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Hospital-level Neuraxial Use in Orthopedics: Comment

To the Editor:

In a large retrospective study, Memtsoudis *et al.*¹ demonstrated that patients receiving neuraxial anesthesia for primary hip and knee arthroplasties had lower costs of hospitalization. Presumably, neuraxial anesthesia may provide a clinical benefit (*e.g.*, decreased incidence of deep vein thrombosis, reduced cardiopulmonary complications, reduced opiate consumption, and lower incidence of postoperative delirium) when compared to general anesthesia for total joint replacements. Curiously, none of the clinical outcomes assessed in this study reached a level of significance, leaving three possible explanations for their results: a type II error, an accounting error, or some other downstream clinical benefit not measured in this trial. We believe that the first explanation is unlikely given the size of the study population and the third will require further study. However, the second explanation deserves a closer examination.

Previously, Adam *et al.*² established that variability in costing methods applied raises questions about the validity of study results. Memtsoudis *et al.* extracted all the study data from the Premier Healthcare (Charlotte, North Carolina) database where the data elements associated with costs were dependent on each hospital's accounting methodology. Further complicating the picture is the fact that a smaller number of hospitals submitted charges, which were subsequently converted using Medicare cost-to-charge ratios, for the purposes of the study. Incorporating charge data into costing analysis can be misleading because of the lack of fixed relationship between costs and charges. Although it is possible that the clinical benefits of neuraxial anesthesia extend beyond the intraoperative period, it is unlikely that a reduction in the length of stay or lower anesthesia costs led to the results from the study. Basques *et al.*³ showed no difference in length of stay between general and spinal anesthesia for total hip arthroplasty in more than 20,000 patients included from the American College of Surgeons National Surgical Quality Improvement Program (Chicago, Illinois) database. Even when it comes to anesthesia supply costs for neuraxial *versus* general anesthesia, Wanderer *et al.*⁴ recently argued that intraoperative “savings resulting from interventions focused on the clinical practice of attending anesthesiologists may be negligible.”

Long ago, Macario *et al.*⁵ suggested that “anesthesia practice patterns may influence downstream events in the hospitalization, some of which may have substantial economic impact.” Indeed, Memtsoudis *et al.* build upon the work examining the operative, safety, and patient-centered outcomes for a perioperative surgical home focused on total joint replacements.⁶ By including a cost analysis, however inaccurate, the results show that the preferred anesthetic of choice for primary arthroplasties may be some form of neuraxial anesthesia. Whether or not the administration of spinal and/or epidural anesthesia will result in indelible cost savings will remain a mystery until more rigorous cost accounting is undertaken.

Competing Interests

The authors declare no competing interests.

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Hospital-level Neuraxial Use in Orthopedics: Reply

In Reply:

We welcome the thoughtful comments by Martin *et al.* in reply to our study¹ in which we aimed to assess the relationship between hospital-level neuraxial anesthesia utilization and outcomes. While we included various outcomes, our main finding was related to cost as we demonstrated that increased hospital-level use of neuraxial anesthesia is associated with lower hospitalization cost for lower extremity joint replacements. Martin *et al.* note correctly that almost none of the clinical outcomes under study appear significantly associated with hospital-level use of neuraxial anesthesia, and while they provide three potential mechanisms to be responsible they mainly focus on “an accounting error” as the likely culprit. Indeed, accurate cost data are notoriously hard to come by,² and the authors are right to state that costs captured in the Premier Healthcare (Charlotte, North Carolina) database are dependent on each hospital’s accounting methodology, while a smaller number of hospitals submit charges that then have to be converted using Medicare cost-to-charge ratios. Importantly, however, this is all *independent* of hospital-level neuraxial anesthesia use and thus should not affect the relative effect estimates provided in our study. We therefore respectfully disagree with Martin *et al.* on the role of accounting errors on our study results. To further evaluate the proposed mechanisms mentioned by

Martin *et al.*, we performed a large number of analyses in our study for which we applied multiplicity (Bonferroni) adjustments, which is not without controversy as it results in wider CIs and increases the likelihood of type II errors³; this may have affected our results and thus could have been a potential mechanism behind our findings.¹ Moreover, the complication outcomes included in our study were selected based on strengths of association as well as prevalence of outcomes found in our previously published *individual-level* models.⁴ This is by no means a complete selection of all complication outcomes, and it could very well be that some of the association between hospital-level neuraxial anesthesia use and cost is driven by unmeasured (and more subtle) complications. Finally, it is important to keep in mind that our study focuses on *hospital-level* and not *individual-level* use of neuraxial anesthesia. This crucial distinction may very well imply that hospitals with (a high) neuraxial anesthesia utilization in lower extremity joint arthroplasty are different in other aspects as well, including increased cost-effectiveness levels through other pathways. For example, neuraxial anesthesia is commonly mentioned in enhanced recovery pathways, which have been linked to superior outcomes. Indeed, hospitals with higher volumes of neuraxial anesthesia may therefore be more likely to have adopted these pathways, which could also be one of the drivers of the effects found in the current study.

In summary, we welcome the academic discourse by Martin *et al.*, but have to disagree on their assessment. While we welcome studies that would aim to validate our findings using alternative data sources, we feel that our results are robust, particularly because the association between cost and neuraxial volume persisted across the multitude of analyses performed in our study.

Competing Interests

The authors declare no competing interests.

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