An operating room with a surgical table, lights, and medical equipment. The room is dimly lit, with the primary light source being three large surgical lamps hanging from the ceiling. The surgical table is covered with a green drape. Medical equipment, including monitors and carts, is visible in the background.

AnsellCARES[®]
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A SELF STUDY GUIDE

IMPROVING OUTCOMES IN THE OPERATING ROOM

Registered Nurses

OVERVIEW

As the focus on improving outcomes continues to be an expectation for healthcare facilities, professionals are looking for new ways to make a difference at every level of care. Reduced infections, surgical complications, length of stay and overall cost of care are some of the factors driving healthcare professionals to seek out new ways of delivering improved care. The increased focus on improving staff, patient and physician satisfaction is creating new opportunities for healthcare professionals, especially in the operating room to identify and implement areas of improvement. Reducing the incidence of surgical site infections (SSIs) is a major initiative for all healthcare organizations as this contributes to complications that increase cost to the facility and the patient, increase the length of stay in the hospital and have a negative impact on patient satisfaction and the reputation of the healthcare facility. As healthcare professionals in the operating room look for better ways to deliver care and improve outcomes, many factors need to be considered. This continuing education activity will provide perioperative nurses with information on improved strategies to protect themselves and patients in the operating room. It will review single-use versus multiple use items, provide up-to-date information on barrier protection and look at ways to control waste and protect the environment. Finally, it will cover strategies that potentially have the ability to control or reduce supply costs and improve productivity in the operating room.

OBJECTIVES

After completing this continuing nursing education activity, the participant should be able to:

1. Identify the factors to be considered in decisions to use single-use versus reusable items.
2. Discuss the necessity and importance of barrier protection.
3. Describe the benefits of single-use disposable linens.
4. Review the issues related to waste disposal and environmental concerns.
5. Discuss the advantages of turnover kits to prevent contamination, infections and injuries.

INTENDED AUDIENCE

The information contained in this self-study guidebook is intended for use by healthcare professionals who are responsible for or involved in the following activities related to this topic:

- Educating healthcare personnel.
- Establishing institutional or departmental policies and procedures.
- Decision-making responsibilities for safety and infection prevention products.
- Maintaining regulatory compliance.
- Managing employee health and infection prevention services.

INSTRUCTIONS

Ansell Healthcare is a provider approved by the California Board of Registered Nursing, Provider # CEP 15538 for 2 (two) contact hours. Obtaining full credit for this offering depends on completion of the self-study materials on-line as directed below.

Approval refers to recognition of educational activities only and does not imply endorsement of any product or company displayed in any form during the educational activity.

To receive contact hours for this program, please go to www.ansellcares.com. You will receive your certificate via email.

AN 85% PASSING SCORE IS REQUIRED FOR SUCCESSFUL COMPLETION. Any learner who does not successfully complete the post-test will be notified and given an opportunity to resubmit for certification.

For more information about our educational programs or perioperative safety solution topics, please contact: Ansell Healthcare Educational Services by e-mail at edu@ansellhealthcare.com.

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As employees of Ansell Ms. Chavira, Mrs. Ouellet, Mrs. Taylor and Ms. Werner have declared an affiliation that could be perceived as posing a potential conflict of interest with development of this self-study module.

IMPROVING

OUTCOMES

IN THE

OPERATING ROOM

TABLE OF CONTENTS

<i>INTRODUCTION</i>	4
<i>OVERVIEW</i>	5
<i>PROTECTION</i>	5
<i>BARRIER PROTECTION</i>	7
<i>SINGLE USE LINENS</i>	10
<i>WASTE DISPOSAL AND ENVIRONMENTAL CONCERNS OF SINGLE-USE PRODUCTS</i>	12
<i>OR TURNOVER KITS</i>	15
<i>GLOSSARY</i>	18
<i>REFERENCES</i>	19





IMPROVING OUTCOMES IN THE OPERATING ROOM

INTRODUCTION

Healthcare associated infections (HAIs) account for close to two million occurrences annually and continue to grow every year.¹ The operating room historically has been one of the departments where the control of infections, has been at best a challenge. Despite the fact that this is an aseptic environment, the constant flow of patients and staff doing a wide range of procedures every day where there is continuous exposure to a broad range of pathogens in blood, body fluids and tissues encountered makes this an ongoing challenge. Dusaj reported that about one half of all surgical procedures resulted in an employee being exposed to blood contamination with subsequent risk of disease transmission. The traditional surgical clothing (scrub suits, surgical gowns, lab coats) has been made of cotton that offers no protection to the surgical team against the penetration of biological fluids that are potentially pathologic in nature.² This brings up the question of what type of material should surgical attire be composed of that optimally protect the surgical teams and ultimately the patient. It raises the question of the benefits of single-use versus multiple use products across the entire operating room. Are single-use products more cost effective? Do single-use products provide better protection? Is there a safe method to reprocess single-use devices without impacting product performance or clinical outcomes? Do single-use items contribute to additional waste that impacts the environment? It has been reported that hospitals generate six billion tons of waste annually and approximately 15% of that waste is infectious or medical waste. Historically, the operating room used a wide range of reusable products including surgical instruments. While there has been a shift from reusables to disposables, there are still many reusable products in today's operating rooms. The following information will examine and explore the benefits and limitations, advantages and disadvantages, cost, environmental and operational impacts of single versus multiple use products in the operating room.

OVERVIEW

SINGLE-USE VERSUS REUSABLE LINENS

According to AORN Standards and Recommended Practices, “surgical gowns, gloves and drape products for use in the perioperative setting should be evaluated and selected for safety, efficacy and cost before purchase or use”³ In an article published in 2012, single-use surgical gowns and drapes currently meet the required standards for medical worker and patient protection.⁴ In addition, they are composed of materials that are comfortable to wear in the perioperative environment and their pricing is competitive. On the other hand, disposable perioperative textiles consume significantly more resources (energy and water) and generate more waste than do reusable. Since two of the key factors (cost and comfort) are reasonably similar, it would appear that reusables offer a better alternative to environmental sustainability. It is important to note that there has been limited research in the area of comfort and cost in the last decade so basing a decision purely on these two factors should not drive decisions for drape and gown materials in the operating room.⁵ There are other factors that also need to be considered when selecting the type of surgical gowns and drapes used in the perioperative setting which include product-specific requirements, procedure-related requirements, end-user requirements and preferences, patient-related requirements, environmental considerations, compliance with federal, state and local regulatory agencies and compliance with standards-setting bodies.⁶



1940s Operating Room

PROTECTION

HAIs are a major concern for all healthcare providers. It has been clearly documented that a significant number of HAIs are acquired in the operating room. The primary purpose of patient draping and staff gowning has been to reduce the transfer of pathogens from the patient and staff into the surgical wound.⁷ According to AORN’s Standards and Recommended Practices, products that are used in the operating room, need to be able to resist penetration by blood and body fluids to protect the wearer from exposure to blood, body fluids and other potentially infectious substances.⁸ Manufacturers must demonstrate to the regulatory bodies, such as the FDA and OSHA, that their products do not allow blood or body fluids to pass through and reach the employees’ work clothes or undergarments. While cotton and cotton-polyester fabrics are comfortable, drapeable and strong when dry, they deteriorate over time, especially when laundered with hydrophobic agents to eliminate potential bacteria.⁹ In addition, they have very limited barrier factors because of their open, woven structure. On the other hand, disposable drapes, disposable table linens and gowns (single-use) are made from hydrophobic materials that are highly resistant to fluids and afford optimal protection every time because they are used only once. There are some synthetic reusable gown and draping materials available. The limitation is that, like cotton and cotton-polyester, they did not perform well with repeated laundering and sterilization.¹⁰



Today’s Operating Room



IMPROVING OUTCOMES IN THE OPERATING ROOM

PERFORMANCE

While the ability to reuse or reprocess either cotton or synthetic gowns and drapes reduces clinical waste, it is key to consider product performance when selecting drapes and gowns for the operating room. While some of the synthetic textile materials have demonstrated that they offer improved barrier protection over cotton, there are still concerns about their overall quality. In one study conducted in Germany, these products performed poorly in light table, liquid penetration and microbial penetration tests. Unlike the disposable products, they need ongoing monitoring to validate quality of the material. The study concluded that it was difficult to maintain acceptable barrier properties for the life of the product due to the high number of processing cycles.¹¹ On the other hand, single-use, disposable products, typically have consistent barrier properties and there is no concern with them “wearing out” due to being reprocessed. When comparing single-use products to reusables, they were found to reduce infections 2.5 times more than the standard textile products.¹² According to a study cited in AORN’s Standards and Recommended Practices, most of the disposable, non-woven drapes tested remained impenetrable (allowed fewer than 100 colony forming units to form) for at least 90 minutes.¹³

SAFETY

When considering single-use, disposable drapes, operating room table linens and gown products versus reusable ones, another consideration is safety. Safety for the perioperative staff has been reviewed, but another consideration is that of employees involved with the handling of contaminated linen including reusable drapes, table linens and gowns from the operating room. Laundry personnel are responsible for processing hundreds of thousands of pounds of contaminated linen and may be at risk if the proper precautions are not followed.¹⁴ When textiles are contaminated with blood and body fluid (reusable drapes, linens and gowns), they can contain high bacterial loads and could pose a risk for disease transmission for laundry workers if not handled properly.¹⁵ This again supports the benefit of using single-use items where there is no potential exposure for the laundry personnel. While there is limited research to validate that surgical site infections are the result of reusable gowns, table linens and drapes, it is possible that when there are outbreaks of surgical site infections in the operating room and reusable drapes, table linens and gowns are being used, laundry practices need to be considered as a possible factor.

LINT AND AIRBORNE PARTICULATES

While studies are inconclusive, there is a growing concern that airborne particles may play a role in the development of SSIs.¹⁶ One of the amazing factors about the human body is its' ability to self-repair. Without this ability, undertaking any type of surgical procedure would present major challenges. In order to optimize healing, it is necessary to keep microbial contamination at the wound site to a minimum, keep tissues moist, and properly align wound margins.¹⁷ Another important consideration in minimizing wound contamination and maximizing healing is to limit the number of foreign particles in the wound. Lint that is shed from perioperative staff clothing constitutes "debris" or foreign bodies that can get into the surgical wound. While it is nearly impossible to reduce all of the lint that is shed, it is possible to significantly reduce it. This raises the question of which materials (multi-use cotton versus single-use polypropylene) have lower lint levels. In a 2013 article in the Journal of Hospital Infection, the conclusion was that colony-forming particles from shed lint were significantly lower when single-use clothing was used.¹⁸ The goal to improve outcomes in the operating room to specifically reduce the incidence of SSIs can be achieved by adequate ventilation or by staff wearing low permeable scrubs or surgical gowns.¹⁹ This would support that operating rooms need to seriously consider single-use clothing, table linens and drapes to limit lint particles as a means to potentially reduce the incidence of SSIs. While some studies report conflicting evidence or the lack of valid evidence to support single-use over multi-use materials, there is generalized agreement that polypropylene (single-use materials) can help to reduce lint and subsequently bacterial counts and contamination in the operating room.



BARRIER PROTECTION

A major concern for all healthcare workers including the perioperative team is the transmission of pathogens and bacteria from themselves to the patient and vice versa. According to an article by Kelly Pyrek, Healthcare workers (HCWs), are at risk for exposure to an increasing number of pathogens that live and thrive in the healthcare setting.²⁰ One of the major challenges in the transmission of pathogens from infected patients to HCWs is that there is limited active surveillance of patients which means that the HCWs are unaware of the pathogens that the patient may have. Exposure to pathogens for HCWs is not limited to patients, but can also happen via contaminated items such as devices and equipment. Common human pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *enterococcus* (VRE) are two of the more virulent organisms that can survive for prolonged periods on hospital surfaces.²¹

Medical equipment and devices are categorized into three groups: critical, semi-critical and noncritical. Examples of some common critical items are those, which come in contact with patient tissue or the blood stream, such as surgical instruments, vascular catheters and implants. Semi-critical items come in contact with mucous membranes or non-intact skin and would include laryngoscope blades, endoscopes and respiratory or anesthesia devices such as endotracheal tubes and oral and nasal suction devices. Non-critical items are objects or substances that come in contact with intact skin, but not mucous membranes. Some examples include blood pressure cuffs, pulse oximetry probes and bed or stretcher mattresses. While these items are often considered low risk for disease or pathogen transmission because they do not come in contact with mucous membranes of non-intact skin, there are increasing concerns that these items do present a growing risk for infection transmission for both patients and HCWs.



MRSA



IMPROVING OUTCOMES IN THE OPERATING ROOM

BACTERIAL CONTAMINATION OF MATTRESSES

In reviewing the literature on non-critical items that contribute to infection transmission, there was a study done on bed mattresses. In this study, the FDA received 458 reports that the mattress covers failed to prevent blood and body fluids leaking into the mattress.²² Fluid ingress (leaking into inner surfaces) is the result of covers that are worn or damaged. Microscopic holes and tears along with inadequate disinfection or cleaning have the potential to harbor harmful pathogens which put both the patient and HCW at risk for acquiring infections. For example, the ICU patient who is already compromised might be infected with a pathogen from a mattress that would otherwise not infect a patient on a Medical unit.²³ Bacterial contamination of mattresses is also a consideration for the perioperative team. While the mattress covers for the surgical bed may appear to be intact, they should be closely examined on a regular basis to identify any breaks in fabric integrity, penetration of inner surfaces by cleaning liquids or blood and body fluids. Zippers tend to be an area of common fluid penetration as well and need to be checked regularly. Any mattress cover that shows signs of wear or defect no matter how small should be replaced immediately to minimize patient and HCW exposure to harmful pathogens.

ENVIRONMENTAL SURFACE CONTAMINATION

In addition to mattresses, HCWs should be constantly aware that environmental surfaces act as a reservoir for bacterial and viral gathering and proliferation.²⁴ The organisms can be on keyboards, back tables, mayo stands and equipment such as electrosurgical units. They come from colonized patients and are transmitted through direct and indirect contact. These organisms have a unique ability to survive and multiply. For example *C. difficile* has been known to survive as long as five months on a hospital floor; MRSA can live on plastic laminate surfaces for two days and is spread rapidly through contact.²⁵ So why is it important for the perioperative team to be meticulous in terms of cleaning and disinfection along with implementing stringent measures to minimize contact pathogen spread? SSIs are serious complications that have a significant impact on operating room, patient and facility outcomes. In a study done in 2009, SSIs occurred in 2% of all surgical procedures and overall were responsible for 20% of all HAIs. SSIs extended hospital stays by 9.7 days and increased costs/admission by \$20,842. In the aggregate, SSIs resulted in an additional annual increase of 406,730 hospital days at a cost exceeding \$900 million. In addition SSIs resulted in 9,161 readmissions that cost over \$700 million in care delivered.²⁶ SSIs are a significant financial burden to the hospital, the patient and the community. In addition,

since healthcare organizations are no longer being reimbursed for SSIs, this magnifies the impact to the hospital's bottom line. SSIs, while not totally preventable MUST be addressed and reduced. Today's challenges are that many of the current pathogens have become resistant to the available antibiotics. No longer can healthcare workers, including the perioperative team, rely on prophylactic drugs to reduce SSIs. There has to be increased emphasis on using the proper products for cleaning and disinfection coupled with focused efforts to educate and train individuals in proper methods to clean equipment and medical devices. Finally, there needs to be ongoing processes to ensure that healthcare workers are compliant with facility policies and procedures for cleaning medical equipment and devices.

SINGLE-USE VERSUS REUSABLE LINENS FOR CLEANING

Barrier protection is a consideration for reusable cleaning products such as cotton and microfiber towels. In one study done reviewing the laundering practices for these products it was found that the processes used did not sufficiently remove bacterial contaminants. Of the towels tested in this study, 93% contained *E. Coli* and *Klebsiella*.²⁷ These products, if then reinfused into the hospital laundry, had the potential to contaminate other linens as well as unnecessarily expose HCWs to harmful bacteria. In addition it becomes questionable if contaminated towels can effectively be used to remove/reduce bacteria when used for cleaning subsequent equipment. Proper cleaning of reusable textiles is critical if the facility elects to utilize these products. According to the FDA, soiled linens should be handled as little as possible, with minimal agitation to limit contamination of the air and persons handling it. They also recommend that linens should be contained in the place used and not laundered at location

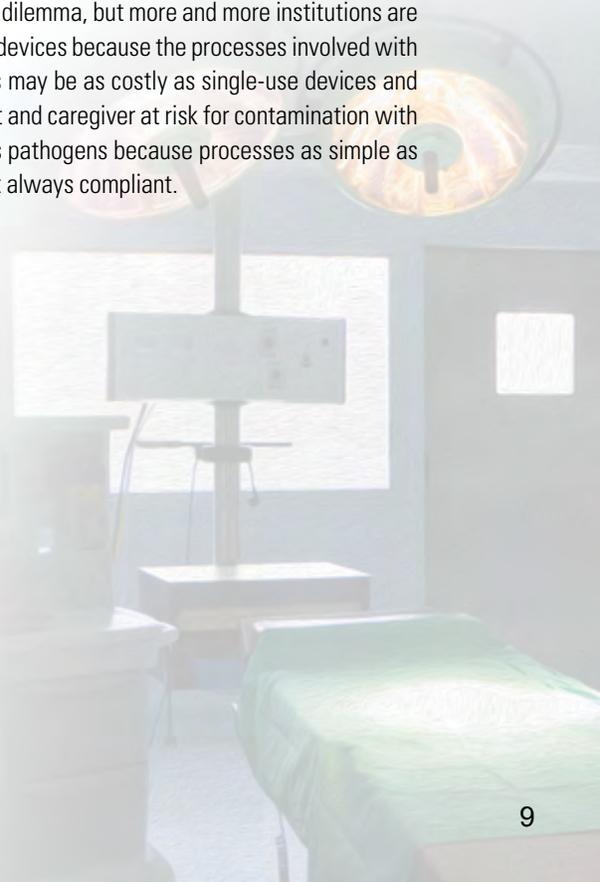
used.²⁸ The CDC (Centers for Disease Control and Prevention) has very defined and rigorous requirements for laundering multi-use fabric products. This raises the question of the efficacy of using reusable products as opposed to single-use products for equipment cleaning procedures. In a report published in 2010, CDC investigators identified an outbreak of a potentially fatal fungal-based infection that was directly linked to contaminated reusable hospital textiles.²⁹ Again the case for using single-use cleaning materials is substantiated.

SINGLE-USE MEDICAL DEVICES

Studies have demonstrated that single-use medical devices such as sensors, lead wires and blood pressure cuffs reduce potential exposures to harmful bacteria. The justification for single-use devices is that there is often less than optimal cleaning of these devices between patients. While the cost of single-use devices may be higher than multi-use devices, healthcare facilities must weigh the costs associated with HAIs or SSIs as opposed to the cost associated with single-use devices. Given that HAIs and SSIs are no longer being reimbursed, healthcare facilities must evaluate more than just the cost. If a facility elects to use reusable medical devices, they need to assess if their processes for cleaning the devices renders them safe for patients and staff. They need to assess the associated labor costs of cleaning. There are also questions that need to be assessed with single-use devices. What is the impact on the environment and how will the single-use products be integrated into the existing supply chain? There is no single solution to this dilemma, but more and more institutions are moving to single-use devices because the processes involved with multiple use products may be as costly as single-use devices and often puts the patient and caregiver at risk for contamination with potentially dangerous pathogens because processes as simple as hand washing are not always compliant.



Laundry Facility





IMPROVING OUTCOMES IN THE OPERATING ROOM

WHY CONSIDER SINGLE-USE DISPOSABLE LINENS?

The benefits of using single-use disposable linens include the fact that product quality is consistent. In a recent study comparing single-use and textile products, 56% of the textiles showed serious faults impairing functionality compared to 0% of the single-use products.³⁰ They also reduce the need for sterilization in Central Sterile Processing (CSP). This enables CSP staff to focus on the processing and sterilization of surgical instruments and other needed supplies. Given that there is a new product every time, studies have continued to demonstrate that single-use linens are a better barrier to limiting the transfers of microorganisms subsequently reducing the risk of SSIs.

COMMON SINGLE-USE LINENS IN THE OR

Towels

Huck towels, as they are sometimes referred to are generally made of 100% cotton. The cotton material used in Huck towels, while highly effective in absorbing fluids, has the limitation of emitting cotton fibers. These fibers could become debris or a foreign object in the wound which subsequently could result in scarring or infection post-operatively.³¹ According to Susan Ball, "Foreign debris interferes with optimal wound healing and contributes to surgical site infections."³² Many complications from foreign debris have been reported which include, but are not limited to, mitral valve thrombus formations, granulomas and intra-articular inflammation. There have been numerous articles written about the challenges of minimizing lint on OR reusable towels. Some of the common causes of lint formation are mechanical action and abrasion as well as the inferior quality of the cotton used in these towels.³³ According to Ms. Ball, perioperative nurses need to be proactive in identifying and promoting products that have low linting potential. Single-use towels come packaged sterile and generally have lower lint than do reusable towels.

Drapes, Linen and Gowns

Traditionally drapes, table linens and gowns used in the operating room have been made of cotton or cotton/polyester. These materials have been preferred over other products because they are comfortable to wear, easy to drape and have absorptive properties. Like the towels, they produce lint that can be introduced into the surgical wound. While it is

sometimes difficult to convince members of the perioperative team to change to single-use gowns, table linens and drapes, educating them on the benefits as well as the flexibility in terms of choices and wear ability is important to ensure that the patient has the optimal product for their surgical procedure. While some may challenge single-use products based on the “acquisition” cost, all factors need to be considered. What is the cost associated with laundering and processing of reusable gowns and drapes? Do reusable drapes and linen offer the best protection to staff and patients? Is the quality of reusable gowns, linens and drapes consistent i.e., do they perform at the expected level EVERY time? These are important considerations for management and staff when considering the optimal drape, linen and gown for their operating room.

Overview of Drape, Linen and Gown Materials

Currently there are several types of materials that are being used in the operating room for gowns, linens and drapes. The following table provides an overview of these products.

Limitations of Single-Use Linens

There is a perception that single-use linens negatively impact the environment. Those who are opposed challenge that single-use items significantly increase the medical waste generated in the operating room. They also argue about the associated costs for disposal. At this time, improvements in single-use disposable linens continues to be a “work in progress.” To address the concerns about the environment, single-use manufacturers’ are now developing environmentally friendly products that can be reduced to carbon dioxide and ash via incineration.

Conclusion

While there continues to be differing opinions about single-use versus multi-use linens in the operating room, more and more facilities are converting to single-use products because studies have continued to prove that they are safer, provide the optimal levels of protection and there is little difference in cost when all of the variables are evaluated.

Product Type	Product Benefits	Product Limitations
Cotton/Cotton Polyester	<p>Comfortable to wear when dry; drapeable, strong.</p> <p>* Special note – tightly woven textiles made of polyester and cotton that are treated with a repellent perform better than cotton alone.</p> <p>Limited barrier effects especially when wet; open weave structure, which allows for fluid penetration.</p>	<p>Repellent must be reapplied after laundering.</p> <p>Require laundering and sterilization.</p> <p>Life cycle limitation.</p>
Micro-filament Yarns	<p>Densely woven with fine polyester – have good fluid control when treated with a repellent agent.</p>	<p>Repellent must be reapplied after laundering; require laundering and sterilization.</p> <p>Life cycle limitation.</p>
Laminates	<p>Produced by combining a micro-porous membrane bonded between polyester – provides a reasonable barrier to fluid penetration.</p>	<p>Stiff, does not drape well, uncomfortable for the end users; require laundering and sterilization.</p> <p>Life cycle limitation.</p>
Single-Use Products	<p>Non-woven, single or multi-layer; provide several different types of barrier protection, drapeable, comfortable for end users; delivered pre-sterilized.</p>	<p>Cost to purchase/dispose of, environmental impact.³⁴</p>



IMPROVING OUTCOMES IN THE OPERATING ROOM

WASTE DISPOSAL AND ENVIRONMENTAL CONCERNS OF SINGLE-USE PRODUCTS

Gowns, linens and drapes are extensively used in healthcare facilities. The primary purposes of the gown are to minimize exposure of HCWs to pathogenic organisms, to reduce the risk of patient-to-patient transmission and to optimize sterility during operative and invasive procedures. Drapes have been used as well during operative and invasive procedures to maintain the sterility of the environment, specifically the operative field and the equipment used during surgery such as the back table and mayo stand.³⁵ Contemporary comparisons of reusable and single-use perioperative linens (drapes, linens and gowns) report that they use fabrics that are comfortable to wear and the overall price for both is competitive. The question then arises as to the safety and environmental impact of disposable, single-use versus those that are reusable. While reusable linens may be rendered safe for the patient and HCWs, they require intense processes to render them free from bacteria and to provide adequate protection from blood and body fluids.

They require sterilization in order to be used during operative and invasive procedures. The efficacy and safety of single-use linens has been validated in numerous studies over the years. Since cost for both is similar, we will now explore the challenges of preserving the environment as relates to both products.

Opponents of single-use linens argue that these products significantly increase medical waste, cause the facility unnecessary expenses in waste disposal and negatively impact the environment. It has been reported that hospitals produce nearly six billion tons of waste annually. The healthcare industry is credited with being the largest producer of waste and of that waste 15% is considered to be medical or infectious.³⁶ While these facts are true, it is a little known fact that single-use gowns, linens and drapes account for only 2% of the total waste generated. Available research on the environmental impact of reusable versus single-use drapes and gowns does not provide a clear conclusion that reusables are more environmentally friendly. In a White Paper published by the McIlvaine Company in 2009, they conclude that single-use products have a very strong case for the performance attributes of single-use products. They assert that single-use products provide effective barrier protection, are consistent as relates to overall quality, minimize

linting and flammability, are comfortable to wear and provide safety to the healthcare worker and the patient. They also assert that the study revealed that the cost-per-use for single-use products could be competitive with reusable products. From an environmental perspective, the study found that the environmental burden for single-use products is actually less than for reusable products.³⁷ Each of these factors will now be explored in more detail.

PERFORMANCE STANDARDS

As discussed, the purpose of surgical gowns, linens and drapes is to protect the HCW and the patient from exposure to pathogens. Barrier protection is a key factor to be considered in selection of these products. Unlike single-use products, reusable medical textiles undergo multiple washings that involve the use of strong chemicals and excessive heat. Multiple launderings reduce the quality and barrier protection of reusable textiles. Since there is no actual data to determine the life of a reusable material, it is difficult to know when the product needs to be discarded. A quote from the McIlvaine paper states: "when you compare reusables and disposables, single-use comes out on top... it is well documented that the barrier properties of multiple-use product degrade with time. The data we have shows single-use products as having very effective barriers against not only fluids, but microbial transmission."³⁸ A 2013 study conducted by Palm Medical demonstrated an antimicrobial OR table linen to provide broad spectrum antimicrobial protection including organisms with antibiotic resistance (*E. coli*, MRSA, CRE). Consistency and reliability have shown to be better with single-use garments as opposed to multiple use, which must be examined after every use to ensure the quality has not been compromised. As discussed earlier, linting is a concern in the operating room. Woven textiles such as cotton and cotton/polyester have significant linting issues. This article states that "using non-wovens (single-use disposable products) reduced the amount of lint in the operating room and reduced the particle count by 99%".³⁹ Another consideration is product flammability. While cotton has the lowest ignition temperature, cotton/polyester blends most often have the highest ignition rates. Combination fibers (cotton/polyester) once ignited burn more intensely than fabrics composed of one fiber. Polypropylene (single-use items), on the other hand does not ignite in air under the influence of lasers.⁴⁰

COMFORT AND WEAR

Although comfort remains an important consideration in surgical gown selection, it is no longer the defining issue between woven and non-woven textiles. In the past, it was believed that comfort and protection were mutually exclusive. This is no longer the case. Today's manufacturers have made significant improvements in nonwoven materials so that the end user does not need to sacrifice protection for comfort with single-use gowns. The comfort versus safety tradeoff has been largely eliminated by current fabric constructions, gown designs and OR environmental controls.⁴¹

COST PER USE

There are ongoing discussions as to whether single-use gowns, linens and drapes are more expensive than those made of reusable fabrics. This is a key factor that should be taken under consideration when operating rooms are trying to control supply costs. It is important to note that the McIlvaine White Paper clarified that the cost of the single-use gown was the purchase price per gown and the reusable gown was calculated by the purchase price per gown divided by the average number of launderings in the gowns life cycle, plus the cost of laundering each gown. While the cost per single-use gown was approximately \$2.03, the cost per gown for reusables has a range of \$2.10 to \$3.70.⁴² This supports that single-use gowns can compete with reusables on price.





IMPROVING OUTCOMES IN THE OPERATING ROOM

ENVIRONMENTAL BURDEN

From an environmental perspective, the study found that the environmental burden for single-use products is actually less than for reusable products. The environmental burden (CO₂, NO_x, water pollutants and solid waste) created in the manufacture, use and disposal of both single-use and reusable medical textiles are relatively small. According to the EPA, medical landfill waste is less than 1% of the total municipal waste stream. The study concludes, "single-use garments have a lower overall burden than reusable garments, largely because of the laundering burden of reusable garments."⁴³ Generally reusable gowns are made of cotton/polyester or 100% polyester while single-use gowns are made primarily from polypropylene. While the natural fibers (cotton/polyester or 100% polyester) are thought to be more environmentally friendly, cotton requires pesticides to ensure healthy growth and effective harvesting. Man-made fibers (polypropylene) require energy and because they are made from oil, deplete natural resources. The studies that have been done conclude that both reusable and single-use textiles have similar environmental burdens. When opponents to single-use garments argue that reusables generate less waste, they rarely consider the waste generated in the laundering process. Chemicals used in the laundering process, when dumped into municipal sewer systems can significantly affect the flora of the water supply if not properly pretreated. It is important to note that hospital wastes fall into three categories: 1) Hazardous waste such as mercury; 2) Regulated medical waste (commonly referred to as "red-bag waste") which includes all products saturated with blood or body fluids; and 3) Solid waste or general trash (newspapers, non-infected waste) which can be disposed of in a municipal landfill.⁴⁴ For purposes of this discussion, we will focus regulated medical waste.

REGULATED MEDICAL WASTE

While single-use gowns, linens or drapes that are saturated with blood or body fluids are considered to be Regulated Medical Waste, those that are not can be disposed of as solid waste or general trash. Reusable gowns, linens and drapes are also considered solid waste and can be disposed of likewise. This would lead one to conclude that the cost to dispose of non-saturated gowns and drapes whether reusable or disposable would be similar. While polypropylene gowns, linens and drapes do not react with water, they do not contribute to landfill leach. Unlike cotton, they are not biodegradable. Disposing of regulated medical waste is more expensive than disposal in a municipal landfill. In order to conserve costs, it is critical that healthcare facilities make every effort to segregate regulated medical waste. This extends to single-use gowns, linens and drapes. In the past single-use gowns, linens and drapes have been falsely implicated for increasing the cost of disposal. When they are properly segregated, their disposal costs are similar to that of any other solid waste. While opponents of single-use drapes and gowns challenge that these products are not "green friendly", this is not necessarily the case. Single-use garments provide high BTU fuel for incinerators and waste-to-energy plants as well as being converted to pellets, which can be used as a replacement for coal in power plants.⁴⁵

In conclusion, it is important for the perioperative team and the healthcare organization to be educated in all of the facts about the benefits of single-use textiles so that they can make rational decisions about their choice of materials for surgical gowns and drapes.



OR TURNOVER KITS – DO THEY MAKE A DIFFERENCE?

"How much does one minute of operating room time cost?" is a question that is often asked.⁴⁶ In a 2009 study done at the University of Michigan College of Engineering, they initiated a Six Sigma Project to examine their processes for throughput in their operating rooms. The team was charged with examining current processes to determine the causes for inefficiencies, identify the variable involved with their inefficiencies, and create and implement solutions to improve performance.⁴⁷

One of the variables identified in the study was OR turnover time. While studies vary in their estimate of the cost per minute for OR time, ballpark figures in 2009 indicate that the cost per minute ranged from \$29/minute for low complexity to a high of \$80/minute for high complexity procedures. This did not include anesthesia costs.⁴⁸ The cost per minute of OR time, while often difficult to quantify exactly is generally made up of fixed costs such as equipment and utilities and variable costs such as supplies and wages. The important factor to remember in a time when hospitals are struggling to be profitable is that down times (turnover times) do not generate revenue.

In the University of Michigan Study, the Executive Team was unhappy with the low processing rate of the operating rooms. For purposes of this discussion, the target will be to see how





IMPROVING OUTCOMES IN THE OPERATING ROOM

operating rooms can be more efficient by improving turnover times. Assuming that the average cost of an OR minute is \$50, when turnover time is 30 minutes, there is lost revenue to the hospital of \$1500. Assuming that turnover time could be reduced by 10 minutes/case through improved processes, there is a potential to generate additional cases and subsequent revenue. For example, if the OR improves turnover time by 10 minutes per case times 5 cases per day. This adds an additional 50 minutes of actual operating time at \$50/minute for a potential of \$2500 of billed charges. In today's competitive environment overlooking \$1,000 in potential revenues can no longer be ignored.

In an effort to improve existing turnover processes, it is important to understand the accepted definition of turnover time. According to the University of Michigan, turnover time is "the time it takes to prepare the room for the next surgery".⁴⁹ So what is an acceptable turnover time and what, if anything can be done to improve current processes? According to Patrick Garner, turnover times mean different things to different people. For example, the surgeon generally likes to have the turnover time be from the incision close on patient A to incision open on patient B. Anesthesia, on the other hand views "turnover" time as the time from delivering patient A to the Post-Anesthesia Care Unit (PACU) to the time induction is beginning for patient B.⁵⁰ Nurse "turnover" time is generally accepted as the time patient A leaves the room to the time patient B enters the room. For purposes of discussion, the following information will focus on nurse turnover time.

In an article by Anne Dean, she sites that even in the ASC (Ambulatory Surgery Center) environment; the previous expectation for ten-minute turnover times has continued to lengthen.⁵¹ The question has continued as to whether or not there are valid reasons for extended turnover times. Justifications for extended turnover time range from increased patient complexity to an increased focus on more personalized care to the growing technology that is found in the operating rooms of today. Since efficient operating room turnover is essential to the hospital's productivity and financial profitability, there needs to be an ongoing effort to identify strategies that can improve these processes.

One of the initial steps in improving turnover is to get consensus from the perioperative team on what definition of turnover time they all agree on. This is important because without this agreement, there will be limited commitment to changing and improving current processes.

As facilities explore potential options to improve turnover times, many have implemented the use of room turnover kits. These kits have shown to shorten turnover times when used in combination with an organized process of assigning staff specific tasks in the process of room turnover. Identifying the needed tasks is step one. Who will be responsible for wiping down the equipment? Who will be assigned to mopping the floor? Who will be responsible for opening the sterile supplies or securing equipment for the next case? Defining the tasks and assigning these tasks to specific staff members can have a significant impact on decreasing turnover times. Turnover kits are another solution to help streamline the process of room turnover. While initially there may be resistance to the use of turnover kits, they are gaining increased acceptance in many operating rooms. Either hospital assembled kits or those that can be purchased commercially can include a variety of supplies to accomplish room turnover. Most kits include the linens needed to remake the bed, patient safety straps, mop heads, replacement waste bags, and fluid solidifier. Advantages of turnover kits, in addition to improved productivity, include consistency in cleaning practices. Consistency in cleaning practices is increasingly important as hospitals look to decrease HAIs and SSIs. Operating rooms are challenged to maintain sterile, clean environments. Handling multiple patients with varying procedures in a single day requires consistent processes and practices to ensure that each patient is provided with the safest environment possible.

While many facilities choose to package their own turnover kits, many are moving to single-use kits. Single-use kits offer several advantages over reusable kits. They have table linens that offer the advantage of being impermeable to moisture and strike through and are effective barriers when wet. Made of a quilted, breathable material with a hydrophilic layer that facilitates fluid absorption, the material eliminates wrinkling that reduces the risk of skin breakdown, and ulcer formation. The disposable linens have the added advantage (because of their absorption qualities) of protecting the OR bed from contamination with blood and body fluids.

This is important in preventing cross contamination between patients and reducing the potential for SSIs. The linens help to extend the life of the OR tables by limiting exposure to excess fluids. Finally, linting from single-use linens (OR table over, arm board covers and pillow and headrest covers) is minimal which contributes to a reduction in airborne particles.

Additional advantages include ready availability in a single kit that eliminates the need to stock multiple supplies for room turnover activities. It reduces the amount of laundry that must be processed, provides clean, safe linens for every patient, every time! The single-use kits are compliant with OSHA, JCAHO, AORN and APIC standards of practice.

CONCLUSION

Perioperative teams are constantly looking for new and better ways to deliver safe, efficient care. While there are ongoing discussions about the cost associated with single-use items, the overall benefits to the patients and the facility continue to make this an option of choice for an increasing number of facilities. Patient safety, optimizing the OR environment to control HAIs and SSIs, improved staff productivity, reduced air borne particles from traditional linen products and reduced OR turnover times are a few of the benefits afforded by single-use, disposable products. While the decision to embrace single-use, disposable items to replace reusable products, requires in-depth analysis by perioperative leadership, they can make a significant difference in delivering quality care, improving staff and physician satisfaction, and ultimately improving patient outcomes.





IMPROVING OUTCOMES IN THE OPERATING ROOM

GLOSSARY

HEALTHCARE ASSOCIATED INFECTION (HAI)

An infection whose development is favored by a hospital environment, such as one acquired by a patient during a hospital visit or one developing among hospital staff. Such infections include fungal, viral and bacterial infections and are aggravated by the reduced resistance of individual patients.

OPERATING ROOM TURNOVER TIME

The time between one patient's exit and the next scheduled patient's entry to the same OR on the same day. More specifically for the OR nurses it is the time it takes to prepare the room for the next surgery.

TURNOVER KITS

Kits designed to help streamline the process of OR turn over time. Either hospital assembled kits or commercially assembled kits can include a variety of supplies to accomplish room turnover. Most kits include the linens needed to remake the bed, patient safety straps, mop heads, replacement waste bags and fluid solidifier.

SURGICAL DRAPE

A sterile fabric or fabric-like material used to isolate the surgical site from the rest of the body and other possible sources of contamination. Their role is to improve patient safety but also to minimize the spread of infectious agents such as antibiotic resistant bacterial strains, human immunodeficiency virus (HIV), and others, and therefore to decrease the risk for staff as well as other patients to be contaminated by these infectious agents.

SURGICAL GOWN

A sterile fabric or fabric-like material that must be worn by a member of the surgical team during a surgical procedure in order to minimize the exposure of healthcare workers to pathogenic organisms. Also gowns reduce the risk of "patient-to-patient" transmission of pathogenic organisms and optimize sterility during operative and invasive procedures.

SINGLE-USE MATERIALS

Nonwoven materials are the essential component of single-use surgical gowns and drapes. They are based on various forms of natural and synthetic fibers, that is, components such as wood pulp and cotton, or polyester, polyolefin.

SURGICAL SITE INFECTION (SSI)

An infection that occurs after surgery in the part of the body where the surgery took place. Surgical site infections can sometimes be superficial infections involving the skin only. Other surgical site infections are more serious and can involve tissues under the skin, organs, or implanted material.

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