during medical appointments and other activities outside their room. **Methods:** We conducted an observational cohort study of MRSA-colonized long-term care facility (LTCF) residents to determine the frequency and mechanisms of contamination of surfaces outside patient rooms. Nares, skin, and clothing of patients in contact precautions for MRSA were cultured for MRSA, and high-touch surfaces in the residents' room were contaminated with the live virus bacteriophage MS2 and cauliflower mosaic virus DNA. The participants were observed during activities and medical appointments outside their rooms for 3 days, and sites that were contacted were sampled for recovery of MRSA, bacteriophage MS2, and cauliflower mosaic virus DNA. **Results:** As shown in Fig. 1, bacteriophage MS2 and cauliflower mosaic virus DNA was transferred to 1 or more surfaces outside the resident's room by 5 of the 7 participants, and MRSA was recovered from surfaces touched by 6 (86%) participants. MRSA was recovered during 16 of 35 episodes (46%) where sampling was performed, and recovery was similar for medical appointments (eg, hemodialysis, physical therapy) and nonmedical activities (eg, using the dining room or activity center). Moreover, MRSA, MS2, and the viral DNA marker were recovered both from sites contacted only by participants' hands and from sites contacted only by clothing. Bacteriophage MS2 and the viral DNA marker were also recovered from portable equipment and from the nursing station. **Conclusions:** MRSA-colonized LTCF residents frequently disseminated MRSA and viral surrogate markers to surfaces outside their rooms through contact with contaminated hands and clothing. Efforts to reduce contamination of hands and clothing might reduce the risk for pathogen transmission.

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Does Blood on "Dirty" Instruments Interfere With the Effectiveness of Sterilization Technologies?

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Table. Effectiveness of the microbicidal activity of sterilization technologies in the presence of blood on "dirty" instruments[1]

Test Organism	Method of Sterilization	Instruments "dirty" (non-cleaned) with or without blood	Instrument Quantitation (Mean)	No. of Positives/ No. of Runs (% Positive)
Geobacillus stearothermophilus (spores)	Steam Sterilization	Dirty	~ $1.56x10^5$	0/10 (0)
		Dirty with blood	~ $1.82x10^5$	0/15 (0)
	ETO	Dirty	~ $1.53x10^5$	0/10 (0)
		Dirty with blood	~ $2.35x10^5$	0/11 (0)
	HPGP	Dirty	~ $1.58x10^5$	5/10 (50)
		Dirty with blood	~ $2.35x10^5$	9/15 (60)
Mycobacterium terrae	Steam Sterilization	Dirty	~ $4.25x10^6$	0/10 (0)
Bacillus atrophaeus (spores)	ETO	Dirty	~ $2.30x10^7$	6/10 (60)
		Dirty with blood	~ $4.08x10^7$	9/10 (90)
MRSA	ETO	Dirty	~ $2.62x10^6$	0/10 (0)
		Dirty with blood	~ $1.72x10^6$	0/10 (0)
	HPGP	Dirty	~ $1.13x10^6$	4/15 (27)
		Dirty with blood	~ $1.27x10^6$	4/10 (40)
VRE	ETO	Dirty	~ $2.27x10^6$	0/10 (0)
		Dirty with blood	~ $3.59x10^6$	0/10 (0)
	HPGP	Dirty	~ $2.42 x10^6$	3/15 (20)
		Dirty with blood	~ $2.34x10^6$	9/10 (90)

[1]Study conditions not representative of practice or manufacturer's recommendations
Abbreviations: ETO, ethylene oxide; HPGP, hydrogen peroxide gas plasma; MRSA, methicillin-resistant *Staphylococcus aureus*; VRE, vancomycin-resistant *Enterococcus*

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Background: Surgical instruments that enter sterile tissue should be sterile because microbial contamination could result in disease transmission. Despite careful surgical instrument reprocessing, surgeons and other healthcare personnel (HCP) describe cases in which surgical instruments have been contaminated with organic material (eg, blood). Although most of these cases are observed before the instrument reaches the patient, in some cases the contaminated instrument contaminates the sterile field, or rarely, the patient. In this study, we evaluated the robustness of sterilization technologies when spores and bacteria mixed with blood were placed on "dirty" (uncleaned) instruments. **Methods:** "Dirty" surgical instruments were inoculated with 1.5×105 to 4.1×107 spores or vegetative bacteria (MRSA, VRE or *Mycobacterium terrae*) in the presence or absence of blood. The spores used were most resistant to the sterilization process tested (eg, *Geobacillus stearothermophilus* for steam and HPGP and *Bacillus atrophaeus* for ETO). Once the inoculum dried, the instruments were placed in a peel pouch and sterilized by steam sterilization, ethylene oxide (ETO), or hydrogen peroxide gas plasma (HPGP). These experiments are not representative of practice or manufacturer's recommendations because cleaning must always precede sterilization. **Results:** Steam sterilization killed all the *G. stearothermophilus* spores and *M. terrae* when inoculated onto "dirty" instruments in the presence or absence of blood (Table 1). ETO failed to inactivate all test spores (*B. atrophaeus*) when inoculated onto "dirty" instruments (60% failure) and "dirty" instruments with blood (90% failure). ETO did kill the vegetative bacteria (MRSA, VRE) under the same 2 test conditions (ie, "dirty" instruments with and without blood). The failure rates for HPGP for *G. stearothermophilus* spores and MRSA were 60% and 40%, respectively, when mixed with blood on a "dirty" instrument. **Conclusions:** This investigation demonstrated that steam sterilization is the most robust sterilization process and is effective even when instruments were not cleaned and the test organisms (*G. stearothermophilus* spores and MRSA) were mixed with blood. The low-temperature sterilization technologies tested (ie, ETO, HPGP) failed to inactivate the test spores but ETO did kill the test bacteria (ie, MRSA, VRE). These findings should assist HCP to assess the risk of infection to patients when potentially contaminated surgical instruments enter the sterile field or are unintentionally used on patients during surgery. Our data also demonstrate the importance of thorough cleaning prior to sterilization.

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Does Nursing Shift Influence Adherence to Central-Line Maintenance Bundles?

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Background: Proper care and maintenance of central lines is essential to prevent central-line–associated bloodstream infections (CLABSI). Our facility implemented a hospital-wide central-line maintenance bundle based on CLABSI prevention guidelines. The objective of this study was to determine whether maintenance bundle adherence was influenced by nursing shift or the day of week. **Methods:** A central-line maintenance bundle was implemented in April 2018 at a 1,266-bed academic medical center. The maintenance bundle components included alcohol-impregnated disinfection caps on all ports and infusion tubing, infusion tubing dated, dressings, not damp or soiled, no oozing at insertion site greater than the size of a quarter, dressings occlusive with all edges intact, transparent dressing change recorded within 7 days, and no gauze dressings in place for >48 hours. To monitor bundle compliance, 4 non–unit-based nurse observers were trained to audit central lines. Observations were collected between August 2018 and October 2019. Observations were performed during all shifts and 7 days per week. Just-in-time feedback was provided for noncompliant central lines. Nursing shifts were defined as day (7:00 A.M. to 3:00 P.M.), evening (3:00 P.M. to 11:00 P.M.), and night (11:00 P.M. to 7:00 A.M.). Central-line bundle compliance between shifts were compared using multinomial logistic regression. Bundle compliance between week day and weekend were compared using Mantel-Haenszel χ^2 analysis. **Results:** Of the 25,902 observations collected, 11,135 (42.9%) were day-shift observations, 11,559 (44.6%) occurred on evening shift, and 3,208 (12.4%) occurred on the night shift. Overall, 22,114 (85.9%) observations occurred on a week day versus 3,788 (14.6%) on a Saturday or Sunday (median observations per day of the week, 2,570; range, 1,680–6,800). In total, 4,599 CLs (17.8%) were noncompliant with $\geq$1 bundle component. The most common reasons for noncompliance were dressing not dated (n = 1,577; 44.0%) and dressings not occlusive with all edges intact (n = 1340; 37.4%). The noncompliant rates for central-line observations by shift were 12.8% (1,430 of 1,1,135) on day shift, 20.4% (2,361 of 11,559) on evening shift, and 25.2% (808 of 3,208) on night shift. Compared to day shift, evening shift (OR, 1.74; 95% CI, 1.62–1.87; $P < .001$) and night shift (OR, 2.29; 95% CI, 2.07–2.52; $P < .001$) were more likely to have a noncompliant central lines. Compared to a weekday, observations on weekend days were more likely to find a noncompliant central line: 914 of 3,788 (24.4%) weekend days versus 3,685 of 22,114 (16.7%) week days ($P < .001$). **Conclusions:** Noncompliance with central-line maintenance bundle was more likely on evening and night shifts and during the weekends.

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Does the Fist Bump Transfer Less Methicillin-Resistant *Staphylococcus aureus* Than a Handshake?

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Background: Contaminated hands are the most important source for transmission of pathogens in healthcare settings. It has been proposed that replacing the handshake with alternative greetings such as the fist bump might reduce the risk for pathogen transmission. **Methods:** In a cohort of 50 patients with methicillin-resistant *Staphylococcus aureus* (MRSA) colonization, we compared the

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