

Performance, Cost Per Use, and Environmental Impact of Single-Use and Reusable Surgical Gowns & Drapes: A Summary

In order to establish a foundation for evaluating single-use and reusable surgical gowns and drapes, The McIlvaine Company—an independent marketing research company—has performed an in-depth study to analyze and compare each products' key aspects and characteristics. The primary factors examined in this study were:

- functional efficacy and performance, measuring safety, barrier qualities, and infection prevention
- cost-per-use
- eco-efficiency and sustainability
- physiological issues for doctors and nurses (or comfort of the products)
- legal and regulatory issues
- additional issues related to their usage and aspects

In this summary of The McIlvaine Company White Paper on “Performance, Cost Per Use, and Environmental Impact of Single-Use and Reusable Surgical Gowns & Drapes,” the facts are thus:

- 1.) that the performance element of single-use products makes them competitive with reusable products, and may tilt the scale in single-use products' favor.
- 2.) that single-use products are competitive with reusable products based on the cost-per-use analysis conducted by The McIlvaine company.
- 3.) that the environmental impact of single-use products is lower than for reusable products, contributing largely to the water and heat involved in laundering reusable textiles.
- 4.) that in the arena of safety, single-use products may have an advantage in that reusable products are exposed to contaminated surfaces and fluids, and thus require additional processing in the laundering stage and may deter people from wanting to reuse these garments.
- 5.) that green opportunities exist in equal amounts for both reusable and single-use products, primarily in the facets of waste-to-energy use of disposed items, the use of biological-based (rather than petroleum-based) polymers in the supply chain, and the utilization of carbon credits for offsetting environmental impacts of garment and textile disposal.

The study finds favorably for the future of both woven (reusable) and nonwoven (single-use) products, but also finds that the inherent values of both products tend to give single-use products an advantage in cost and in performance. It also finds that in safety and comfort, both are on the same footing, but that there could be a potential advantage to be had for single-use products in the arena of safety due to the highly infectious and contaminated liquids present on many reusable products that are not an issue for

single-use products. Additionally, it finds that both have an advantage in the employment of more environmentally friendly processes in all aspects of the production and life cycle of the product.

The study also examines the legal and regulatory issues involved in disposing of and cleaning of reusable textiles. Some of these laws and regulations include the Clean Air Act, regulations for cotton production, OSHA's blood borne pathogen rules, and waste classifications. For the purposes of this summary, suffice it to say that the regulation of soiled textiles is precise and exacting, and involves both reusable and single-use products in myriad ways that do not necessarily address the performance, cost-per-use, and environmental advantages or disadvantages of woven and nonwoven garments and products. The study finds that single-use products may be the more cost-effective solution in a hospital (or any environment) where barrier protection is paramount, and comfort, environmental costs, and financial costs matter.

Functional Efficacy & Performance: How do reusable and single-use products match up?

When it comes to the integrity of a product, barrier protection is possibly the most important element to consider. Particularly in a medical, sanitary, lab, or industrial setting, keeping the barrier of protection intact is essential to the function of the product itself. Thus, the garment or cover must prevent transmission of infectious or contaminated materials.

The McIlvaine study draws upon an article written by William A. Ritala, PhD, MPH; and David J. Weber, MD, MPH, entitled "a Review of Single-Use and Reusable Gowns and Drapes in Health Care" that describes one of the primary draw backs of reusable items, which is the difficulty in determining the barrier properties after laundering and over time. According to the article, with single-use products, it is easier to maintain "manufacturers' specifications...compared with reusable products." Because specifications for one-time use products are extremely predictable precisely because they are used only once, many medical facilities are reaching out to manufacturers of these products and purchasing one-time use goods in an attempt to regulate the barrier qualities of garments and other protective wear.

The data suggests that with the degradation of multi-use products, it is hard to know how long a garment has in its barrier protection lifecycle, though the Gelbo Lint Test, which measures the number of lint particles removed from a fabric during repeated flexing, found that some woven fabric products fare better than others depending on material and quality. Garments must be inspected prior to use to verify material integrity has not been compromised through the laundering and sterilization cycles. 100% cotton textiles, for instance, create the most lint of any woven textile, and synthetics or synthetic blends are widely recognized as a better choice for the OR and medical environments. Because of the identification of lint as a primary source of contamination and the cause of infections and pyrogenic affects, it is paramount that medical garments are free of lint or contain only a negligible amount. This is

why single-use textiles have been making their way into the OR and medical environments: no laundering, no barrier degradation, and no lint.

Comfort—including drapeability, air permeability, the ability of the wearer to maintain their desired body temperature, and water vapor transmission rate (WVTR)—is no longer a tradeoff for safety in either woven or nonwoven products. This means that whether you use a single-use textile or a multi-use textile, you will be equally comfortable while also being safe. As far as barrier performance, both work equally well, and linting is not much of a problem with modern polypropylene nonwoven fabrics. Still, such products must be checked before every wear to ensure safety and barrier integrity. Consistency and reliability in single-use disposable products is more assured over the life of the textile, since it is only used once and meets the manufacturer’s specifications at every use.

Cost-Per-Use

Cost-per-use is central to the purchasing decision by buyers and management, and rightfully so. The debate over which is cheaper—single-use or multi-use garments and textiles—can come closer to being put to rest after The McIlvaine Company’s research and report. After looking at single-use surgical gowns and their purchase price per gown (which can vary from location to location and with volume pricing, discounts, and the like) alongside reusable gowns’ purchase price per gown (calculated by dividing the purchase price per gown by the average number of launderings in the life cycle of the gown, plus the laundering cost per gown, per use), the cost-per-use came out to be \$2.10-\$3.70 per reusable gown versus \$2.03-\$3.49 per single-use gown. It is the laundering of reusable textiles that eats into the cost savings of reusing garments. Single-use textiles are proving to be stiff competition in the healthcare market as both their cost-per-use, their comfort, functional efficacy and performance are converging with and in some cases *exceeding* those elements in their woven counterparts.

Environmental Burden (Life Cycle Analysis)

According to The McIlvaine Company’s study on single-use and reusable surgical gowns and drapes, the aggregate “environmental burden created by surgical garments is small in the context of total environmental burden.” Shocking to most people might be the fact that after McIlvaine completed its study, they determined that the total environmental burden of single-use surgical gowns is less than the environmental burden of reusable gowns per use. Though single-use textiles are intended to be thrown away after one use, the environmental costs of laundering reusable textiles, through water and heat/power consumption primarily, make it a larger environmental burden than disposable single-use products. Also during the laundering process, there are CO₂ and NO_x air emissions, chemical and biological oxygen demand (CBOD) and Total Suspended Solids (TSS) present in the laundry water. These are the biggest contributors to the environmental burden of the garment and textile life cycle. But environmental

burdens occur during the manufacturing and disposal steps of the product life cycle also, though such burdens are often similar for both single-use and reusable products.

The study did find that there is a higher manufacturing burden for single-use disposable garments versus the reusable variety because industry convention dictates that around 50 single-use garments should be produced for every reusable one. So the increased manufacturing burden for one-use textiles ensues considering that 50 items are being counted in the manufacturing process of single-use products, where one reusable garment is counted against the 50 single-use disposable ones. The disposal phase can have a variable environmental burden based upon how textiles are disposed of, but the aggregate burden for both product types is relatively small (less than 1% of the total municipal waste stream in the U.S.). As of 2009, the EPA estimates show that the percentage was *much* smaller than 1%; it was more along the lines of 0.5%. But comparatively, reusable garments consume approximately 4.5 times as many resources as single-use garments, and this number comes predominantly from the water used in laundering.

Conclusion

The study is a discussion of the costs and benefits of woven (reusable) and nonwoven (single-use) textiles and garments and their usage in the hospital or medical work environment. A large part of the study discusses the use of these products in the context of contaminated and infectious environments and the need for a product that can either be cleaned or sanitized (reused) or disposed of after one usage (single-use). The study describes the benefits and drawbacks to each product type and the financial, safety, comfort and environmental costs involved in each type of product. The McIlvaine Company's research finds favorably for the future of both woven (reusable) and nonwoven (single-use) products, but also finds that the inherent values of both products tends to give single-use products an advantage in cost and in performance. It also finds that in safety and comfort, both are on the same footing, but there could be a potential advantage to be had for single-use products in the arena of safety due to the highly infectious and contaminated liquids present on many reusable products that are not an issue for single-use products. Additionally, it finds that both have an advantage in the employment of more environmentally friendly processes in all aspects of the life cycle of the product.

The discussion on government regulating soiled products is relevant to the cost-per-use and environmental burden of both single-use and multi-use textiles, since laundering reusable garments offsets the cost benefits potentially gained in the initial cost-per-use of the products (purchase price divided by number of wears). Ultimately, the study concludes that contrary to perceived notions of higher waste and higher costs for single-use products, these products may be the more cost-effective solution in a hospital environment, or any environment where barrier protection is paramount and comfort, environmental costs, and financial costs matter.