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Commentary: "The Impact of Surgical Trainee Involvement in Total Knee Arthroplasty: A Systematic Review of Surgical Efficacy, Patient Safety, and Outcomes"

Ryan S. Marder, Neil V. Shah, Aditya V. Maheshwari*

Department of Orthopaedic Surgery and Rehabilitation Medicine, State University of New York (SUNY) Downstate Medical Center, Brooklyn, New York, USA

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***Correspondence:**
*Dr. Aditya V. Maheshwari, MD, MPH, Associate Professor of Orthopaedics, Director Adult Reconstruction and Musculoskeletal Oncology, SUNY Downstate Health Science University, Brooklyn, New York, USA;
Email: Aditya.Maheshwari@downstate.edu

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Surgical trainee involvement in patient care has raised concerns about the risk of potentiating adverse events and increased costs, and has led to patient discomfort and fear[1,2]. Moreover, new bundled-payment systems[3], resident duty-hour restrictions[4,5], and an increased focus on quality measure-based reimbursement[4-6] have magnified the relevancy of the concerns surrounding surgical trainee participation in patient care in the United States (U.S.). However, trainee participation in the operating room is not only essential but remains one of the most crucial aspects for their progression towards becoming the next generation of proficient surgeons. Total knee arthroplasty (TKA) is one of the most commonly performed and protocol-driven orthopaedic surgeries[7,8], and has been identified as a substantial training requirement by both the Accreditation Council for Graduate Medical Education (ACGME) in the U.S. and the Specialty Advisory Committee (SAC) in the United Kingdom for residents and surgical registrars, respectively[9,10]. Based on these factors, TKA procedures have been commonly utilized as models for several quality performance analyses, and can be used to evaluate the impact of trainee involvement in patient care.

Our study[11] highlights and details the current consensus and controversies that remain concerning trainee involvement in TKA in terms of surgical efficacy, patient safety, and functional outcomes. While our study confirmed that more time is spent in the operating room during cases of TKA with trainee involvement, the overall complication rates and functional outcomes were similar. While data concerning the cost of TKA procedures was limited, evidence did point towards an increased total cost in cases performed by teaching services compared to private services. For our present study, conclusions must be tempered due to the inherent heterogeneity that exists within the literature and the many confounding factors at play. The level of trainee experience, the degree of trainee participation, and the amount of senior surgeon supervision/intervention during TKA procedures were inconsistently reported. Moreover, most of these studies are large database studies and have their own intrinsic limitations and biases, and do not have a good control or a matched group for a higher level of evidence.

One possible way to mitigate the above limitations is a single stage bilateral comparative study design with different sides for the senior surgeon and the trainee[12-14]. Although this model provides the most direct comparison by controlling the confounding variables as much as possible, they are limited with their ability to differentiate

other outcomes, like systemic complications and other hospital-based logistics like length of stay, mortality, and total cost, that are independent of the laterality. In addition, preoperative and technical differences between the two sides may exist, creating another bias. In a recent study, where the trainee did the right side first followed by the attending on the left side on most patients, Sheridan et al.[12] found similar tourniquet times and outcomes between the two groups. Similarly, in a study by Goto et al.[13] where the attending first did the knee with a lower functional score, there was no difference in functional and radiographic scores between the two groups, although the trainee took significantly longer to complete the TKA procedure. However, the level of the trainee and the degree of the attending involvement in supervision was not specified in either of these studies.

Our group[14] recently utilized a similar model eliminating some of the earlier biases, and found that the attending surgeon completed his side significantly faster (incision to dressing, 70.2 minutes vs. 96.9 minutes, p<0.001) compared to the chief residents (PGY-5), presenting an opportunity cost of one TKA to the attending and the hospital per three TKAs performed with residents' active participation. These findings should be interpreted with the fact that the residents do play a significant role in several other ancillary workload and save a lot of time and pressure for the attending indirectly. In addition, our study sub-divided the TKA procedure into eight standardized and critical steps, and the "exposure" and "closure" steps were found to be the most time-consuming/time-difference steps of the surgery for the chief resident cohort in comparison to the attending surgeon. By identifying the limiting steps of the TKA procedure, trainees can focus on and practice these techniques in the operating room and simulation models to become more efficient and skilled at completing these steps. This is important as 45% of primary TKA procedures in the U.S. are performed by surgeons who are not fellowship trained, and thus residency training becomes pivotal[15]. Despite these differences in operative timing, functional outcomes 90 days postoperatively (Knee Society Score [KSS] attending vs. resident, 95.6 vs. 91.1; p=0.414), and intraoperative complications (none recorded) and patient laterality preference (attending vs. resident, 14.2% vs. 10.2%; p=0.393) at 1-year follow-up were comparable in our study[14].

Optimizing and enhancing trainee hands-on experience during surgical procedures must be weighed against the potential adverse outcomes that may be associated with such involvement. Although one-third of all orthopaedic procedures performed are completed at teaching hospitals[16], concern among patients, payors, and policymakers has become more relevant in recent years. These concerns are not limited to TKA and are also present during other orthopaedic procedures (e.g., total hip arthroplasty) and in various other surgical subspecialties. Our systematic review[11] and the recent single-staged bilateral TKA analyses[12-14] should help to reassure all those concerned that trainee involvement in TKA is relatively safe. We do emphasize that 'hands-on' training is a necessary investment to create a future skilled workforce and should not be compromised. Future studies should supplement these results and analyze the impact of trainee involvement in various orthopaedic and non-orthopaedic procedures in an effort to enhance patient care and safety.

Conflict of interest

Dr. Maheshwari, Dr. Shah, and Mr. Marder declare that there is no conflict of interest.

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