



Improving Patient Safety and Reducing Alarm Fatigue: The Right and Wrong Way to Use Continuous Surveillance Monitoring

Michael Wong:

Welcome to the health and safety podcast. My name is Michael Wong. I'm the founder and executive director of the Physician-Patient Alliance for Health & Safety.

This clinical education podcast is made possible by an unrestricted educational grant from Bernoulli Health.

Today, we are speaking about nuisance alarms and the need for better alarm management.

We have with us a very distinguished panel of experts:

- Dr Leah Baron is chief of the department of Anesthesiology at Virtua Memorial Hospital;
- Maria Cvach is director of policy management and integration for Johns Hopkins Health System; and
- Marc Schlesinger is senior associate at ECRI Institute's applied solutions group.

For those listeners who may not be familiar with you or your work could you give us a brief introduction about yourself? Dr Baron, perhaps we can start with you?

Leah Baron:

Thank you, Michael. As Michael said, I am chief of anesthesia at Virtua Memorial Hospital in Mount Holly, New Jersey. I have been a practice for many years, and have seen a lot of improvement in patient care. With that said, we still have a lot of patient safety issues that we would like to address and we need to address. At this point, especially, my interest is in addressing opioid-induced respiratory depression in post-operative patients. And, our best intentions of managing patients' post-operative pain has been focused achieving best pain relief. A side effect of it has been identifying patients who side effect of their opioid use has produced unnecessary dependence or potentially dangerous - and one of them is respiratory depression. So, that's how I got interested in this field and have done work to see what we can do clinically as clinicians and in the healthcare system to create for our patients a safer environment.

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

Wong:

Thank you, Leah. And, Maria, perhaps you could give your background?

Maria Cvach:

Sure thanks, Michael. So, as Michael said, I am the director of policy management and integration for the Johns Hopkins Health System and I've worked at Johns Hopkins as a nurse leader since 1986. My background is in cardiology and I've had experience in coronary care, intensive care, and progressive care nursing. During my work as an Assistant Director of Nursing from 2005 to 2015, I was asked to form and co-lead the Johns Hopkins Hospital alarm management committee and it is this work that really forms my research and publication interest on evidence based practice and alarm management strategies for hospitalized patients. We shared a lot of our work in publication, and also I have served as the national chairperson for the Association for Advancement of Medical Instrumentation otherwise known as AAMI. I have worked on their alarm systems steering committee and we have published a lot of work and best practices that hospitals can use to start their work on alarm management.

Wong: Thank you so much, Maria, and last but certainly not least Mark?

Marc Schlesinger:

Yes, thank you, Michael. My name is Mark Schlesinger. I'm a senior associate at ECRI Institute in Plymouth Meeting, Pennsylvania, right outside of Philadelphia. I do have a clinical background and that is as a respiratory therapist. I've been a licensed respiratory therapist since 1978. I quickly moved into the management role, so I have about 35 years of management experience in operations running, not only respiratory, but most of the other ancillary departments in hospitals, including cardiology, pulmonary, rehabilitation, etc. My role at ECRI is very varied. ECRI Institute is a nonprofit. We're celebrating our 50th anniversary next year. I help clients with everything from capital purchase selections to technology, so I help with OR integration-type projects and my specialty is alarm integration and alarm management. Thank you.

Wong:

Thank you so much, Mark.

In 2014, The Joint Commission set better alarm management as a National Patient Safety Goal. The Joint Commission has implemented this goal in two phases. The first phase began January 1, 2014 with the objective of heightening awareness of the potential risks associated with clinical alarms, such as cardiac monitors, IV machines and ventilators. The second phase began January 1, 2016 and introduced requirements to mitigate those risks. So, I'd like to ask the panel - why is alarm management such a critical patient safety issue? Or, in other words, why should we really care.?

Cvach:

So, the reason why we got into it at Hopkins Hospital was actually because we have what are called CUSP units (comprehensive unit safety program), where we ask the bedside units, "how

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

will your next patient be injured?" and one of our units identified that they were really concerned about the amount of noise that just serves to distract people and isn't necessarily helping with safety. And, so, that is actually how we got started with this and when we started digging, you know it was like peeling the layers of an onion, once you start digging you're going to find all kinds of things. What we found is that we had so many alarms, many of which weren't really actionable, but they were just serving to distract and were a potential for missed alarms and making errors. And, so, I think that that's probably your biggest problem is your alarm should be about directing your attention from something that's less important to something that's more important. And when your alarm is not doing that, then you have the potential to distract staff from things that they're working on that are more important. Your taking their attention away from that. And that's where things can get missed or mistakes can be made and so that's why we felt this was an important thing to manage.

Wong:

So, really what you're talking about is distinguishing between actionable alarms versus non-actionable alarms, correct?

Cvach:

Correct.

Baron:

I wanted to add to this how we got into our alarm management study, and just to echo Maria's statement - the challenge is to identify true actionable alarms. And, when we first introduced capnography to monitor patients for respiratory depression related to their opioid therapy, we very quickly found out that the amount of alarms that were bombarding our health care workers was unmanageable. And, the reality was that they could not respond to all of them, but a lot of them were just pure noise. And, that's why we realized that if we want to use this effectively, we need to figure out how to identify these actionable alarms and filter the noise, and that's why, subsequently, we decided that we're going to do another study and see if we can achieve better results with that.

Wong:

Right, and we'll get into Dr Barron's study in a moment. Since The Joint Commission pronouncement in 2014, how have each of your hospitals changed the way that alarms are managed?

Cvach:

So, we've really been ahead of the curve on this requirement. I know that the requirement went into effect in 2014 with the phased in effect all the way up until 2016, but we had an alarm management committee in place since 2006. And, the leaders at our organization put a lot of focus and a lot of financial support to trying to figure out what the problem is - what the root cause of all of this is - and part of the reason that occurred was because we were putting up two new towers, where almost all of our clinical units were being relocated to. When you build these new buildings, they have very spacious floor plans. You don't have a single nursing unit

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

anymore. On some of our units, there are about the size of a football field and there is more than just one nursing station, there might be three or four nursing stations. And, so you can't think like in the old days where you had your patients all centered around a nursing station and you could hear everything. Patients want private rooms and they have bigger spaces, and so we really had to think outside of the box before those buildings went up on how we were going to ensure primary notification and then secondary notification, so if you aren't in the room or near the monitor, how are you going to figure out who's alarming. And, so that's how we changed our alarm management in that we initially had very small units - very contained units - now they're much bigger and we have very sophisticated middleware, where we're relying on both the primary and the secondary notification, and we're using wireless devices in a way that we didn't use prior to The Joint Commission requirement.

Wong:

Thank you, Maria, those are great comments. We've all heard of instances in which clinicians turn off or mute the alarms on monitors. What would you like to say to these clinicians? Maria, perhaps you'd care to comment?

Cvach:

I'm happy to and then it's Leah wants to comment as well. I have to say that there are times when it may be appropriate to turn off or silence an alarm, but considerable thought needs to go into that decision. It should be done with caution, it should not be done routinely and as a way to just alleviate the noise on a unit. You don't want to just do it routinely. It should be done cautiously. It should be done after discussion with others. It could be that you're discussing it with another charge nurse on the unit or with a physician on the unit. If the clinicians are routinely doing this, that's a sign that there is a problem with their alarm management strategy. So, they need to really re-look at whether or not that is something that they are routinely doing or if it's done for the purpose of a very valid reason for doing it.

Baron:

If I may just add to it. I think the important thing is to identify why people turn off the alarm. Are these alarms [do] they think they're just noise and they're not clinically relevant? There may be many reasons why clinicians chose to turn off the alarm. By better identifying and building a truly meaningful alarm into everybody's practice, hopefully, we can provide the clinicians taking care of their patients, alarms they feel valuable and important to them that they don't want to turn off - they want them to be on - because they should be helpful in their goal of providing good patient care. The other point that I think is valuable is building alarm thresholds and realistic alarm thresholds into our system. Sometimes not one size fits all and how we manage alarms within the institution also is important in a creating a support system - technologically support system for clinician, the technology that will help them to take better care of their patient.

Wong:

Well, thank you, Dr Baron.

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

ECRI Institute has done a lot of work and awareness about alarm management and, recently published their top ten health health technology hazards for 2018. Number four on this list deals with how missed alarms may result from inappropriately configured secondary notifications devices and systems. Mark, would you care to elaborate on that for our listeners?

Shlesinger:

Yes, thank you. So, alarms have been our top ten technology list for probably the last four years in various degrees. The current 2018 list deals with secondary notification and the improper use of secondary notification, or the improper settings of secondary notification. So, for the listeners who are not familiar with the term secondary notifications for alarms, it can be anything from a one way pager to a iPhone-type smartphone device, and really anything in between including annunciator boards, nurse call systems, etc.

The true value comes when the devices are used properly. When we do an integration for middleware and secondary alerting devices at a hospital, the most common request is that pretty much every alarm goes to the device initially, which is totally the wrong approach. So, what we try to do is convince the nurses and respiratory therapists that the only alarms they really want to see and hear on their personal devices are critical alarms and actionable alarms. However, again, you don't want to just take the ventilator or the physiologic monitor, and make every alarm go to your device, because, at that point, you're doubling your alarm fatigue, because not only is the device alarming and the central station alarming, you then have the alarm on the person.

The other thing that is very important to set, and it's a very individualized approach. You have to look at this staffing schedules, you have to look at the architectural layout of the nursing unit, the time of day, this has to do with escalation patterns. Escalation is, if I'm the respiratory therapist - the primary person - and I get a ventilator alarm and I don't acknowledge that alarm in so many seconds, it needs to go to the next respiratory therapists or perhaps the nurse, depending on their care model.

Escalation patterns are very unique to each unit and, eventually, it has to automatically go to someone who can act and take care of the patient. And, it is very important that the timing of the escalation pattern is correct. We've been in institutions where, on such alarms, when a lead is off. Which many hospitals do not consider a critical alarm, where it is a 20 to 25 minute escalation pattern - that's much too long, because leads off on a physiologic monitor means you're not monitoring the patient.

Cvach:

Can I comment on that as well? I want to say how important it is what Mark talked about. This is exactly how we have developed our system.

Just a couple of things to mention is algorithms. It is important when you're using middleware to develop algorithms and those algorithms need to be developed at the level of the alarm. So, for instance, you can have an algorithm for a ventilator alarm in which it goes to the respiratory

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

therapist first, then it goes to the nurse, then it goes to the secondary nurse, and then it goes to the charge nurse. But, it's really important that you have those algorithms built at the level of the alarms, because, like Mark said, a lead fails, you may not want that to go immediately, because you know somebody is moving around or they're just readjusting something, so you don't want that to go immediately, but certainly you don't want to wait 30 minutes or have your algorithm be 30 minutes apart, you have to be rational on how you develop your algorithm. And, that's the beauty of the middleware, is you can write all these rules within the middleware. I think that we have at least 10 to 20 algorithms for our devices and how they work. And, one of the things that we have done is in case someone has failed to put their escalation system in - and, of course, that's subject to change as your staff change. So, we have it set that if somebody fails to put in the primary or the secondary person, it's still going to go automatically to the charge nurse. The charge nurse is automatically going to get it. So, if the charge nurse starts getting all these alarms, they know that somebody hasn't been put in as the primary or the secondary, and they know to go and figure that out. And, the last thing I want to say about this is that, Wifi devices are subject to fail. And, so it's really important that you don't rely on it solely, that there are other things that you're looking besides just a phone. You can't just rely on that because Wifi is subject to fail, so we have built in multiple ways in which we can get notified for those critical things that you want anybody the best.

Wong:

Excellent. And, Dr Baron, you recently conducted a study at your hospital that addresses the concerns that Mark and Maria have just spoken about. Details of the study have been recently published in AAMI's Biomedical Instrumentation and Technology magazine in the article, "Continuous Surveillance of Sleep Apnea Patients in a Medical Surgical Unit." Could you please tell us about the study?

Baron:

As you alluded earlier, there are two stages of our project. Our initial project actually started, I think, back in close to 2010. We looked at instituting capnography on med-surg floors, because of the importance of monitoring patients for respiratory depression. And, the reason we chose capnography because, as you know, a lot of evidence that capnography is an earlier detector of respiratory depression in post-operative patients compared, for example, to pulse oximetry.

So, as we investigated devices and technology, and looked at all the recommendations, we decided that capnostream was the device we wanted to use for our purposes and wanted to do it on med-surg floors, where a lot of our post-operative patients recover from surgery.

And, as we implemented the technology, we realized that our best intentions created a very difficult workflow for the nurses, because of all of the alarms that were really truly not clinically significant - they were like noise, they're not actionable alarms. And, it became obvious that we needed to develop a better alarm management project to filter out those non-actionable alarms and only try to have the alarms that truly have clinical significance.

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

So, that brought us to a second stage of our project. And, the reason we did that study because implementing remote monitoring of patients on the floor, using the middleware and alarm management with capnography is not widely yet accepted in many institutions and there is very little guidance of how to create those safe actionable alarms that would not jeopardize patient care.

So, we selected patients with what we thought have a higher chance of having this respiratory depression - patients with significant serious sleep apnea undergoing major surgery. And, we created these algorithms that we wanted to test on our med-surg floors and see if they meet our expectations. So, that was our goal in this study. And, we actually were able to significantly reduce our alarms, without having a single patient event that went unnoticed. We used research nurses to make sure that nurses respond to every alarm, regardless if it was a noise or it was an alarm that we thought is going to be actionable alarm to make sure, again, that we don't jeopardize any patients on the floor.

And, we created, as Marc was saying, alarm management notification to the nurses and secondary notification. Actually, we had three levels of notification, so if somebody did not respond to the alarm, there was a secondary nurse - kind of a buddy nurse - and then it went to the nurse manager and actually a fourth level was a respiratory therapist. So, we tried to make sure that there was a safety chain of command to those alarms that we were building. So, that was [the] objective of our project and the results were very encouraging.

Wong:

So, really you're connecting capnography to middleware, if I could summarize, really helped you to distinguish between actionable and non-actionable alarms and then, as well, to help you to escalate the alarms when they occurred. Is that correct?

Baron:

Yes. We did create algorithms using parameters that we were obtaining from our capnostream monitors and algorithms that helped us, again, to identify the events that were clinically significant for our patients.

Wong:

So, what do you think are some of the biggest challenges to implementing this type of program in a hospital?

Baron:

I think if I can separate them - I think it's a clinical side of it and technological side of it. I think clinical side of it, as [with] anything new, you need staff that is appropriately trained - from the nurses, respiratory therapists, physicians, hospitalists, pulmonologists - everybody who is going to be taking care of these patients. There is a learning curve and, truthfully, acceptance curve also to all this implementation of this new technology on the clinical floor in the unit.

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

The second clinical challenge is continuous education. For sure, like in every facility, when something new gets implemented, all hands [are] on deck and everybody is educating and everybody's gung-ho to go, but then people come and go. You need to create an educational system for everybody where that level of knowledge gets reinforced and educated, so new people when they come in, because it's not something that they may have encountered in other institutions. So, educational component is very important. As Maria was saying, we actually had to make sure that all the areas had a very strong Wifi signal. We actually had to delay some of the implementation until all the areas that we wanted to monitor had a strong enough Wifi system that would support this alarm notification.

And, last but not least, is also support from our IT. It was huge and integrating all these devices, we could not have done this without the help of our IT that was instrumental in doing it. And, our biomedical department - maintaining this equipment - again all of this equipment needs to be maintained, serviced and making sure that it's in a condition that provides appropriate information and is reliable. So, these are all of the pieces that we identified that have to work together in order for these devices to serve us the way you like to it.

Wong:

So, you can have a great technology, but you have to have human systems in place in order to make sure that the technology is used appropriately or functions appropriately, as you say. So, Dr. Baron, do you believe that what you've done could be replicated at another hospital or perhaps, Maria, this is something that you guys have done as well at Johns Hopkins?

Cvach:

Yeah, absolutely, I mean it's not something that is without cost. There is definitely cost associated with doing what we described. There has to be leadership that supports this, but you know the return on investment is that you make your staff more efficient in how they manage things. Also, there's less likely going to be litigation associated with bad outcomes from missed events. So, you have to look at it from that point of view, but there is definitely some cost associated with doing the things that we've discussed.

Wong:

So one of the things that Dr Baron had mentioned is making sure that the system keeps functioning the way you want it to. What have you done at Johns Hopkins, for example, to standardize the practice to decrease variation in alarm management, because clearly that variation is what one might cause litigation at the of the day.

Cvach:

Yeah. This is more or less a six step approach. First of all we rely on data to make any decision on what we're going to do. It's almost impossible to arbitrarily pick a solution without having some data to figure out your before and after outcome. So, we rely on retrieving data from our devices to help us with our strategy. So, not all units require the same strategy, so, for instance, an ICU could be very different than the telemetry unit or from a PACU environment. So, these are the six steps depth that we rely on.

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

First of all, if you're going to get started at your hospital, you need to convene an interdisciplinary alarm management committee. I emphasize the word "interdisciplinary," because a lot of times when I'm asked to consult, I've noticed that they're asking one department to fix the problem, like nursing or engineering. It really is an interdisciplinary approach and you need to include people from various disciplines - respiratory therapy, nursing, physicians and include the bedside user, because they're the ones who can really give you what the problems are and tell you whether or not your possible solutions are going to work. So, convening an interdisciplinary committee is step one.

Step two is conduct an alarm assessment on each of the units. Don't just rely on getting it from one unit. You really need to get it from all units. We found that things were very different on telemetry units than they were in an ICU. We have seven ICUs here in our hospital. Pediatrics is very different than adults and surgery patients are different than medical patients. So, it's really important that you do an alarm assessment on each of your units.

The third step is to determine what measures are going to work to decrease your alarms looking at your data. So, for instance if you are trying to fix your alarms, try to find out what is alarming. So, if you're having a lot of lead fail alarms, fixing your defaults are not going to matter. What you have is a problem with your electrode practices or with people taking people off the monitor arbitrarily without pausing or without notifying somebody. So, you really have to target your interventions at what is the problem. So, these are the things that we target - We enable actionable default threshold for the population that we're monitoring. We standardize the default settings across similar settings. So, for instance all of our telemetry units have the same thresholds or limits - all of our pediatric settings, we have settings for different age brackets, so zero to 12 months, or one to three year olds, or four to seven year olds - we have a threshold established for that. Making sure that your staff understand good at electrodes and skin prep practice. We also look at daily evaluation of the need to be on telemetry - if you don't need to be on telemetry, why are you on - and, so, daily evaluation of that is built into our electronic health record. And, then we do allow alarm customization within certain parameters. So, making sure that a nurse doesn't say, "Oh, that is alarming and I'm not allowed to change it," they have the ability and they are able to go in and make changes as needed. So, that was step three.

Step four is to assure that you have backup systems for your critical alarms and don't just rely on one you may have to have multiple backup systems. So, it may not just be your wireless device, you may have to look at your monitor to see if you have other things. For instance, we use a feature called auto view on alarm that our monitor has - a lot of monitors have these features, so you want to really get to know your monitor and really know what's out there for you to use as a backup.

The fifth step is to develop your alarm policy, your alarm management policy, after you have shown that you are steps work. You don't want to do your policy as your first step, it's more or less your last step, because you can't really write a policy unless you have the actual strategies

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

in place. Otherwise, the staff really can't follow something, so you really need to write your policy after you have developed a strategy that works.

And, then, finally this is step six. Make sure that you are providing initial and ongoing staff training. A lot of times when you get new monitors, they are so complex and trying to fit everything in a 20 minute in-service is impossible. So, you might have to start with the basics and then bring your vendor in later, so that you can do more in-depth education and then you may then also have to have champions on the unit who have a higher level of knowledge than others. You might want to have [delete] like [delete] a train the trainers or somebody who is a little bit more knowledgeable about that monitor, so that they can do some extra training with the staff. So, that's kind of our six step approach for making sure our alarms don't get missed.

Wong:

It sounds like folks who might be looking at improving their alarm management might be better off learning from you or Dr Barron. Mark, I know you have integrated or implemented implementation systems in hospitals, anything you might want to add to that?

Schlesinger:

Basically, every system is unique, I believe. Maria said that already, but right down to the individual unit - telemetry units are very different than ICUs - and even as you go from shift to shift, the staffing patterns all change and that will truly affect your escalation schemes and other primers that you have to take into consideration.

Another thing that a lot of hospitals do not consider is the architectural layout of the unit. If you have a unit that is large with multiple long hallways, you almost need to have either remote viewing monitors or personal alerting devices, such as a smart phone or wireless type of device. We were recently consulted in a hospital where a very large unit about forty beds on it and in an "H" shape and conventionally they had the monitors right at the middle of the unit and, once you got about three doors down from the monitors, it was impossible to hear them regardless of the volume. So, we made some recommendations on that.

Wong:

In conclusion, any further advice the three of you might give to hospitals looking to improve their alarm management?

Baron:

My advice, and it somewhat echoes Maria's comment that she made, and kind of resonated with me, you need to have true champions within the institution, who will be passionate about it, knowledgeable about it, and to keep the programs building and educating others. Those champion are very valuable. And, I think one other important thing to remember is that the bottom line is there are patients.

And, we saw a true real patient saved by being alerted with these device. Nothing brings the message better to people who care for the patients when they see something like that

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

happening right in front of their eyes. So, that's very encouraging. Anecdotally, some of those devices can be very annoying and we don't have all private rooms and we had, for example, one case where we had a semi-private room and the patient in the next bed was very annoyed by these alarms going off, rightfully so because the patient in the next bed was recovering from surgery and had severe episodes of apnea, so the alarms were going off. But, subsequently, with that patient, this other patient require surgery, he said, "I hope you're going to use this machine on me as well, because I want to make sure you don't miss me stop breathing." So, that was a kind of a funny story that we had. Sometimes people get annoyed, but it's when it's their life, then they want to make sure they're safe, they say, "I want it to".

Wong:

You're absolutely right. Certainly we can't stop using monitors just because someone is being annoyed about it. The final goal is to make sure everyone leaves the hospital safely, so thank you so much, Dr Baron for that message and reminder.

Cvach:

I'd like to give some advice. Just remember alarm management is a team effort. It's not one department's responsibility to solve. Keep up to date on current alarm management strategies through reading. There's a lot of stuff that has been published. It's coming out regularly. So, keep up with publications. Do a search just to see what's out there, but a lot of the information that's coming out is quality improvement and things that have been tried at other hospitals, so keep up with that. And, also ask the staff to help you in identifying potential strategies. Don't just rely on top down leadership - you want to make sure that you ask the bedside user what it is that can help with improving alarm management on that unit because they have to use whatever is developed, so it's something that would help if they participate in developing it.

Don't forget to engage your manufacturers for assistance. A lot of times, we don't engage the vendors and vendors are very helpful in providing you with information and things that you can use to assist your staff. And, also they have a lot of ideas. So, for instance, some new features that are coming out on monitors are use of profiles and profiles are things that you can use to eliminate unnecessary alarms. So, for instance, we all work in hospitals and know we have patients that are DNR patients and a lot of times those patients have a lot of alarms. And, so a profile that we're seeing in these new monitors are called comforteer profile which you can use on patients so that you aren't hearing some of these unnecessary alarms or using profiles for pediatrics. So, just bear in mind that your vendor has a lot of ideas. There's a lot of stuff built into monitors. I always say that we use our monitors to about 20 percent of its capacity and there's a lot of features in there that we don't even know about. So, get to know your monitor and get your vendor to help you with that.

Wong:

Excellent advice. I think the final word is you can learn from so many others. You don't need to reinvent the wheel. Take a look at everyone who might be around you. So thank you so much. This is great! I would like to thank Dr Baron, Maria and Mark for joining me on this podcast.

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

Hopefully, our listeners will find your advice and recommendations useful for better managing their alarms. Thank you and thank you to our listeners. That's great. Thank you, guys.

Panel:

You're welcome. Thank you.

This clinical education podcast is made possible by an unrestricted grant from Bernoulli Health.

This is a machine transcription of the podcast, so this transcript and the actual interview may differ.

© 2018 Physician-Patient Alliance for Health & Safety