

Patient Safety Tip of the Week

February 9, 2016 It was just a matter of time...

It was just a matter of time... In response to the serious problem of alarm fatigue across the nation, many hospitals have put in place sophisticated IT systems linking alarms to paging or messaging systems in attempt to get prompt responses by responsible staff to alarms. But a recent incident at a California hospital illustrates how wrong things can go in spite of (or because of) such systems.

The case ([CDPH 2015](#)) involved a patient with hypercarbic respiratory failure who was admitted to an ICU and put on a ventilator. As we see in most incidents resulting in patient harm, a series of events rather than a single event led to the untoward outcome.

The alarm management system at that hospital assigns a pager ID to a nurse and a respiratory therapist (RT) who have primary responsibility to respond to alarms/pages for each individual patient. But on the evening of the incident the patient expressed her desire to have a female respiratory therapist so the RT responsibilities were switched to another RT. But there was no change made in the alarm management system to indicate this switch in responsibility.

Around 3:00 AM a section of the patient's ventilator circuit became disconnected from a Y-connector. Heart rate and oxygen alarms went off and a series of pages/messages were sent to an LVN (licensed vocational nurse) and an RT (respiratory therapist). Unfortunately, the RT with responsibility for the patient never received any such pages/messages and the RT to whom pages/messages were erroneously sent did not respond since he did not think he had any responsibility for this patient.

Though the patient's room was only 13 feet from the nurses' station and two nurses, including the charge nurse and the RN with primary responsibility for the patient, heard the loud audible alarm but none responded.

Statement from the RN with primary responsibility for the patient (who was at the nurses' station and heard the audible alarm): "It was just the vent alarm, it's not like it was the oxygen saturation alarm, so I didn't think anything of it". She saw the LVN go into the room. The LVN came out of the patient's room and called the RN for help. They found the patient unresponsive and cyanotic and called the Rapid Response Team. Another respiratory therapist arrived with the Rapid Response Team and found the expiratory limb of the ventilator circuit had become disconnected from the Y-connector. It was determined that the ventilator had alarmed for 12 minutes due to oxygen desaturation before there was a response. The patient suffered anoxic brain damage and subsequently died.

The charge nurse, who was also at the nurses' station, recalled hearing multiple alarms and did not respond to any because she was "distracted" by the report she was receiving from another nurse. The charge nurse did see the LVN enter the patient's room and also recalled getting a phone call (just prior to the Rapid Response Team call) from the technician at the alarm center that was sending out the pages/messages stating that the patient was desaturating.

And there was another telling quote from the respiratory therapist to whom the alarm messages/pages were erroneously sent. While he denied receiving any pages at all, he said "It didn't matter if I don't get a page on that patient, the nurses get the pages too and they should have responded."

Review of the central alarm system logs showed that 23 pages/messages had been sent to the RT who had not been assigned this patient and 24 were sent to the LVN. The pages had been sent because of both a rising heart rate and oxygen desaturation. In addition, the alarm center technician made 3 phone calls to the nurses' station. The first was unanswered. The second was answered by the nurse with primary responsibility for the patient and she was told of the oxygen desaturation. The third was answered by the charge nurse who was informed of continued oxygen desaturation. The Rapid Response Team announcement went out shortly after that third call.

This unfortunate incident, of course, points out some of the key vulnerabilities of alarm management systems.

Firstly, it points out that the **hi-tech systems are only as good as the data input to them**. The computerized system appropriately sent out messages/pages to the personnel for whom it was programmed. But it was human error and system error that led to the failure to change the recipients after the change in assignment of RT responsibility had occurred.

Secondly, it points out blatantly **what happens when more than one person is designated as responsible** for the patient. **Each assumes the other will respond** and then no one responds. And even the nurses who were almost within arm's length of this patient failed to respond because they expected someone else to respond. We've talked about this "**dual responsibility**" issue before. In our October 13, 2009 Patient Safety Tip of the Week "[Slipping Through the Cracks](#)" we cited a paper ([Singh et al 2009](#)) on radiology reports that demonstrated dual alerts (those sent to both the referring physician and the primary care physician) were twice as likely to go unacknowledged. In the current case multiple parties all assumed someone else would respond.

There apparently was no system for **escalation**. A good system would escalate the messaging after a certain time elapses without a response from the individual with primary responsibility. In this incident the alarm system technician did escalate in that she made phone calls to the nurses' station when the oxygen desaturation alarm continued. But apparently there was no formal escalation procedure in their policy and

procedure for alarm management. Perhaps the system might have sent an initial page/message to the LVN, then a second page to both the LVN and RN if there was no response within 1 minute, and so on. The report also does not mention whether the RN who had primary responsibility for the patient was even in the messaging loop (the RN was paired with the LVN because of limited scope of practice for the LVN so both were responsible for the patient). Would it not have been appropriate for the system to escalate the pages/messages to that RN when others had not responded?

Note also it is not clear how this alarm management system recognizes whether someone has responded to the patient. Presumably the central technician would continue sending out pages/messages until the alarms stopped alarming. The technician would not know whether appropriate responders were already at the bedside attending to the patient.

The **policies and procedures** were deficient in that they **did not clearly delegate responsibilities** for responding to alarm messages/pages. Their policies and procedures for assignment of patient responsibilities was also deficient and there was **no guidance for conveying changes in responsibility**.

The hospital also **had not been tracking response times** as part of their quality improvement/patient safety monitoring. In our July 2, 2013 Patient Safety Tip of the Week "[Issues in Alarm Management](#)" we noted one hospital found it took on average 9.5 minutes before a clinician responded to high priority alarms. Had the hospital in the current incident been tracking such response times before the event they might have identified and fixed problems in the system and avoided this unfortunate outcome.

We also wonder whether there was a **knowledge deficit**. The quoted comment above from the nurse who said it was only a ventilator alarm, not an oxygen desaturation alarm, probably had a poor understanding of respiratory physiology. This patient was admitted with hypercarbic respiratory failure. That means the patient might have progressive respiratory depression with hypercarbia which would occur before significant oxygen desaturation occurred, particularly if the patient was receiving supplemental oxygen. Perhaps other staff need re-education on all facets of hypercarbic respiratory failure as well.

How did the hospital respond?

- 1) They implemented daily ventilator alarm response drills
- 2) They implemented daily ventilator alarm checks
- 3) They developed a pager assignment verification process (each shift the supervisors for Respiratory Therapy and Nursing are to verify pager assignment for their respective staffs)
- 4) A multi-disciplinary Clinical Alarms Task Force was convened
- 5) A FMEA (Failure Modes and Effects Analysis) was completed
- 6) 3 individuals were terminated (see below)
- 7) Performance benchmarks were set for expected response times to ventilator alarms

- 8) Policy and procedure were revised to include “ventilator circuit connections shall be checked by staff after repositioning, bathing, and provision of care at the bedside”
- 9) The central alarm system policy and procedure was revised to include pager verification process steps to follow if they receive a page on a patient not assigned to them
- 10) Pager verifications to be reviewed daily
- 11) Several clinical indicators to be monitored were added including: staff response to ventilator alarms in <1 minute, pager assignment verification, internal ventilator alarm function test, and external ventilator alarm function test

The hospital’s Plan of Correction (POC) indicated that 3 individuals had been terminated (the RN and LVN with primary responsibility for this patient, and the RT to whom the alarm messages/pages had been erroneously sent). **Should the 3 really have been fired?** That is always a dual-edged sword. Who are the 3 individuals most likely to never make those mistakes again? Yes, the 3 individuals you just fired! And if during one of your ventilator alarm drills several other individuals do not respond promptly, would you fire them? We often make the mistake of taking one action based on the outcome of an incident and a different one when the outcome was benign even though the same mistakes were made in both circumstances. It may well be that other issues (eg. attitude, honesty, previous problems, etc.) played into their decision to terminate individuals. But it is very important to root out what was part of a problem with the **safety culture** of the unit as opposed to bad actions solely accountable to individuals. Could the same thing have happened had 3 different individuals been in those roles that evening? We obviously don’t know those answers. But there were certainly many upstream system defects that put those individuals in a position to make fatal errors.

There are several other considerations if you are using alarm management systems linking alarms to messaging/paging capabilities. One of these has to do with **battery life**. In our February 4, 2014 Patient Safety Tip of the Week “[But What If the Battery Runs Low?](#)” we recommended that if you are using cell phones or pagers for alerting staff to various alarms, consider doing a FMEA (failure mode and effects analysis) and ask not only what would happen if the primary responder’s battery is low but also what would happen if more than one responders’ battery is low. You also need to consider that there may well be “**dead zones**” in your facilities where transmission to a cell phone or other device may be blocked or otherwise unavailable. And you’ve never **misplaced** your smartphone even temporarily? Unlike anachronistic pagers that you kept attached to your belt except to look at what number to call, today’s smartphones or similar devices are typically used for much more than responding to pages/messages. The more frequently you remove that smartphone from its holster, the higher the likelihood that at some point you will put it down somewhere and lose it.

When we do RCA’s or review RCA’s we always also try to recognize things that were done well in addition to those not done well. In this case the hospital did several things well immediately after the incident:

- Patient’s family was notified both of the change in condition and fact that an RCA would be undertaken (and that family would be updated regarding findings of RCA)
- Staff present during the incident were immediately interviewed in the RCA
- Ventilator was sequestered pending the investigation
- All alarms on that ventilator were verified as being operational
- Daily ventilator alarm checks were implemented
- Ventilator response drills were begun
- A pager assignment verification process was begun

So do we think such centralized alarm management systems linking alarms to messaging/paging capabilities are a bad idea? No. They have the potential to add valuable defenses in combating alarm fatigue. Yet the current incident provides many lessons learned that other hospitals need to consider:

- Make sure that alarm response times are clinical indicators you follow regularly
- Make sure your system incorporates procedures for dealing with changes in assignment of responsibility
- Make sure your policies and procedures make responsibility and accountability for alarm responses clear
- Make use of escalation procedures for alarm responses and beware of the real threat that “dual alerts” might unintentionally make it more likely no one will respond
- Consider doing ventilator alarm drills periodically
- Do a FMEA that looks at factors that could thwart prompt responses (such as low batteries in pagers/smartphones, dead zones, etc.)

And we refer you back to our July 2, 2013 Patient Safety Tip of the Week “[Issues in Alarm Management](#)” for numerous other recommendations for your alarm management program.

Prior Patient Safety Tips of the Week pertaining to alarm-related issues:

- March 5, 2007 “[Disabled Alarms](#)”
- March 26, 2007 “[Alarms Should Point to the Problem](#)”
- April 2, 2007 “[More Alarm Issues](#)”
- June 19, 2007 “[Unintended Consequences of Technological Solutions](#)”
- April 1, 2008 “[Pennsylvania PSA’s FMEA on Telemetry Alarm Interventions](#)”
- February 23, 2010 “[Alarm Issues in the News Again](#)”
- March 2, 2010 “[Alarm Sensitivity: Early Detection vs. Alarm Fatigue](#)”
- March 16, 2010 “[A Patient Safety Scavenger Hunt](#)”
- November 2010 “[Alarms in the Operating Room](#)”

- February 22, 2011 “[Rethinking Alarms](#)”
- February 2013 “[Joint Commission Proposes New 2014 National Patient Safety Goal](#)”
- May 2013 “[Joint Commission Sentinel Event Alert: Alarm Safety](#)”
- July 2, 2013 “[Issues in Alarm Management](#)”
- August 2013 “[Joint Commission Formalizes 2014 NPSG on Alarm Management](#)”
- February 4, 2014 “[But What If the Battery Runs Low?](#)”
- October 2014 “[Alarm Fatigue: Reducing Unnecessary Telemetry Monitoring](#)”
- December 15, 2015 “[Vital Sign Monitoring at Night](#)”

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