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Solving the Long-Standing Problem of Improper PPE disposal and Overflowing

Introduction

Throughout the US in hospital isolation rooms, waste receptacles are filled to overflowing with used isolation gowns.[1] Leaders must ask two questions: Are disposable isolation gowns overflowing waste receptacles in your patient rooms?; Is that creating an unsightly environment impacting your cleanliness rating?[1,2] Have you tried encouraging best practices for removing PPE or increased the frequency of trash pulls, only to be frustrated with improper doffing techniques and unsightly waste? Epidemiological studies have shown contamination of the skin and clothing of health care personnel frequently occurs (46.0%) during the removal of contaminated gloves and gowns.[3,4] Through the inter-collaboration of leaders from EVS and Nursing at a large academic center, work was undertaken to help solve these issues. A quality improvement project started to address the problem. We introduced isolation gowns with a unique pocket design which allows the used contaminated gown and gloves to be wrapped in a small bundle for compact disposal during the doffing process. The result was a reduction of waste volume and liners used, decreasing the number of trash pulls and providing a cleaner, safer patient room environment.

Impact of Unclean Environment on Patient Safety

Maintaining the hygiene of a hospital environment is necessary to patient safety and should focus on delivering a patient-centered promise.[5] Maintaining appropriate cleanliness of an environment is

directly connected to how a patient perceives the quality of care and preventing infections.[1] When performing an analysis of the relationship between components of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS), the researchers were able to explain the three factors that provide the greatest variation in a patient's willingness to recommend an institution to family and friends. They included the doctor and nurse listened carefully, and the third factor was how often your room and bathroom were kept clean.[1] Those that reported a > 90% score in all three highly recommended the healthcare facility, making cleanliness a differentiating factor for high performing hospitals. Based on hospitals HCAHPS scores, they can lose or gain 2% of Medicare reimbursement. The patient's view of cleanliness is also closely correlated to the risk of hospital-associated infections.[2] Hospitals with the highest rate in cleanliness as perceived by patients had the lowest rates of MRSA and c-difficile as per the 2014 CMS data.[1]

Studies show a clear correlation between discharge rooms of patients with a multidrug-resistant organism and the new patient becoming colonized or developing an infection with the same resistant organism.[6-9] Infections caused by MDROs result in greater risk for hospitalization, incur significantly higher costs, require a longer hospital length of stay, and result in complications. According to the CDC, at least 2 million people become infected with resistant bacteria, and at least 23,000 people die each year as a direct result of these infections.[10] In studies evaluating one of the most common MDRO's, methicillin-resistant staff aureus (MRSA) versus methicillin-susceptible Staphylococcus aureus (MSSA), the incremental cost for treating MRSA ranges from $4,000–$19,000 per infection.[10]

Process Variation in Doffing of PPE's: Impacts Contamination and Cleanliness

Hospital hygiene should involve the integration of established and new technology, together with human elements. They must work together synergistically to achieve the best results, including hand

hygiene, appropriate disposal of waste, and even picking up after oneself.[5] With a greater number of patients in isolation for MDRO's, the problems of appropriate PPE doffing and in-room waste management have become part of the environmental cleanliness and HAI risk factors.

In a study examining doffing of 48 health care personnel (HCP) across eight units, deviation in the process of doffing were numerous. The variation and or errors occurred with rolling up the gown with bare hands, not rolling up the gown with removal resulting in overflowing trash receptacles and gowns on the floor. These factors contribute to the lack of cleanliness of the room perceived by patients and families. Only 23% of the HCP's avoided any visible breaks in the process associated with self-contamination.[4] Forty-two percent of the staff did not follow the hospital's specified technique for rolling up the PPE before disposing of in the trash. The risk of self-contamination is a significant and frequent problem because of improper doffing techniques, which can contribute to the transmission of MDRO's within the health care setting.[3] Okamoto et al. studied 125 HCP's interacting with 95 patients in contact precautions in adult ICUs. Overall, 36% of the HCP's self-contaminated with the targeted MDRO after patient interaction with 30% attributed to the PPE. In the same study, it was observed that 39% of the caregivers made multiple doffing errors and were more likely to have contaminated their clothes.[3] Education and training to provide safe doffing practices do not offer 100% protection from self and environment contamination.[11-13] Designing PPE's to make it easier to remove and dispose of safely should be part of the human factor engineering of the entire PPE process.[14] In one study, one hundred three doffing failure modes were identified during seven simulated doffing procedures. The greatest priority failure modes included gown and glove removal, moving between clean and contaminated areas, and self-inspection while preparing to doff.[15] Most researchers conclude that a redesign of the doffing process, taking into account human factor engineering of the gown design and the environment is critical to reducing self-contamination and potential transmission of microorganisms.[16-18]

Partnering between nursing, and environmental services and operational leaders is critical to improve the cleanliness of the environment and can be accomplished by creating new and innovative solutions to benefit both the patient and the health care worker.

Quality Improvement Initiative

Previously, we had little success with improving staff gown doffing. This included specific twice daily demonstrations of all staff, videos made available to staff from infection prevention and real time correction and reinforcement of behaviors. Recognizing that education alone was not enough we looked for other solutions. We embarked on a quality improvement project with environmental services to introduce an innovative technology (Go Gown®) to force function proper doffing techniques and examine the impact on environmental waste. The Go Gowns design has an inside wrapper panel that allows the contaminated gown and gloves to be wrapped in a small bundle for compact disposal to make it easier for the healthcare practitioner to eradicate the 40% error in doffing that occurs with removal and disposal. The QI study was a pre-post design in an academic medical center's Surgical Intensive Care Unit over a 2-month period in 2018. Education was provided to staff on the use of the Go Gown® as well as the traditional gowns. The education for both groups included videos, daily demonstrations to staff and real time reinforcement and correction of behaviors. The study variables included number of trash liners used, number of trash pulls, and impact on cost related to waste control prep and post implementation. A two Tail T-test was used with a significance at $p=0.05$. In preliminary Go Gown® trials it was noted that doffed gowns were easy to dispose directly into a waste basket without overflowing. (Figure 1) During the baseline period of standard gown use, we noted many rooms with unemptied trash overflowing the containers. (Figure 2)

Figure 1. Example of Isolation Gown disposable with and without Go Gown® technology

Figure 2: Picture of the SICU isolation trash receptacles prior to Go Gown Trial

Results:

We evaluated the number of trash liner pulls/patient/day. For the Go-Gown it was 1.01 and 0.56 for the standard gown. P value was significant at < 0.0001. To insure that the decrease in trash liner pulls was not due to a decrease in the number of gowns used each day we examined the number of gowns used/day during the Go Gown® trial and noted that was slightly more than the number of standard gowns used during the baseline measurement. Go Gown® use enabled EVS to reduce the number of trash pulls on the midnight shift from 2/shift to 1/shift. Using an estimated cost of liners and time to pull trash by EVS workers we estimated a savings of $52,000/year (Table 1).

Table 1. Overall T-Test for liners/contact room

	Baseline	*Trial*
Mean	19.22480159	40.51065163
Variance	38.76624399	341.901847
Observations	10	19
Pooled Variance	240.856646	
Hypothesized Mean Difference	0	
df	27	
	-	
t Stat	3.510665752	
P(T<=t) one-tail	0.000794642	
t Critical one-tail	1.703288446	
P(T<=t) two-tail	0.001589283	
t Critical two-tail	2.051830516	

This test is bring run only on days where we have complete data across all 3 shifts.
The value being measured is the ratio of liners to contact rooms

Anecdotally the staff initially felt that using the Go-Gown was more difficult to roll up than a standard gown but this improved significantly over time. By the end of the trial staff had developed muscle

memory for Go Gown® removal. Both staff and families were pleased by the cleanliness that the Go-Gown provided in the rooms. After discussion with EVS leadership, we did not feel that the decrease in trash liner pulls would enable a reduction in EVS staffing but we anticipated that the new EVS worker time would better be deployed to other environmental cleaning needs that were evident on patient surveys. While not directly studied in this trial, there is the potential for impacting HCAHPS scores based on a cleaner hospital environment and reducing microbiological contamination of the workplace.

Summary

Implementation of an innovative gown with a pocket did help to force function staff into an improved doffing gown process. After education and a short training period staff developed muscle memory on proper doffing. Staff felt that this decreased the risk of infection spread and both families and staff appreciated the cleaner work environment. We did see modest savings in reduced trash pulls and use of liners but was offset by the extra cost for the gown. While not directly studied, there is the potential for impacting HCAHPS scores based on a cleaner hospital environment and reducing microbiological contamination of the HCW resulting in cost avoidance related to reimbursement and potential hospital acquired infection reductions.

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