

inner gloves, hands, face, and scrubs were sampled for viral contamination using infectivity assays. HCWs performed the entire sequence twice, first with a 1-layer hood with 1 shroud then with a 2-layer hood with 2 shrouds. The Wilcoxon rank-sum test was used to compare viral contamination between the 2 hood types. HCWs were video-recorded to identify failure modes in their doffing process using a failure modes and effects analysis to identify ways that individual actions deviated from optimal behavior. **Results:** $\Phi 6$ transfer to hands, inner gloves, and scrubs were observed for 1 HCW using the 1-layer hood versus scrubs only for 1 HCW using the 2-layer hood. MS2 transfer to hands was observed for 2 HCWs using the 1-layer hood versus none using the 2-layer hood. Inner glove contamination was observed for 6 of 8 HCWs using the 1-layer hood versus 2 of 8 using the 2-layer hood. **Conclusions:** A significantly higher number of MS2 virus was recovered on the inner gloves of HCWs using the 1-layer versus the 2-layer hood (median difference, 2.27×10^4 ; $P = .03$). In addition, 31 failure modes were identified during removal of the 2-layer hood versus 13 failure modes for the 1-layer hood. The magnitude of self-contamination depends on the type of PAPR hood used. The 2-layer hood resulted in significantly less inner glove contamination than the 1-layer hood. However, more failure modes were identified during the doffing process for the 2-layer hood. In conclusion, the failure modes identified during the use of the 2-layer hood were less likely to result in self-contamination compared to the failure modes identified during use of the 1-layer hood.

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Poster Presentation

Self-Contamination While Doffing Personal Protective Equipment

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Background: Personal protective equipment (PPE) effectiveness can be undermined by inappropriate doffing methods.

Objective: We used human factors engineering methods to evaluate self-contamination during PPE doffing. **Methods:** In this study, 30 participants at a Midwestern academic hospital (A) donned and doffed 3 mask styles ($n = 10$), 2 gown styles ($n = 10$), and 2 glove styles ($n = 10$; the Doffy glove has a tab to facilitate doffing). Also, 30 additional participants at hospital A (residents or fellows, nurses, special isolation trained staff [SITS]) and 10 SITS at academic hospital B doffed a surgical mask, a breakaway neck gown, and exam gloves (PPE ensemble) twice: once while distracted with conversation and once when not distracted. We randomized the order in which participants used different PPE styles or they did the doffing scenario. We collected demographic data. We applied Glo Germ Mist (1.5 dilution in water) with a mucosal atomizer to participants' PPE before they doffed. We video-recorded

Table 1.

Table 1: Contamination Results

PPE type tested	Number of participants who self-contaminated	Median (range) number of spots
Masks & Gloves		
Earloop	7/10	2 (0-12)
Pouch	8/10	3 (0-14)
Surgical	6/10	2 (0-7)
Gloves		
Standard exam gloves	8/10	2.5 (0-9)*
Doffy glove	3/10	0 (0-2)*
Doffy glove after viewing "beak method" training video	5/10	0.5 (0-4)
Gowns & Gloves		
Breakaway	8/10	6.5 (0-38)
Tape-tab	7/10	3.5 (0-30)
PPE Ensemble		
<i>Residents and Fellows</i>		
Distraction	6/10	2.5 (0-16)*
Non-distraction	8/10	13.5 (0-43)*
<i>Nurses</i>		
Distraction	7/10	4.5 (0-22)
Non-distraction	9/10	6.5 (0-23)
<i>Hospital A SITS</i>		
Distraction	9/10	7.5 (0-46)
Non-distraction	10/10	11.5 (2-35)
<i>Hospital B SITS</i>		
Distraction	6/10	3 (0-12)
Non-distraction	8/10	3.5 (0-32)

participants as they doffed, and we photographed their scrubs and exposed skin before and after each donning and doffing episode. We reviewed videos for doffing errors and photographs for fluorescent spots. We counted fluorescent spots and noted their locations. **Results:** Overall, 45 (64.3%) participants were women, 31 (44.3%) were nurses, 24 (34.3%) were physicians. Among the participants, 25 (35.7%) had >15 years of experience and 61 (87.1%) had some training in doffing. Participants frequently contaminated their skin or clothing while doffing (Table 1). For all scenarios, hands followed by the torso were contaminated most frequently. Analysis of the videos found that touching the gown front with bare hands was the most common doffing error. Fewer participants self-contaminated when using the Doffy glove without training than when using the standard exam glove. Although most participants in the glove trial indicated that they did not need to watch the Doffy glove training video again, most had difficulty doffing the Doffy glove with the beak method. Many participants stopped doffing to answer questions when they doffed the PPE ensemble during the interruption scenario. **Conclusions:** Self-contamination was very common with all PPE styles and during all scenarios. Distraction did not increase the risk of contamination. However, participants often stopped doffing to answer questions, which they rarely do in practice. Watching a video was inadequate training for the beak glove-doffing method. The Doffy glove, which decreased contamination compared with the standard glove in the untrained scenario, may have advantages over standard exam gloves and should be evaluated further.

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Semiquantitative *Staphylococcus aureus* Nasal Colony Reduction in Elective Orthopedic Surgery Reduces Surgical Site Infection

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Background: Clean surgical procedures such as hip and knee replacement and spine surgery have a low infection complication rate; however, if infections occur, there is substantial morbidity and increased cost. *Staphylococcus aureus* causes 30% of surgical site infections (SSIs). *S. aureus* colonization increases the risk of developing SSI. Nasal povidone-iodine 5% application reduces the

S. aureus colonization burden. **Objective:** We aimed to reduce SSIs by applying nasal povidone-iodine 5% prior to hip and knee replacement and spine surgery. **Methods:** Adult patients hospitalized for elective hip replacement, knee replacement, or spine surgeries from February 2018 through August 2019 comprised the study cohort. All patients received preoperative guidance in the outpatient clinic. On admission, the evening before surgery, a nasal swab for *S. aureus* colonization was performed, followed by povidone-iodine 5% application in both nostrils and body chlorhexidine gluconate 4% bathing. Application of these substances was repeated in the morning before surgery. Within 24 hours after surgery, an additional nasal swab for *S. aureus* colonization was taken. A 90-day follow-up for SSI was done. Data were compared with a similar 2016–2017 cohort without the

Table 1.

Table 1: Pre- and post-surgery data of the present cohort

Semi-quantitative nasal culture results	Spine 24-h pre-surgery (N=101)	Spine 24-h post-surgery (N=101)	Hip and knee 24-h pre-surgery (N=85)	Hip and knee 24-h post-surgery (N=85)
Negative	84	94	65	74
MSSA scant growth	12	5	15	10
MSSA confluent growth	3	0	4	0
MRSA scant growth	1	2	1	1
MRSA confluent growth	1	0	0	0

preoperative measures. **Results:** In total, 186 patients were included: 85 underwent hip or knee replacement (age 69 ± 13.2 y, 66% men), and 101 spine surgery (age 55 ± 15.4 y, 52% men). At screening, 18.3% were colonized with methicillin-sensitive *S. aureus* and 1.6% colonized with methicillin-resistant *S. aureus*. Pre- and post-surgery data for the cohort appear in Table 1. The SSI rate per 100 patient days for hip and knee replacement and for spine surgery decreased from 0.29 and 4.0, respectively, in the 2016–2017 cohort to 0 and 0.99, respectively, in the present cohort. **Conclusions:** Nasal povidone-iodine 5% reduced the *S. aureus* colonization burden. The SSI rate in elective hip and knee replacement and spine surgery significantly decreased. We show that there is no need for *S. aureus* eradication presurgery; semiquantitative *S. aureus* nasal colony reduction should suffice in reducing SSIs. Further research is needed using quantitative measurements for *S. aureus* colonization.

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Seroprevalence of Measles in Healthcare Workers in South Korea

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Background: Measles is a highly contagious disease that is transmissible by airborne particles but is preventable by vaccination. South Korea has maintained a highly immunized adult population; however, small local outbreaks of measles continued to occur, and there have been some reports of pockets of underimmunity among the young adult population. It is important to know the seroepidemiology of healthcare workers (HCWs) for policy-making processes, but data on the seroprevalence of measles in HCWs in South Korea are limited. **Methods:** We investigated the seroprevalence of HCWs at Asan Medical Center, a 2,705-bed tertiary-care hospital in Seoul, South Korea, with 8,329 HCWs. In 2014, after an outbreak of measles occurred in a university in Seoul, Asan Medical