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LEARNING OBJECTIVES

1. List the types of cleaning brushes used in sterile processing departments.
2. Perform a brush risk assessment.
3. Describe how to assess and mitigate potential harms associated with cleaning brush use.

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SELF-STUDY SERIES

Brushing up on brushes

Instrument cleaning brushes and patient safety: Assessing and reducing risks

by Tamara Behm and Janet Strong

Every trained chef knows her tools and how to use and maintain them. When she reaches for a knife, for example, she selects the one most appropriate for the job at hand. Using a meat cleaver to cut bread or a butter knife to cut tomatoes damages the food and could injure the chef. Chefs keep a variety of knives available to optimize each of the many food preparation tasks they perform.

In addition, chef's knives must be maintained. Dull knife blades, loose handles and rusty edges all lead to poor performance that directly impacts the chef's ability to make great food safely.

At the sterile processing sink, technicians are the chefs. Their primary tools are water, cleaning chemistries and instrument cleaning brushes. As with chef knives, there are various brushes designed to do specific tasks, and improper brush use can lead to serious consequences for patients and providers, such as infections and instrument damage.

Despite the critical importance of brushes as an infection prevention tool, little published guidance has been directed towards them. It's important to know how to assess their associated risks and to develop risk-reducing procedures for proper use and maintenance.

Types of brushes

Brushes are defined as "implements having bristles, hair, feathers, wire or other flexible fibrous material, fixed in a handle or a back, used for sweeping, scrubbing, painting, cleansing, smoothing, etc."¹ Cleaning brushes used in healthcare are designed to reach and remove soils that have become adhered to surgical and diagnostic devices. When designing an instrument cleaning brush, important factors to consider include the intended medical instrument, specific components or accessories that need to be accessed for cleaning, and the soils that are likely to adhere to it during use. Brush types include general, toothbrush-style, burr, channel, valve, and acetabular reamer brushes. Each brush is designed for a specific purpose.

- **General cleaning brushes** have a wide plastic handle with nylon bristles. These brushes are used for cleaning larger smooth instruments, such as organ retractors, and instruments with hinges or box locks, such as clamps.
 - **Toothbrush-style brushes**, as the name suggests, are thinner brushes with multiple rows of bristles at one end of a handle, like that of a toothbrush. The bristles can be metal or nylon bristles. These brushes are designed to clean fine surfaces of instruments.
 - **Burr cleaning brushes** are a subset of the toothbrush style brush. They are designed to clean burrs and rasp style instruments, which are typically encrusted with orthopedic soils. This style of brush typically has rigid stainless-steel bristles and sturdier handles.
 - **Channel brushes** are long-handled nylon brushes used to clean devices with lumens or channels, such as endoscopes. Typically, they are designed with twisted wire that fans the bristles 360° around, or flexible plastic tubing. They come in a variety of diameters and lengths. It is important to match the diameter of the brush to the diameter of the lumen. Using a brush smaller than the lumen prevents the bristles from contacting all inner surfaces. A brush with a larger diameter than the lumen causes the bristles to bend, preventing good contact with the inner lumen walls. Choosing the right diameter allows for the bristles to clean the lumen effectively.
 - **Valve brushes** are short channel brushes having one or two circular rows of nylon bristles at the end. These brushes are used for cleaning the insides of valves and short lumens.
 - **Acetabular reamer brushes** are either curved or round in design to fit into the reamers, which are often difficult to clean due to their shape and the many grater holes on each reamer.
- Regardless of brush design, all function in a similar fashion: they are moved against the surface of the device while submerged in cleaning solution. The bristles physically dislodge soil and debris, which then become



lodged within the bristle material and suspended in the cleaning solution.

Brushes become contaminated with patient debris during use, which makes them a source for potential cross-contamination. Despite this risk, little guidance has been made available regarding appropriate infection prevention practices. According to ANSI/AAMI ST79, "Brushes should be checked for visible soil and damage following each use and should be frequently cleaned and disinfected. Brushes should be stored clean and dry."² What does "frequently" mean? There is even less guidance on how to inspect brushes, and on the associated risk from damaged instruments that could result in patient harm.

It is at the discretion of the facility to establish policies and procedures for managing brushes. The hospital-established policies must consider the specific harms and risks associated with the use of the various types of cleaning brushes within the facility. The first step in this process is a risk assessment.

Assessing the risks

In the most general sense, a risk is the probability of a negative event occurring. Healthcare workers commonly use risk assessments to identify the potential for a specific harm to occur and prevent it from happening.

Risk assessments have four steps: (1) identifying risks, (2) rating risks, (3) mitigating risks and (4) communicating any remaining risks. A facility's first step in the risk assess-

ment process is to identify all the potential harms that may occur when using brushes.

The first step is to identify the risks. Assemble a multidisciplinary team that includes an infection preventionist, a risk manager, department managers and end users. It is imperative that the group includes those who use brushes and those who use the devices that were brushed. The group should then brainstorm as many ways as possible in which a brush can cause harm either directly or indirectly. Table 1 shows a list of examples of harms and the events that must occur to cause those harms.

Another way to identify risks is to map the process. At each step of the process potential changes, missed steps or other "defects" are identified. The team then determines what harm these events might cause. For example, brushes can be used on several devices. The team would identify all harms that could occur when the brush is used on more than one device. Examples may include cross-contamination of devices with *Clostridium difficile* spores that are not eradicated during high-level disinfection, brush wear that leads to damage that makes devices unusable, the formation of biofilm between uses that can be passed on to other devices, or weakened bristles that break from reuse, can be transported to the patient procedure site and can harm the patient. It's important to note that several of these harms could happen from a single event. Reusing a single-use brush can result in damage to the instrument and patient harm, infection or even death from loosened bristles and cross-contamination.

Risk can also include events that jeopardize the healthcare facility's accreditation. The Joint Commission (TJC) is an accrediting body that hospitals invite to evaluate processes for patient safety standards. The Joint Commission provides performance standards for safe patient care that align with CMS federal guidelines. The 2017 facility survey guidance for inspectors includes evaluation of variances in a healthcare facility's elements of performance. When a violation is observed, such as when a single-use brush is reused, TJC inspectors calculate the harm the finding could cause to a patient and typically cites the facility for that violation. For example, if they see an SPD staff member cleaning instruments with a wire brush that contradicts the instruments' instruction for use, they would assign that as a pattern with either medium or high risk. If in the same facility the inspector observes reuse of single-use brushes in another department, such as GI, it may lead to an immediate jeopardy finding from widespread misuse of brushes in the facility.

Severity

Although there are many risks associated with healthcare practices, not every risk has the same chance of occurring. A damaged brush is more likely to damage an instrument than it is to transmit microorganisms that cause a lethal infection. Additionally, some risks are more tolerable than others. A patient's death is intolerable, whereas replacement of a damaged instrument is more acceptable. The next step in the risk assessment process is to rate all risks using an assessment of occurrence probability and severity of harm.

Severity is a rating of the impact the harm has. Severities range from very serious harms, such as life-threatening events, to minor nuisances, such as a pinch that does not require medical intervention. A severity scale is developed by the facility. Several organizations, like APIC and CDC, can help provide guidance regarding severity scales. Regardless of the scale used, examples of harms associated with the brushes should be included to help the risk assessment team compare the various harms when assigning a severity rating to each one.

Table 1: Harms and Causes

Harm	Events that must occur to cause the harm
Unusable instrument due to damage	Use a metal wire brush on a soft surface
	Forced a brush that is too big for the channel through the channel
Patient infection	Brush forms a biofilm that transmits microorganisms to the lumen establishing a device biofilm that is resistant to high level disinfection or sterilization
	A damaged brush scratches the device providing a protective area for microorganisms against high level disinfection or sterilization processes
	Used the wrong brush resulting in residual debris that protects microorganism during sterilization.
Patient Death	Brush forms a biofilm that transmits microorganisms to the lumen establishing a device biofilm that is resistant to high level disinfection or sterilization
	A damaged brush scratches the device providing a protective area for microorganisms against high level disinfection or sterilization processes

Self-Study Test Answers: 1. A, 2. A, 3. D, 4. C, 5. D, 6. D, 7. A, 8. B, 9. B, 10. A

Probability of harm

There is no question that a serious life-threatening harm must be addressed, but it becomes less obvious when the harm is minor. And investing a great deal of time and money to prevent a harm that is already unlikely to happen may not be prudent either. This is why the second part of the risk rating considers the probability that a harmful event will happen.

Probability is the likelihood of an event occurring. It can be stated as a fraction/decimal or as a scale of occurrence. A 90% chance of rain is an example of a fractional expression. It can also be expressed as 9 out of 10 places will receive rain. Regardless of the way it is stated, there is a high probability of rain. The same is true for predicting the probability that a harm will occur.

Several factors must be considered when assigning a probability. For example, patient infections caused by using the wrong brush to clean have six steps. Each step along the way changes the probability of the event occurring.

1. The technician uses the wrong brush
2. Bioburden is left on the instrument
3. An infectious microorganism is present
4. The microorganism survives the sterilization process
5. The microorganism is transferred to the patient
6. The patient develops an infection

The type of microorganism trapped within the bioburden can also influence probability. Examples of organisms that have been transmitted by gastroenterology scopes include *E. coli*, *Pseudomonas sp.*, *Klebsiella pneumoniae*, *Stenotrophomonas maltophilia*, and Carbapenem-resistant Enterobacteriaceae. One hospital outbreak of *Klebsiella pneumoniae* resistant to beta lactam drugs (ESBL) was linked to improper cleaning of a duodenoscope that infected 16 patients. It wasn't until repeated flushing and brushing that the source of the microorganisms was identified as the scope's channels.³ Since these organisms have been associated with outbreaks, the probability of this event happening is increased when these organisms are identified in the facility.

Determining a risk value

The probability of a harm occurring is considered in relationship to the severity of harm to determine a relative risk value. This value is typically presented using a grid but can also be expressed using a calculated value.

The last step is determining when the risk rating warrants mitigation. This reduces the probability of the event occurring or eliminates the risk altogether. In the example of Table 2, action must be taken to mitigate risk

Table 2: Example of risk value table*

		Mitigation Required	Mitigation Required	Mitigation Required
Severity	Severe (Life-Threatening / Death)	Mitigation Required	Mitigation Required	Mitigation Required
	Serious (loss of limb or infection)	Mitigation Required	Mitigation Required	Mitigation Required
	Moderate (Instrument is damaged and unusable)	Mitigation Required	Process Improvement	Process Improvement
	Minor (Instrument must be recleaned)	No Mitigation Required	No Mitigation Required	No Mitigation Required
		>70% of the time	Between 30-70% of the time	<30% of the time
		Probability of occurrence		

*Each facility must determine its own table.

that can or did result in a serious or severe harm, and sometimes even cause moderate harms. It's important to note that industry benchmarks are an important resource for establishing mitigation scales.

Mitigating risk

Mitigation involves all steps taken to ensure that the chance of harm occurring is reduced to acceptable levels. The risk of harm can never be truly eliminated but it can be reduced so that it is unlikely to happen. Applying the chef analogy again; there is a possibility that our chef will cut her finger. However, by using proper cutting techniques, the correct knives and cut-resistant gloves, she can significantly reduce the possibility of being cut.

The first step in mitigating a risk is to remove the possibility of the events occurring. For example, one risk that may be associated with brushes is the development of biofilms on the brush itself that can be transmitted to all devices that it is used to clean. To reduce the potential of forming biofilms, the department can establish cleaning and high-level disinfection/sterilization frequencies that reduce or eliminate the microorganisms found on reusable brushes. Or, they can use single-use disposable brushes to eliminate the risk of biofilm formation caused by brush use.

The second step is training. This must be based on the department's written procedures to help reinforce performance consistency. Of course, the training is only as good as the follow-up auditing. Over time, shortcuts may evolve, or new staff may enter the workflow, both of which can cause inconsistent processes. Regular refresher training and audits are important tools for success.

Communicating remaining risk

After all attempts are made to reduce the potential of occurrence, all remaining risks must be communicated to the users. These can be communicated through wall charts, references and symbols that enforce the risks. For example, single-use brushes

should not be reused. However, when both single-use and reusable brushes are used at the same sink, the probability of reusing a single use brush is high. Single-use brushes are typically labeled with a symbol that indicates they are to be used only once. The department can remind technicians with posters or other communication to confirm they have the correct brush by looking for the "single-use" symbol.

Tools to help you

Several organizations provide tools and training on risk management and infection prevention. One such tool is the Center for Disease Control & Prevention (CDC) Risk Management Plan. There are templates and training for this assessment available on the CDC website. The tool allows the end user or leadership team to walk through a process as if they were an end user. Their step-by-step process takes you through an evaluation to determine patient risk at each step of your processes.

Another tool is the APIC Risk Assessment. This tool begins with a multidisciplinary team like the one we have described above. The risk assessment evaluates the potential impact, probability, and the organization's preparedness, specific to the prevention of infections.

Do no harm

Cleaning brushes are critical tools designed to help assure the safety of reusable instrumentation. The lack of detailed guidance on proper use and maintenance of brushes places the responsibility on each healthcare facility to address the risks in their departments. This requires the engagement of not only the sterile processing professionals, but leaders from infection prevention and risk management functions as well. Performing a multidisciplinary risk assessment and developing a mitigation plan will result in specific guidance that will help each facility reduce its potential for brush-related patient harm. **HPN**

See references online at www.hponline.com/21084043.

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CONTINUING EDUCATION TEST • JULY 2019

Brushing up on brushes

Instrument cleaning brushes and patient safety: Assessing and reducing risks

Circle the one correct answer:

- Channel, toothbrush, acetabular reamer and burr are all types of brushes.**
 - True
 - False
- Before using any type of brush on an instrument, what document should be referenced?**
 - Instrument instructions for use
 - Technical data sheet
 - Ultrasonic cleaner manual
 - None of the above
- Which of the following is NOT a potential harm?**
 - Unusable instrument
 - Patient infection
 - Patient death
 - None of the above
- How can you tell if a brush can be reprocessed?**
 - All brushes can be reused
 - It will have a 2 on it inside a circle with a line through it
- The brush packaging will give clear instructions on reprocessing.**
 - It will be listed in the washer's operator manual
- A multiple disciplinary team to review harm should include ALL of the following except**
 - Infection Prevention
 - End Users
 - Risk Management
 - Environmental Services
- What can happen when a technician uses the wrong brush to clean a medical device?**
 - Damage the instrument
 - Leave behind bioburden
 - Miss crevices and important areas requiring cleaning
 - All the above
- To determine the risk value, you should include the severity of the risk and the probability of occurrence**
 - True
 - False
- If a risk value is serious you should:**
 - Tell the supervisor
 - Take steps to prevent it from happening
 - Do nothing, it is up to the supervisor
 - Monitor the number of times it happens
- Policies and procedures should be developed by the facility to establish cleaning and disinfection of single use brushes to reduce risk of harm.**
 - True
 - False
- Training and Auditing are essential activities for decreasing the risk of harm**
 - True
 - False

CONTINUING EDUCATION TEST SCORING



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