
S P E C I A L R E P O R T

Mobile Patient-Care Equipment: Addressing Challenges Related to Cleaning and Monitoring

Routine, thorough cleaning of patient-room items such as beds and bathroom fixtures is a part of hospitals' environmental hygiene programs, but what about patient-care objects and equipment that move freely about the healthcare environment? Items such as mobile X-ray machines, stethoscopes, blood pressure cuffs, wheelchairs and IV poles, to name a few, can become contaminated quickly when used and can be a reservoir of pathogenic bacteria if not cleaned and disinfected before the next use.

By Kelly M. Pyrek

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Mobile Patient-Care Equipment:

Addressing Challenges Related to Cleaning and Monitoring

By Kelly M. Pyrek

Routine, thorough cleaning of patient-room items such as beds and bathroom fixtures is a part of hospitals' environmental hygiene programs, but what about patient-care objects and equipment that move freely about the healthcare environment? Items such as mobile X-ray machines, stethoscopes, blood pressure cuffs, wheelchairs and IV poles, to name a few, can become contaminated quickly when used and can be a reservoir of pathogenic bacteria if not cleaned and disinfected before the next use.

As Ernst (2014) explains, "One area that is often overlooked, but presents a significant opportunity to reduce infection risk, is the disinfection of mobile equipment. Mobile equipment, such as wheelchairs, IV poles and computers/workstations on wheels, are touched thousands of times every day by patients, visitors and staff. As this occurs, pathogens can spread from the individual to the equipment, and vice versa, and bacteria spreads from one area of the hospital to another. Numerous studies have shown that hospital surfaces and frequently used medical equipment become contaminated by a variety of pathogenic and nonpathogenic organisms. Common human pathogens, such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), *Clostridium difficile*, *Acinetobacter* species, and noroviruses can survive for prolonged periods on hospital equipment. According to the CDC, 'surfaces frequently touched by hand potentially could contribute to secondary transmission [of infection-causing bacteria] by contaminating hands of healthcare workers or by contacting medical equipment that subsequently contacts patients.' Proper decontamination of mobile equipment, therefore, plays an important role in stopping the spread of HAIs."

Weber and Rutala (2013) concur, "Multiple studies have demonstrated that less than 50 percent of hospital room surfaces are adequately cleaned and disinfected when chemical germicides are used. Similarly, inadequate cleaning of portable medical equipment by nursing staff has also been demonstrated." Havill, et al. (2011) say that "Increased attention has been focused on disinfection by housekeepers, but few data are available on disinfection



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of equipment by nurses. The researchers used adenosine triphosphate bioluminescence assays and aerobic cultures to assess the cleanliness of portable medical equipment disinfected by nurses between each patient use. They found that the equipment was not being disinfected as per protocol and that education and feedback to nursing are warranted to improve disinfection of medical equipment.”

The Centers for Disease Control and Prevention (CDC) reminds clinicians to clean frequently used vital signs equipment (including patient chair, blood pressure cuff, pulse oximetry sensors and thermometers (if not disposable) by including it in daily (or more frequent) cleaning of high-touch surfaces. And for equipment such as IV poles, the Occupational Safety and Health Organization (OSHA) requires that “All equipment and environmental and working surfaces shall be cleaned and decontaminated after contact with blood or other potentially infectious materials” according to 29 CFR 1910.1030(d)(4)(ii). OSHA adds that contaminated equipment such as IV poles require labels or tags in accordance with 29 CFR 1910.1030(g)(1)(i)(H). The labels must also identify which portions of the equipment are contaminated.

Solomon (2012) found that IV stands tested positive for bacterial contamination and at least two components of each IV stand were bacterially contaminated: “The highest contamination rates were found on the pole, hook and base of the IV stand. Five distinct species of bacteria were identified. If bacteria existed on any single component of the IV stand, there was a 76.5 percent chance that it would be identified on at least one other component. This suggests that bacteria are frequently and easily transferred during routine clinical handling and practice. The connector at the end of the IV line (the male luer) is a known route for CRBSI. Because contamination on the IV stand can be transferred among the components hanging on the stand, such as from the IV pole to IV fluid line, all equipment hanging from the IV stand should be considered potentially contaminated, unless measures are taken to protect the equipment and IV lines from contamination. Any medical device hung from or touching an IV stand must be protected from contamination, especially if it will ultimately touch a patient’s skin. A medical device can safely be stored on an IV stand if the entire device is protected from contamination, such as by a sterile-barrier wrapper that can be removed before the device is used.”

Because several epidemiological studies have shown that fomites may have a role in transmission of dangerous pathogens such as VRE, equipment which is frequently shared, such as the aforementioned blood pressure cuffs, electronic thermometers, IV poles, etc., should be dedicated for use on the VRE-positive patient and thoroughly cleaned and disinfected prior to use on another individual. (In hospitals where VRE is endemic, this may not



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be practical. In such cases, decisions about dedicated equipment should be made on a case-by-case basis as circumstances permit.)

Schwegman (undated) notes that medical devices such as sphygmomanometers, thermometers and stethoscopes have been implicated in the spread of HAIs through indirect contact transmission: “In a study by Base-Smith, sphygmomanometer cuffs from various inpatient settings were found to have bacterial colonization rates of 81 percent to 100 percent. Also, 45.7 percent of the ‘clean’ cuffs were contaminated with organic and/or inorganic substances that should not have been present. Additionally, the patient contact sides of cuffs were contaminated twice as often as the nonpatient sides. Stemicht, et al. found similar colonization rates of re-used disposable blood pressure cuffs. Myers et al identified a single blood pressure cuff as the common source of a nosocomial infection outbreak in a neonatal intensive care unit. Similarly, Livornese, et al. found an electronic thermometer as the vehicle which caused an outbreak of vancomycin resistant *Enterococcus Faecium* in a med-surg intensive care unit and ward of a university hospital. Marinella, et al. found that 100 percent of stethoscopes were contaminated with coagulase negative staphylococcus and 38 percent were contaminated with *Staphylococcus aureus*.”

Matsuo, et al. (2013) note that although blood pressure cuffs are commonly used and shared in medical facilities, their routine disinfection is performed infrequently. The researchers investigated the contamination of blood pressure cuffs by methicillin-resistant *Staphylococcus aureus* (MRSA). The MRSA level on the inner side (the surface in contact with patients’ skin) of blood pressure cuffs used in the wards and outpatient clinics of a university hospital (733 beds) was determined using the gauze and swab wiping methods. Using the gauze wiping method (n = 35), the MRSA contamination rate was 31.4 percent, and the MRSA contamination level was $1,702.6 \pm 9,996.1$ (0-58, 320) colony-forming units (cfu)/cuff. No MRSA was detected on blood pressure cuffs after washing (n = 30) or wiping with 80 percent ethanol (n = 18).

Grewal, et al. (2013) say that blood pressure (BP) cuffs are potential vectors for transmission of multi-resistant organisms (MROs). The study aimed to determine MDRO colonization rates in BP cuffs from areas of high patient flow as an assessment of the quality of disinfection and infection control practices. BP cuffs in the ED, high dependency unit (HDU) and operating theaters (OT) were prospectively examined after routine disinfection procedures. Swabs collected from the inner and outer surfaces of BP cuffs during inter-patient intervals were plated onto replicate organism detection and counting, methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococcus* (VRE) chromogenic agar plates to detect rates of bacterial, MRSA and VRE colonization, respectively. High bacterial colonization rates were detected in BP cuffs from all three areas. BP cuffs from OT were significantly less colonized compared with cuffs from HDU and ED; 76 percent versus



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96 percent and 100 percent for inner surfaces and 86 percent versus 98 percent and 100 percent for outer surfaces, respectively. Equivalent or higher bacterial growth was observed on the inner surface compared with outer surface in 54 percent, 84 percent and 86 percent of BP cuffs from OT, HDU and ED, respectively. MRSA was detected in 3 of 150 (2%) swabs collected, but no VRE was detected.

Wilkins (1993) tested reusable pulse oximetry sensors from 15 hospitals throughout the United States. Each sensor was deemed by the hospital to be ready for patient use, and it had been prepared for use according to hospital procedures. Patient-contact areas of each sensor were swabbed, and the swabs were analyzed for bacterial contamination using standard testing procedures. This study had two stages, and different sensors were tested in each stage. In the bacterial-growth stage, swabs were evaluated for bacterial contamination but organisms were not identified; in the identification stage, bacterial species were identified. Forty-four sensors were evaluated, 16 in the bacterial-growth stage and 28 in the identification stage. Bacteria were cultured from 29 of the 44 sensors (66 percent), including 20 that had been cleaned with alcohol or an antibacterial/antiviral agent. Among the isolated organisms were *Staphylococcus aureus*, *Staphylococcus haemolyticus*, *Enterococcus faecalis*, and *Klebsiella oxytoca*. Bacterial contamination was found on sensors from 12 of the 15 participating hospitals.

Davis (2009) notes the challenges of finding time to attend to the decontamination, cleaning and disinfection of non-critical monitoring equipment such as blood pressure cuffs and pulse oximeters in the hospital emergency department. In this single-center prospective study within an emergency department treating more than 35,000 patients annually, researchers obtained 30 swabs from re-usable blood pressure cuffs and pulse oximeters (Group A). The swabs were cultured for a period of 48 hours. Both new and cleaned equipment enabled the formation of control groups B and C, respectively. Equipment in Group C was cleaned according to the Spaulding Classification System and then swabbed by the principle researcher. Of the 30 swabs obtained in group A, 83 percent reported growths of saprophytes predominantly being a combination of mixed skin flora and environmental pathogens. Two pulse oximeter sensors returned clinically significant colonies of *Staphylococcus aureus* and *Bacillus* species.

There have been many studies in the literature implicating stethoscopes in the transmission of pathogens. In one of the very latest studies, Longtin, et al. (2014) sought to compare the contamination level of physicians' hands and stethoscopes and to explore the risk of cross-transmission of microorganisms through the use of stethoscopes. The researchers conducted a structured prospective study involving 83 inpatients at a Swiss university teaching hospital. After a standardized physical examination, four regions of the



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physician's gloved or ungloved dominant hand and two sections of the stethoscopes were pressed onto selective and nonselective media; 489 surfaces were sampled. Total aerobic colony counts (ACCs) and total methicillin-resistant *Staphylococcus aureus* (MRSA) colony-forming unit (CFU) counts were assessed. Median total ACCs for fingertips, thenar eminence, hypothenar eminence, hand dorsum, stethoscope diaphragm, and tube were 467, 37, 34, 8, 89, and 18, respectively. The contamination level of the diaphragm was lower than the contamination level of the fingertips but higher than the contamination level of the thenar eminence. The MRSA contamination level of the diaphragm was higher than the MRSA contamination level of the thenar eminence. The correlation analysis for both total ACCs and MRSA CFU counts revealed that the contamination level of the diaphragm was associated with the contamination level of the fingertips. Similarly, the contamination level of the stethoscope tube increased with the increase in the contamination level of the fingertips for both total ACCs and MRSA CFU counts. These results suggest that the contamination level of the stethoscope is substantial after a single physical examination and comparable to the contamination of parts of the physician's dominant hand.

In another recent study, Shiferaw, et al. (2013) randomly selected and swabbed 176 stethoscopes owned by healthcare workers and medical students. A total of 151 (85.8 percent) stethoscopes were contaminated. A total of 256 bacterial strains and a mean of 1.44×10^4 CFUs/diaphragm of stethoscopes was isolated. Of the 256 isolates, 133 (52 percent) were potential pathogens like *S. aureus*, *Klebsiella* spp., *Citrobacter* spp., *Salmonella* spp., *Proteus* spp., *Enterobacter* spp., *P. aeruginosa* and *E. coli*. All strains were resistant to multiple classes of antibiotics (two to eight classes of antibiotics). Disinfection practice was poor. Disinfection practice was found to be associated with bacterial contamination of stethoscopes. High contamination rate 100 (90.9 percent) was observed among stethoscopes that had never been disinfected; while the least contamination 29 (72.2 percent) was found on those disinfected a week or less before the survey.

Portable X-ray machines also get around the hospital and may serve as potential reservoirs. Levin, et al. (2009) say that the routine chest radiograph provides an unexamined opportunity for bacterial spread: close contact with each patient and sequential examination of ICU patients. Their study examined infection control procedures performed during routine chest radiographs, assessed whether resistant bacteria were transferred to the radiograph machine, and determined whether improved infection control practices by radiograph technicians could reduce bacterial transfer. Radiograph technicians were observed performing chest radiographs on all ICU patients. Culture specimens were taken from the radiograph machine. An educational intervention directed at technicians was instituted, and its effect on infection control and machine contamination was measured. Surveillance of 173, 113,



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and 120 chest radiographs during observation, intervention, and follow-up periods was performed. Adequate infection control was practiced during the performance of 2 of 173 observation period radiographs (1 percent), 48 of 113 intervention period radiographs (42 percent), and 12 of 120 follow-up period radiographs (10 percent). Radiograph machine surface culture samples yielded resistant Gram-negative bacteria on 12 of 30 occasions (39 percent), 0 of 29 occasions, and 7 of 14 occasions (50 percent), respectively, for the observation, intervention and follow-up periods.

Sometimes it's the most innocuous free-floating items that need the most scrutiny. For example, Chen, et al. (2014) identified and compared the incidence of bacterial contamination of hospital charts and the distribution of species responsible for chart contamination in different units of a tertiary hospital. All beds in medical, surgical, pediatric, and obstetric-gynecologic general wards (556) and those in corresponding special units (125) including medical, surgical, and pediatric intensive care units (ICUs), were surveyed for possible chart contamination. The outer surfaces of included charts were sampled by one experienced investigator with sterile cotton swabs rinsed with normal saline. For general wards and special units, the overall sampling rates were 81.8 percent (455/556) and 85.6 percent (107/125); the incidence of chart contamination was 63.5 percent and 83.2 percent, respectively. Except for obstetric-gynecologic charts, the incidence was significantly higher in each and in all ICUs than in corresponding wards. Coagulase-negative staphylococci was the most common contaminant in general wards (40.0 percent) and special units (34.6 percent). Special units had a significantly higher incidence of bacterial contamination due to *Staphylococcus aureus* (17.8 percent), methicillin-resistant *Staphylococcus aureus* (9.3 percent), *Streptococcus viridans* (9.4 percent), *Escherichia coli* (11.2 percent), *Klebsiella pneumoniae* (7.5 percent), and *Acinetobacter baumannii* (7.5 percent). Logistic regression analysis revealed the incidence of chart contamination was two- to four-fold higher in special units than in general wards.



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In a poster presentation, "Cleaning of Portable, Multiple-Use Medical Equipment: An Observation Tool," presented at the 2012 IDWeek meeting, researchers at Penn State Hershey Medical Center explained that portable equipment used on a series of patients are a potentially important source of transmission of multi-drug resistant organisms in hospital settings. Approaches to decrease spread of pathogens include hand hygiene and cleaning of equipment after each use. There are limited data on the evaluation of equipment cleaning in clinical settings. Attia, et al. (2012) conducted a cross-sectional study at a 500-bed tertiary-care center to evaluate equipment cleaning practices. Equipment selected for observation included commonly used devices that are in direct contact with multiple patients on a daily basis. We designed a survey tool to standardize data collection.

Observations were performed over the course of four weeks in three medical-surgical units during different work-shifts. Cleaning of equipment was monitored before and after use of the equipment for a patient; any attempt to clean the equipment (before or after contact with the patient) with disinfectant cloths was recorded. Disinfectant cloths are mounted on the wall by each door and are in baskets attached to electronic blood pressure devices. The researchers monitored 110 patient encounters. Types of equipment under observation were stethoscopes (36.4 percent), portable electronic blood pressure cuffs (25.5 percent), thermometers (20.9 percent), point-of-care glucometers (16.4 percent), and mobile X-ray machines (0.9 percent). Equipment was cleaned for 23.9 percent of contact precautions encounters and for 7.3 percent of non-contact precautions encounters. Hand hygiene before and after patient care occurred for 33.6 percent and 81.8 percent of encounters, respectively. In contact precautions encounters, 76.8 percent of providers used gloves and 83.0 percent used isolation gowns. Attia, et al. (2012) concluded that cleaning of medical equipment was more commonly performed for contact precautions encounters compared to non-contact precautions encounters. However, overall cleaning was done infrequently. Failure to clean equipment between patient encounters may contribute to the transmission of healthcare pathogens.

Philip Carling, MD, of Boston University School of Medicine, calls such mobile medical equipment “orphan objects,” and in a presentation at the 2013 IDWeek meeting, “Owning Orphan Objects: Tracking and Cleaning,” he reviewed what these objects are and their potential role in HAI transmission. He explained that based on two types of evidence — prior-room occupant transmission studies, and extended transmission reports — orphan objects can be implicated in disease transmission. Carling pointed to epidemiologic clusters with transmission probability, including: MRSA and VRE found on computer keyboards and IVAC units; *Pseudomonas* found on ventilator controls; and VRE and *C. difficile* found on portable thermometers.

Just like the proverbial iceberg, Carling says that orphan-object transmission is difficult to study and likely underestimated. “I think orphan objects continue to be an overlooked issue, and there is really no good data on this subject yet,” he says. “Dr. Mark Rupp of the University of Nebraska and I are hoping to do a study starting this summer to look more specifically at the issue. If you have a system for addressing orphan objects and if you take the additional step of finding out if you are really following the procedure agreed upon by the participants, you can probably do relatively well. The ideal standard is to clean and disinfect after each patient use and before use by another patient but is that really being done and are people taking the issue of orphan objects seriously? That’s hard to say — some hospitals are doing such good work and others still haven’t developed a good environmental hygiene monitoring program. Only a couple hundred hospitals around the country have really good monitoring programs in place even though the value of such programs was confirmed seven years ago.”



Carling says that findings from one of his and Dr. John Poe's studies of computer keyboards caught the attention of the leadership at a local medical center. "We had a hard time with the issue of mobile equipment cleaning until one of our students performed some environmental cultures and we found VRE on a computer keyboard — yet no patients with VRE had been cared for during the previous month in that area. This finding got people's attention and that helped bring the issue into focus. Dr. Anthony Harris's group in Maryland found *Acinetobacter* on computer keyboards and that got them focused on orphan objects as well. Using environmental cultures to monitor orphan objects has unique challenges and significant costs but sometimes they can be used to raise awareness and educate on the issue."

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Carling says that the solution to the problem of orphan objects is to first develop a program, and then evaluate this program. To get started, Carling suggests defining a specific area of focus. For example, if the desired area of focus is the patient room in the ICU, daily cleaning should include portable items such as electronics, IVAC units and ventilators, while terminal cleaning should also include any moveable equipment. In the operating room, mobile equipment should be cleaned between cases as appropriate and also during terminal cleaning. Ownership issues relating to the cleaning and disinfection of anesthesia- and radiology-related equipment are particularly important to discuss. In patient-care areas, shared equipment such as stretchers and Hoyer lifts should be addressed, as well as mobile patient-contact equipment such as commodes, pulse oximeters and glucometers. For all of these items, departments must define and negotiate responsibility for cleaning and disinfection among environmental services, nursing, anesthesia and respiratory therapy personnel. The next step requires defining the cleaning and disinfection methods that will be used on this portable and mobile patient-care equipment, whether it is a disinfectant product in a spray or wipe format or the addition of a no-touch machine.

"One of the more challenging aspects of the orphan object issue is that these things are difficult to clean on a daily or more frequent basis because they are close to the patient or in use on the patient, such as pulse oximeters and other electronic equipment," Carling says. "They also are objects that environmental services personnel are hesitant to clean because they are afraid they might hurt the patient if they clean them, that's been a significant problem. The same goes for keyboards — we found that environmental services personnel were afraid to clean keyboards so we developed a policy to specifically address the issue; nursing staff in the ICU cleaned and disinfected the keyboards and other high-touch surfaces at the same time every day — they did it at 6:30 a.m. just before the change of shift. And when they got feedback on how well they were doing, it was very effective in improving their performance. But when feedback stopped, compliance fell off pretty quickly. If you develop a system and a program, you can address these issues relatively well."

Because it is difficult to tell whether a fluorescent marker has been removed by cleaning or was not marked to begin with, a modified system needs to be used for monitoring. “The way we did this in a pilot study a number of years ago, was by using fluorescent marking on orphan objects to evaluate if they were being cleaned according to policy by double-marking them. You put a mark on the objects where it is easily cleaned, but also mark it underneath where it should not be cleaned. Then you can be sure you have marked that item of equipment if the monitoring mark was removed. If you don’t yet use fluorescent marking or other CDC-recommended monitoring programs, you can start by flagging objects for cleaning and disinfection by putting tags on these items. Some hospitals simply put clear bags over cleaned pieces of equipment and tie them to keep the dust off the object. If you have such systems in place, you are at least starting to address the problem. So that’s the first part — a policy and procedure, and then the second part is developing a system of monitoring how well the policy and procedure is being followed.”

A critical component of such an evaluation program relates to the need of providing feedback about the cleaning and disinfection practices being performed by staff. One approach by some hospitals has been to conduct random ATP testing to show EVS personnel on-the-spot cleaning performance, Carling says. However, a negative-feedback approach can sometimes result in staff members rationalizing isolated oversights in following cleaning protocols. Furthermore, Carling says, episodic negative feedback has a very limited ability to produce optimal or sustainable results. The CDC guidance advocates an ongoing objective monitoring system that once implemented, will be easily sustained and provide accurate data with which to evaluate and provide objective feedback on cleaning and disinfection practices.

Ernst (2014) emphasizes that disinfection of mobile equipment falls short in U.S. hospitals: “Procedures and practices for disinfecting mobile equipment vary greatly among facilities, if they are in place at all. In a study in the September 2012 issue of *Infection Control and Hospital Epidemiology*, researchers observed that only 50 percent

Creating a Mobile Equipment Cleaning and Disinfection Protocol

Ernst (2014) says that when creating best practices and SOPs the following critical components need to be included:

- ✦ Selection and placement of disinfection products
- ✦ Collaboration and clear communication of roles and responsibilities among various departments and staff.
- ✦ Instruction on the use of the disinfectant chosen
- ✦ Ongoing staff education and compliance monitoring

of high-touch surfaces in the operating rooms at a 1,500-bed teaching hospital were cleaned properly. Some of the surfaces sampled included “anesthesia-related equipment — keyboards, knobs, switches, oxygen reservoir bags and adjacent medication drawers — bed control panels, Mayo stands, intravenous poles, intravenous pumps, OR entry doors, overhead lamps and the floor.”

Ernst (2014) outlines several best practices hospital staff can follow to ensure hard and mobile surfaces are properly treated to prevent the spread of HAIs.

According to the CDC’s 2008 guidelines for Disinfection and Sterilization in Healthcare Facilities, mobile equipment largely consists of noncritical items — objects that come in contact with intact skin, but not mucous membranes — under the Spaulding Classification of Medical Devices and Levels of Disinfection system. The CDC’s guidelines recommend the use of a low-level, EPA-registered disinfectant with broad efficacy against bacteria, viruses and fungi for disinfecting noncritical items unless they are visibly soiled with blood or bodily fluids. Non-disposable items should be cleaned and disinfected at least daily, as recommended by the CDC, or encourage the use of single-use, disposable towels impregnated with a disinfectant to achieve the low-level disinfection required for non-critical items.

Here’s a checklist for the cleaning of non-critical objects:

- ✦ All equipment must be cleaned immediately if visibly soiled, and immediately after use on patients with contact precautions (MRSA, VRE and *C. difficile*) regardless of cleaning schedule

- ✦ Patient-care equipment should be dedicated to the use of a single patient and cleaned, disinfected and/or reprocessed before reuse with another patient or before placed in storage. Hospital units should establish a schedule for cleaning with specific assignments to ensure tasks are completed.

- ✦ Cleaning and disinfection processes must align with manufacturer’s recommendations.

- ✦ Special, additional cleaning may be required in an outbreak situation. Procedures should be determined and coordinated with the infection preventionist.

- ✦ Disposable patient care equipment and supplies should be immediately discarded after use.

Use the following steps for cleaning non-critical items:

- ✦ Follow device manufacturer’s recommendations for cleaning and maintaining medical equipment.

- ✦ In the absence of recommendations, clean non-critical medical equipment surfaces with a mild detergent followed by cleaning with a disinfectant.

- ✦ Follow product recommendations for disinfectants (amount of time to apply and leave on the surface, etc.).

- ✦ Use protective equipment such as gloves, goggles and gowns as needed.

- ✦ Monitors and LCD screens should not be cleaned with a disinfectant. They can be dusted with a soft, lint free cloth. A damp cloth can also be used to remove dirt and smudges.

Additionally, Ernst (2014) says that healthcare organizations should continue to encourage frequent handwashing among staff. Successful efforts to improve hand hygiene (e.g., asking providers to wash hands before entering and leaving a patient room) further reduce the risk of bacteria transfer to and from mobile equipment, since potential pathogens are eliminated before they are spread to hard surfaces.

While these seem like fairly straightforward recommendations, Ernst (2014) says hospitals often unwittingly fail to adhere to them: "Adherence challenges are even greater for mobile equipment that, by its nature, doesn't stay in one place. Accessibility of the disinfectant product is especially important to improve adherence. The easier it is for staff to easily locate the disinfectant product, the more likely they will be to use it, the more likely the hospital will be to achieve better disinfection rates, and the more likely patient outcomes won't be damaged because of an HAI. Studies have shown that compliance increases with increased accessibility to disinfectants. A proactive environmental and hand hygiene initiative at a 137-bed long-term care facility identified a lack of convenient and accessible solutions for disinfection. In response, a greater number of products were installed and strategically placed on medication, treatment and housekeeping carts as well as in all nursing stations, dining, therapy and activity rooms, and public lounge areas. Staff input was solicited to determine optimal placement. This, coupled with intensive staff education for all shifts, resulted in a dramatic reduction of hospital transfers due to HAIs, reduced employee absenteeism and reduction in cost association with antibiotic use. Disinfection solutions should be placed in multiple areas where equipment may be used, stored or moved to. Ideally, products should be placed on, or connected directly to, the equipment so the ease of access and use is continuous. Product placement on equipment also serves as a constant reminder to disinfect, thereby improving compliance."

Ernst (2014) emphasizes the importance of ongoing education and monitoring of cleaning and disinfection practices: "As with most healthcare improvement efforts, though, the problem doesn't lie with identifying best practices; rather, the challenge comes with ensuring adherence to best practices becomes an ongoing and ubiquitous part of organizational life. To ensure this occurs, healthcare organizations must put a formal, written protocol into place that clearly defines who is responsible for disinfection, when it is to take place, and what standards, processes or procedures should be followed. After identifying the responsible staff members and training them on best practices, organizations should also offer regular education, reminding the staff of disinfection processes and its importance. Furthermore, organizations should put in place some mechanism to regularly monitor that the standardized processes are being appropriately followed."

Establishing a Protocol

Ernst (2014) says it is critical to address the cleaning and disinfection of mobile equipment by putting a protocol in place. To begin, establish the “status quo” or baseline for mobile equipment disinfection and review/record any current cleaning procedures across departments and equipment. Consider creating an interdepartmental committee to take on this charge. Assess current cleaning procedures through environmental contamination testing. These initial measures will establish a baseline for evaluating program progress and successes. Next, determine high-risk areas or equipment (i.e. items used in critical care units with higher-risk patients or ones that are passed between patients most frequently). As the number of equipment types can be quite large, starting with the highest-risk may be more manageable — and has the potential for the greatest impact on positive patient outcomes.

The following components should be considered and incorporated as elements in your standard procedure.

✦ **Staff responsibility and chain of possession**

It will be important to clearly identify roles and responsibilities, most likely across departments.

- ◆ Who will be responsible for cleaning the equipment?
- ◆ When should they be disinfecting the equipment?
- ◆ How will staff identify what is clean?

✦ **Monitoring and reporting procedures**

Compliance is greatly increased when someone is paying attention and holding staff accountable.

- ◆ How will you monitor compliance?
- ◆ How frequently will this be done?
- ◆ Who is responsible tracking mobile equipment disinfection?

✦ **Staff education and re-education**

Staff should be trained on the proper use of the disinfectant and adhere to the overall contact time. They should also be frequently reminded of the importance and empowered to do their part.

- ◆ How will you keep the program top-of-mind?
- ◆ What tools and resources are available to educate staff on proper disinfection procedures?

References and Recommended Reading

Attia F, Whitener C, Hnatuck P, Stolberg D and Julian KG, MD, from Penn State Hershey Medical Center. Cleaning of Portable, Multiple-Use Medical Equipment: An Observation Tool. Poster presented at 2012 IDWeek.

CDC (2008). Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008.

Chen KH, Chen LR, Wang YK. Contamination of medical charts: an important source of potential infection in hospitals. *PLoS One*. 2014 Feb 18;9(2):e78512.

Davis C. Blood pressure cuffs and pulse oximeter sensors: A potential source of cross-contamination. *Australasian Emergency Nursing Journal*. Volume 12, Issue 3, August 2009, Pages 104–109

Ernst, E. Microorganism Movers: Mobile Equipment and Implications for Infection Prevention. whitepaper. 2014.

Grewal H, Varshney K, Thomas LC, Kok J, Shetty A. Blood pressure cuffs as a vector for transmission of multi-resistant organisms: colonisation rates and effects of disinfection. *Emerg Med Australas*. 2013 Jun;25(3):222-6. doi: 10.1111/1742-6723.12076. Epub 2013 May 20.

Havill NL, Havill HL, Mangione E, Dumigan DG, Boyce JM. Cleanliness of portable medical equipment disinfected by nursing staff. *Am J Infect Control*. 2011 Sep;39(7):602-4. doi: 10.1016/j.ajic.2010.10.030. Epub 2011 Apr 15.

Levin PD, Shatz O, Sviri S, Moriah D, Or-Barbash A, Sprung CL, Moses AE, Block C. Contamination of portable radiograph equipment with resistant bacteria in the ICU. *Chest*. 2009 Aug;136(2):426-32. doi: 10.1378/chest.09-0049. Epub 2009 Apr 17.

Longtin Y, Schneider A, Tschopp C, Renzi G, Gayet-Ageron A, Schrenzel J and Pittet D. Contamination of Stethoscopes and Physicians' Hands After a Physical Examination. *Mayo Clin Proc*. 2014;89(3):291-299.

Matsuo M1, Oie S, Furukawa H. Contamination of blood pressure cuffs by methicillin-resistant *Staphylococcus aureus* and preventive measures. *Ir J Med Sci*. 2013 Dec;182(4):707-9. doi: 10.1007/s11845-013-0961-7. Epub 2013 May 3.

Peretz, et al. (2013, August 11). Do Wheelchairs Spread Bacteria within hospital walls? *World J Microbiol Biotechnol*.

Schwegman D. Prevention of Cross Transmission of Microorganisms is Essential to Preventing Outbreaks of Hospital Acquired Infections. Accessed at: <https://www.welchallyn.com/documents/Blood%20Pressure%20Management/FlexiPort%20Blood%20Pressure%20Cuffs/MC5032WHP%20White%20PaperHR.pdf>

Shiferaw T, Beyene G, Kassa T and Sewunet T. Bacterial Contamination, Bacterial Profile and Antimicrobial Susceptibility Pattern of Isolates From Stethoscopes. *Ann Clin Microbiol Antimicrob*. 2013;12(39)

Solomon D. IV Stands and Medical Devices Hanging From IV Stands Are Vectors of Infection. Feb. 9, 2012. Accessed at: <http://www.catheterconnections.com/iv-stands-and-medical-devices-hanging-from-iv-stands-are-vectors-of-infection/>

Weber DJ and Rutala WA. Understanding and Preventing Transmission of Healthcare-Associated Pathogens Due to the Contaminated Hospital Environment. *Infect Control Hosp Epidemiol*. Vol. 34, No. 5, May 2013.

Wilkins MC. Residual bacterial contamination on reusable pulse oximetry sensors. *Respir Care*. 1993 Nov;38(11):1155-60.