

A cost-utility analysis comparing the total cost of reusable duodenoscopes to single-use duodenoscopes

Helena Strømstad Travis¹, Sara Larsen², Rasmus Vinther Russell², Lars Holger Ehlers³

¹School of Medicine and Health, Aalborg University, Aalborg, Denmark

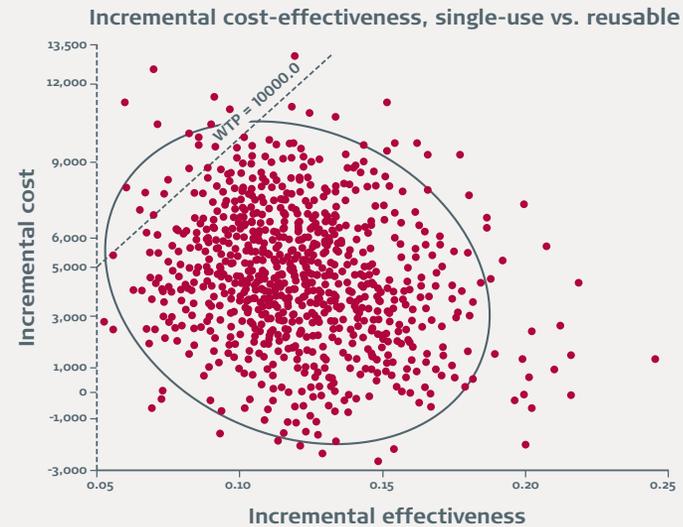
²Ambu A/S, Ballerup, Denmark

³Department of Business and Management, Danish Center for Healthcare Improvements, Aalborg University, Aalborg, Denmark

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Objective

In the USA more than 500,000 endoscopic retrograde cholangiopancreatographies (ERCPs) are performed annually¹. Multiple studies have shown that contaminated duodenoscopes can lead to infection with multi-drug resistant organisms (MDROs)². This will likely cause a decrease in the patients' quality of life (QoL) and may lead to additional healthcare cost. Currently, ERCP procedures is most often performed using reusable duodenoscopes; nevertheless, cleaning of reusable duodenoscopes is difficult due to complex design compositions, and single-use equipment have been proposed as an alternative and safer technology for ERCPs^{3,4}. The aim of this study was to investigate the expected incremental costs and consequences of reusable versus single-use duodenoscopes.



Results:

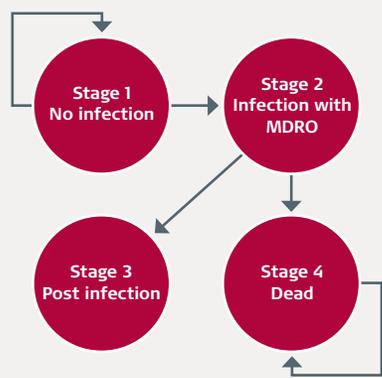
Base-case results illustrate an additional cost of \$38,591 per QALY. Thus, the single-use duodenoscope is cost-effective at a willingness-to-pay (WTP) at \$50,000-\$150,000 per QALY using an estimated cost at \$1,500 per single-use duodenoscope^{9,10}. The endoscopy-related infection risk was estimated at 1.11% based on available literature. The endoscope-related infection risk was used as the transition probability between no infection and infection in the Markov model. The weighted per-procedure cost for a reusable duodenoscope was \$423 (range: \$239 - \$3,659) and the cost for treatment of an infection with MDRO is \$47,181. For single-use duodenoscope a 0% endoscope-related infection risk was assumed. The QoL from the literature review are stated as 0.8810 for no infection, 0.275 for infection, 0.639 for post-infection, and 0 for dead.

Conclusion

We found that single-use duodenoscopes are cost-effective at a WTP \$50,000-\$150,000 per QALY. To support and validate the findings of this study more evidence is needed to confirm the endoscope-related infection risk and the subsequent effects on the patients' QoL.

Methods

A decision analytic (Markov) model was designed in TreeAge Pro with the following stages; no infection, infection, post infection, and dead⁵. A 10-year cycle was applied based on the assumption that either all patients are healthy or dead within the time horizon. Two systematic literature reviews were conducted in PubMed and Embase from January 2010 to March 2020, to identify studies assessing quality-adjusted life years (QALYs), contamination, and infection data. QALY data included a baseline and a 12-months follow-up. Contamination data were based on the rate of contaminated duodenoscopes (positive samples) and infection data contained number of duodenoscope-related infections following ERCP. The endoscope-related infection risk was calculated in using R Studio[®] and the *metafor* package using a random effects model. Cost data were collected from seven US endoscopy units using micro-costing method. Capital cost were annuitized using a 3.5% discount rate⁶. All costs are presented as 2019 prices in USD⁷. The cost for using a reusable duodenoscope was calculated as a weighted average based on procedure volume. The cost of treating an MDROs was obtained from HCUPnet using relevant ICD-10 codes⁸.



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