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CORR Insights®: Have the Causes of Revision for Total and Unicompartmental Knee Arthroplasties Changed During the Past Two Decades?

Andrew J. Schoenfeld MD, MSc

Where Are We Now?

Knee arthroplasty remains one of the most successful treatments for patients with knee

This CORR Insights® is a commentary on the article “Have the Causes of Revision for Total and Unicompartmental Knee Arthroplasties Changed During the Past Two Decades?” by Dyrhovden and colleagues available at: DOI: [10.1007/s11999-017-5316-7](https://doi.org/10.1007/s11999-017-5316-7).

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osteoarthritis who originally pursued nonsurgical care [5, 9, 13]. Advances in prosthesis design and surgical safety have increased the number of arthroplasty procedures, with more than 700,000 of these surgeries performed annually in the United States alone [5]—a number expected to rise when considering the aging American demographic [2, 5, 9]. Concomitant with the rise in primary knee joint replacement procedures are burgeoning rates of revision arthroplasty [2, 3, 7, 9]. While approximately 30,000 revision knee arthroplasties are performed per year, this number is expected to increase by a factor of six during the next 10 to 15 years [3, 7, 13].

Revision knee arthroplasty procedures are more expensive, disproportionately consume more resources, carry higher risks of perioperative

morbidity, and generally lead to inferior results compared to primary surgery [2–4, 7, 10, 12]. Orthopaedic surgeons need a better understanding of the factors that can lead to primary knee arthroplasty revision and minimize the likelihood of such events.

In this context, Dyrhovden and colleagues examined 20 years of data from the Norwegian Arthroplasty Registry and reported encouraging news: 10-year survival rates for primary total knee replacement increased from 91% to 94% between the years 1994–2004 and 2005–2015. At the same time, 10-year survival of unicompartmental knee arthroplasty remained static, holding steady at around 80%. One of the most-impressive findings in this paper, however, is the change in the diagnoses associated with the revision procedures that are performed. In the most recent period (2005–2015), revisions precipitated by wear-related changes and aseptic loosening diminished, while infection became a more-prominent indication for repeat surgery.

A. J. Schoenfeld MD, MSc (✉)
Department of Orthopedic Surgery,
Brigham and Women's Hospital and
Harvard Medical School, 75 Francis
Street, Boston, MA 02115, USA
e-mail: ajschoen@neomed.edu

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Where Do We Need to Go?

Database studies such as the work conducted in the Norwegian Arthroplasty Registry provide estimates of changes in clinical practice over time, as well as identifying issues that call for further exploration. But they do not generally unpack the underlying etiologies behind the observed findings. In addition, there is the issue of external validity—generalizability—of these findings from Norway to other countries and other practice settings. For example, the population of Norway is comparable in size to that of Greater Boston, and there may be substantial and clinically important variation in socio-demographic and medical characteristics, as well as indications for surgery, between Norwegian patients and those in other larger and more diverse countries [8].

I frequently share with my patients the notion that degenerative disorders of the musculoskeletal system are best viewed as chronic conditions, akin to diabetes or heart disease. Nonoperative and surgical interventions, including knee arthroplasty, are intended to assist patients in managing the degenerative disease process, and it is misleading to consider them curative. A knee joint prosthesis is best viewed as a machine with a finite life span, similar to an automobile. Now, based on their age, physiology, body habitus, lifestyle

requirements and the technical proficiency of their procedure, some patients may never reach the point at which their primary joint replacement will undergo revision. Others, for a variety of reasons including the development of infection [2–4, 10, 12] may go through a secondary procedure within only a matter of years. Changes in prosthesis design may add a few more proverbial miles to the overall longevity of a prosthetic implant, but these cannot influence the ancillary and possibly more profound impact of infection risk, body habitus, and functional requirements, which are essentially all matters of patient selection. Additionally, they cannot alter issues related to the technical performance of the index procedure [11, 14].

At the end of their paper, Dyrhovden and colleagues issue a call for further improvements in prosthesis design that will enhance survival, but I am not nearly so sanguine about this notion. I believe we are already in the flat of the curve that plots advances in prosthesis design against the clinical improvements those advances might deliver. More-dramatic improvements in the survival of primary knee arthroplasty procedures are likely to result from alterations in patient selection [3, 10, 12], and increases in our understanding of the role that surgical and hospital volume [14] play in influencing implant survival. With

respect to patient selection, the role that increased patient longevity, enhanced physical demands, and chronic medical conditions play in driving revision surgery need to be better understood [3, 9, 10, 12, 13]. At the same time, the influence of individual surgeon and hospital volume on outcomes following joint arthroplasty has only recently been appreciated [14] and should be explored in a more robust way.

The ideal means of reducing the risk of revision arthroplasty derives from a solid understanding of the most-influential causes and the complex intersection of patient characteristics with surgeon- and hospital-level factors. Viewed in this light, calls for further improvements in the mechanical design of knee prostheses and polyethylene wear rates seem somewhat hollow. We may already be looking at the upper limit of what we can expect in terms of implant survival. Further improvements in this arena are likely to exert only a marginal effect, akin to the 3-percentage point improvement over a decade encountered in this Norwegian study.

How Do We Get There?

The orthopaedic community needs to acknowledge that current research does not adequately address such

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patient- and provider-level concerns, and then recognize that such studies may only be complementary to prospective work that is specifically designed to examine those factors responsible for revision arthroplasty procedures.

The ideal investigation would consist of a multicenter, prospective, observational study that could accurately measure patient and provider factors at baseline and then document revision rates over the course of several years if not decades. This might be similar in approach to the observational arm of the Spine Patient Outcomes Research Trial (SPORT) [6] or the Maine Lumbar Spine Study [1]. Of course, given current estimates of the revision rate at 2-years following surgery (2% to 3.3%), a study such as this would have to enroll tens of thousands of patients from surgeons and hospitals across the nation to reach the numbers necessary to detect meaningful differences in important clinical and provider characteristics. Short of this, it is possible that some of the more recent registry initiatives may provide actionable information, predicated on the integrity and clinical granularity of data on patient characteristics, surgeon experience and hospital volume. Were such a study to be performed, however, careful hierarchical analysis that accounted for variation at the patient, surgeon and

hospital level, would be necessary to engender best estimates on the relative influence that each of these facets exert on the risk of revision surgery following knee arthroplasty.

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