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Implementing **Wireless** Temperature Monitoring with Ease

Wireless temperature monitoring (WTM) delivers significant efficiencies in the pharmacy by shifting workload from staff to technology. Pharmacy staff no longer needs to go from refrigerator to refrigerator manually recording temperatures in paper logs as this technology provides accurate 24/7 monitoring system-wide while also automating documentation tasks. Because of the continuous monitoring capabilities, the risk of losing costly medications due to refrigerator malfunctions is limited. In addition, WTM can significantly aid in achieving compliance with regulatory standards regarding medication storage and temperature documentation. While the technology itself is not incredibly complex, implementing a WTM system can be, and undertaking this task requires rigorous planning, careful, step-by-step employment, and testing to help avoid unnecessary challenges.

Selecting a Monitoring System

To help ensure that the WTM system selected is one that works best for all stakeholders, a team that will lead the project should be identified. Ideally, the team will include representation from pharmacy, nursing, IT, and engineering.

Connectivity of the devices is a key selection consideration. Some systems feature monitoring devices that connect directly to the hospital's wireless network. While this approach requires less hardware, it means there must be adequate wireless coverage in all areas designated for monitoring. Keep in mind, this option will add significant traffic to the hospital's wireless network, so it must be capable of handling this increase. If the network needs to be bolstered to handle the increase, cost and time associated with the implementation will be increased as well. Other WTM systems broadcast on a radio frequency, and this type of solution requires more hardware (the receptors for the radio signals) but does not depend on the reliability of the hospital's wireless network. An analysis of the costs associated with each system and the reliability of the hospital's wireless network should be performed before choosing a system.

Another key consideration is the monitoring device's sensitivity to temperature fluctuations. Systems that set off an alarm every time a refrigerator door is opened are frustrating for end-users. To prevent this, some systems provide thermometers immersed in a liquid (eg, propylene glycol) or encased in an airtight chamber. Both reduce the monitoring device's sensitivity to changes in ambient air temperature, thus preventing alarms from sounding during routine use. The vendor should be able to supply information regarding the device's sensitivity to changes in air temperature. Additionally, the devices can have different battery lives, and this also needs to be considered when selecting devices.

Pre-Implementation Decisions

There are several decisions that need to be made to help streamline implementation prior to going live with a WTM system. For example, it is important to designate who will receive alerts and who will respond to them, especially in areas without 24/7 staff coverage, such as ambulatory clinics. When a monitor detects an out-of-range temperature, an e-mail or page alert is generated. The recipient either responds to the alert or notifies another staff member to respond. The responder assesses whether any medications need to be moved. The responder also might need to evaluate the viability of the refrigerator or freezer itself; if so,

the expertise of the hospital engineering department is required.

Staff selected to receive and respond to WTM alerts must be able to meet these responsibilities, and need to be trained. While pharmacy might appear to be the best choice to receive the alerts, this may not be the case for every situation. When an out-of-range alert is received from a unit that is closed, for example, pharmacy may not even have access to that unit. Also, pharmacy staff may not know what medications (if any) are present, and the strategy for dealing with an alert in a refrigerator containing \$20,000 worth of vaccines will be different than that for a refrigerator containing only a partial vial of insulin.

To ensure that processes for responding to alerts are clear to all stakeholders, it is important to develop guidelines for how to handle various scenarios—such as when to remove medications from a refrigerator that went out of range, when engineering or pharmacy needs to get involved, and how to properly document actions taken in response to the alert.

How often the WTM system documents refrigerator and freezer temperatures also needs to be determined prior to implementation. The system monitors temperatures nearly continuously and documents them at intervals the hospital chooses (eg, every eight hours), in addition to automatically documenting any time a refrigerator temperature is out of range. In some systems the frequency is set before installation; in others it is adjustable. An added advantage of routine documentation is that it helps the hospital track refrigerator and freezer reliability. WTM records can help identify any appliance that is underperforming and needs replacement, such as one that experiences temperature fluctuations from the upper to the lower limit multiple times a day.

Also, careful consideration should be given to where temperature monitoring is needed. While the initial plan might be to monitor all refrigerators and freezers containing medications, other areas of the hospital also could benefit from WTM. For instance, operating rooms and areas where investigational drugs are stored may require documentation of room temperature. Similarly, refrigerators and freezers used for food storage may be candidates for WTM. An assessment of all of these areas is necessary to determine the number of temperature monitors needed for implementation.

Questions for the Planning Process

Before installing a wireless temperature monitoring system, ask yourself . . .

- How many temperature monitoring devices does the hospital need?
- Who should receive and respond to alerts when a refrigerator goes out of range?
- What will the response consist of?
- How will the responder document actions taken for an out-of-range temperature?
- How frequently should monitoring devices routinely record temperatures?



Roadblocks to Implementation

- **Lack of adequate wireless coverage, especially inside refrigerators and freezers.** It is not enough to simply verify that there is adequate wireless coverage in the area where the unit is to be installed, the wireless signal also must penetrate the appliance.
- **Inability of non-medication-grade refrigerators to maintain temperatures within acceptable ranges.** Some refrigerators may be identified for replacement even before the system has been fully implemented.
- **The monitoring devices.** If possible, consider testing some of the devices against each other to ensure that they read the same temperature.

Device Installation

There are two key considerations when installing the monitoring devices. First, the placement of the monitoring device within the refrigerator or freezer is critical. During our implementation, we were able to minimize recorded temperature fluctuations by mounting the device as close to the center of the refrigerator as possible. The type of device chosen can impact where the optimal location will be, so it is a good idea to place some monitoring devices in multiple locations in a few refrigerators during the testing phase. You might discover that the sensitivity of the monitoring devices requires replacing some refrigerators. For instance, dorm-room-style refrigerators may not be able to maintain temperatures within the acceptable range.

Secondly, once installed, monitoring devices need to be tested to verify that the signal is being received, either on the hospital's wireless network or by the radio signal receptor. Verifying wireless coverage in the area where the refrigerator or freezer is located (eg, medication room) is not sufficient, as the walls of the appliance may interfere with the signal. Coverage must penetrate the appliance itself.

Testing the System

Before going live, it is advisable to run a pilot test to ensure that both the system, as well as the processes in place for responding to and documenting alerts, are functioning. The pilot should test multiple devices in different locations, such as devices in the pharmacy, a nursing unit, and a clinic. The importance of the pilot cannot be overstated; it is crucial that the system is working well before being fully implemented. During our pilot, the system generated over 6000 alerts in one week. If the system had been fully implemented during this time, it would have brought hospital operations to a screeching halt.

Conclusion

Implementing WTM decreases workload while increasing the consistency and reliability of temperature monitoring, alerts, and documentation. Staff can attend to other responsibilities when freed of the time-consuming task of completing paper-based temperature logs. Further, regulatory compliance is facilitated when refrigerators and freezers are monitored on a nearly continuous basis and record keeping is systemized. Careful planning and testing before going live with the system can help avoid unnecessary issues that might delay or challenge an effective system-wide implementation. ■



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