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Global arthroplasty in action: women surgeons shaping practice across borders

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ABSTRACT

Background: The present study assessed demographic patterns and surgical practices across international TKA outreach trips led by Women Orthopaedist Global Outreach (WOGO), which provides care to underserved communities worldwide. Access to total knee arthroplasty (TKA) remains limited in low- and middle-income countries (LMIC).
Methods: This retrospective study included 186 patients (249 knees) who underwent TKA (246 primary, 3 revision) across five international sites: Tanzania (2016; 2025), Cuba (2018), Guatemala (2022), and Guyana (2023). Data collected included demographics, comorbidities, surgical characteristics, and complications. Descriptive statistics summarized trends across trips, and ANOVA, chi-square, and post-hoc Tukey tests were used for between-country comparisons.
Results: Despite site-to-site variation in demographics and pre-operative deformity, higher-constraint implants were rarely needed: condylar constrained components were used in only 4.8% of cases, and augments in 2.2%. The in-hospital complication rate was low (1.1%), and 98.4% required only tramadol for pain control. Guatemala had the oldest cohort (mean age 69 vs 62-65 years elsewhere, p=0.0008), and valgus deformity was more common in the first Tanzania trip (48%) than in Guatemala (3%, p=0.002), without affecting implant needs or complications.
Conclusions: Standard implant sets and protocols met the needs of nearly all patients across five WOGO outreach trips, with higher-constraint implants used in fewer than 5% of cases at every site and consistently low complications, despite site-level differences in patient age and deformity. These findings support standardized planning for future arthroplasty trips.

Keywords: Total knee arthroplasty; Global health; Surgical outreach, Low- and middle-income countries

INTRODUCTION

Access to musculoskeletal care in low-and middle-income countries (LMIC) remains limited despite the rising global need for total knee arthroplasty (TKA). The constraints are largely due to a shortage of trained surgical teams, rehabilitation professionals, implant availability, and perioperative resources.[1] As a result of these shortages, patients in LMICs often experience prolonged disability and lost productivity from degenerative joint conditions that worsen over time.[2] To address the growing disparities in care worldwide, global orthopaedic organizations are filling this gap until local surgeons can obtain the skillset and capacity to perform TKA in their communities. Modern global orthopaedic organizations have created short-term and long-term interventions, focusing on sustainable partnerships spanning clinical care, education, and advocacy while collaborating with local leadership teams.[2]

Existing literature on global arthroplasty demonstrates that joint replacement procedures can be delivered safely and with substantial functional improvement, even in resource-limited settings.[3,4] Reports from Operation Walk-affiliated teams have shown substantial improvements in patient-reported outcomes after hip and knee arthroplasty performed during short-term outreach trips.[5] Uniquely, Kavolus et al captured the perspective of patients who received care from outreach trips, showing that they may be skeptical of the care, expressing concern most for ability to pay medical and personal bills after their surgery.[5] Thus, it is important to partner with the surrounding community to address the concerns of patients who will be receiving care from international surgical teams and understand their goals, expectations, and concerns of the surgery.

Research studies focused on the logistical implications of itinerant arthroplasty have also outlined pragmatic pathways to success. These studies have focused on the importance of implant selection, infection prevention, and perioperative analgesia.[4] These factors are particularly important to assess the feasibility of arthroplasty care for the local hospitals who may experience disruptions in the supply chain.[4] Additional research on the logistics of international surgical care has also shown large improvements in care through early follow-up in underserved communities.[3] There can be high levels of attrition in long-term follow up, however, since patients from remote communities often return to their homes after their surgical care and do not have a reliable means of contact.[3]

Despite substantial literature on the impact and logistical models of global outreach, there is a paucity of data on how patient characteristics, operative strategy, and perioperative practices vary across international sites when the same organization and core surgical team deliver care. The assessment of these differences can guide future outreach trip planning and can highlight existing differences among global patient populations. The primary aim of this study was to compare patient demographics, pre-operative clinical characteristics, and operative practices across multiple international outreach trips led by Women Orthopaedist Global Outreach (WOGO), an affiliate of Operation Walk. Secondary aims were to evaluate trip-level differences in procedure type, operative duration, implant constraint and augment use, analgesic strategies, and early in-hospital complication rates.

METHODS

Study population and setting

The study conducted a retrospective chart review on patients who underwent TKA during WOGO outreach trips from 2016 to 2025, which included patients ≥ 18 years old from five international sites: Tanzania (2016; 2025), Cuba (2018), Guatemala (2022), and Guyana (2023). For each trip, paper logs were kept for each patient which were then converted into a spreadsheet on a password protected device at the trip's completion. Patients were eligible for inclusion if they were 18 years of age or older and underwent primary or revision TKA during one of five WOGO outreach trips between 2016 and 2025. All patients underwent pre-trip screening by local providers followed by surgical evaluation and medical optimization at an on-site pre-operative clinic. Patients who were evaluated but did not undergo surgery, patients who underwent procedures other than TKA, and patients with incomplete operative records were excluded. This study received institutional review board (IRB) approval (STU-2025-2119).

Data collection

Descriptive characteristics, including age, sex, and nationality, were extracted in addition to patient comorbidities (hypertension (HTN), diabetes mellitus (DM), congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), asthma, chronic kidney disease (CKD), hyperlipidemia (HLD), hypothyroidism, and osteoporosis), pre-operative deformity (valgus and varus), and knee range of motion (ROM). Pre-operative criteria in active use in the United States (US), such as HgA1c, BMI <45 and general medical optimization, were applied to our patient population. The type of procedure (unilateral TKA, bilateral TKA, and revision TKA) as well as the operative duration, use of condylar constrained implants, and augment use were obtained. Of note, condylar constrained implants and augments were used for both primary and revision TKA cases. Patients' analgesic use and in-hospital complication rates were also reviewed. Minor complications were defined as in-hospital adverse events that did not require reoperation or implant revision and resolved with nonoperative management. Transfusion criteria aligned with US standards <7.0 mg/dl.

Data analysis

Descriptive statistics were reported as means and standard deviations (SD). For the primary analysis, we assessed differences in demographic and clinical characteristics between trips (Tanzania #1, Cuba, Guatemala, Guyana, and Tanzania #2). Continuous variables such as age, ROM, and surgery duration were analyzed using independent-sample T-tests or one-way ANOVA when normally distributed, and Mann-Whitney U or Kruskal-Wallis tests when non-normally distributed. Categorical variables, including sex, presence of comorbidities, deformity, operative technique (e.g., condylar constraint or augment use), and complication rates, were compared using Chi-Square or Fisher's Exact tests, where appropriate. For secondary analyses, we examined associations between comorbidities and surgical outcomes using Chi-Square and Mann-Whitney U tests. Correlations between patient age, ROM, and surgery duration were further evaluated using Spearman's Rho. Post-hoc Tukey tests were used to identify inter-group differences. All analyses were performed with IBM SPSS Statistics for Windows, Version 27 (IBM Corp., Armonk, N.Y., USA) with statistical significance defined as $p<0.05$.

RESULTS

Characteristics of the cohort

A total of 186 patients (249 knees) underwent TKA across the analyzed international trips. Patients were predominantly women (76.9%, n=143) with a mean age of 65.0 years±8.5 (Table 1).

Table 1: Demographic data by site.

Demographic characteristics	Tanzania (2016)	Cuba (2018)	Guatemala (2022)	Guyana (2023)	Tanzania (2025)
Age (years), Mean (SD)	62.6 (8.6)	68.1 (7.7)	69.2 (8.2)	62.4 (8.8)	64.1 (6.8)
Gender, N (%)					
Women	19 (76%)	30 (81.1%)	24 (77.4%)	44 (77.2%)	26 (72.2%)
Men	6 (24%)	7 (18.9%)	7 (22.6%)	13 (22.8%)	10 (27.8%)

Note: SD = Standard Deviation; N = Number of participants.

Overall, 59.1% of patients had at least one comorbidity; of these, hypertension was the most common (86.4%), followed by diabetes (22.7%) and other conditions (19.1%) (Figures 1 and 2).

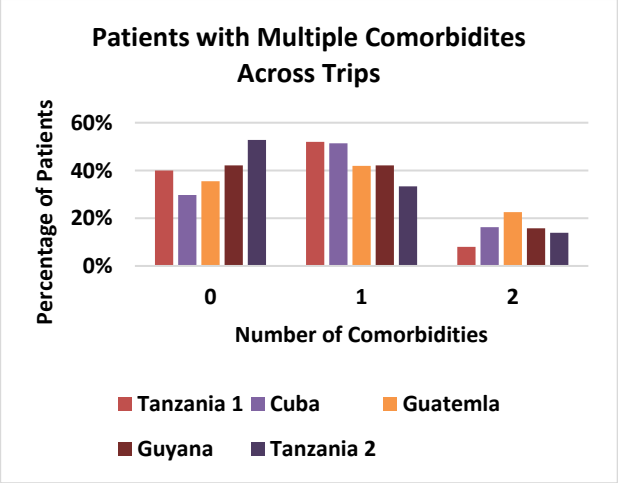

Figure 1: Number of comorbidities by site.

Clinical, operative, and post-operative outcomes

Pre-operative ROM was analyzed with mean motion arcs of 3–109° for the right and 4–110° for left knees, respectively (Table 2). Varus deformity was present in 53.8% of patients, while valgus deformity was found in 22.0%. Most of the procedures were primary TKAs (98.4%), while revision surgeries accounted for 1.6% of surgeries which were all performed for infection (Table 3). Approximately one-third of patients (34.4%) underwent bilateral TKA procedures, and the remainder underwent unilateral surgery with a noted trend of less bilateral surgeries with each successive trip (68% Tanzania #1, 44% Cuba, 20% Guatemala, 25% Guyana, 29% Tanzania #2). Condylar constrained components were used in 4.8% of cases, and augments were used in 2.2% of cases (Table 3). Of the augments used, they included tibial half augments (one, Guatemala) and full tibia augments (one, Tanzania #1), distal femoral augments (one, Tanzania #1 and one, Tanzania #2), and posterior femoral augments (one, Tanzania #1 and one, Tanzania #2). Surgical duration varied by procedure type: bilateral TKAs averaged 187.6±62.2 minutes compared to 106.7±26.7 minutes for unilateral procedures (Table 3). All surgeons utilized their standard US surgical techniques intraoperatively and the techniques used were not standardized. Post-operative pain was primarily managed with tramadol (prescribed as one to two 50mg tablets by mouth every 6 hours as needed for pain) as a single agent; a small percentage of patients took hydrocodone/acetaminophen oral (1.1%) or morphine parenterally (0.5%). The overall in-hospital complication rate across all trips was 1.1% (Table 3). Complications included hypotension (Tanzania #1) and a partial medial collateral ligament avulsion (Guyana) that was repaired primarily intraoperatively.

Trip-level variations

In comparing individual trips, differences were observed in demographic and clinical characteristics. Between-country analyses showed that Guatemala had the oldest patient population with a mean age of 69 years±8.2 compared with younger patients from the first trip to Tanzania (63 years±8.6) and Guyana (62 years±8.8; p=0.0008) (Table 1). The first trip to Tanzania had higher bilateral TKA rates (68%) with a longer surgical duration (236 minutes±71) than the second trip to Tanzania (20%; 142 minutes±23). Patients from the first trip to Tanzania also had higher rates of valgus deformity (48%) compared to other sites, with only 3% of patients from Guatemala having valgus deformity (p=0.002; Table 2). Other variables, such as comorbidities, ROM, augment use, and condylar constraint use did not differ significantly (Tables 2 & 3, Figure 1).

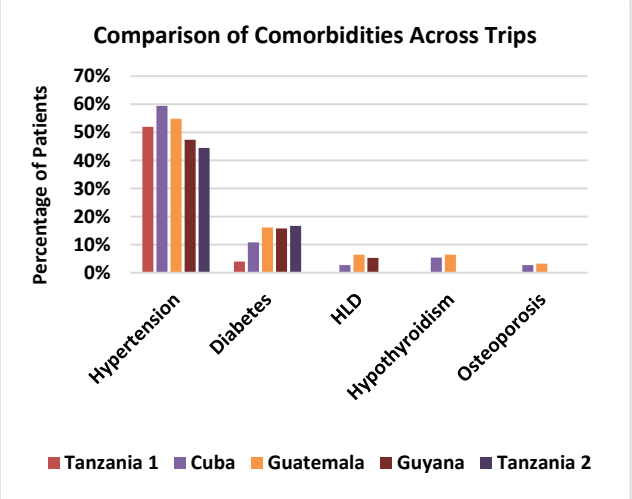

Figure 2: Types of comorbidities across sites.

Table 2: Knee range of motion and deformity pattern by site.

Parameters	Tanzania (2016)	Cuba (2018)	Guatemala (2022)	Guyana (2023)	Tanzania (2025)
Range of motion (Mean ± SD)					
Left knee	1.7 (SD 5.9)–115.5 (SD 12.2)	0.8 (SD 4.2)–106.3 (SD 18.9)	4.58 (SD 7.9)–114 (SD 9.2)	9.5 (SD 6.7)–107.9 (SD 16.9)	2.9 (SD 5.1)–109.8 (SD 27.2)
Right knee	2.89 (SD 4.0)–109.6 (SD 15.6)	-0.56 (SD 5.4)–110 (SD 15.8)	3.2 (SD 5.9)–107.2 (SD 11.2)	6.5 (SD 22.1)–104.9 (SD 13.3)	3.2 (SD 3.6)–112.5 (SD 14.9)
Deformity, N (%)					
Varus deformity	8 (32%)	17 (45.9%)	15 (48.4%)	37 (64.9%)	23 (63.9%)
Valgus deformity	12 (48%)	7 (18.9%)	1 (3.2%)	11 (19.3%)	10 (27.8%)

Note: SD = Standard Deviation; N = Number of participants.

Table 3: TKA surgeries performed by site.

Procedure, N (%)	Tanzania (2016)	Cuba (2018)	Guatemala (2022)	Guyana (2023)	Tanzania (2025)
Primary TKA	25 (100%)	36 (97.3%)	30 (96.8%)	57 (100%)	35 (97.2%)
Revision TKA (all for infection)	0 (0%)	1 (2.7%)	1 (3.2%)	0 (0%)	1 (3.8%)

Note: TKA = Total Knee Arthroplasty; N = Number of participants. Original values have been retained. Please verify the Tanzania (2025) revision percentage (2.8%) against the original source.

Table 4: TKA surgical duration by site.

Surgical procedure, Mean (SD) minutes	Tanzania (2016)	Cuba (2018)	Guatemala (2022)	Guyana (2023)	Tanzania (2025)
Unilateral Primary TKA	100 (20.6)	113.6 (22.2)	96.1 (22.3)	106.3 (26.4)	114.7 (33.2)
Bilateral Primary TKA	235.7 (71.3)	180.9 (47.7)	204 (35.7)	158.6 (57.1)	142.4 (23.4)
Unilateral Revision TKA	220 (0)	0 (0)	227 (0)	0	204 (0)

Note: TKA = Total Knee Arthroplasty; SD = Standard Deviation. Original values have been retainedThere were no cases of unilateral revisions for Tanzania (2016) and Guatemala.

DISCUSSION

This study demonstrates notable demographic differences across WOGO outreach trips, with a patient population predominately made of women, and the highest mean age observed in Guatemala. The women predilection is not surprising given that women have a higher prevalence of osteoarthritis than men.[14] Furthermore, the predominance of women may be higher than expected since WOGO preferentially provides care to women in underserved communities in accordance with its mission. Cultural and religious norms commonly allowed physical examination and communication with women patients and women surgeons that may have been an unperceived barrier by other Operation Walk teams. Arthroplasty reports from West Africa have similarly shown differences in characteristics due to different referral practices, affordability, and health system readiness which can affect the age and sex distribution of patients presenting for surgery.[8,9,10] These findings reinforce the importance of anticipating site-specific needs such as implant availability and perioperative resources for patients depending on region.

Pre-operative deformities also differed by country, with valgus deformity being more present in the first Tanzanian trip and uncommon in Guatemala. This aligns with demographic data that shows that women of African descent are more likely to ambulate with a valgus thrust which, over time, contributes to the development of lateral compartment wear and valgus deformity/instability.[15] Furthermore, patients encountered on WOGO missions may have more severe disease, presenting as deformity, due to their lack of access to timely operative care in relation to when their symptoms begin.[6,7] Surgeons must anticipate this and bring specialized implants to compensate for the ligamentous incompetency which may not be surmountable with gap balancing and instead requires higher level of constraint. The WOGO protocol frequently identified cases involving severe deformity or revision knee arthroplasty that required additional instrumentation or stemmed augment implants. To ensure that revision instrumentation remained available, these cases were staggered throughout the surgical day. This scheduling approach likely influenced the sequence of the remaining procedures and was necessary to allow for sterile reprocessing given the limited implant and instrument resources.

The type of procedure performed and the length of time for these operations significantly differed across repeat visits by the WOGO team, with higher bilateral TKA rates and longer bilateral times during the first Tanzania trip compared with the later trip. This trajectory is consistent with prior reports that showcase programs becoming more efficient as partnerships with host institutions mature since the WOGO team returned to the same hospital as previously visited in Tanzania.[4,11,12] Differences in the length of time of bilateral TKAs can also be attributed to an increased number of simultaneous bilateral TKAs in which two senior surgeons operated side by side on each extremity compared to operating on each limb sequentially during the same operative encounter. Potential tourniquet uses and staged inflation/deflation was also coordinated with our anesthesia teams to allow minimal fluid shifts peri and post-operatively. Our single-team, multi-country observations extend the literature by demonstrating how differences in approach and increased familiarity within an organization can influence operative characteristics.

Early in-hospital complications were low across sites, despite unfamiliar care settings in patients with pre-operative comorbidities. This finding aligns with existing research that international arthroplasty can be safe when there are standardized perioperative protocols in place along with shared responsibility with local institutions.[3,4,13] Of the complications encountered, hypotension can be managed with fluid resuscitation, blood products, and vasopressor medication, if necessary, though it is important to differentiate the etiology of the hypotension as many patients after TKA may have orthostatic hypotension.[18] The other complication encountered was an MCL avulsion, and in accordance with the literature, we repaired this primarily.[19]

From a pain perspective, the majority of patients only received tramadol, though many likely took over the counter paracetamol (acetaminophen) and NSAIDs such as ibuprofen in addition to home remedies. More potent rescue medications were available on trips but were not utilized unless patients reported intolerable levels of pain, which we defined as above 7 out of 10. This may be secondary to differences in pain reporting across cultures.[16] Rather than relying on the numerical rating scale (NRS) alone as it may be affected by language barrier, patient education, and cultural differences, it is important to use other factors to assess pain such as grimace and vital sign alterations.[17] Volunteer organizations must communicate clearly with the local care providers to ensure that post operative pain is being adequately addressed and coordinate regarding analgesic availability to determine whether volunteers must bring their own supply.

As with all research, several limitations should be acknowledged. Most notably, this study measured only in-hospital outcomes, and the lack of standardized longer-term follow-up means that outcomes such as infection, implant loosening, or functional recovery at 3–12 months were not captured; this likely underestimates the true complication rate and limits our ability to assess how patients ultimately fared after each trip. Additional limitations common to medical outreach trips include the retrospective design and heterogeneous documentation across sites. Selection bias may also exist due to pre-trip screening by local providers and on-site surgical selection that occurs after the pre-operative clinic on the first day. Comorbidities were by patient report, as many patients

did not have available hospital records, and therefore may have been under-reported; similarly, there was no quantification of comorbidity severity (i.e., no available glycosylated hemoglobin [A1C] level for patients with diabetes). Lastly, operative times may be affected by changes in team personnel and resources available at the host country, rather than true site-level differences.

CONCLUSION

This multi-country analysis of WOGO outreach trips performing TKAs found that, despite meaningful differences in patient demographics and deformity patterns across sites, higher-constraint implants were rarely needed at any site (condylar constrained components in under 5% of cases at every trip) and in-hospital complications remained consistently low. This suggests that standard implant sets and protocols can reliably meet patient needs across diverse international settings. The observed variation nonetheless underscores the value of anticipatory planning for analgesia, rehabilitation pathways, and follow-up tailored to each host hospital and country. These results indicate that standardized perioperative protocols can be safely adapted in LMIC when paired with strong local partnerships to provide safe, effective global arthroplasty care.

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Conflict of interest: None declared
Ethics approval and informed consent: This study was approved by the Institutional Review Board (STU-2025-2119). As a retrospective chart review, the requirement for individual patient informed consent was waived by the IRB

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