, Ferri CP, Fèvre EM, Finucane MM, Flaxman S, Flood L, Foreman K, Forouzanfar MH, Fowkes FG, Fransen M, Freeman MK, Gabbe BJ, Gabriel SE, Gakidou E, Ganatra HA, Garcia B, Gaspari F, Gillum RF, Gmel G, Gonzalez-Medina D, Gosselin R, Grainger R, Grant B, Groeger J, Guillemin F, Gunnell D, Gupta R, Haagsma J, Hagan H, Halasa YA, Hall W, Haring D, Haro JM, Harrison JE, Havmoeller R, Hay RJ, Higashi H, Hill C, Hoen B, Hoffman H, Hotez PJ, Hoy D, Huang JJ, Ibeanusi SE, Jacobsen KH, James SL, Jarvis D, Jasrasaria R, Jayaraman S, Johns N, Jonas JB, Karthikeyan G, Kassebaum N, Kawakami N, Keren A, Khoo JP, King CH, Knowlton LM, Kobusingye O, Koranteng A, Krishnamurthi R, Laden F, Lalloo R, Laslett LL, Lathlean T, Leasher JL, Lee YY, Leigh J, Levinson D, Lim SS, Limb E, Lin JK, Lipnick M, Lipshultz SE, Liu W, Loane M, Ohno SL, Lyons R, Mabweli J, MacIntyre MF, Malekzadeh R, Mallinger L, Manivannan S, Marcenes W, March L, Margolis DJ, Marks GB, Marks R, Matsumori A, Matzopoulos R, Mayosi BM, McAnulty JH, McDermott MM, McGill N, McGrath J, Medina-Mora ME, Meltzer M, Mensah GA, Merriman TR, Meyer AC, Migliori V, Miller M, Miller TR, Mitchell PB, Mock C, Mocumbi AO, Moffitt TE, Mokdad AA, Monasta L, Montico M, Moradi-Lakeh M, Moran A, Morawska L, Mori R, Murdoch ME, Mwaniki MK, Naidoo K, Nair NM, Naldi L, Narayan KM, Nelson PK, Nelson RG, Nevitt MC, Newton CR, Nolte S, Norman P, Norman R, O'Donnell M, O'Hanlon S, Olives C, Omer SB, Ortblad K, Osborne R, Ozgediz D, Page A, Pahari B, Pandian JD, Rivero AP, Patten SB, Pearce N, Padilla RP, Perez-Ruiz F, Perico N, Pesudovs K, Phillips D, Phillips MR, Pierce K, Pion S, Polanczyk GV, Polinder S, Pope CA 3rd, Popova S, Porrini E, Pourmalek F, Prince M, Pullan RL, Ramaiah KD, Ranganathan D, Razavi H, Regan M, Rehm JT, Rein DB, Remuzzi G, Richardson K, Rivara FP, Roberts T, Robinson C, De León FR, Ronfani L, Room R, Rosenfeld LC, Rushton L, Sacco RL, Saha S, Sampson U, Sanchez-Riera L, Sanman E, Schwebel DC, Scott JG, Segui-Gomez M, Shahraz S, Shepard DS, Shin H, Shivakoti R, Singh D, Singh GM, Singh JA, Singleton J, Sleat DA, Sliwa K, Smith E, Smith JL, Stapelberg NJ, Steer A, Steiner T, Stolk WA, Stovner LJ, Sudfeld C, Syed S, Tamburlini G, Tavakkoli M, Taylor HR, Taylor JA, Taylor WJ, Thomas B, Thomson WM, Thurston GD, Tjeyhe IM, Tonelli M, Towbin JA, Truelsen T, Tsilimbaris MK, Ubeda C, Undurraga EA, van der Werf MJ, van Os J, Vavilala MS, Venketasubramanian N, Wang M, Wang W, Watt K, Weatherall DJ, Weinstock MA, Weintraub R, Weisskopf MG, Weissman MM, White RA, Whiteford H, Wiebe N, Wiersma ST, Wilkinson JD, Williams HC, Williams SR, Witt E, Wolfe F, Woolf AD, Wulf S, Yeh PH, Zaidi AK, Zheng ZJ, Zonies D, Lopez AD, AlMazroa MA, Memish ZA. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*. 2012 Dec 15;380(9859):2197-223.
- Brooks PM. The burden of musculoskeletal disease—a global perspective. *Clin Rheumatol*. 2006 Nov;25(6):778-81. Epub 2006 Apr 12.
- Nugent R. Chronic diseases in developing countries: health and economic burdens. *Ann N Y Acad Sci*. 2008;1136:70-9.
- Rudan I, Sidhu S, Papan A, Meng SJ, Xin-Wei Y, Wang W, Campbell-Page RM, Demail AR, Nair H, Sridhar D, Theodoratou E, Dowman B, Adeloye D, Majeed A, Car J, Campbell H, Wang W, Chan KY. Global Health Epidemiology Reference Group (GHERG). Prevalence of rheumatoid arthritis in low- and middle-income countries: a systematic review and analysis. *J Glob Health*. 2015 Jun;5(1):010409.
- Hawker G, Wright J, Coyte P, Paul J, Dittus R, Croxford R, Katz B, Bombardier C, Heck D, Freund D. Health-related quality of life after knee replacement. *J Bone Joint Surg Am*. 1998 Feb;80(2):163-73.
- Ethgen O, Bruyère O, Richy F, Dardennes C, Reginster JY. Health-related quality of life in total hip and total knee arthroplasty. A qualitative and systematic review of the literature. *J Bone Joint Surg Am*. 2004 May;86(5):963-74.
- Maki J, Qualls M, White B, Kleefeld S, Crone R. Health impact assessment and short-term medical missions: a methods study to evaluate quality of care. *BMC Health Serv Res*. 2008 Jun 2;8:121.
- Snyder J, Dharamsi S, Crooks VA. Fly-By medical care: Conceptualizing the global and local social responsibilities of medical tourists and physician volunteers. *Global Health*. 2011 Apr 6;7:6.
- Green T, Green H, Scandlyn J, Kestler A. Perceptions of short-term medical volunteer work: a qualitative study in Guatemala. *Global Health*. 2009 Feb 26;5:4.
- Wright IG, Walker IA, Yacoub MH. Specialist surgery in the developing world: luxury or necessity? *Anaesthesia*. 2007 Dec;62(Suppl 1):84-9.
- DeCamp M. Scrutinizing global short-term medical outreach. *Hastings Cent Rep*. 2007 Nov-Dec;37(6):21-3.
- Abdullah F. Perspective of West Africa: why bother to “mission”? *Arch Surg*. 2008 Aug;143(8):728-9.
- Martiniuk AL, Manouchehrian M, Negin JA, Zwi AB. Brain gains: a literature review of medical missions to low and middle-income countries. *BMC Health Serv Res*. 2012 May 29;12:134.
- Sykes KJ. Short-term medical service trips: a systematic review of the evidence. *Am J Public Health*. 2014 Jul;104(7):e38-48. Epub 2014 May 15.
- Operation Walk. About Operation Walk. 2017. <http://www.operationwalk.org/>. Accessed 2017 Oct 18.
- Stenquist DS, Elman SA, Davis AM, Bogart LM, Brownlee SA, Sanchez ES, Santiago A, Ghazinouri R, Katz JN. Physical activity and experience of total knee replacement in patients one to four years postsurgery in the Dominican Republic: a qualitative study. *Arthritis Care Res (Hoboken)*. 2015 Jan;67(1):65-73.
- Nwachukwu BU, Collins JE, Nelson EP, Concepcion M, Thornhill TS, Katz JN. Obesity & hypertension are determinants of poor hemodynamic control during total joint arthroplasty: a retrospective review. *BMC Musculoskelet Disord*. 2013 Jan 14;14:20.
- Dempsey KE, Collins JE, Ghazinouri R, Alcantara L, Thornhill TS, Katz JN. Associations between preoperative functional status and functional outcomes of total joint replacement in the Dominican Republic. *Rheumatology (Oxford)*. 2013 Oct;52(10):1802-8. Epub 2013 Jun 7.
- Dempsey KE, Ghazinouri R, Diez D, Alcantara L, Beagan C, Aggouras B, Hoagland M, Thornhill TS, Katz JN. Enhancing the quality of international orthopedic medical mission trips using the Blue Distinction criteria for knee and hip replacement centers. *BMC Musculoskelet Disord*. 2013 Sep 23;14:275.
- Niu NN, Collins JE, Thornhill TS, Alcantara Abreu L, Ghazinouri R, Okike K, Katz JN. Pre-operative status and quality of life following total joint replacement in a developing country: a prospective pilot study. *Open Orthop J*. 2011;5:307-14. Epub 2011 Aug 10.
- Niu NN, Davis AM, Bogart LM, Thornhill TS, Abreu LA, Ghazinouri R, Katz JN. Patient disease perceptions and coping strategies for arthritis in a developing nation: a qualitative study. *BMC Musculoskelet Disord*. 2011 Oct 10;12:228.
- Niu NN, Perez MT, Katz JN. Singing intervention for preoperative hypertension prior to total joint replacement: a case report. *Arthritis Care Res (Hoboken)*. 2011 Apr;63(4):630-2.
- Katz JN, Perez MT, Niu NN, Dong Y, Brownlee SA, Elman SA, Stenquist DS, Santiago A, Sanchez ES, Collins JE. Development and validation of a Spanish translation of the Yale activity questionnaire. *BMC Musculoskelet Disord*. 2014 Apr 7;15(1):120.
- Bido J, Singer SJ, Diez Portela D, Ghazinouri R, Driscoll DA, Alcantara Abreu L, Aggouras BM, Thornhill TS, Katz JN. Sustainability assessment of a short-term international medical mission. *J Bone Joint Surg Am*. 2015 Jun 3;97(11):944-9.
- Devine CA, Yu A, Kasdin RG, Bogart LM, Davis AM, Alcántara Abreu L, Ghazinouri R, Thornhill TS, Katz JN. Postoperative pain management among Dominican and American health-care providers: a qualitative analysis. *J Bone Joint Surg Am*. 2016 Jun 15;98(12):e50.
- Yu A, Devine CA, Kasdin RG, Orizondo M, Perdomo W, Davis AM, Bogart LM, Katz JN. Pain management among Dominican patients with advanced osteoarthritis: a qualitative study. *BMC Musculoskelet Disord*. 2016 May 17;17(1):211.
- Elman SA, Dong Y, Stenquist DS, Ghazinouri R, Alcantara L, Collins JE, Beagan C, Thornhill TS, Katz JN. Participation in physical activity in patients 1-4 years post total joint replacement in the Dominican Republic. *BMC Musculoskelet Disord*. 2014 Jun 16;15:207.
- Bido J, Yang YH, Collins JE, Dong Y, Driscoll DA, Alcantara LA, Thornhill TS, Katz JN. Predictors of patient-reported outcomes of total joint arthroplasty in a developing country. *J Arthroplasty*. 2017 Jun;32(6):1756-62. Epub 2017 Jan 26.
- The World Bank. Dominican Republic. 2016. <http://data.worldbank.org/country/dominican-republic>. Accessed 2017 Oct 18.
- Donabedian A. The quality of care. How can it be assessed? *JAMA*. 1988 Sep 23;260(12):1743-8.
- Braveman P, Gottlieb L. The social determinants of health: it's time to consider the causes of the causes. *Public Health Rep*. 2014 Jan-Feb;129(Suppl 2):19-31.

- 34.** Benroth R, Gawande S. Patient-reported health status in total joint replacement. *J Arthroplasty*. 1999 Aug;14(5):576-80.
- 35.** Braeken AM, Lochhaas-Gerlach JA, Gollish JD, Myles JD, Mackenzie TA. Determinants of 6-12 month postoperative functional status and pain after elective total hip replacement. *Int J Qual Health Care*. 1997 Dec;9(6):413-8.
- 36.** Nunnally J. *Psychometric theory*. 2nd ed. New York: McGraw Hill; 1978.
- 37.** Weber R. *Basic content analysis*. 2nd ed. Thousand Oaks: Sage Publications; 1990.
- 38.** Beaton DE, Clark JP. Qualitative research: a review of methods with use of examples from the total knee replacement literature. *J Bone Joint Surg Am*. 2009 May;91(Suppl 3):107-12.
- 39.** Blue Cross Blue Shield Association. Blue Distinction specialty care: selection criteria and program documentation: knee and hip replacement and spine surgery. 2015 Oct. https://www.bcbs.com/sites/default/files/file-attachments/page/KneeHip.SelectionCriteria_0.pdf . Accessed 2017 Oct 18.
- 40.** Dipietro L, Caspersen CJ, Ostfeld AM, Nadel ER. A survey for assessing physical activity among older adults. *Med Sci Sports Exerc*. 1993 May;25(5):628-42.