The importance of costing perspective: an example evaluating the cost-effectiveness of a locking versus nonlocking plate in medial opening wedge high tibial osteotomy

Codie A. Primeau, MSc, PhD
Jacquelyn D. Marsh, PhD
Trevor B. Birmingham, PhD
J. Robert Giffin, MD, MBA

Accepted July 27, 2018

Correspondence to:
C. Primeau
School of Health and Rehabilitation Sciences
Western University
Rm 1400
London ON N6G 1H1
cprimea@uwo.ca

DOI: 10.1503/cjs.018317

SUMMARY

High tibial osteotomy (HTO) fixation can be achieved using various plate designs. Compared with nonlocking plates, the stability of locking plates allows patients to return to weight-bearing and work sooner and may also decrease postoperative complications, introducing the potential for overall cost savings. However, material costs for locking plates are higher, and the plate bulkiness may lead to additional surgery to remove the plate. We conducted a retrospective study to evaluate the cost-effectiveness of a locking versus a nonlocking plate in HTO from both the health care payer and societal perspectives up to 12 months postoperative. We observed that from a health care payer perspective, the locking plate was not cost-effective. However, the locking plate was cost-effective from the societal perspective (addition of indirect costs, such as time off work). These findings highlight the importance of considering costing perspective in economic evaluations for chronic conditions, particularly in publicly funded health care systems.

The global burden of musculoskeletal (MSK) diseases is substantial and continues to grow as the population ages, posing a heavy economic burden on the Canadian health care system. In osteoarthritis (OA) specifically, there was an estimated $195.2 billion in OA-related costs for Canada in 2010, with indirect costs accounting for 63% of these costs.[1] For OA of the knee, the most commonly affected joint, treatment options include surgical intervention. Medial opening wedge high tibial osteotomy (HTO) is a surgical realignment procedure for patients with medial compartment knee OA and varus malalignment.[4] The procedure aims to correct the malalignment and reduce medial loading in the knee and to slow disease progression. The surgery involves a period of progressive weight-bearing using ambulatory aids (e.g., crutches) and a postoperative rehabilitation protocol.

Adequate fixation of the osteotomy with a plate is important for bone healing and progression in weight-bearing status. HTO plates can be categorized as locking and nonlocking. Locking plates have been shown to provide greater mechanical stability than nonlocking plates,[5] resulting in an earlier return to weight-bearing, earlier return to work and activities, and fewer postoperative complications that introduce further surgical costs (e.g., nonunion).[3,4] Using a locking plate for HTO, therefore, has the potential for direct and indirect cost savings. However, the raw cost for locking plates is more expensive because of their larger size and the greater number of screws used for fixation. Furthermore, the bulkiness of locking plates can cause irritation and may lead to surgical removal of the plate. Given these implications, it is unknown whether the higher direct costs of the locking plate are offset by a reduction in indirect costs. The cost-effectiveness of a locking plate may depend on the cost perspective included in the analysis.

To test this hypothesis, we retrospectively reviewed the cases of patients who underwent a medial opening wedge HTO with a locking plate versus a nonlocking plate and evaluated the cost-effectiveness from the health care payer (Ontario Ministry of Health and Long-Term Care) and societal perspectives at 12 months following surgery. A description of our methods and results are reported in Appendix 1, available at canjsurg.ca/018317-a1.

Our cost-effectiveness analysis showed that from the health care payer perspective, the use of a locking plate in HTO is unlikely to be cost-effective. The health care payer perspective includes any direct costs (e.g., surgery, staffing, imaging) to the public payer. However, from a societal perspective, the locking plate is highly likely to be cost-effective, highlighting the importance of costing perspective in economic evaluations. The societal perspective includes both direct and indirect costs (e.g., time off work).

Although patient-reported outcomes (Knee injury and Osteoarthritis Outcome Scores [KOOS]) slightly favoured the locking plate, the difference was not statistically significant, suggesting that the cost-effectiveness is highly driven by cost differences. We found that the surgical and postoperative complication costs were similar between groups. Therefore, the difference in direct cost between interventions (+$665 for the locking plate) is reflected in the difference in plate and screw costs.

The incremental cost-effectiveness ratio (ICER) value for the health care payer perspective was +$399.41 per 1 additional point improvement in the KOOS total change score, suggesting that the public payer must be willing to pay $4000 more per patient to achieve a clinically important improvement in KOOS (i.e., 10-point improvement) to use the locking plate. This was further supported by net benefit regression (NBR) and cost-effectiveness

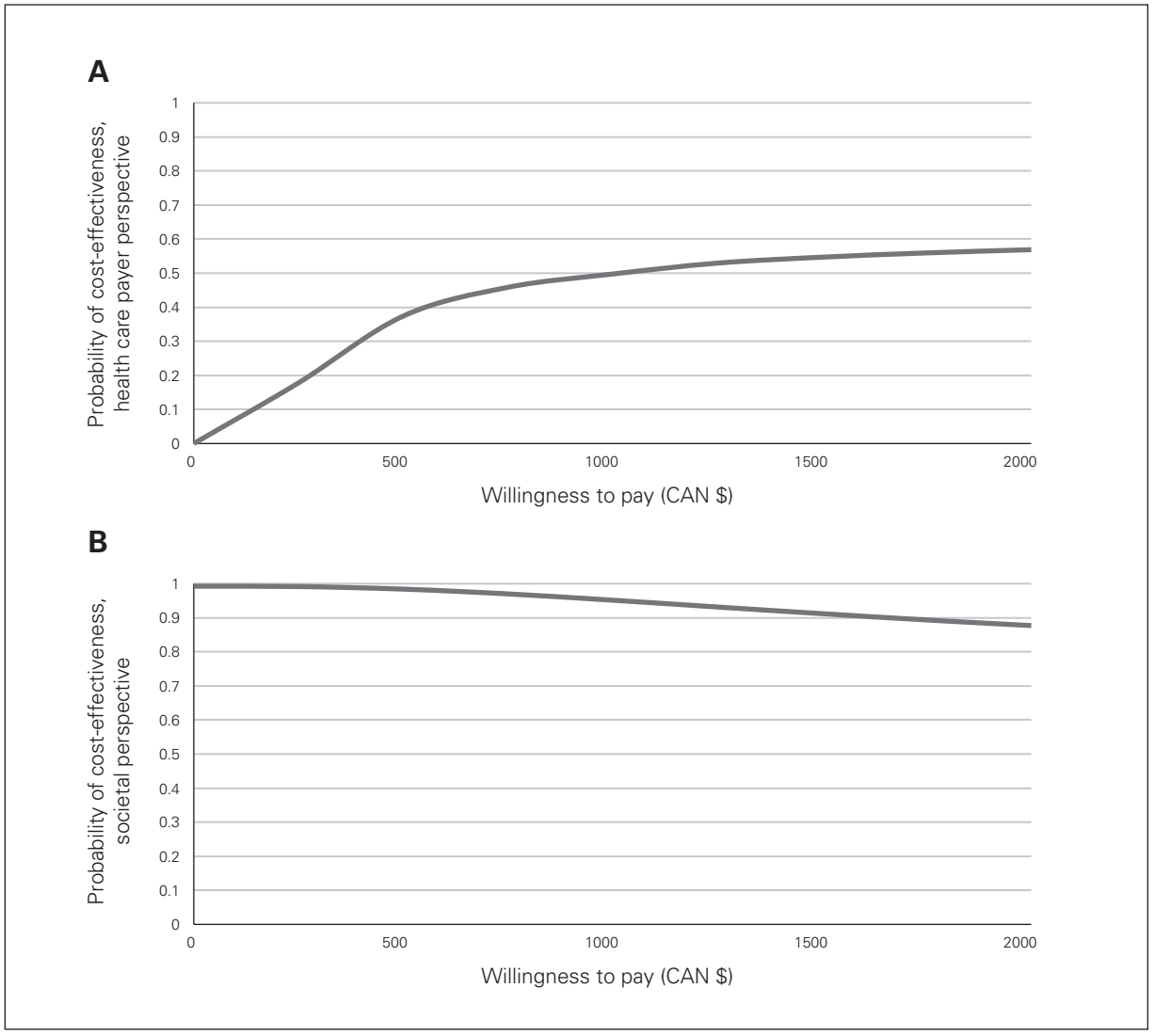

Fig. 1. (A) From the health care payer perspective, the probability that the locking plate is cost-effective did not exceed 55% at a willingness to pay (WTP) of $1000 or greater. (B) From the societal perspective, the locking plate was cost-effective with 99% certainty, regardless of WTP.

acceptability curve (CEAC) results, which showed the probability that the locking plate is cost-effective does not exceed 55% at a willingness to pay (WTP) of $1000 (Fig. 1A). Therefore, from a health care payer perspective, which looks strictly at direct costs to the public payer, the locking plate is likely not cost-effective.

Alternatively, we found that by incorporating indirect costs (e.g., time off work) to evaluate from a societal perspective, the locking plate is cost-effective. The difference in societal costs between treatment groups favoured the locking plate, with $6228.21 cost savings at 12 months following HTO. Additionally, the NBR and CEAC indicated that the locking plate was cost-effective with 99% certainty, regardless of WTP (Fig. 1B). The cost difference is largely attributable to a sooner return to work and activities for patients receiving the locking plate.

An institutional decision-maker examining our results may opt to use the nonlocking plate owing to lower system costs; however, considering solely the direct costs could substantially undermine the true societal benefit of using the locking plate. The rehabilitation period after HTO involves altered weight-bearing (i.e., crutch ambulation) that can continue several weeks after surgery. Consequently, most patients are required to take time off work and are limited in daily activities for extended periods of time, which can generate large losses in productivity for society, particularly for young patients (around 45 years of age) who are members of the working population. These are vital aspects to consider when assessing cost-effectiveness in this population.

In economic analyses for OA, much attention is given to the direct health care costs. Indeed, these costs are important to consider when comparing surgical interventions. However, this paper emphasizes that inclusion of indirect costs is arguably more important. An estimated 80% of the overall annual costs for OA result from time lost from work and leisure by both participants and unpaid caregivers.[2] In Canada, 1 in 8 workers has OA, and this number is projected to grow to 1 in 3 workers over the next few years.[1] Similar trends are seen in other chronic MSK conditions (e.g., rheumatoid arthritis) that lead to disability and for interventions, such as elective orthopedic interventions, that involve an extended recovery period that limits patient activity. As the rate of MSK diseases continues to increase along with its economic burden, it is essential to identify interventions that are cost-effective. Importantly, our results show that the conclusions regarding the value of interventions are likely to change depending on the perspective of the analysis. These findings highlight the importance for consideration of costing perspective in economic evaluations for chronic conditions, particularly in publicly funded health care systems.

Affiliations: From the Faculty of Health Sciences, Western University, London, Ont. (Primeau, Marsh, Birmingham); the School of Kinesiology, Western University, London, Ont. (Primeau); the School of Physical Therapy, Western University, London, Ont. (Marsh, Birmingham); the Schulich School of Medicine & Dentistry, Western University, London, Ont. (Giffin); the Wolf Orthopaedic Biomechanics Laboratory, Western University, London, Ont. (Primeau, Birmingham, Giffin); the Fowler Kennedy Sport Medicine Clinic, London, Ont. (Primeau, Birmingham, Giffin); and the Bone and Joint Institute, Western University, London, Ont. (Primeau, Marsh, Birmingham, Giffin).

Competing interests: None declared.

Contributors: All authors contributed substantially to the conception, writing and revision of this article and approved the final version for publication.

References

1. Bombardier C, Hawker G, Mosher D. The impact of arthritis in Canada: today and over the next 30 years. Arthritis Alliance of Canada; 2016.
2. Gupta S, Hawker GA, Laporte A, et al. The economic burden of disabling hip and knee osteoarthritis (OA) from the perspective of individuals living with this condition. *Rheumatology* 2005;44:1531-7.
3. Jung WH, Chun CW, Lee JH, et al. Comparative study of medial opening-wedge high tibial osteotomy using 2 different implants. *Arthroscopy* 2013;29:1063-71.
4. McNamara I, Birmingham TB, Fowler PJ, et al. High tibial osteotomy: evolution of research and clinical applications — a Canadian experience. *Knee Surg Sports Traumatol Arthrosc* 2013;21:23-31.
5. Pape D, Kohn D, van Giffen N, et al. Differences in fixation stability between spacer plate and plate fixator following high tibial osteotomy. *Knee Surg Sports Traumatol Arthrosc* 2013;21:82-9.