ECONOMIC BENEFITS OF ULTRASONIC DEVICES IN THYROIDECTOMY

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Introduction
The use of ultrasonic devices in thyroidectomy may have significant economic impact due to improved efficiency and benefits of clinical outcomes without increasing rates of surgical complications.

To fully characterize the potential economic benefit of ultrasonic devices in thyroidectomy, the objective of this study was to develop a provider cost impact model to quantify potential cost savings over conventional surgical techniques. The overall objective was to determine the per-patient cost differential between use of ultrasonic devices and conventional approaches in thyroidectomy.

Methods
A cost impact model was developed from the perspective of a US hospital, comparing the use of ultrasonic devices to the use of conventional techniques in patients undergoing thyroidectomy. Cost impact is reported on a per-patient basis.

Clinical parameters were derived from published literature, including a meta-analysis of 26 studies, and focused on the differences between ultrasonic and conventional surgical approaches across four major areas, specifically 1) operating time, 2) hospital stay (duration of recovery time), 3) risks of complications such as surgical site infection (SSI), and 4) consumables. A list of parameters and associated unit costs included in the model is shown in Table 1.

- Costs of care were obtained from published commercial and Medicare fee schedules, and other costs and risks relating to thyroidectomy were obtained from published literature. Cost of OR time and hospital stay were attributed to blood loss, facilities and time of staff
- The risk of SSI was reported only for conventional surgery, as a result the computed probability of SSI associated with the use of ultrasonic devices was based on the assumption that the risk of SSI was linearly correlated with OR time.
- Anesthesia charges are calculated as follows: (Base units * time units + modifying units) * Conversion factor = Anesthesia charge. This charge was then multiplied by the charge-to-cost conversion ratio of 0.3 to determine the final cost of anesthesia. Anesthesia units are defined as 15-minute increments. For the purposes of these calculations, anesthesia durations are assumed to be identical to operating time. Thyroidectomy incurs 5 base units as determined by CPT code 00610, and no modifying units are added. 6

All costs were inflated to 2013 US dollars using the medical care component of the consumer price index.

Results
The analyses are presented in Figure 1.

Use of ultrasonic devices demonstrated significant clinical and economic advantages compared to conventional surgery. Specifically, compared to $10,719 procedure cost of conventional surgery, use of ultrasonic devices resulted in procedure costs of $9,395, resulting in 12% cost savings of $1,323 per procedure.

Discussion
Ultrasonic devices have been shown to significantly reduce the volume of blood loss in thyroidectomy, with surgeons noting that the reduced blood loss resulted in a clearer view of the surgical site and led to reduced operating time. In addition, patients have shown a reduced need for time in post-operative care. These two benefits were borne out in the model; of the six cost drivers of budget impact relating to ultrasound, the majority of costs were found in the SSI category, and other ultrasonic devices, and other ultrasonic consuming smaller components to the whole. Although the ultrasonic device is more expensive than a conventional scalpel, the up-front cost is offset by savings in operating time and post-operative care.

This study has some limitations due to data availability. No study directly reported the duration of anesthesia time during thyroidectomy, and although it is understood that patients remain under anesthesia for a duration longer than that of the operation, the lack of a verified figure led to the assumption of anesthesia time being equal to operating time. In addition, probability of SSI was linked with OR time due to lack of data on ultrasonic devices and their impact on risk of SSI. Further research is needed to determine the impact of ultrasonic surgery on other side effects associated with operating time such as venous thromboembolism, as well as possible impacts of shorter time procedures on provider practices.

Conclusion
The clinical benefits of ultrasonic devices in thyroidectomy can be translated into economic benefits for providers in the US. Research opportunities exist in determining additional downstream impacts of the use of ultrasonic devices in thyroidectomy practice and surgical provider management.

References