Authors have nothing to disclose with regard to commercial support.

cerclage control group was individual surgeon discretion qualified only as a minimum of 6 wires. On review of the article, I could not find any quantification of the average number of wires used. Kamiya and colleagues² demonstrated that use of fewer than 8 wires in high-risk patients was associated with an increased incidence of sternal complications.

Allen and colleagues¹ suggest that despite the increased cost of the rigid fixation plates, 6-month costs were no different. Unfortunately, although costs to the global health system may be no different, the initial cost to hospitals will be. If, as is the norm, most patients received only 6 wires, then this article is only a comparison of a more costly sternal closure method to a method shown to be inferior to other closure techniques.

Because this article will be used by a manufacturer to promote this product, it is important that appropriate comparisons be made. Whereas use of 6 wires is inferior, is use of 8, 9, or 10 wires equivalent (and less expensive)? As presented we cannot use this article to guide this decision.

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References

1. Allen KB, Thourani VH, Naka Y, Grubb KJ, Grehan J, Patel N, et al. Randomized, multicenter trial comparing sternotomy closure with rigid plate fixation to wire cerclage. *J Thorac Cardiovasc Surg*. 2017;153:888-96.
2. Kamiya H, Al-Maisary SSA, Akhyari P, Ruhparwar A, Kallenbach K, Lichtenberg A, et al. The number of wires for sternal closure has a significant influence on sternal complications in high-risk patients. *Interact Cardiovasc Thorac Surg*. 2012;15:665-70.

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THE RIGHT WIRING CONFIGURATION FOR STERNAL CLOSURE: SCIENCE OR MYTHOLOGY?

Reply to the Editor:

We appreciate Savage's interest in our multicenter, single-blind, prospective, randomized trial comparing rigid plate fixation with traditional wire cerclage after median sternotomy.¹ Despite Savage's contention, there is currently *no* established standard method for wire

closure after median sternotomy, and in fact most surgeons passionately tout or teach their wiring configuration as the "correct" closure technique. In light of this, our study represented a real-world scenario in which we left the sternal closure technique in the control group to institutional or surgeon preference, with the sole proviso that a minimum of 6 wires be used.

In the retrospective, nonrandomized study referenced by Savage, Kamiya and colleagues² *actually* reported that the number of wires had *no* influence on sternal complications in the entire patient cohort, which had similar demographic characteristics to the control group in our study. In a subgroup analysis, Kamiya and colleagues² did report that for certain high-risk patients the use of 7 or more wires was associated with a decreased incidence of sternal complications and that for patients with diabetes mellitus the use of 8 or more wires was associated with the decreased incidence of sternal complications. We are pleased to update our article and assuage Savage's concerns that not enough wires were used in our control arm by reporting that the mean number of wires used in our control arm was 7.7 ± 0.8 . In fact, 6 wires were used in only 3.3% (4/120) of the control patients, and no sternal complications occurred in any patient with 6 wires. In addition, the use of more sternal wires did not correlate with better sternal healing. As reported, the only correlate with better sternal healing was the use of rigid plate fixation. These findings, along with many published mechanical studies that demonstrate that wires are inferior to rigid plate fixation, explain why *all* specialties, other than cardiac surgeons, that manage osteotomies or fractures have abandoned wires in favor of rigid plate fixation. Overall, we believe that our control group is representative of real-world, current clinical practice and is therefore appropriate.

Savage's concerns about the initial cost of rigid plate fixation for the hospital are misplaced. The primary concern should be improving patient outcomes for longer than the index admission while remaining cost neutral. This was an important aspect that was demonstrated by our randomized trial. The era of rewarding providers for complications that occur after the index admission/30 days is waning. Although bundled care is currently in flux, payors will increasingly demand that providers be responsible for costs of follow-up care, readmissions, and reoperations after discharge. In our study, 50% (3/6) of the sternal complications occurred after 30 days. Technologies such as rigid plate fixation that improve clinical outcomes without increasing total costs will become dominant in this new environment. We look forward to seeing prospective, randomized, controlled trial data on the clinical and economic benefits of other sternal closure technologies, including the

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method recently developed by Savage's colleagues at the Cleveland Clinic.³

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References

1. Allen KB, Thourani V, Naka Y, Grubb KJ, Grehan J, Patel N, et al. Sternal closure using rigid plate fixation versus conventional wire cerclage: results from a prospective, randomized multi-center study. *J Thorac Cardiovasc Surg.* 2017;153:888-96.
2. Kamiya H, Al-maisary SS, Akhyari P, Ruhparwar A, Kallenbach K, Lichtenberg A, et al. The number of wires for sternal closure has a significant influence on sternal complications in high-risk patients. *Interact Cardiovasc Thorac Surg.* 2012;15:665-70.
3. Cleveland Clinic. Consult QD: at last a better way for postoperative sternal closure (video)—the rationale and benefits of a new rigid sternal closure device. September 10, 2015. Available at: <https://consultqd.clevelandclinic.org/2015/09/at-last-a-better-way-for-postoperative-sternal-closure-video/>. Accessed August 15, 2017.

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IS MORE ALWAYS BETTER IN STERNAL CLOSURE?

Reply to the Editor:

Wire cerclage remains the most common method of sternal closure. The literature describes different configurations for sternal closures with wires.¹ Savage highlights an important question regarding the randomized clinical trial in which Allen and colleagues² compared rigid plate fixation with wire cerclage.² The question posed by Savage is fundamental in the evaluation of novel technologies for adoption in health care systems. The foundation of all economic evaluations requires that the new intervention be compared with the appropriate standard of care.

In the study by Allen and colleagues,² surgeon discretion dictated how many wires were placed, with the minimum being 6. This is a pragmatic approach to

conducting a clinical trial and allows generalizability of findings of this study. Savage, however, purports that at least 8 wires are required in high-risk patients according to findings from a previous retrospective observational analysis of 4466 patients undergoing cardiac surgery.³ This study found that in selected high-risk groups, sternal complications were lower in patients who received at least 7 or at least 8 wires relative to those who received less than 7 or 8 wires, respectively. There was no difference between those who received more or less than 9 wires. The results from this study were interesting. Patients with diabetes (as a lone risk factor) who received 8 or more wires had fewer sternal complications than those who received less than 8 wires. When patients with diabetes and an additional risk factor (chronic obstructive pulmonary disease or renal failure) were compared with less than 8 or 8 or more wires, however, there was no difference in sternal complications between the groups. Patients with very high risk features were excluded from the study of Allen and colleagues.² In a prospective study by Schimmer and associates⁴ comparing conventional wire cerclage (≥ 6 wires) with the Robicsek method (ie, additional lateral reinforcement in addition to standard wire cerclage closure) in high-risk patients (those with at least 1 risk factor for sternal complication), there was no difference in sternal complication rates between the treatment arms. In a retrospective cost-comparison study by Park and colleagues⁵ of 75 high-risk patients who received either rigid plate fixation or a modified wire technique (either Robicsek or wire cerclage in figures-of-eight), crude rates of sternal complications were higher in the wire cerclage group than in the plating group. The optimal number of wires and the optimal technique used for closure, even in high-risk patients, thus remain uncertain and controversial.

Savage brings up an important point regarding the conduct of economic evaluations, from which perspective costs should be measured and compared. In the analysis of Allen and colleagues² analysis, they compared hospital costs at discharge and at 6 months. Savage highlights that the high acquisition costs of plates are an immediate burden to hospitals, whereas the overall health care system may reap the potential benefits in longer term cost savings through reduction in readmission events. Choosing the correct perspective (hospital vs third-party payer, eg, Medicare) is important; in an era in which institutions are reimbursed in a bundled payment scheme, hospital budgets are no longer “siloes” between departments. Most health technology assessment guidelines would recommend the perspective of the third-party payer (often the public payer), and this would represent the total costs to the entire health care system.⁶ To address the topic of cost-effectiveness fully, a cost-utility analysis incorporating both differences