ANALYSIS OF PATIENT MONITOR ALARMS IN ADULT INTENSIVE CARE UNITS; Patricia Harris, RN, MSN, PhD

MS. HARRIS: Thank you. I'm an RN by background. I work mostly in critical care, and for the past two years I've been mostly doing research.

I'm going to talk to you about our analysis of patient monitor alarms in the adult ICUs at UCFS. And I just want to thank AAMI and HTSI for bringing us all together to have our first coalition meeting.

I'd like to disclose that the study was funded by GE Healthcare and in agreement with our contracts office and our IRB.

So our UCFS Research Team consisted of myself as Co-Investigator and Project Director. But it was really the brainchild of Dr. Barbara Drew who is the primary investigator on this study. Co-Investigators include Xiao Hu who was originally at UCLA, and he is a computer expert.

Then we have Tina Mammone who is here today. She did an outstanding job. Also Dan Schindler and Jessica Zegre-Hemsey worked on this study as Co-Investigators.

So our study aims were pretty straight-forward. We concentrated quite a bit on arrhythmia alarms, which is a little different than the parameter alarms we've been talking about so far today. We decided we were going to assess the alarm prevalence of patient's physiological monitor alarms. We'll identify the alarm burden, analyze a select high priority number of arrhythmia alarms and determine patient characteristics that may be associated with the frequent alarms.

I'd like to say what I'm presenting here is very preliminary results and the analyses as I'm going. Ethical considerations were of course addressed by our IRB, which is called the Committee on Human Research at UCSF. It was approved with a waiver of consent since we are gathering data that was used in the normal course of patient care. We also did presentations for the UCSF Privacy Office and received their approval to go ahead with the study. And we could not have done this without a close relationship with our IT security and bioengineering.

So we used specialized software that was provided by GE Healthcare through their Carescape Gateway, and developed specifically for this study. This was done in

collaboration with another company called Excel Medical, which provided us software for storage and capturing all of the waveforms and alarms. And we used the software called BedMasterEx.

We comprehensively gathered monitoring and alarm data 24/7 over a one month period last March 20, 2013 in our adult ICUs. We have five adult ICUs, one cardiac, two neuro and two medical-surgical ICUs with 77 beds. And we also concentrated on annotating arrhythmia alarms.

So this is a picture of what we saw with BedMasterEx. It provides an excellent visual reference for the waveforms. This is the interface that displays exactly what was on the bedside monitor. And of course this is showing a normal sinus rhythm along with the pleth waveform and respiratory waveform.

We also could get all seven leads with full disclosure. And this is pretty typical also of what we saw with artifact, a true PVC and a CVP waveform, invasive pressure, the pleth waveform and respiratory. So here is an example of our first finding of a true ventricular fibrillation and here is a true asystole.

So we went ahead and we annotated six alarms.

Alarm types were asystole. Ventricular fibrillation, ventricular tachycardia, accelerated ventricular, ventricular brady and pause. And we felt this was a particularly unique feature of our study where we comprehensively collected and looked at the arrhythmia alarms and annotated them whether they were true or false.

We also had a comprehensive annotation plan that was developed by Dr. Barbara Drew. And there were three main features of it and I'll go over each one individually.

So we had a standardized annotation plan. Dr. Drew provided a written protocol and I'll show you an example of asystole in a moment; a three-hour annotation training course to kick us off, plus additional training throughout. Dr. Drew's team included four RNs, and Tina Mammone sitting over here is one, and myself and two others who have experience and expertise in ECG monitoring.

We had weekly meetings to discuss the annotations and come to a consensus on problematic waveforms, and we analyzed data from the EMR such as the code blue and patient diagnoses to corroborate what we were finding.

So this is an example. This is what we are looking at in the annotation plan. First, true asystole

alarm; for true asystole we looked for a drop of the invasive arterial pressure or any other pressure waveform that was being monitored, a code blue documentation, or if the patient was a DNR, documentation that the asystole was true. We confirmed that asystole lasted at least five seconds, and also we accounted it as a true asystole but was a very low amplitude VF.

For false alarms, we would see no drop in the invasive pressure, and there would be a visible QRS in at least one lead.

So this is an example of the annotation spreadsheet that we developed. And this is basically just outlining the questions that we'd already identified in our plan, and we logged everything in into Excel spreadsheets.

Excel Medical worked very closely with us, and we could not have done this study without them. They provided us with PDF alarm reports for every single alarm that we were annotating. So this is an example of a VTACH alarm. And you can see that we have a picture of all seven leads, so it’s full disclosure data. This is not what you usually see on the monitor at the bedside. And usually, the arrhythmia detection is done with four leads. And this was

a true positive alarm. You can see that this ventricular waveform carries through across all of the leads.

So this is the second page of the annotations. We had two pages for each annotation. These are some of the same waveforms with the ECG, but it also gives us pressure, a pleth waveform and respirations. And you could see that the pressure decreases with the arrhythmia.

Yeah, you can see that the pressure decreases, and that one was a true ventricular fibrillation. With this arrhythmia alarm, this is also VTACH, you can see that this is a non-artifact lead; that's six of the leads show ventricular tachycardia but one shows a beautiful sinus rhythm. A toothbrush? Possibly, we don't know for sure. So this was a false positive alarm.

So looking at the next page, this is the second page of arrhythmias. And you can see with a non-artifact lead, but we want to also assess the arterial and the Sp02. So the arterial pressure is in accord with RR interval in the non-artifact lead, and as well the pleth waveform. So there was no drop in pressure, as you can see, and this was a false positive alarm.

Interestingly, you can see that the artifact is

mimicked in the respiratory waveform there. I don’t know if you can see that, but it's saying that the respiratory rate is 162, which is not correct.

So in our preliminary analysis, this gives us 2.5 million reasons why this is important. I want to emphasize that this was specialized software that we requested to bring over every bit of information that could be obtained. So we brought over every blip in the screen. And the 2.5 million is not audible alarms. But interestingly, we did find 65 percent of the alarms that we viewed were arrhythmia alarms. 26 to 27 percent were parameter alarms and 8 percent were technical alarms.

Only 380,000 approximately of the 2.5 million were audible alarms. These were alarms that were priority alarms. Thus, some of the other alarms might have been audible if they had been the only alarm, but they were buried beneath the audible alarm. And we also brought over every single message alarm that didn’t have any audibility on the theory that even these could be distracting.

So over the course of March 2013, we had 461 unique patients. So we only counted them once if they left the ICU, but come back; but we counted their entire

monitoring time.

Only 252 patients of the 461 had actual alarms that we were annotating. The rest had zero alarms, or annotatable alarms, I should say. That doesn't mean that they had no alarms at all.

And just briefly, our demographics included 46 percent female. Their median and mean age was 60. Latino is 11 percent and the demographics, the racial profile reflected the San Francisco Bay area.

We also had about 15 percent smokers, 31 percent were obese. A tremor that we could identify was in about eight percent. We are looking at things that might be associated with a high number of alarms. Interestingly, 43 percent were confused, maybe perhaps leading to agitation; a problem for nurses but also for the engineers who are developing this software.

We had ventricular pacing in seven percent of our population, a left ventricular assist device in less than one percent, just three people. And our mechanically ventilated population was 36 percent.

So we annotated 12,674 alarms. Tina Mammone over here annotated 1500 of them while working full-time as a

hospital director. Thank you. I annotated 7500 myself. You're welcome. And then the other researchers did the rest. Our analysis showed that less than .2 percent were unanalyzable; almost every alarm that we annotated, actually we could identify whether it was true or false.

We had a large range of annotations with, like I said, close to 50 percent having no annotatable arrhythmia alarms, of those six high priority alarms that we considered. But one patient had 5,725 alarms. That was 45 percent approximately of all the alarms we annotated. Another patient had about 10 percent. So those two patients together accounted for 55 percent alarms; basically supporting what the speaker said yesterday from Mass General, that a few people or very few people can generate a huge number of alarms.

So we analyzed the alarms over a total monitoring time of 46,500 hours approximately. And the mean monitoring time was close to a hundred hours per patients, but the median was only 53 hours, just reflecting the skewness of the data.

So I wanted to emphasis that the signal quality overall was good. We could see the signals. There was

less than nine percent that were poor that we had a difficult time annotating. So I think this probably would be true for most monitors. It was pretty easy to see using seven leads. And over 90 percent of the time, we are able to use only the seven leads. We didn't even have to confirm it with the blood pressure to be able to distinguish whether or not the alarm was true or false.

One of the great challenges we had was inaccurate information in the monitor. I spent most of last summer reconciling maybe one wrong number in the MRN to find the real patient who was in the bed. If somebody whose name was Elizabeth, for example, turned out that she liked to be called Liz and the nurse would appropriately change her name on the monitor from Elizabeth to Liz and our data would show up initially as two different people.

So just finding this kind of error took a lot of time. And I think that now the monitors can be paired with EMR so that, I think for future studies, it's going to become easier.

So one limitation of course for our overall study was that we only analyzed information over one month and it took quite a long time. In fact, I would say that I

devoted the last two years of my life to this, and all condensed down to 20 minutes.

So for our next steps we're going to complete the analysis of patient characteristics. And like I said, the data was quite skewed, so some of our initial analysis don’t appear significant. But I'm working with our UCSF statistician to make sure that we have the appropriate statistical methods to use.

We assessed alarm burden over a number of months. We're currently collecting data. We have a whole year's worth of data now, and we have IRB approval to look at all of this data further. So we want to look at atrial fibrillation alarms, for example, perhaps VTACH greater than two, that was brought up yesterday; and continue to work with the engineering community, nurses, patients, family members to determine appropriate interventions and increase the specificity and the predictive positive value of the alarms.

I used selected references to put this together. I just want to say thank you to the people who were instrumental, some of the people -- this is not everybody by any means, but were instrumental in helping us. So you

might recognize Steve Treacy who's sitting here today who we could not have done this study without. He really was the lead engineer putting together the research version of the Carescape Gateway.

Thank you. Questions? [Applause]

MS. CVACH: And thank you, Trish. This is the level of research that is needed out there and thank you for taking the time, two years out of your life, to do this.

So you looked at only a certain number of arrhythmias. You said it was like six or seven different arrhythmias?

MS. HARRIS: Well we looked mainly at six different arrhythmias that we considered high level that were either life-threatening or could deteriorate into something life threatening.

MS. CVACH: And those are the only one that are reflected?

MS. HARRIS: Right. And actually I do want to mention -- I'm glad you brought that up because we also looked at the code blue data, and our monitors were much better at detecting arrhythmias associated, real true

arrhythmias associated with the code blue. And as Dr. Goldman had brought up yesterday, it's very important to look at bradycardia because the initial rhythm in three of the 16 codes that I've looked at, the initial rhythm was bradycardia. So I think that's really important to consider.

MS. CVACH: Yes. So the 87 percent false alarms that you said, was that --

MS. HARRIS: Was only in the annotated, the six annotated arrhythmia alarms.

MS. CVACH: And it didn't address clinically non-actionable, it was just false alarms? That's what that was? In other words, it was technically false that you saw?

MS. HARRIS: Technically false, but I would suspect -- or we did not bring in all of the medical record. We did not interview nurses to find out what kind of interventions they did. But I suspect most of these false alarms wouldn't be actionable because there's no action you need to take.

MS. CVACH: Thank you. Other questions? Jim?

MR. PIEPENBRINK: Are you going to publish your

annotated files?

MS. HARRIS: The entire files of annotations?

MR. PIEPENBRINK: Yes.

MS. MAMMONE: That would be up to Dr. Barbara Drew whether or not she would like to use that approach.

MS. HARRIS: We definitely will be publishing our results but I can’t say that we publish our entire annotated files. I couldn’t speak for her.

MS. CVACH: Other questions?

MS. BOURIE: Hi. Tricia Bourie from Beth Israel Deaconess in Boston. My question is related, Maria, to the one you are asking. Could you go back to the slide that showed your results?

MS. HARRIS: Sure. Which results?

MS. BOURIE: The one that showed that 87 percent of what you found were false positives. I think we need to talk about that. That's a lot of alarms that the computer was telling the nurses there was an alarm and something bad was happening to their patient, and 87 percent of the time it wasn't true. So the nurses were responding to that critical alarm, because it is a three-star high critical alarm, going to the room or doing something. So 87 percent

just seems really high. And I think that this is an area where we need to investigate further and talk about.

MS. HARRIS: Is there a question?

MS. BOURIE: It's really more to kind of bring discussion about it.

MS. HARRIS: Yes.

MS. BOURIE: What did you find behind it?

UNIDENTIFIED FEMALE: I would just like to say I think this is why you really need human monitor watchers, because this is the -- I'm not surprised at that at all. And so the monitor watchers could check a couple of different leads or you look at the patients and see they're brushing their teeth.

MS. HARRIS: It is in accord to what other researchers have found that 87 percent were false. We actually are presenting our findings this coming weekend. And so I'm giving you a preview with just a taste of what we found; but I am also holding back some information because we're waiting until we actually can present our final findings at the International Society for Computerized Electrocardiology and for GE Healthcare who funded this study, so they get first dibs.

MS. CVACH: To your comment though, if 87 percent of the time it's false, it's going to impact the nurses and how they react the next time that occurs. You're absolutely right. And we know that there is research out there. If it's false 90 percent of the time, you're going to react slower.

MS. HARRIS: And you'd tune it out, exactly.

MS. CVACH: Yeah, and you'd tune it out, exactly, that it's, oh it's Mr. Jones, it's VTACH and he's always ringing VTACH today. So you're absolutely right about that.

And to your point about monitor watch; I wish there were some better and high level monitor watch studies. Because in a hospital like Johns Hopkins, it is impossible to justify getting 80 FTEs for a centralized monitor watch because it's all cost. And I can tell you, we did go down that path and it was denied so we had to think of a better way.

And albeit I used to be in monitor watch; I was a monitor watch when I was in the CCU; I used to sit at monitors. I actually enjoyed it because I got to sit for an hour and watched monitors. You know, we have a stick

and we just went up and down. There was a red light, yellow light, you know, this is going way back.

So I actually enjoyed it because I really got good at watching the monitors. But monitor watch only solves a portion of the problem. It doesn't solve the ventilator alarms and the IV pump alarms and so forth. So it's just looking at a portion of it. So until we have good studies that say that it really impacts, I think it's hard for hospitals to justify the cost that's associated with it.

MS. HARRIS: Yes. Just to the point of how the nurses tune out the alarms after a while. Actually, a huge number of those false alarms were accelerated ventricular, which is set as a default to the warning level, but actually that can be adjusted. And so a lot of these alarms actually were not necessarily audible alarms. Sometimes they were adjusted down to the message level because the nurse was thinking okay well I know that, I know that, I know that. And so it wasn't all audible. I should've pointed that out earlier. Thanks. But still it's distracting, I'd say.

UNIDENTIFIED MALE: You showed a high percentage of the signal quality to be good or fair?

MS. HARRIS: We did in the annotated alarms.

UNIDENTIFIED MALE: And did you do daily electrode replacement? Was that your protocol?

MS. HARRIS: No, that was not. We just did standard care. We didn’t do any intervention. This was an observational study.

MS. JACQUES: I'm Sam Jacques from Texas Children’s. I'd be interested in looking at your data to see if a delay, so that if you had a 15-, 20-, 30-second delay, would have gotten rid of some of your alarms so that perhaps 87 percent of them wouldn't have been false alarms. To kind of see what size delay in the data would have helped the throughput of those alarms going to the nursing bedside.

MS. HARRIS: Right. I think that will be one of the things we'll be looking at in the future.

MR. HENGL: Dave Hengl from Draeger. You said 87 percent of these were false but then you mentioned there were two patients that generated half of that. So does that mean this number is really much inflated because of two patients that the treatment and the setting of the alarm limits weren't adjusted because of care?

MS. HARRIS: That's a great question, and I actually looked at that myself and the numbers do go down a little. However, before the analysis of these two patients last October, the number was still about the same, or the percent of false alarms was still close, not quite, but close to 87 percent. It was definitely in the 80s. And so I think that even though we have two extreme outliers, the number of false alarms overall did not change significantly. That's a great question though. Thank you.

MS. BLAKE: This is not a question but I'd be remiss if I didn't tell people that -- oh, Nancy Blake, Children's Hospital, Los Angeles, but I'm also on the evidence-based practice workgroup for AACN. And AACN does have a practice alert that recommends daily electrode change as long with prep of the skin. And I did a workshop last week at an AACN conference in Las Vegas. A lot of places said they cut down their false alarms from electrode problems greater than 50 percent by instituting the practice alert. And the practice alert is attached to the webinar that I did in December. AACN did allow it to be attached so it is on the HTSI webinar list. But for the clinicians, they should be prepping the skin and changing

the electrode daily.

MS. HARRIS: Well UCSF does have a protocol where you'd gently wash the skin and put on the electrodes and change them as needed.

UNIDENTIFIED FEMALE: So you don’t know really if they did or not? So you’re not sure?

MS. HARRIS: I would not expect a daily change.

UNIDENTIFIED MALE: But if you look at the waveform data, you'd know that.

MS. HARRIS: Tina might be able to address that better.

UNIDENTIFIED FEMALE: Can you shed some light on that?

MS. MAMMONE: Hi, I'm Tina. I'm one of the Directors of Nursing at UCSF Medical Center in the adult hospital and I oversee many of the ICUs and units.

And to Tricia's point, we do have a policy and procedure in place for nursing staff to change the electrodes every 48 hours at the moment. And our skin prep includes washing the skin with soap and water, drying with gauze and applying. Our standard electrodes that we use currently are the silver-silver chloride hydrogel

electrodes. But we all know for those that work in an ICU setting or are intimately involved in nursing operations we can put whatever recommendations we want in a policy or procedure. But the reality is we're not sure if that actually gets performed.

We all know that, as our patients, if you're a trauma center or a busy hospital, patients will come in through different portals of entry, whether it's the ED, Cath lab, straight to the OR. And usually those first set of five electrodes that are placed on the skin are the ones that carry the patient throughout the hospitalization until they fall off.

It's sad to say, but until there is a method to actually date your electrodes every day, you actually don't know when they were last changed. And that's not something that we would require as documentation. That's just one more thing for nurses to do. It's really changing the culture and I think there are still more studies to be performed to determine the optimal frequency to change ECG electrodes.

MS. HARRIS: Thanks, Tina.

MS. COSPER: Tricia, I'm curious -- Pam Cosper,

Emory University Hospital -- on the analysis, did you all break it apart as far as crises, audible versus warning, how the percentages fell out?

MS. HARRIS: We did. The Carescape Gateway did not always bring over the exact level, however. And we did know obviously all the crises alarms because those are the highest level; these were never drowned out and not changed. But we have an estimate of the number of crises versus warning versus advisory versus message. I don't have that information directly in front of me.

MS. COSPER: Great. I hope that's part of the publication. It would be interesting to know.

MS. CVACH: Anybody else?

MS. GIERAS: Izabella Gieras from Huntington Hospital in Pasadena, California. Very interesting study. Actually I was interested with the 87 percent. Is there anyway, if you are doing that part of your study of how much time the nurses are dedicating to those false alarms, and could that time, once we go through the assessment, be shifted to of course everything else that they need to be doing that is more actionable and obviously will be more applicable to the patient care?

MS. HARRIS: That definitely will be a next step that we could look at in how it's impacting the nursing staff. One of the speakers spoke about focus groups with nurses to find out a little more about how this is impacting them, and I think that would be worthwhile.

I suspect, as some of the other questioners and speakers alluded to, that nurses and practitioners just basically tune this out because it's true, “I know that, I know that, I know that; I don’t need this to keep repeating.” And it just is tuned out, which speaks to the sentinel events that have happened in hospitals and why this is so essential, so important, and what brings us out here today. I think we're all very much aware that it's an issue, a big problem.

MS. FLACK: We are actually on schedule, so we have a couple of minutes and then it's the break. So if there are any other questions for Trisha, Ben or Marlyn, so now is a good time to get those questions in. Any last minute questions? The first one over here (note: on ‘parking lot’ easel)says, "Are waveforms important for nurses to receive on the end device?"

MS. CVACH: I think that’s an interesting

question. I think the question is basically saying, when you send data to a nurse, is it important for them not only to get the contextual but also to get the waveform. And I know there's a bunch of nurses in the room and I'd be interested in knowing what your response is. I would rather not share mine yet. I'd like to know what your response is to that. First down here, Sharon?

MS. ALLAN: No, I don't believe it. We actually have pagers. Sharon Allan with Johns Hopkins. The pagers themselves, you have to scroll down several lines to even read the entire message. I can't imagine reading a strip on the pager making any difference. You might as well just go to the room or the central monitor.

MS. CVACH: Okay. So one nurse says no, it doesn't really make a difference.

MR. BURGOON: Hunter Burgoon with Kaiser Permanente, and we've asked our nurses a lot about this. We have a variety of devices that we use Vocera tags to Cisco phones. Cisco phones do allow a small strip to be displayed. And 20 percent of the nurses don't care particularly because of the small display. They call it a walk/run notice. But most of the nurses do want a

waveform, but I think there's another question that needs to be asked. Do you want the current waveform or do you want the alarm waveform?

So we are talking about that now as we move forward to Smart Phones. What is it that we want to deliver, the current state? So are they still in asystole or do I want to be able to look? Of course we'd like to go back and look, but what's the most important thing if you are going to deliver a waveform. What are you going to deliver?

MS. BLAKE: Nancy Blake, Children's' Hospital, Los Angeles. We had this discussion last night. And I think people need to understand that phones and pagers are a secondary device and that doesn't keep you from going in and checking on the patient when there is an alarm. I think managing the alarms, keeping them to a minimum and then having an alert that has the nurse go check the patient is probably the best way. But a lot of people are trying to use them as a primary device and they're not.

MS. MCFARLANE: Jennifer McFarlane, Huntington Hospital, Pasadena, California. We have used pagers that show a short strip of the alarm condition for years. And

the majority of our nurses like that more than just getting an alert. I think though it becomes different if you are able to decrease the number of alerts that a nurse will get that are not actionable.

MS. CVACH: And which waveform is it, the alarm waveform?

MS. MCFARLANE: It's the alarm waveform.

MS. CVACH: And Sue?

MS. SENDELBACH: And Sue Sendelbach, Abbott Northwestern. I think this is one of the things that Maria talks about. We need signs. We think it's nice to have on there; does it change patient outcomes? We think as nurses, oh yeah, I really like it. Does it change what happens with the patient? And I think this is where we need the signs to guide us.

MS. FLACK: I think it would help if it was the waveform after the signal.

MS CVACH. : No. It’s interesting because I come from a world where we actually had them and then lost them. And so for my environment -- I was a CCU nurse -- we used to have the device. I don’t want to say what brand it was, but it doesn't exist anymore, and we lost it. And I think

that staff really felt that they liked having the alarming waveform. But does it prevent you from going into the room when you see it's false? That's the thing. But Tina has a comment.

MS. MAMMONE: So I think when you ask what the nurses prefer, do you have to sort of divide it into acute care or the ICU setting? In our acute care setting, we do and are fortunate to have monitor watchers which are centralized, although there are displays on all the units. And we have transmitters that actually allow the waveform in real time or near real time, and also all the alarms. And our nurses find that very valuable before administering medications and whatnot.

In our ICU settings, we are getting smart phones, the iPhones that will display the waveforms. We're not sure how valuable that'll be in our ICU, given our extremely generous nurse staffing ratios in the state of California. But given that we're changing buildings, and like Hopkins, our rooms are getting bigger and bigger and further and further apart.

We may see value in that and we will study that, but we are aiming to provide the waveforms where the nurse

can provide the care, especially in the acute care units where we're depended on monitor watchers as well as the nursing staff.

MS. CVACH: And they get both waveforms, Tina, the alarm and the post --

MS. MAMMONE: Currently, on our transmitters and our telemetry, yes, and not in the ICU at the moment because we don’t have those smart phones quite just yet. We're working with a vendor to do that.

MS. CVACH: So you’re supportive of our waveforms. Any other comments?

MS. CROAK: Barb Croak of Northshore University. We had a very healthy discussion, and one of the things that is challenging is when you say that those pagers are secondary devices. So again, you want to in best practice say that your nurse does not rely on that as their primary source. But again, in this room, a nurse does a lot more than just manage alarms.

So if you take a nurse who's fully garbed in PPE in a room and she's got a five or six to one ratio, six to one on nights at our hospital, five to one on days, to know whether that’s artifact or Vtach, until you totally deprobe

off of your PPE and you’re doing a sterile procedure at the bedside and you have to run to only find out that the patient's moving, it is very frustrating.

So if I were able see on my beeper that I'm mimicking VFib and I just Vocera to a tech and say, just tell me what that patient's doing; oh, they're watching television. I didn’t have to de-garb and stop what I'm doing.

Otherwise we look like spastic idiots running around the place, and we cannot focus on the other twenty-five thousand things we do. So when you say you don’t want that to be your secondary device, when you don’t have a centralized war room, then what do you want that nurse to do, just sit at the central monitor all day? But she's doing millions of other things, or he is doing millions of other things.

And if we were sitting here talking about safe medication practices from ISMP, you say when you’re taking medicines and you’re cross-checking across an EMR, don’t ever get interrupted and do anything else. Now if we were in medication Management Safety Forum Coalition, we would say don’t be looking at your alarms, look at your meds and

your EMR. Okay?

And so it's just competing initiatives for a nurse. So again, you know, when you say oh we don't like this as your secondary device, we need lots of secondary devices 'cause we're running heavy ratios, high acuities; the only people that are getting admitted now are super sick and you have to multitask up the ying-yang. And forget about lunch break and going to the bathroom, but that's not your secondary device. Go look at the central monitor.

So, I mean, unless we go to three to one ratios and have massive backfill, we need the monitors to be really accurate, decrease artifact, and let us see as much as we can when we're a hundred and fifty yards down the hall with our third or fourth or fifth patient.

MS. CVACH: Gotcha. And Dr. Kanter?

MS. HARRIS: I just want to add that what you're saying is so true, and why it's so important for the clinicians to partner with engineers and the people in this room to solve this problem. It's really essential. Thank you.

DR. KANTER: Ben Kanter, Palomar. I think we

can’t forget about the physician. Messaging the physician is also important. And when the physician isn't onsite -- we're not an academic teaching hospital and critical care may be doing something else, you know, particularly in the afternoon or the evening. It's often not Vtach or VFib. It's more often, is it SVT, is it AFib, is it sinus tach? That's more often the question. We need the rhythm.

The future is going to be sending you the rhythm. The future is going to be sending you everything. There is no reason why you can’t get that today, in fact you can. You can get all of the historical rhythms. You can interrogate that on your smart phone or your device. You can look at a snippet of what was the onset of the arrhythmia, the offset.

If you’re going to do that for the medical staff, then really your question isn't do I build this for the nursing staff, it's simply whether you'll enable it. I think it's a given that you’re going to have the technology to do this.

MS. CVACH: I think we should take a break, think more about it and come back.

[WHEREAS A BREAK WAS TAKEN]

COMMENTS; Marjorie Funk, PhD, RN, FAHA, FAAN

MS. FUNK: Thanks Maria, and thank you Marilyn. We have some of the greatest minds around alarms in this room. So I just wanted to bring up kind of the conversation that was started at the Alarm Summit back in 2011 about the necessity for research.

Now Tricia presented their study with Tina and it was fascinating, a wonderful observational study, but we need intervention studies. And people have talked about, you know, we need to look at patient outcomes. It's just not about decreasing the number of alarms. We want to make sure as we decrease the number of alarms that there are not adverse patient events. And we certainly know the big events, but we need to look at that. So I want to say that we need rigorously designed randomized clinical trials to look at some of these interventions.

Some of the interventions we've talked about are common sense, they probably don’t need to be tested. But we need to think about -- we've talked about delays, we've talked about parameter limits, we've talked about a number

of things. And I'm wondering if there is at least a subgroup in this room who would like to start to think about designing a big trial.

If we're looking at some of these patient outcomes that happens so infrequently, we need a huge sample size to have sufficient statistical power to look at differences in outcomes with various interventions. So I think we represent across the country here, you know, is this something people are interested in?

MS. CVACH: Yes. Hopkins is definitely interested I know, and others.

MS. FUNK: Yeah. Maria's group, we've talked about this, but we haven't gotten anything going. It's extraordinarily expensive. I've talked with folks at NIH, they're not really interested. Maybe I didn't present it well enough, but I did have a conversation with somebody at the National Institute of Nursing Research and that's really not on their agenda.

But if we could think creatively about that, what are sources of funding or do we really need a lot of money. Marilyn brought up, well maybe there is a certain amount of coordination and making sure we have a rigorous design and

then farming it out to various hospitals for people to do. Little, little bit of things. I don't know.

So I would just be interested in, you know, if people are A) interested or is this really all QI stuff. Is it really, you know, we need to test it in our individual hospitals. Something may work at Johns Hopkins but not at Mass General and vice versa. Or is it something that we need to do rigorous research. You know, the hospitals, like at Yale we're a little behind; but we want to know are there things, are there interventions that have been tested that we should be trying.

MS. CVACH: Maybe we should at the lunch time talk with you specifically if you're interested in doing something like that.

MS. FLACK: Or we could just coordinate it through the web page. So after the meeting, we'll put out a note; remember what Marg said, if you're interested, we'll have a sign up. And we could start from there, grass roots and build it up. Okay?

MS. CVACH: Yeah. I would say one thing about this though, Marg. Sharon and I are working on some magnet projects for strategic initiatives to maintain magnet. And

it does take a lot of time even to do observational studies as we saw with Tricia, how long it took. So we need to consider funding for these things because they are so expensive. It does take time, and we use our staff for purposes of collecting data and so forth. So I think we do need to consider how to fund them.

MS. FLACK: Yeah. I'd still like to try it as cheap as we can. Otherwise, nothing ever happens.

MS. FUNK: But I mean we talked about NIH funding, but are there foundations? Is there industry money available? I know money's tight all over; but I think you're right, I think it would be tough to do.

MS. CVACH: Just the data analysis in and of itself is just so complicated. And we are using School of Nursing's faculty to help us with some of ours. But that's an option.

MS. FUNK: Yeah. I am the School of Nursing now.

FEMALE SPEAKER: I know. There you go. It's students that can do it.

MS. FUNK: But also, I mean there's been a lot of talk here about monitor watchers. I mean I did a study 20 years ago that showed that they don't make any difference

in patient outcomes. But that's the last study I've seen, and that was just on one unit at Yale New Haven Hospital. So I think that’s a big issue. Do we look at monitor watchers versus other ancillary notification types or what?

MS. CVACH: Yes. Thank you. And now Samantha is going to be talking to us. She's from Texas Children's and we've asked her -- she's actually a fully integrated hospital and so we asked her to say a couple of words about her hospital.

COMMENTS; Samantha Jacques, PhD, FACHE

MS. JACQUES: So I know we're going to start webinars after we leave, right? Texas Children's is signed up for June's webinar, so I want to mercilessly plug what we're going to talk about in June. But we are a fully integrated hospital. And what I'm going to present is a methodology that we've utilized to go ahead and garner all of the data that you guys have been talking about; how do we get the data, how does the data go into some magical warehouse. How do we mine the warehouse to go ahead and get really good data to go ahead and provide us with the information we need to set appropriate alarms.

A lot of us are working at a very high level around setting the alarm parameters at the monitor level. That's the first step for us, guys. We have got to get to a place where we're setting alarms on a patient-by-patient basis. And you can even tell from the last presentation, there are two patients that were your massive outliers. If we appropriately set alarms for those two patients, those would go away.

And so what I'll present for you guys -- and I'm

happy to talk to any of you that are interested in it -- is what we've used and how we use or middleware and how we garner that information and that data so that we have a very rich set of data to do a lot of the research on.

And depending on what you guys want to talk about in June, please let me know. I've got a colleague out at the cardiology study this week actually using our exact dataset in a research methodology to show for children coming out of our CVOR, we can predict on an 80 percent basis which ones are going to have an event in the next eight hours; whether or not they're going to go into VFIB, whether or not they're going to have asystole in the next eight hours, based on historical data. The data is the most important thing that we could have at this point.

So I will see you guys in June and I will tell you guys what we're doing. But it works perfectly with what we're talking about today. So thank you.

MS. CVACH: Thank you, Samantha.

MS. JACQUES: Is it what?

FEMALE SPEAKER: The data submitted?

MS. JACQUES: Yes. Our data is tied on a patient-by-patient basis, so we get data for that individual