How to Measure Productivity in Sterile Processing

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About the Authors

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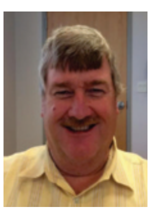

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Many sterile processing departments (SPDs) are being asked to measure productivity. Frequently, SPDs are given a standard metric (e.g., surgery minutes, surgical case volume, adjusted patient days, adjusted patient discharges) for use in measuring productivity. Unfortunately, none of these metrics really measure productivity in sterile processing. In many SPDs, adjusted patient days or adjusted patient discharges have little to do with the volume of work being performed by the SPD.

In most hospitals, surgery is responsible for generating the largest volume of work for the SPD. Because of this, many people think that surgery minutes or surgical volume will be a good indicator for SPD productivity. Surgical minutes are an indicator of productivity for the clinical team performing the surgery, but this does not necessarily carry over to SPD. Likewise, surgical volume might seem like a good productivity indicator for the SPD, as a higher volume of surgery performed would seem to indicate a greater use of instrumentation. However, neither of these indicators measure the volume and complexity of the surgical instrumentation used and therefore fail to elucidate SPD productivity.

Before productivity can be measured effectively, the major factors driving productivity for the SPD have to be determined. These factors can vary from one department to another. In addition to defining the tasks that are performed, the time to complete each task and the level of quality required for completion also must be determined. After this process is complete, then a metric or metrics can be developed to measure SPD productivity effectively.

Developing SPD Productivity Metrics: Factors to Consider

Many factors influence the volume of work performed in SPD, including the type of work performed (e.g., processing floor procedure trays, reusable textile packs, patient care equipment, surgical instrumentation, surgical case carts, specialty procedure carts, individual instruments [wrapped and peel packed]; maintenance of decontamination and/or sterilization equipment located in other departments or facilities). Productivity also is influenced by other factors, including the level of customer service required, swings in workload, expected daily completion rate, department versus customer location, how items needing processing are sent to SPD, how processed items are returned to the applicable department, hours of coverage in SPD, drop-off time for loaners, length of turnaround time, time standards, and acceptable quality levels. To develop a system that accurately measures productivity in the SPD, all of these factors must be considered.

Types of SPD Work

Work can be divided into two basic types: fixed and variable. For fixed work, the number of hours required each week will be the same regardless of the volume of tasks performed. Fixed work can include administrative support and management time. For example, the number of reports compiled and written by administrative support personnel will not change because of increases or decreases in the number of trays processed. Conversely, the hours spent performing variable work change from one day to the next. For example, the number of case carts picked will depend on the number of surgical cases scheduled on a given day. Similarly, the number of trays processed will vary depending on the number and complexity of the trays needed for each case.

When developing a productivity system, determining the number of hours needed for both fixed and variable tasks is necessary. Ideally, every function performed will have its own time standard, but this can be time consuming and expensive without necessarily providing a lot of benefits. If an automated tracking system is available, then it may be possible to develop a time standard for each set or item processed. Some tracking systems are able to monitor and compare performance among employees who are performing similar tasks. Goals can be set to improve productivity. As shown in the example in Figure 1, assembly productivity varies from week to week. Assembly productivity is an indication of how many minutes are needed to assemble one tray. This is an average based on historical data.

Another way to address productivity is to determine the level of difficulty required for each task and the time needed to perform a task belonging to a particular difficulty level. The Association for the Advancement of Medical Instrumentation (AAMI) has attempted to address this process through its *Benchmarking Solutions—Sterile Processing* tool. According to the tool, these varying degrees of difficulty are called "intensity" levels.

In addition to looking at fixed and variable time components, adding factors for personal time, fatigue, and delay is necessary. The personal time factor includes sick, holiday, vacation, or personal time off. This factor can vary depending on the length of service for individual employees. To address this component accurately, departments with several long-term employees who have accrued the maximum time off will need a higher factor added to their base time.

The fatigue factor involves compensating for the fact that employees will become fatigued as they perform a task. This factor will be higher for jobs that require manual labor than for jobs that can be done by setting up a machine and then watching it run. Although a lot of different types of machines are used in sterile processing, the job typically involves a high degree of physical movement. This will require a higher factor to compensate for the fatigue that will naturally occur.

The delay factor involves compensating for delays caused by factors outside of employees' control. For example, the technician cannot change the cycle time for the washer.

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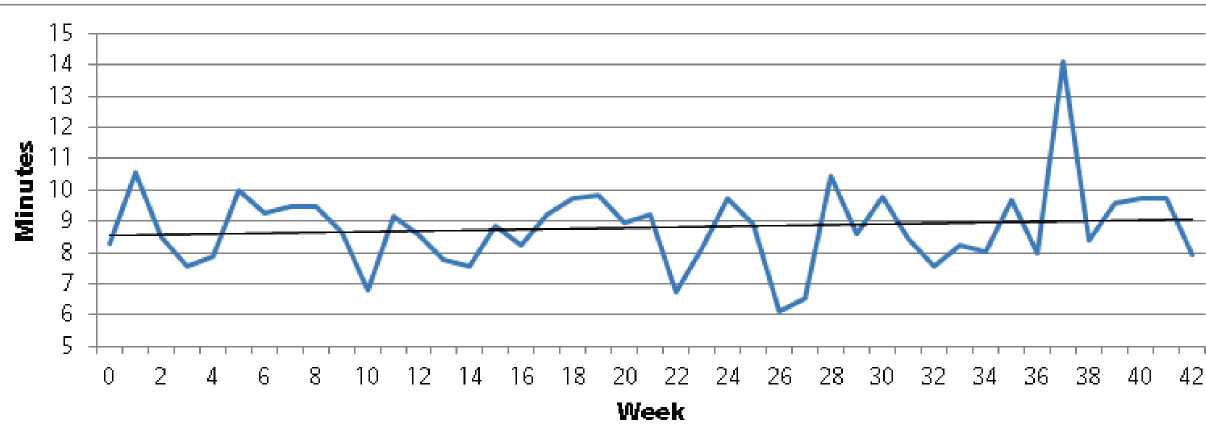

Figure 1. Assembly productivity for the Sterile Processing Department at the Peninsula Regional Medical Center, where "down" equals "good" (benchmark = 12 minutes)

After the washer starts, the cycle needs to run its complete cycle. Even if it's possible to abort a cycle, this is not recommended from a quality and patient safety view point.

The personal, fatigue, and delay factors are important to consider. Otherwise, problems with meeting designated performance and productivity standards can result.

Acceptable Levels of Customer Service and Quality

The level of customer service required can have a substantial impact on the amount of time that needs to be allocated to a particular task or group of tasks based on intensity level. For example, if the expectation is that all requests from customers must be delivered within five minutes of receiving a request, then having a person who is dedicated to doing deliveries only might be necessary. If a person who is inspecting and assembling instrument sets has to stop to deliver supplies, then it will take longer to assemble the instrument sets and, therefore, more personnel will be required to accomplish this goal. Frequent interruptions also can have a negative impact on quality.

Productivity levels needs to be met without compromising quality. If specified productivity levels can only be met by cutting corners and not following a specified manufacturer's instructions for use (IFU), then this is not acceptable. It is important to remember that manufacturers' cleaning and sterilization processes have been validated, and following the IFU ensures that an acceptable level of sterility assurance is reached. Following a manufacturer's IFU does not mean taking extra or less time than specified to compete a step. There is a happy medium that needs to be established between quality and productivity.

One way of measuring quality is to look at defects per million opportunities (DPMO). This is a universal measurement that can be used to compare one SPD with another. When measuring quality, DPMO brings more focus to the defects and process variations. For example, if an SPD processes 2,071 sets and has four defects, this may not sound bad at first glance. However, when looked at in terms of DPMO, this would be 1,931 defects. This is calculated by taking the number of defects, then dividing by the total number of sets processed, then multiplying by 1,000,000 (i.e., $4/2{,}071 = 0.001931 \times 1{,}000{,}000 = 1{,}931$). This information can be trended over time to see if improvement is occurring. When measured in raw numbers, defects tend to be minimized, whereas DPMO brings greater attention to improving quality. In turn, greater resources can be allocated to resolving and improving set quality. As DPMO improves, new goals can be set.

Figure 2 provides an example of measuring quality in terms of DPMO. As can be seen, quality varies widely from one week to the next. This can happen as productivity volumes change and the complexity of tasks performed increases or decreases.

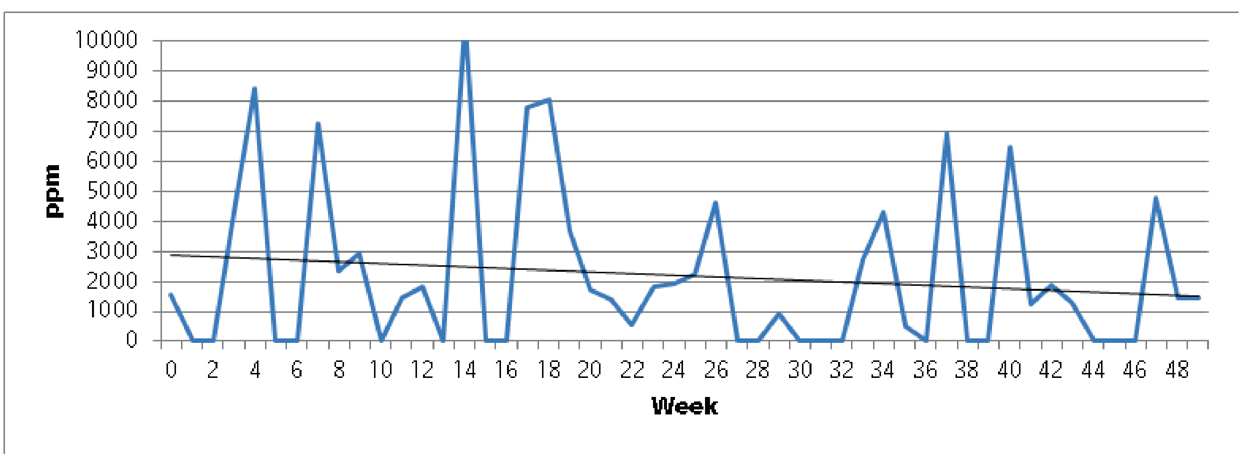

Figure 2. Quality measured according to defects per million opportunities, where "down" equals "good" (goal is 10,000 ppm [parts per million]), based on data from the Peninsula Regional Medical Center

Swings in Workload

Swings in workload affect the number of employees required to staff the SPD. Usually, a minimum number of employees are needed for the SPD to be open. In a small department, this might be one person per shift. If the department requires one person to be present on each shift on weekends and holidays (e.g., in case of an emergency surgery), then that person might not be productive. For example, if no emergencies occur, then the person's productivity level will be very low. On the other hand, if several emergencies occur, then that person might not be able to get all of the work done. Usually, trends over a period of time are used to determine the minimum staffing level. This is a part of the fixed time component. Basically, fixed time cannot be changed. The volume of work might increase or decrease, and this will cause a need for more or fewer employees based on the volume of work. This is known as variable time. To calculate the number of employees needed, looking at both the fixed and variable time components is necessary.

Figure 3 provides an example of how the number of instruments processed can vary based on customer demand. This variation requires the number of staff to be increased or decreased based on the level of demand.

Daily Completion Rate and Hours of Coverage

The expected daily completion rate can have a major impact on the staffing levels required in the SPD. If surgery or loaner trays arrive in the SPD late in the day, more personnel may be needed to complete processing by the end of the day. In addition, if these particular trays are needed by the following morning, then other work might have to be delayed to accommodate this need. If possible, the SPD manager should try to staff according to the expected volume for a given time of day. The ability to do this will be depend on the total workload that the department needs to complete. If a hospital also is a trauma center, then it might be necessary to provide coverage on all shifts (24 hours a day, seven days a week, 365 days a year). If no traumas occur, then this staff might not meet minimum production expectations.

Department versus Customer Location

Department location in relation to customer location can affect the length of time needed to complete certain tasks. For example, if the SPD is directly connected to surgery, then delivering case carts, surgical instruments, and other supplies will be faster than if the SPD is located on a different level and has to share service elevators with other departments. Department layout within the SPD also can affect the time to perform certain tasks. If a department has a long counter that separates the washers from the rest of the prep-and-pack area, extra steps will be needed to move items. When obstacles hinder employees from moving items quickly from one work area to the next, the time needed to perform tasks will need to be adjusted or the obstacles removed.

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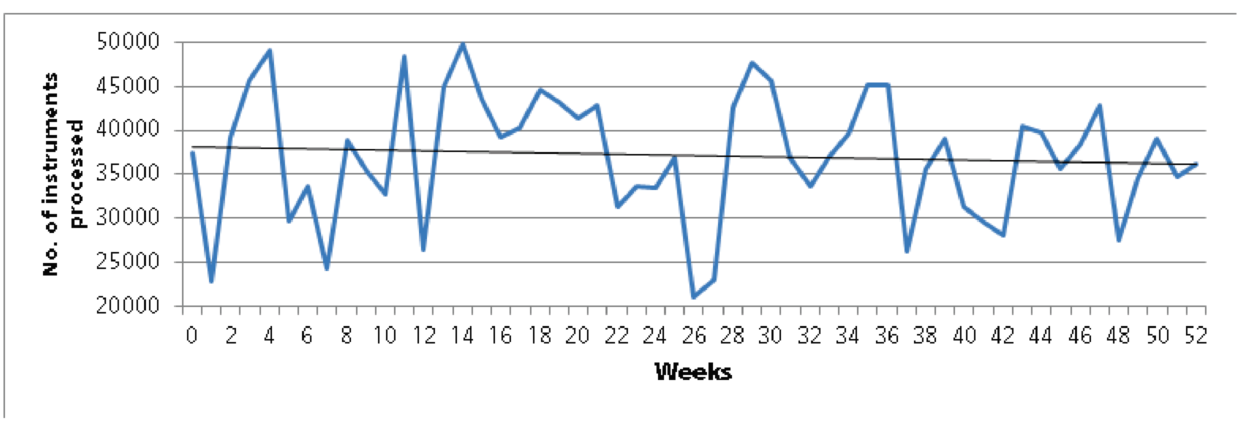

Figure 3. Example of how the number of instruments processed can vary according to customer demand (mean is 38,000 individual instruments), based on data from the Peninsula Regional Medical Center

When establishing quick-turnaround times, one must remember that it is necessary to follow the manufacturer's IFU. It is not acceptable to manually process instruments as a way of speeding up reprocessing time.

Delivery and Pickup of Items Processed in the SPD

Some SPDs have employees who make rounds to pick up items used throughout the hospital that must be reprocessed and/or sterilized by the department. After the items are processed, an SPD employee returns the item to the department from which it came. Departments might call for items that aren't kept in the SPD, and these also must be delivered by SPD personnel. In other hospitals, the department that uses an item must deliver it to the SPD for reprocessing, then pick it up after it has been reprocessed. Depending on the system used, the SPD will need more or fewer employees.

Loaner Trays

The use of loaner trays can have a considerable impact on SPD productivity, resulting in additional workload for the SPD. These trays need to be processed and sterilized when they are received, then will need to be processed and possibly sterilized again after they are used. Conversely, trays that are kept at the hospital will only need to be processed and sterilized once. In addition to this double workload, extra loaner trays often are brought to the hospital as a precaution. Sometimes, the exact number of instruments needed cannot be known until the surgeon can see the surgical site. SPDs that receive large numbers of loaner trays will need to have more employees to accommodate for this uncertain variation.

The time that loaner trays are dropped off also will affect employee staffing requirements. If trays are received 48 to 72 hours in advance, then this work can be fit into the workload. If, however, the trays arrive 24 hours or less in advance, then the number of staff needed to perform the work may need to be adjusted.

Turnaround Time

At times, the SPD may need to reprocess a particular set of instruments quickly. Many factors can influence how long it takes to process a quick-turnaround tray. When establishing quick-turnaround times, one must remember that it is necessary to follow the manufacturer's IFU. It is not acceptable to manually process instruments as a way of speeding up reprocessing time. Manual reprocessing of instruments can only be used if the manufacturer has provided instructions for this method. Often, manual reprocessing takes longer than mechanical methods. Using immediate-use steam sterilization (IUSS) also is not an acceptable way of speeding up the reprocessing cycle. IUSS should only be used for medical emergencies. Depending on the complexity of a particular tray, quick turnaround usually will take three to four hours. Establishing a time of less than three to four hours might indicate that unacceptable corners are being cut and the manufacturer's IFU is not being followed.

Establishing the normal time it should take to turn around a tray also is necessary. This process involves looking at the manufacturer's IFU along with throughput capacity of the equipment and the number of employees available. Ideally, more employees should be available during peak times and fewer employees when the volume slows down. Depending on the complexity of the trays, most departments will be able to inspect and assemble three to four trays per hour. It can take more than one hour to inspect and assemble a tray with a large number of highly complex instruments. Establishing a standard turnaround time can help in monitoring if particular trays are allowed to sit for an excessive amount of time before processing. This standard also will help establish when additional help is needed based on tray complexity and machine capacity.

Time Standards

When developing difficulty levels, it is necessary to determine the time range for each intensity level. A good idea is to track everything being done for a period of time, usually two to four weeks, and then analyze this information to determine if there are any natural ranges that seem to develop. Once the time ranges are established then each task must have an intensity level assigned to it. Development of time ranges and intensity levels is critical to developing a productivity system.

Many things can affect the amount of time that is needed to perform a particular task. For example, the amount of time needed to deliver case carts to surgery will be affected by the process and distance that the SPD is from surgery. If SPD and surgery are connected by a dedicated elevator to deliver case carts then less time is needed than if the case carts have to be delivered by using the service elevator that is used by everyone. Also, if the SPD is across the hall less time will be needed to deliver case carts than when the SPD is on a different floor and has no direct connection to the operating room. Some tasks will need to have more than one time standard.

An alternative to developing your own intensity levels is to use a benchmarking program, such as that offered by AAMI.[1] Although "canned" programs cannot account for all variables needed to generate truly accurate time standards, they will provide an estimate of the number of full-time equivalents (FTEs) needed in your department. The AAMI benchmarking tool was developed by a team of experts in sterile processing. The tool is very detailed and takes into account all the non–value-added tasks that need to be included when measuring productivity. Depending on the number of metrics used in the program, it also might be possible to demonstrate the differences in your department that account for the higher or lower productivity levels. This information then can be used to justify your staffing levels. AAMI's benchmarking tool also allows for comparison of your facility with other similar facilities. This can be helpful in justifying the number of positions needed.

Department hours per instrument set, as shown in Figure 4, is one way of monitoring and setting a time standard.

Measuring Productivity at the Peninsula Regional Medical Center

The Peninsula Regional Medical Center (PRMC) in Salisbury, MD, calculates daily "Takt" time based on the number of assembly hours versus operating room (OR) case cart demand. ("Takt" time is derived from the German word "Taktzeit," which is the baton that an orchestra conductor uses to regulate the tempo of music. This can be thought of as a measurable way of determining the rate [tempo] at which a finished product needs to be completed in order to meet customer demand.) Assembly is where the most value-added tasks are performed within the department, and the assembly process has the most variation with respect to time. The SPD at PRMC collected data over several years. These data were used to calculate the following standard times: mean sets per case cart (currently nine), assembly mean (eleven), and mean number of add-on cases (six).

This information is then used to look at the employee schedule and calculate Takt. The AAMI benchmarking program uses a similar method for measuring productivity but with more detail. The AAMI tool accounts for all non–value-added time, which allows the manager to calculate total FTEs needed. The Takt calculation at PRMC was developed by pulling the fixed number of sets per case cart and average assembly time from a 12-month rolling average. This represents the OR demand. The total assembler hours available is then used to determine the available resource time. A calculation can

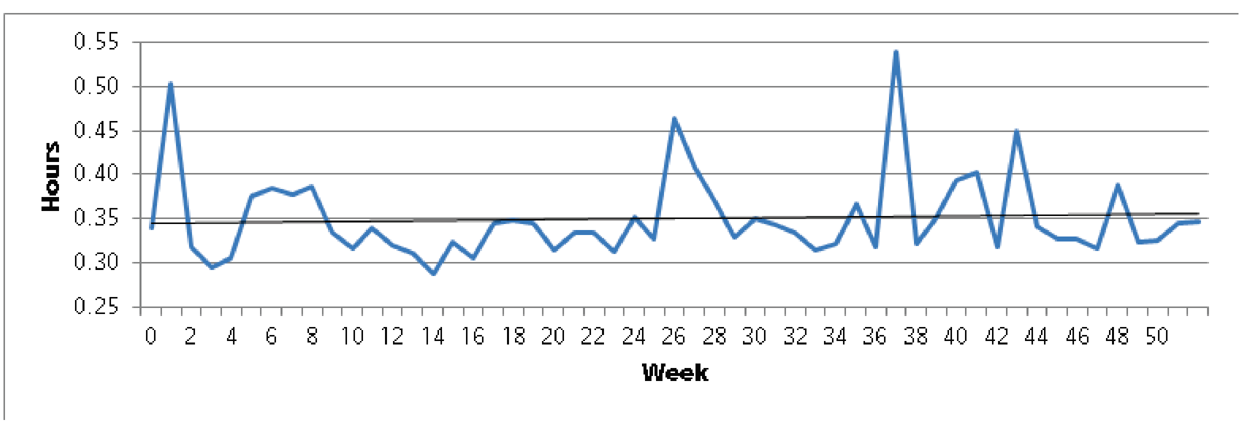

Figure 4. Department hours per instrument set, based on data from the Peninsula Regional Medical Center

then be made to determine the Takt. An additional factor is used to account for the increased number of trays used in orthopedic procedures. The following data are used in the calculation at PRMC: The information below refers to the Takt chart in Figure 5.

- Forty-three regular cases at seven trays per case cart indicates that the estimated number of trays that need to be processed for the day is 301.
- Orthopedic cases require an average of two more instrument sets per case. Therefore, since there are five orthopedic cases, an additional 10 instrument sets need to be added to the total estimated trays that need to be processed. The total trays to be processed are now 311.
- Two sets were left at 7 a.m. from the previous day. These need to be added to the total sets needing to be processed. The total estimated instrument sets to be processed is now 313 trays.
- Average assembly time per instrument set is 12.5 minutes.
- Based on the above information, an estimated 3,913 minutes are needed to process the instrument set volume for the day.
  - 313 instrument sets needed multiplied by 12.5 minutes needed to assemble each instrument set on average: 313 × 12.5 = 3,912.5 (rounded o 3,913).
- Eight FTEs are available for instrument set assembly.
- Each employee on average can be productive for 430 minutes per day.
  - The total minutes available to assemble instrument sets is 3,440 minutes: 8 × 430 = 3,440.
- On this day, the department is short 472.5 minutes needed to complete the sets (3,912.5 – 3,440 = 472.5 minutes or 7.875 hours of overtime or standby employees needed to complete the work).

TAKT TIME CHART			Capacity/Needs	
Number of cases ?		43		
Set average per	7			
	Total	301		
Ortho Knee/Hip Mix factor Cases ?				
2	5	10		
		Todays Demand		
		311	Avg set assy min ?	
Wip in ASSY		2	12.5	
			Demand Minutes	
	Grand total	313	3913	
	Hours			
Shift	Assemblers ?	Decontam	Shift Total	
1st	1.5	1	2.5	
2nd	4	1	5	
3rd	2.5		2.5	
Assy FTE	8		10	FTE Total
Work hours (Min)	430		Capacity Minutes	
	Total avail minutes	3440	3440	
Employee GOAL			472.5	Difference
	TAKT (minutes	10.99	Needs List	
	Takt (Hours)	5.5	Sets	37.8
11/30/2015	*Today's Assy*	39	Hrs	7.88

Figure 5. Chart showing "Takt" time measurement at the Peninsula Regional Medical Center (see text for additional details)

In addition to calculating the amount of time needed to complete the work, one also needs to look at what PRMC calls the "power shift." A power shift chart is shown in Figure 6.

- The orange vertical lines and green horizontal bar indicate the power shift. This was determined by measuring the time of day case carts arrive to the decontamination area. Based on this information, employee schedules were staggered to fall within the power shift. During this time, the assemblers' primary responsibility was to assemble instrument sets; they have no other tasks. The assembly tables also were reorganized so that everything that the employee needs is readily available. Time is not wasted because the employee has to retrieve needed supplies.
- The red vertical line is the time that everything has to be completed by. At this time, everything is reset for the next day.
- The red horizontal line indicates the SPD manager, while the orange/green, blue line, and yellow lines indicate other SPD employees, each with particular responsibilities.
- The dark green lines indicate the decontamination area. One employee is responsible for setup, quality tests, and "EZ pass." (EZ pass refers to an expedited

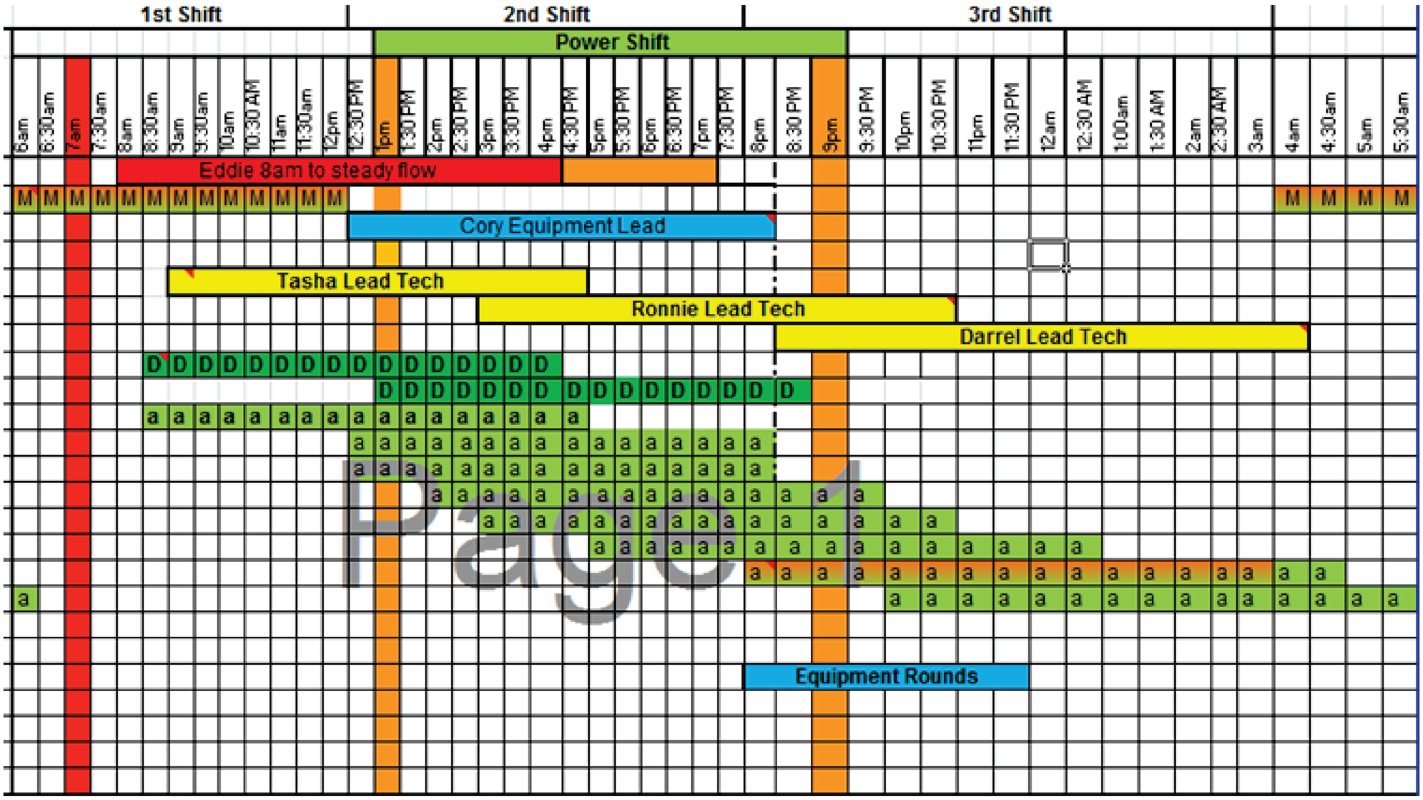

Figure 6. Shift productivity requirements at the Peninsula Regional Medical Center (see text for additional details)

process in which an item undergoes the normal process but is moved to the head of the line, pushing through all existing queues.) The second employee is responsible for continuous flow and decontamination reset.

- The employees represented by the light green lines are responsible solely for instrument set assembly.
- The blue line is for equipment rounds. One-half FTE is responsible for balancing intravenous hubs/kanbans and dirty instrument sets for the operating room.

If either too many or too few employees are scheduled at the wrong time, then it will not be possible to meet productivity requirements. Figures 5 and 6 demonstrate how the Takt was calculated at PRMC.

Conclusion

Measuring productivity is a complex process. Many factors need to be considered when establishing a productivity system. The main problem is to determine what actually drives productivity in a particular department. Productivity is specific to the tasks performed. Using a generic indicator (e.g., surgical minutes, surgical volume, adjusted patient days, adjusted patient discharges) does not provide a good way of measuring productivity and will probably result in the department being either over- or understaffed. ■

Reference

1. **Advancement of Medical Instrumentation.** *Benchmarking Solutions—Sterile Processing.* Available at: www.aami.org/productspublications/ProductDetail.aspx?ItemNumber=1063. Accessed Dec. 9, 2015.