EE401

Return on Investment and Waste Considerations for the Implementation of Rechargeable Batteries in Video Laryngoscopes

D. Brandt[1], M. Blüher[2], R. Saunders[2]

[1]Medtronic, Boulder, CO, USA, [2]Coreva Scientific GmbH & Co KG, Königswinter, NRW, Germany

BACKGROUND

- The operating room (OR) generates about 1/3rd of total hospital waste and interventions to reduce the environmental impact of the OR have been shown to have the potential to achieve cost savings in the long run.[1]
- Of particular interest are batteries used in medical devices, which contain hazardous metals and require special disposal or recycling.[2]
- Here, the return on investment (ROI) for adopting rechargeable instead of single-use batteries for video laryngoscopes (VL) in ORs is assessed from the US hospital perspective.

METHODS

- A model was developed in Excel to estimate the ROI of a rechargeable battery for a hospital with 8 operation rooms performing 50,000 intubations per year, 75% using VL, with a mean 3-minute run time per intubation.
- Cost of disposing of single-use batteries is often higher than that of rechargeable batteries. Recycling single-use batteries is not always readily available, and many end up in landfills. The cost was set to be $1 for rechargeable batteries and $6 for single use batteries. The assumption was informed by commercial disposable cost in the Boulder County, CO, USA with $0.13 ($0.23 with surcharge) cost for the disposal of rechargeable lithium-ion batteries vs. $3.38 ($6.08 with surcharge) for lithium single-use batteries.[2]
- Initial cost of one charger per OR was considered.
- The electricity cost to charge the battery was not considered.
- The model estimated outcomes for a ten-year time horizon.
- Cost are in 2024 USD.

TABLE 1: Key Model Inputs

Variable	Base Case Single-Use	Base Case Rechargeable
Battery Cost/unit	Reusable batteries are assumed to be ~10 times the cost of single-use batteries per unit	
Battery Lifetime	250 minutes	10,000 minutes
Battery Disposal Cost[2]	$6	$1
Battery Charging Station	NA	1 charger per OR
Battery Weight	30g	30g

REFERENCES

1. Gwyneth A. Sullivan, Audra J. Reiter, Andrew Hu, Charesa Smith, Katelyn Storton, Brian C. Gulack, Ami N. Shah, Richard Dsida, Mehul V. Raval, Operating Room Recycling: Opportunities to Reduce Carbon Emissions Without Increases in Cost, Journal of Pediatric Surgery, Volume 58, Issue 11, 2023, Pages 2187-2191, ISSN 0022-3468, https://doi.org/10.1016/j.jpedsurg.2023.04.011. (https://www.sciencedirect.com/science/article/pii/S0022346823002531)

2. BOULDER COUNTY, HAZARDOUS WASTE DISPOSAL COSTS FOR BUSINESSES, ttps://bouldercounty.gov/environment/hazardous-waste/disposal-costs-for-businesses/, accessed April,8 2025.

DISCLAIMER

D. Brandt is an employee of Medtronic. This study was sponsored by Medtronic.
M. Blüher is an employee, and R. Saunders is the owner of Coreva Scientific, which received consulting fees for this work.

RESULTS

- In the base case, transitioning from single-use to rechargeable batteries resulted in an additional cost of $64,157 in year one, and ROI reached in year five. (Figure 1)
- In a scenario analysis, the cost of rechargeable batteries was varied from five to 15 times of the cost of single-use batteries, this resulted in a ROI period between three and seven years.
- Over a ten-year horizon, our model shows that 4,730 single-use batteries are required to complete 375,000 intubations, generating 142 kg of waste with a disposal cost of $17,170. The usage of rechargeable batteries would require disposal of only 103 batteries generating 3 kg of waste and a disposal cost of $13. Adopting rechargeable batteries would reduce the burden of collecting and recycling a total of 4,627 batteries over 10 years. (Table 2)

FIG 1: Cumulative cost of video laryngoscope batteries over a ten-year time horizon

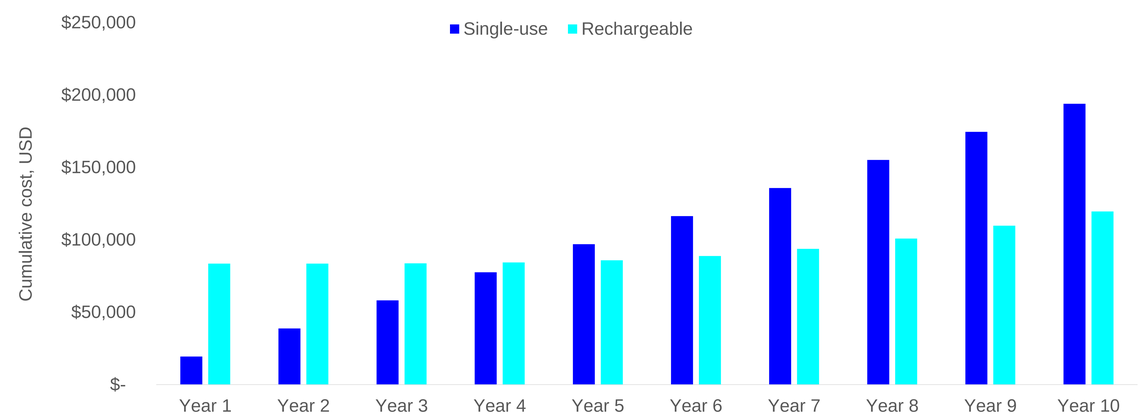

TABLE 1: Cumulative waste

Year	Cumulative Disposed Single-Used Batteries (N)	Cumulative Weight of Waste of Single-Use Batteries (Kg)	Cumulative Disposed Rechargeable Batteries (N)	Cumulative Weight of Waste of Rechargeable Batteries (Kg)
Year 1	473	14.2	0	0.0
Year 2	946	28.4	0	0.0
Year 3	1,419	42.6	1	0.0
Year 4	1,892	56.8	2	0.1
Year 5	2,365	71.0	7	0.2
Year 6	2,838	85.1	15	0.5
Year 7	3,311	99.3	29	0.9
Year 8	3,784	113.5	50	1.5
Year 9	4,257	127.7	75	2.2
Year 10	4,730	141.9	103	3.1

CONCLUSIONS: Transitioning to rechargeable batteries for video laryngoscopy is expected to be cost-saving over longer time horizons and will contribute to reducing the environmental impact of intubation in the OR.