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Original research

Most Military Arthroplasty Surgeons Have a Low Volume Practice in the Military Health System

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ABSTRACT

Background: The purpose of this study is to investigate hospital and surgeon joint arthroplasty volume in the Military Health System (MHS). A secondary aim is to look at interruption in physician practice during the study period.

Methods: Review of all patients undergoing hip or knee arthroplasty in the MHS over >5-year period to examine hospital and surgeon volume for total joint arthroplasty (TJA). We stratified hospital and surgeon volume into low, medium, and high volumes.

Results: Fifty surgeons performed at least 50 hip and/or knee arthroplasties during this period. These surgeons accounted for 75% of TJA in the MHS. When stratified by cases per year, the median primary total hip arthroplasty (THA) per year was 31.4 and primary total knee arthroplasty (TKA) was 47.3 per year. Regarding the volume threshold for primary and revision TJA, all hospitals were classified as having low volumes for both THA and unicompartmental knee arthroplasty/TKA. There were 0 high volume, 7 (21.9%) medium volume, and 25 (78.1%) low volume THA surgeons; there was 1 high volume TKA surgeon, 17 (34.7%) medium volume, and 31 (63.3%) low volume TKA surgeons. The average duration of clinical activity for fellowship-trained surgeons over the study period was 4.0 years, and the average duration of clinical inactivity was 263.7 days (17.9% of practice period).

Conclusions: The highest-volume military arthroplasty surgeons have low volume when compared to their civilian colleagues. There are also long periods of clinical practice interruption. These findings stress the need to establish civilian-DOD or DOD-VA working relationships so that MHS patients experience the best possible care by high-volume surgeons in high-volume surgical centers.

Introduction

Multiple studies have shown a direct correlation between higher hospital and surgeon procedure volume with a lower complication and mortality risk after hip and knee arthroplasty surgery [1–6]. Despite being a large hospital system, these low-volume concerns extend to the Military Health System (MHS) and its surgeons [7–9]. The MHS serves approximately 9.5 million active duty, reserve component, and retired US military personnel and their dependents. Although military service members and retirees may be especially prone to primary and secondary hip and knee osteoarthritis [10,11], previous studies have shown that patients eligible for care at MHS facilities are in fact more likely to receive hip and knee arthroplasty from a civilian surgeon rather than military surgeon [12].

In addition to resource and volume constraints at military hospitals, military surgeons' deployments also decrease surgical volume and patients' access to care at military medical facilities. This lack of clinical time and surgical volume has led to low surgeon morale and decreased retention rates. A recent study cited the inability to maintain skills and perform cases as one of the major reasons for early separation from the military for orthopaedic surgeons [13].

The purpose of the present study is to investigate hospital and surgeon total joint arthroplasty (TJA) volume in the MHS. A secondary aim is to look at interruption in physician practice during the study period.

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Material and methods

We conducted a retrospective review utilizing the Military Analysis and Reporting Tool (M2) to search the Military Health System Data Repository for all military beneficiaries (active duty service members, dependents, VA beneficiaries eligible for care in the MHS, and retirees) undergoing hip or knee arthroplasty in the MHS or at approved external resource sharing agreements (ERSA) civilian facilities from January 2017 to August 2022 to examine hospital and surgeon volume for primary and revision total hip arthroplasty (THA) and unicompartmental knee arthroplasty (UKA) or total knee arthroplasty (TKA).

CPT codes of 27438, 27446, and 27447 were utilized to search the system for primary UKA/TKA; codes 27486, 27487, and 27488 for revision TKA; codes 27130, 27132 for primary THA; and codes 27134, 27137, 27138, 27090, and 27091 for revision THA. We excluded codes 27125 and 27236 for hip hemiarthroplasty in our final evaluation of surgeon and hospital volume.

Individual surgeons were excluded from final analysis if they did not perform at least 50 UKA/TKA and/or 50 primary THA surgeries over the study period, respectively. We stratified hospital surgical TJA volume based on total TJA surgical volume over the study period as well as surgical TJA volume per year. Surgeon volume was based on total TJA volume over the study period and TJA volume per year accounting for time away from practice if no surgeries were performed for at least 30 days. We stratified hospital and surgeon TJA volume into low, medium, and high volume based on total TJA average per year. We also evaluated total TJA revisions by surgeon over the study period and per-year revision TJA volume by surgeon. Surgeons that did not perform at least 50 TJA over the study period were excluded from this revision analysis.

Due to a lack of consensus regarding high and low volume, we used the procedure cutoffs as proposed by Siddiqi et al [14]. Surgeon volume was defined as low = 1 to 48, medium = 49 to 106, and high >106 for THA, and low = 1 to 60, medium = 61 to 129, and high >129 for TKA. Hospital volume was defined by low = 1 to 226, medium = 227 to 423, and high >423 for THA, and low = 1 to 332, medium = 333 to 683, and high >683 for TKA.

To evaluate the impact of deployment, required military training courses, and other interruptions to surgical schedule, pauses in hip and knee arthroplasty procedures were investigated. Any pause in surgical arthroplasty volume greater than or equal to 30 days was noted and characterized as clinically inactive.

Results

During the study period, there were 18,363 hip and knee arthroplasty-related cases performed at MHS or ERSA facilities. When excluding hip hemiarthroplasty (codes 27125 and 27236), there were 17,879 cases performed. Excluding hemiarthroplasty, 347 providers performed at least one hip or knee arthroplasty-related procedure, and 50 surgeons performed at least 50 hip and/or knee arthroplasty procedures over the study period. These higher-volume surgeons accounted for 13,418 procedures (75% of lower extremity arthroplasty in the MHS). Most of these higher-volume surgeons were adult reconstruction or oncology-trained (31/50, 62%). The hospital volume for THA ranged from 1 to 639 cases with 49 hospitals included to include civilian hospitals [13] covered under the ERSA. Hospital volume for TKA ranged from 1 to 1208 with 60 hospitals included to include 16 civilian hospitals covered under an ERSA. The highest hospital volume of THA per year was 109.5 cases, and the highest hospital volume per year of TKA cases was 207.1 (Fig. 1).

Surgical TKA cases at ERSA hospitals accounted for only 573 (4.9% of total TKA cases) cases and ranged from 1 to 141 procedures over the study period. The highest-volume ERSA hospital for TKA ranked 20th in volume compared to other MHS facilities. Surgical THA cases at ERSA hospitals were similarly low, with only 272 total THA cases (5.11% of all THA cases) and ranged from 1 to 77 procedures over the study period. The best-performing ERSA facility was the 18th highest-volume facility for THA cases. Only one high-volume ERSA facility substantially increased 2 surgeons' surgical volume (>10 facility THA/year, >15 facility TKA/year).

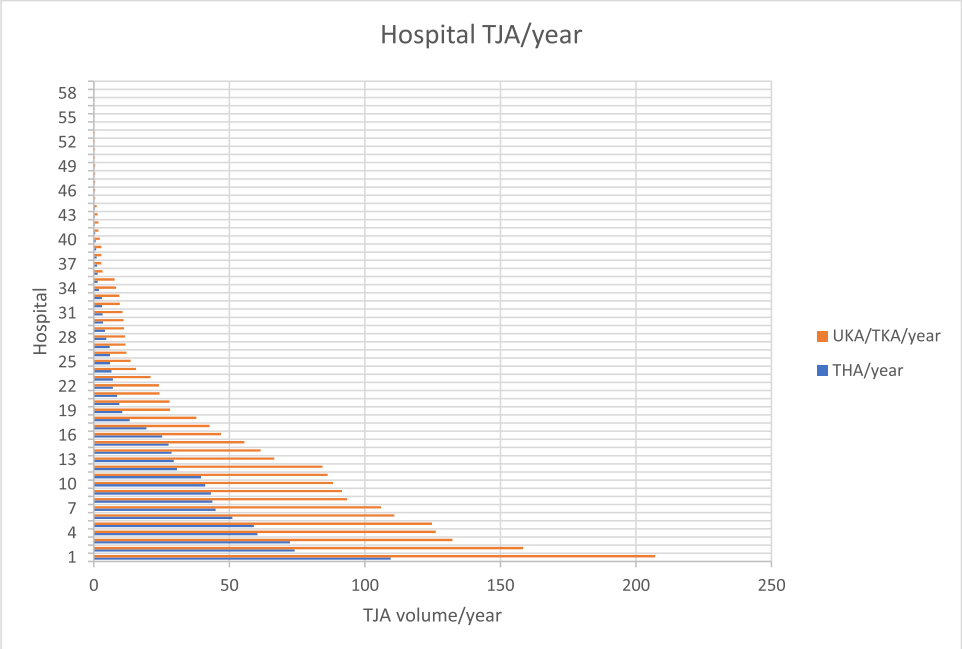

Figure 1. Hospital total joint arthroplasty per year. TJA, total joint arthroplasty.

The individual surgeon volume (with a minimum of 50 UKA/TKA and/or THA) ranged from 50 to 370 primary THA and 50 to 550 primary UKA/TKA cases over the study period. When stratified by cases per year by surgeon, the median primary THA per year was 31.4 and primary TKA was 47.3 per year.

When defining volume threshold for combined primary and revision UKA/TKA or THA, all hospitals were classified as low volume for both THA and UKA/TKA (Fig. 2, Table 1). When defining surgeons' volume as low, medium, or high, there were 0 high volume, 7 (21.9%) medium volume, and 25 (78.1%) low volume THA surgeons (primary and revision); there was 1 high volume TKA surgeon, 17 (34.7%) medium volume, and 31 (63.3%) low volume TKA surgeons (primary and revision).

All medium-volume THA surgeons were fellowship-trained in arthroplasty; 6 of 25 low-volume THA surgeons were not fellowship-trained in either arthroplasty or oncology at the time of the study. Similarly, all high and nearly all medium volume TKA surgeons (16 of 17) were fellowship-trained in arthroplasty, while 16 of 31 low volume surgeons were not fellowship-trained in either arthroplasty or oncology at the time of this study.

There were a total of 1417 TKA revisions and 506 revisions of THA over the study period. Forty-seven surgeons performed at least one TKA revision surgery over this period. Thirty-one surgeons performed at least one revision THA surgery over the study period. The number of revision TKA per "higher-volume" MHS arthroplasty surgeon during the study period ranged from 0 to 153 with a median of 25 revision TKA during the study period and only 7.9 revision TKA per year. The number of revision THA per surgeon during the study period ranged from 0 to 48 with a median of 14 revision THA during the study period and only 4.7 revision THA per year (Table 2).

The average duration of clinical activity for "high-volume" surgeons over the study period was 2.9 years. There were only six surgeons (12%) with no time away from practice. After excluding these surgeons, the mean time in practice for remaining surgeons was 1407.9 days. The mean total time away from practice was 287.9 days, which accounted for 20.4% of total time in practice. The mean number of periods away from practice (greater than 30 days) was 2.5 time periods with an average of 117.6 days away per period of absence. Looking specifically at fellowship-trained surgeons, mean time in practice was 1463.7 days, and mean total time away from practice was 263.7 days which accounted for 17.9% of total practice time. The mean number of periods away from practice (>30 days) was 2.3 time periods with the average period of time away from clinical practice of 122.2 days (Table 3).

Table 1
Surgeon and hospital volume classification by procedure types.

Surgeon and hospital classification	UKA/TKA surgeon	THA surgeon	UKA/TKA hospital	THA hospital
High volume	1 (2.0%)	0	0	0
Medium volume	17 (34.7%)	7 (21.9%)	0	0
Low volume	31 (63.3%)	25 (78.1%)	49 (100%)	49 (100%)

Discussion

The majority (75%) of hip and knee arthroplasty in the MHS was performed by 50 surgeons, and 62% of these surgeons were fellowship trained. However, most surgeons doing lower extremity arthroplasty in the MHS (297 of 347, 85.6%) did not perform more than 50 THA or UKA/TKA surgeries during this >5-year time period. Even among the "higher-volume" MHS surgeons, most relatively high-volume military arthroplasty surgeons are low volume (75.1% THA, 63.3% UKA/TKA) when compared to their civilian colleagues. Unsurprisingly, most military surgeons are operating exclusively at Department of Defense (DOD) facilities, which are all classified as low volume. Due to the dual role of military surgeons, there were also large periods of clinical inactivity (mean 263.7 days for fellowship-trained surgeons) in which surgeons did not operate for >30 days. This time represents 17.9% of fellowship-trained surgeons' practice. Unfortunately, due to the methodology of this study, we were not able to account for specific reasons for time away from practice, but most were likely deployment-related.

In the literature, there are large discrepancies regarding the definition of low- and high-volume arthroplasty procedures. As stated, we used the criteria established by Siddiqi et al In their study, the authors found low surgeon/low hospital volume to have the greatest association with all-cause revisions, early revision for periprosthetic joint infection, and 90-day mortality after THA and TKA [14]. They also found an increased risk of instability and dislocation after THA. A separate study by D'Apuzzo et al [15]

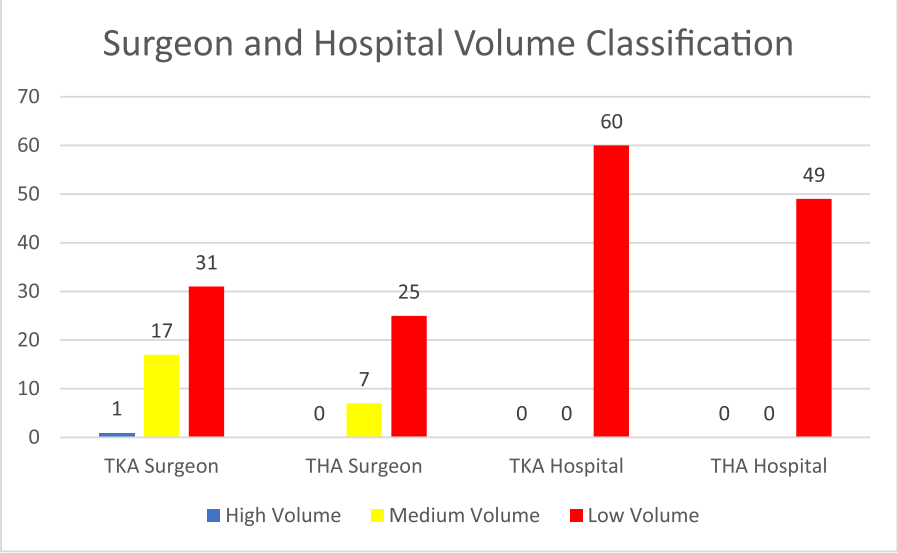

Figure 2. Surgeon and hospital volume classification.

Table 2
Higher volume surgeon primary and revision joint arthroplasty volume.

Surgeon and hospital volume classification by procedure types	Total TJA volume range	Mean total TJA	Median total TJA	TJA/year mean	TJA/year median
UKA/TKA	50-550	157.3	116	50.2	47.3
THA	50-370	122.5	109.5	34.1	31.4
rTKA	0-153	32.6	25	9.7	7.9
rTHA	0-48	16.9	14	5.1	4.7

rTKA, revision TKA; rTHA, revision THA; TJA, total joint arthroplasty.

quantified high-volume facilities as greater or equal to 772 THAs per year and low volume at 30 THAs per year or less. High-volume facilities for TKA were performing greater than or equal to 3218 procedures per year, and low-volume centers were those performing 133 procedures per year or less. These authors found risk-adjusted mortality lower for THA and TKA patients at high-volume centers. Major complications were lower in THA patients but not in TKA patients. Oakley et al [16] utilized the American Joint Replacement Registry and defined low-volume (1 to 42), medium-volume (42 to 96), and high-volume (≥96) surgeons and low-volume (1 to 201), medium-volume (201 to 392), and high-volume (≥392) hospitals for THA. These authors did not find higher surgeon or hospital volume to correlate with higher patient-reported outcome scores following surgery. Hollenbeck et al [17] looked at the National Inpatient Sample for patients undergoing hip or knee arthroplasty and found better patient outcomes, cost, and value as hospital volume increased.

The Defense Health Agency, which runs and oversees all MHS facilities, mandates all military hospitals submit a yearly Leapfrog survey. In turn, the Defense Health Agency uses the survey findings as a guide for credentialing surgeons. The Leapfrog Group publishes individual hospitals' volume numbers for hip and knee arthroplasty and assigns them a quality grade that can be compared to civilian centers. According to Leapfrog, surgeons should be performing >25 and hospitals performing >50 THAs or TKAs a year. Based on our findings, most military surgeons performing lower extremity arthroplasty, including many fellowship-trained surgeons, are low volume according to these procedure thresholds.

The limitations of this paper are inherent in any database study where data is dependent on accurate coding. As mentioned, the cutoffs for high and low volume are arbitrary and vary widely in the literature. Siddiqi et al did not include UKA in their volume thresholds, but our inclusion of this procedure did not appreciably benefit surgical volume in this paper. In addition, we are not able to determine exact reasons for gaps in physician practice, but most military surgeons frequently deploy for 5-6 months at a time, which would coincide with our findings showing a mean of 122 days away from practice per period of absence for arthroplasty surgeons. While this study included the year 2020, in which most facilities experienced COVID-related shutdowns, we noticed large gaps in surgeons' practice unrelated to this period. Our analysis of procedures by year did not see a dramatic drop in procedures in 2020 that would change the findings of this study. Some surgeons did have ERSA agreements with civilian centers, but this did not appreciably increase their surgical volume because work at these civilian centers represents a minority of their block time with only approximately 5% of the total THA or TKA volume performed at ERSA facilities in this study. Due to the nature of a database study and the data available in the Military Health System Data Repository, we were not able to correlate low surgeon volume with increased complication risk though many previous studies have made this association. Many surgeons who performed low levels of lower extremity arthroplasty may have been at teaching facilities with residents doing most of the case. The majority of the high-volume arthroplasty surgeons in the military were fellowship trained in either adult reconstruction or oncology, so it is possible that these surgeons would have better outcomes despite lower surgical volume. Further prospective studies regarding adult reconstruction complication rates in the MHS are needed.

Table 3
Time away from surgical practice among surgeons with >30 days of nonclinical activity.

Military TJA surgeons with time away from practice	
Mean time in practice (days)	1407.9
Mean total days away from practice (days)	287.9
Mean # of periods away from practice	2.5
Mean time away from practice per period of absence	117.6
Fellowship trained surgeons time away from practice	
Mean time in practice (days)	1468.7
Mean total days away from practice (days)	263.7
Mean # of periods away from practice	2.3
Mean time away from practice per period of absence	122.2

Conclusions

These findings show that even the most productive military arthroplasty surgeons are considered low-volume by civilian standards. There is an urgency to increase ERSA utilization and establish civilian-DOD and/or VA-DOD working relationships so that MHS patients experience the best possible care by high-volume surgeons in high-volume surgical centers. This cooperation between hospitals would also undoubtedly benefit military surgeons, who experience significant time away from practice when away from their low-volume hospitals, and perhaps improve surgeon morale and orthopaedic surgeon retention in the MHS.

The views expressed are solely those of the authors and do not reflect the official policy or position of the US Army, US Navy, US Air Force, the DOD, or the US Government.

Conflicts of interest

The authors declare there are no conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2023.101295.

Author contributions

Peter M. Formby contributed to conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, supervision, validation, visualization, writing the original draft, writing the review and editing. Daniel L. Rodkey contributed to conceptualization, data curation, formal analysis, investigation, methodology, software, writing the review, and editing.

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