Automatic Equipment and Productivity in a Sterile Processing Department

BY WILLIAM LEIVA

Learning Objective #1: Understand the basic elements of productivity in a sterile processing department.

Attendees of the Healthcare Sterile Processing Association (HSPA) Annual Conference and Expo may have noticed that many presentations and booths focused on productivity. Productivity is often measured in terms of efficacy, efficiency, process time, reduced manual labor, reduced consumable usage, increased reuse, and more.[1] Improvement strategies explore how technology may help address the needs for increased productivity and how to effectively quantify the improvements. Innovations such as robotic tables that wrap sterilization trays or carts that automatically load onto washer-disinfectors (WD) are commonly displayed at conferences and expos.

First, it is important to understand what the main drivers of productivity are in the sterile processing department (SPD). Significant research has been conducted about productivity, and results indicate that productivity is primarily driven by equipment and technologies, followed by staff training and allocation, then SPD workflow, and inventory management, including loaners. 1-5 Let's explore this further.

The first element, equipment and technologies, is often considered the golden path to improve SPD productivity. However, financial and infrastructure challenges may fail to deliver expected outcomes. The second element, staff, training, and the allocation of resources, involves a complex set of decisions and multiple internal and external variables. On the hospital side, this requires approval for resources, selection, onboarding, and ongoing training that in light of the high turnover rates continue to challenge healthcare systems. The third element is SPD workflows, which can

Learning Objectives

1. **Understand the basic elements of productivity in a sterile processing department.**
2. **Describe technologies and considerations when adopting automatic equipment to increase sterile processing department productivity.**
3. **Discuss the balance between automatic equipment and human resources to achieve desired sterile processing department productivity levels.**

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Variable	Consideration	Impact
Frequency	Frequencies between 35 and 42 kHz are common. Verify with the instrument manufacturer to determine the most suitable frequency.	Higher frequencies are considered gentler on medical devices, given the smaller size of the cavitation bubbles.
Detergent	Enzymatic detergents are often preferred due to their ability to break down multiple debris types	In general, ophthalmologic devices should not be cleaned using enzymatic detergents.
	Higher pH levels may have detrimental effects on instruments.	Always verify the pH of the detergent and ensure the devices are approved for that specific ph.
Time	Newer systems may have multiple cycle times.	Identify the most suitable cycle time for your devices.
Irrigation	A non-irrigated system requires manual irrigation.	Lumened devices must be irrigated with the detergent from the bath prior to starting the cycle.
	Irrigated systems may require specific adaptors.	Consult your medical device manufacturer to ensure adequate irrigation.

Table 1: Considerations and Impacts of the Use of Ultrasonic Cleaning Systems.

always be improved. However, this is similar to equipment and technology due to the investment required and implementation timelines. Inventory management may also be addressed with investment in more instrument sets. Owning more highly specific sets may reduce the dependency on loaners for hospital surgical procedures.

With these elements in mind, looking into new technologies and equipment seems a natural pathway. While not necessarily new, systems such as ultrasonic cleaning baths, and washer-disinfectors (WD) or autowashers, and low-temperature sterilization technologies, highlight time as the key metric to fuel their implementation. In general, these technologies reduce some processing steps and time, which may increase SPD productivity. However, like in any manufacturing process, the primary output of the SPD - the sterile product - is a function of the multiple inputs. Given the complexity of the reprocessing journey, the inputs are diverse and include SPD workflow and staff of an individual process, tools required for that process such as water gun adaptors or brushes, detergents and time required for them to work effectively, and specific cleaning steps of systems such as ultrasonic washers.

Learning Objective #2: Describe examples of how automatic equipment may increase SPD productivity.

There are three primary technologies that help streamline load release and increase SPD throughput. This article will focus on ultrasonic cleaning systems (UCS), WD, and steam sterilizers. UCS use cavitation, tiny bubbles of water and detergent generated by sound waves at very high frequencies, often over 35,000 times per second. These bubbles deliver mechanical action over surfaces that access areas or design features that are hard to reach or simply inaccessible by manual means. Specifically, for lumened devices such as laparoscopic and some endoscopic devices, some UCS have active irrigation that enables connecting the bath with the instruments. This increases the ability of the cleaning bath to soften or remove debris. While UCS cycle times are different for different manufacturers, it is important to consider a few factors during their implementation such as device compatibility, specific limitations including pH, time, frequency, or specific requirements, or incompatibility with enzymatic cleaners, as is the case for ophthalmologic instruments (**Table 1**).

UCS processes may take up to 40 minutes, but the primary benefit to SPDs is that the staff is free to conduct other activities within the department during that time. When adopting this technology or expanding its use, it is important to document specific cycle parameters and UCS compatibility with the instrumentation and devices intended to be cleaned. Also, it is important to use adequate monitoring tools to ensure UCS cavitation is at the desired level.

The second technology, WDs, is a highly sophisticated system that cleans instrumentation in load carriers or wash-carts. WD cycles use pressurized water and specific cleaning steps such as pre-rinsing, cleaning, rinsing, disinfecting, and drying, to clean instrumentation with spray force action. Important factors include the timing of each step, the load carrier or rack that instruments are loaded into, and the detergent(s) used to achieve each cleaning step. Given the effective combination of water pressure, temperature, detergent concentration, and time, they are a highly effective technology to deliver a highly standardized level of cleanliness, in multiple devices, instruments, and configurations.

To deliver the adequate level of cleanliness, specific load carriers or

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Quiz Answers:
1. D, 2. C, 3. D, 4. D, 5. C, 6. D, 7. C, 8. C, 9. A, 10. D

wash carts are used. These are designed to accommodate specific product families, including general surgery, orthopedic cases, anesthesia devices, minimally invasive surgical instruments, or robotic instruments. WDs are not only used to clean devices that will undergo terminal sterilization but are also used with specific load carriers to decontaminate non-critical reusable devices. While these systems are generally compatible with most instruments, it is always important to verify the recommendations from the instrument manufacturer making sure that specific cycle parameters are followed. This ensures that cycles, load configuration, load carriers, and detergents are compatible with the instruments to be cleaned. WDs may utilize utility water and critical water, especially during the final rinse.[6] The process time of WDs will vary widely based on the cycle parameters, load carriers, and specific cleanliness requirements for the devices. Similar to UCS, WDs require no supervision after loading. This frees staff from manual cleaning activities and streamlines the cleaning processes.

Lastly, steam sterilization relies heavily on highly standardized cycles.[7] Although the cycles are fully automated, specific cycle parameters and duration significantly affect the time required to complete a cycle and the ability of each cycle to deliver dry loads. In the United States, cycle parameters closely align with FDA recommendations regarding exposure or sterilization time at a given temperature, and drying time, for which the FDA offers minimum values. Given the significant variations in load configurations such as devices and instruments, their materials (i.e. metal alloys or plastic), and sterile barriers (i.e. peel pouch, wraps, or rigid containers), the drying times are often much longer than those proposed in the FDA recommendations. Sterilization requirements, including exposure and drying time, vary widely between medical device manufacturers. To prevent significant cycle variations, SPD professionals often create product families, with similar devices, and sterile barriers exposed to similar conditions, including their drying time. While this helps to optimize the cycle and the sterilizer throughput, it does not fully solve the challenges around improving productivity.

Understanding the factors that drive drying may prove valuable when assessing productivity and identifying improvement opportunities. Drying is driven by the conditions present in the sterilizer during the drying phase, including the temperature and pressure inside the sterilizer. During the drying phase, the pressure inside the sterilizer is reduced, ideally very quickly, to levels around 1 to 2 PSI (68 to 138 mBar).[8] Rapidly reducing the pressure enables quick vaporization of condensate on the loads, which is drawn out of the sterilizer chamber thanks to the ongoing negative pressure or vacuum. This process relies on an adequately functioning pre-vacuum system, which is affected by the water temperature supplied to the pump6; temperatures above 60°F have a direct impact on pumping speed.

Learning Objective #3: Discuss the balance between automatic equipment and human resources to achieve desired sterile processing department productivity levels.

While productivity can be improved by adopting automated equipment designed to increase the efficiency and efficacy of the process, the adoption of new technologies or the expansion of existing ones, will not deliver increased productivity alone. Any assessment of new technologies should include a holistic approach that considers several factors, including current staff training and ongoing development opportunities, the SPD workflow, the specific nuances of the hospital's workload, and the ability of the SPD infrastructure to utilize each technology for the best possible outcome.

Relying solely on technology to increase productivity may prove fruitless, as many production bottlenecks may remain if overall workflows are not carefully planned, improved, and assessed over time. Specifically, during the cleaning steps, the processes often required by complex devices, such as multiple rinsing, brushing, and soaking, can add significant time to overall production and must be considered when estimating the SPD productivity goal. Another important element is the input of contaminated instruments, which can vary due to differences in surgical cases at each hospital. These variations are impacted by many elements that the SPD cannot control, such as availability of the surgical team and patients, operating room readiness, and in some cases, specific implants.

In general, exploring how cycles can be standardized across instruments and devices into product families can help utilize the ultrasonic cleaning systems to the highest possible levels on every cycle. This approach leads to improved system utilization and use of energy, water, and detergents. The same principle applies to WD systems, where some devices may need to wait for the next available WD that has a compatible cycle and load carrier. By standardizing instruments and devices into product families, the use of cleaning systems can help increase the throughput of each cleaning system.

For steam sterilization, the product family approach may enhance sterilizer utilization rates and streamline cycles by specifying drying times according to each product family. Additionally, collaboration with other departments may enable SPDs to have the right water temperature to increase the effectiveness of the drying phase of steam sterilizers, while understanding the specific cycle parameters, such as pressure and time, to deliver the desired vacuum level can also contribute to reducing the overall cycle time.

Conclusion

Productivity is, and will remain, a concern in health care facilities. SPDs are not exempt from productivity concerns. Cross-collaboration with internal departments, medical devices, and equipment partners can help SPDs address the challenges around productivity by addressing the adoption or expansion of automated systems to deliver faster reprocessing turnaround times. **HPN**

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Automatic Equipment and Productivity in a Sterile Processing Department - Practice Quiz

1. **Research around SPD Productivity shows that it is driven by:**
   A. Equipment and technologies.
   B. Staff training and allocation.
   C. SPD workflow.
   D. All of the above.

2. **Technology and equipment:**
   A. Are the only elements needed to increase productivity.
   B. Are considered the golden path to productivity.
   C. May not be sufficient if other challenges are not addressed.
   D. Are linked to infrastructure and capital investment.

3. **SPD Staff:**
   A. Is an element relevant in productivity.
   B. Is affected by turnover.
   C. Is not affected by training.
   D. A and B.

4. **Examples of SPD Process inputs are:**
   A. Staff
   B. Workflow
   C. Tools
   D. All of the above

5. **Ultrasonic Cleaning systems are effective in:**
   A. Ophthalmologic surgeries instruments.
   B. Flexible endoscopes.
   C. Complex devices with hard-to-reach areas.
   D. High level disinfection.

6. **While implementing Ultrasonic Cleaning Systems, some key variables are:**
   A. Irrigation
   B. Material compatibility
   C. Frequency
   D. A and C

7. **Washer Disinfectors are effective at cleaning all type of reusable medical devices:**
   A. Yes
   B. No
   C. Only devices compatible with the system (load carrier, cycle, detergent)
   D. Only compatible devices

8. **The final rinse on washer-disinfectors is done with:**
   A. Tap water
   B. Cold water
   C. Critical water (AAMI St 108)
   D. Soft water

9. **FDA Recommendations for steam sterilization cycles include:**
   A. Minimum drying time.
   B. Maximum exposure time.
   C. Pressure and steam quality.
   D. Temperature during drying phase.

10. **The "Product families" approach can help streamlining:**
    A. Steam sterilization
    B. Washer-disinfector cycles
    C. Ultrasonic Cleaning Systems
    D. All of the above

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