INTRODUCTION

Although steam autoclaving has long been the default method of terminal sterilization, the increasing use of high-precision, expensive instrumentation has necessitated that many hospitals shift their focus from standard use of sterilization techniques to that of rising equipment replacement costs associated with sterile reprocessing wear and tear. Steam sterilization reaches temperatures of 250°–300°F in order to achieve a sterility assurance level of $10^{-6}$ whereas STERRAD® Systems employ low-temperature, hydrogen peroxide gas plasma technology to achieve the same level of sterility. This advanced process means there’s no need for aeration or cooling of instruments, which potentially shortens the overall sterilization process for busy hospitals everywhere.

Currently, one reason hospitals and institutions retire and replace a laryngoscope is deterioration of the scope light, which relies on a delicate fiber-optic bundle in the blade to deliver light and is potentially susceptible to damage. Research is required to more adequately and definitively determine whether the use of alternative, low-temperature terminal sterilization methods would impose less wear and tear on reusable rigid laryngoscope blades, resulting in extended blade lifetimes and an associated reduction in replacement costs.

The purpose of this nonclinical study was to evaluate the two leading methods of sterilization, to assess how hospitals might extend the lifespan of laryngoscope light components, and to present cost-benefit implications based on a case study.
GREENVILLE MEMORIAL HOSPITAL

Greenville Memorial Hospital (GMH) in South Carolina is part of the award-winning Greenville Health System, self-described as “a public not-for-profit academic healthcare delivery system committed to medical excellence through clinical care, education, and research.”*

This study was conducted at Greenville Memorial Hospital, an 820-bed general medical and surgical hospital, and teaching institution. It is consistently ranked among the top 50 hospitals in diabetes/endocrinology care by *U.S. News & World Report*. The publication has also named GMH as the top hospital in the Greenville metro area and has recognized it as high-performing in 10 specialties. Additionally, GMH has been honored with the National Research Corporation Consumer Choice Award every year since 1996, when the award was first introduced.

GMH employs 325 perioperative nurses and surgical technicians, who perform an average of 80 surgeries per day in 32 operating rooms.

PROTOCOL

The purpose of the STELLAR (Steam Reprocessing of Reusable Laryngoscope Blades and the Potential Extension of Laryngoscope Lifetimes Through a STERRAD® Systems Alternative) Study was to examine the effect of steam versus STERRAD® System reprocessing of reusable rigid laryngoscope blades on light output over time. In addition, the study was designed to quantitatively determine if one sterilization modality better preserves the light output of the reprocessed laryngoscope blades.

Data was collected beginning in September 2015 over a period of 5 weeks. A study population of 24 new, reusable rigid laryngoscope blades was reprocessed and then tested for light output as a function of total cycles; 12 blades from two leading manufacturers were processed using steam and the identical 12 blades were processed using STERRAD® 100NX™ System STANDARD Cycle. Each series of 5 cycles was considered 1 interval and this process was repeated for 20 intervals (100 total cycles). None of the laryngoscope blades reprocessed in this study were in clinical use. In partnership with GMH, it was determined that a 75% reduction in light output would be used as a threshold value to identify laryngoscopes that were no longer considered usable and could be labeled as having reached end of life.

*Source: http://www.ghs.org/locations/gmmc/greenvillememorial
After 100 reprocessing cycles, steam-reprocessed laryngoscopes were found to have lost on average 74% of their light output, whereas the STERRAD® System–processed laryngoscopes had lost only 53%, a statistically significant difference of 21% ($P=0.05$). This translates to STERRAD® System–reprocessed blades being on average 21% brighter than steam-reprocessed blades at 100 cycles.

**Figure 2.**
Laryngoscope light deterioration over time. Percent light output for both experimental arms, steam and STERRAD® System, respectively, decreases by interval [defined as 5 reprocessing cycles].
The implication of this difference in light output is more substantial when its impact on the effective lifespan of these laryngoscope blades is considered. Since laryngoscope blades were deemed to reach their end of life when their light output has diminished by 75%, estimates for the laryngoscope blade replacement rate for both steam and the STERRAD® System can be calculated for Greenville Memorial Hospital’s 225-laryngoscope blade population.

At 100 cycles, 7 out of 12 (or 58%) on average of steam-reprocessed laryngoscope blades had diminished in light output by 75%, reaching their end-of-life threshold, while only 1 out of 12 (or 8%) on average of STERRAD® System-reprocessed laryngoscope blades had reached this threshold.

When these replacement rates (50 blades reprocessed per cycle and all blades are reprocessed on average 1.5 times per day) are applied to the GMH 225-laryngoscope population over a one-year period, steam reprocessing would require 376 blades to be replaced versus only 193 when the STERRAD® System is used—a 52% decrease in the number of new blades required.

**Figure 3.**
A comparison of blades reaching 75% light reduction output at 100 cycles.
ECONOMIC ANALYSIS

In order to determine which sterilization method is more cost-efficient with regard to light longevity and scope replacement, the cost for STERRAD® System versus steam reprocessing was compared in an ad hoc analysis based on GMH statistics. Assuming that in a 225-laryngoscope facility like GMH, 50 blades can be reprocessed per cycle and all blades are reprocessed on average 1.5 times per day, the average number of STERRAD® System cycles per day is 6.75. Based on these economic assumptions and the data collected for this study, it was determined that exclusive usage of STERRAD® System reprocessing for laryngoscope blades would potentially allow an institution to save an estimated $13,932 annually based on savings related to reduced blade replacement.

FOR EVERY

2 steam-reprocessed blades

Only 1 STERRAD® System-reprocessed blade required replacement
The data showed that laryngoscopes reprocessed with the STERRAD® 100NX™ System on average preserved more light output than those processed in steam at 100 cycles. Thus, it was concluded that choosing STERRAD® System sterilization over steam sterilization can potentially extend the longevity of reusable laryngoscopes and thereby reduce cost per use. **Cost basis assumptions used for this study indicate GMH can potentially realize savings of $13,932 per year by reprocessing laryngoscopes exclusively with STERRAD® Systems.**

Based on the findings of the research it conducted, GMH has decided to switch from steam to 100% STERRAD® System sterilization for reusable rigid laryngoscope blades. The data show that STERRAD® System reprocessing can potentially offer a more economical alternative when considering its ability to prolong the life of laryngoscope blades.

While this potential cost savings is significant, the overall implications for hospitals, healthcare workers, and patients are multifaceted: extending the life of laryngoscope blades not only saves money by postponing blade replacement, but longer-lived laryngoscopes mean fewer blades being discarded, which can help with many contemporary institutions’ sustainability efforts.

### Reference
Data on File, Advanced Sterilization Products (ASP).

### Disclosures and Acknowledgments
The research was designed and executed by Actionable Research, an independent third party research firm. All data were collected by the Greenville Memorial Hospital (GMH) Sterile Processing Department staff, led by Mary K. Lane, and analyzed and reported by Actionable Research. The research sponsor is Advanced Sterilization Products (ASP). Special thanks to Greenville Memorial Hospital.

For more information about this study and STERRAD® System low-temperature sterilization, please contact your ASP representative at 1-800-783-7723.