

**Medical Device Alarm Summit
October 4-5, 2011
Herndon, VA**

MEDICAL DEVICE ALARM SUMMIT

DESIRED OUTCOME:

**A list of priority issues that the healthcare
community together can commit to address
related to clinical technology alarms.**

Tuesday, October 4, 2011

Keynote Presentation

George Blike, MD, Dartmouth-Hitchcock Medical Center

Comments:

- Good news--there are more diagnostics and treatments than ever before.
- Bad news--not much has changed
- ABC Video on medical mistakes (e.g. wrong medication, poor supervision of critically ill)
- Outcomes depend on patient factors and procedure factors

Shared goal to address alarm problems:

- Use available science and wisdom to identify and prioritize the problems with today's alarms
- Explore opportunities and solutions that address alarm problems

Reflections re: nuisance alarm problem

- Signal to noise

- The problem and solution are multi-dimensional
- Feedback control loops
 - Detection
 - Select treatment

- Intervene
- Monitor
- Name of the game is detect, diagnose and treat
- Role of monitor--how you see the navigational space; clinicians need to navigate a patient to the safe zone.
- Alarms are about alerting us
- People, tools, and environment can cause potential problems
- Roles of controls, monitors (i.e. how we see the patient), alarms (i.e. how we redirect the patient)
- There's lots of science out there about how to use alarms.

Finish with a story:

Suggests that "this is doable" and foreshadows what we can achieve over next 10-20 years

SESSION I: Defining the Problem: It's More Than A "Nuisance"

James Blum, MD, University of Michigan Health System

Barbara Drew, RN, PhD, FAAN, FAHA, University of California, San Francisco

Session goals:

- a. **Identify** all possible perspectives and aspects in defining **alarms issues**, so that the solution is not driven as simply "reducing nuisance alarms."
- b. **Identify patterns and themes** underlying the issues
- c. Set the stage for the remainder of the event

Identify the Issues:

1. Monitor watchers--look at the management process up front and coordination at the bedside
2. Patients know how to use the electrodes as a nurse calling system
3. Context awareness of the alarms and how generated
4. **Systems integration issue--multi-parameters need to be evaluated and addressed simultaneously**

5. Identify which alarms are actionable

- Why are they on?
- What % of alarms are insignificant?
- Concern about turning off PVC alarms as a unit; could we pair QT monitoring with PVC? Would love to have this option.
- It's not easy to silence PVC alarms by patient; Cardiology won't agree to unit-wide silencing of alarms.
- Look at pharmacological agents being administered.

6. Look at where alarms came from and who are decision-makers and rationale--often it was the vendor who influenced these decisions

- Has there been escalation of number of alarms available over time? Are they necessary because they are available?
- Technology is only going to continue to improve and increase in alarms is likely
- The unit doesn't look at patients across the unit to identify most effective alarms.
- We need alarms based on underlying physiology of harm of patients; move away from target set-point alarms to high-productive algorithms based on multiple variables.

7. Set-point of the alarm--where does it occur; decisions around set-points

- high sensitivity
- low specificity
- Customizing the needs of the patient
- Human response to too much noise bedside; how can any reasonable person pull out 1% of true events? Technologies have extremely high sensitivity; most events are not treatable.
- Buying a system that has both high sensitivity and low specificity is difficult to get in the purchasing decision; don't look at bottom dollar

8. Could we get consensus on problem statement: if we get more alarms per employee than XY, the model isn't practical. Where's the benefit point of the alarm system?

9. Dependence on alarms rather than validation

10. Complexity of equipment

11. Sensor fusion--taking multiple data inputs to make decisions [Combine with #4]

12. Accountability--lack of understanding/misinterpretation of industry best practices and how to implement them in specific units; no source or standard for best practices

13. Education is missing in terms of technologies, not just clinical reasons for alarms to go off [Combine with #14?]

- We need to create experts in technology

- Monitors are so sophisticated now; that sophistication should be used to free up nurses
- Education isn't enough to solve the problem
- Continuing education is needed.

14. We need a system of knowledge base ("super users") regarding technology versus training everyone

- Hospitals don't pay enough attention to training those who are using the alarms
- Ongoing instruction on nuances of the monitors and alarms
- Plan training costs into cost of the systems being purchased

15. We have to think about the signals and having access to the system. We can't tie the elements of the system together. [Combine with multiple signals; integration; sensor-fusion]

16. Open accessibility to data [Combine with #20]

- Clinician approach versus systems/data evaluation approach

17. No incentive for institutions to spend extra money for a better alarm; reimbursement patterns are changing; huge incentive to get it right the first time; six sigma with respect to high volume

18. Alarm duration with alarm event represents the true response needed.

19. Redundancies and lack of fail-safe

20. Open architecture [Combine with #16]

- Published standards of everything that comes out of that monitor

21. Acceptable delays to reduce false alarms--is there research on this? [Combine with #18]

- There is data, but you must strike difference between delay and evaluation of actionable situation; 15 second delay can reduce false alarms by 50%

22. Regulatory implications of some of the suggestions

23. Medical legal implications

24. Thoughtful assessment that a patient really needs the monitor

- Unnecessary monitoring is a huge problem
- Monitoring for longer than needed is also a problem
- Design products that actually meet the needs of clinicians so every patient can be monitored **[NEEDS DISCUSSION]**

25. IPT teams [integrated product team; multidisciplinary] choosing the products based on market research and purchase requirements that are define them up front

26. Delivery of the right alarm information to the right people; how is this done?

27. Consideration of what workflow and processes can be standardized so technology doesn't have to consider "If you've seen one hospital, you've seen one hospital." Not everything can be customized.

- Goes counter to patient specification

Real-time device alarm/data communication standards needed to enable:

- Data fusion
- Adding clinical significance to alarms
- Innovations in patient monitoring

Note: This is contrary to the current trend of proprietary solutions

[Added by a participant after the session]

SESSION II: How We Got Here: Regulatory, Liability, and Risk Management Limitations Impacting Medical Device Alarms (Unintended Consequences Of A “No Risk Tolerated” World)

Felipe Aguel, Ph.D., U.S. Food and Drug Administration

James Keller, MS, ECRI Institute

Katie McDermott, Morgan, Lewis & Bockius LLP

Session goals:

- Identify **obstacles to overcome** in order **to spur innovation of medical device alarms**
- List the **issues that must be addressed in order to reduce nuisance alarms** while maintaining individual patient safety
- Identify the **medical-legal barriers to behavior change** and care improvement
- Prioritize the urgency** of these issues: identify the top 3-5

Obstacles to innovation of medical device alarms:

- Not making changes because they won't be approved [Combine with #8]**
- Lack of documentation/measurement to support changes [Combine with #7]**
- Inefficiencies in innovating--Devices or software
- Medical device mfc's preference for proprietary end-to-end solutions [4 & 5 combined]**
- Free-standing products don't get merged into physiologic monitors**
- Lack of standards for devices in terms of data output and ability to exchange data between manufacturers**
- Insufficient data that allows us to understand the root problems; need complete data set (e.g. complete data set provided by black box in aviation)**
- Lack of clarity from FDA as to what is required by the FDA as "valid evidence" (e.g. published, peer-reviewed, data); need greater clarity from FDA on what is sufficient to gain clearance and definition of "data"**

- When does something move from 510k approval to PMA process? How do we manage and know that?
- FDA (and other agencies) will answer questions; best to ask early on in development
- Lack of resources at FDA to keep up with innovation
- EMRs are not regulated

9. Unable to get funding to look at this area; lack of research dollars

10. Not having the right people in the room to resolve the problem; they need to people who understand acoustics and human factors

11. Thinking that our domain is unique; need to look at other industries for innovations that are transferable

12. Patient not at this meeting to talk about impact; lack voice of the patient in these discussions

- Other medical complications that occur are diagnosed to be part of disease when they are part of the environment

13. Integration of new technology at bedside is very slow; resistance of clinical staff due to shortage of time to learn new technology and implement it

14. Need to look at short-term solutions and not just long-term

15. Lack of pressure from purchasers

16. 510k process vs PMA process (more detailed); need small innovations that can be brought to market faster [Combine with #19]

17. Mfc's have to work together; Need to define ? clearance to improve connectivity of devices between manufacturers [relates to above]

18. Difficulty in analyzing events that are reported; need to standardize (minimal) info collected after events and mobilize the dissemination [Combine with #2 and #7]

19. Regulatory barriers to data fusion from mfc perspective; use clearinghouse as a way to share data [combine with #16]

20. Lack of non-proprietary data to help understand the problem

21. Getting validation information from front-line clinicians/caregivers

22. Paradox FDA accepting false negatives vs. reluctance to share data

23. Proprietary nature of data; issues around credibility and reliability of data

24. Alarms have to be validated. Development is expensive.

Regulation and Cost

Is there a different threshold for software?

- Software can be a device when integrated into hardware
- Need metrics to measure impact of new software in new device on improved outcomes

Issues that must be addressed to **reduce nuisance alarms**:

1.

Medical/Legal barriers to behavior change and care improvement:

1. Lack of resources at FDA to keep up with innovation
2. EMRs are not regulated
3. Ability of one case to serve as a barrier to innovation that would be better for most; eliminate liability through tort system of the one-off's
 - Malpractice won't prevent innovation
4. There are standards that manufacturers know that are unknown to users (e.g. alarms turned off, device must beep)

SESSION III: Luncheon Speaker--Simulation Testing For Medical Device Alarms

Richard McNeer, MD, PhD, University of Miami

Session goals:

- a. Introduce audience members to a **software resource** being developed for the purpose of **facilitating audible alarm design and testing**
- b. Invite audience members to **test the software and offer valuable feedback** during the summit

SESSION IV: "We Didn't Hear It:" Optimizing the Environment of Care

Ilene Busch-Vishniac ,PhD, McMaster University

Maria Cvach, MS, RN, CCRN, Johns Hopkins Hospital

Kathryn Pelczarski, ECRI Institute

Rebecca Shultz, VA Boston Healthcare System

Elena Simoncini, VA Boston Healthcare System

Session goals:

- a. Identify the **human factors that support or detract from** human cognition and **attention to alarm signals**
- b. Learn what **contributes to the friction points**: workflow, system management, and other environment of care issues, and what would enable change

- c. **Prioritize** the top 3-5 issues that must be addressed

Human Factors that support or detract from attention to alarms:

1. **Early, iterative and comprehensive attention to human factors and usability factors; incorporate these efforts at the front end**
 - Needs to be broader than design process
 - Look at characteristics of the people (e.g. fatigue)
2. **Inadvertently disabling the alarms; how do we compensate for this?**
 - Training
 - If training requires millions of dollars, it's probably too complex of a system
 - Too many procedures accompany alarms
3. Preferred response to alarm is to question what's wrong and check out the circumstances and fix them. Reality--There's not enough time to fix all alarm issues.
 - Too many false positives
4. Audibility (tone over background sound) as well as localizability; and conflicts between these two factors
 - Need alarm notification system that comes directly to the practitioner; may not be audible
 - Need a back-up system if response to alarm is inadequate (e.g. practitioner involved in something else); redundancy
 - Human response to different sounds; what do the sounds evoke?
5. Assure alarms are sufficiently audible; regulation preventing escalation of sound [Joint Commission, environment of care standard; Policy fix]; conflicts set up by regulatory
6. **Lack of awareness of an organization or attention to the issues around alarms [Combine with 8]**
7. Background noise impact on humans; degrees of annoyance
 - Degree of alarming affect
8. **Clinical leadership is an essential element to success**
 - Deal with human factors up front
 - Multi-disciplinary team to address the issues
9. Reluctance to publish noise-related problems
10. From Mfc perspective; how can we mfc devices to increase specificity and lower sensitivity [Combine with #19]
11. Workflow
12. Pressure needs to be exerted on vendors through financial incentives and standards
13. **Requirements for alarm notification are unique; e.g. audible alarms transmitted directly to caregiver causes audible alarms to be secondary [Combine with #4]; Requirements for**

alarm notification differ between a device and an alarm notification system because of workflow.

- Impact pager (no longer available)
- Clinician-worn communication device needs to have better information e.g. graphical display as opposed to just text messages

14. Provide clinical context to alarms; where is the alarm coming from; is it a false positive?

15. Keep the focus on the impact on patients

- Aging population and hearing impairments
- Pediatric population
- Patients hear different things than the clinicians (e.g. clinician noise fatigue)

16. Designing out risks and hazards when possible; dichotomous nature of circumstances that result in false negatives, etc.

17. Circumstance of "alarms off" position of devices; need to improve these indicators on devices

18. Signal in piece; need to check every day

19. People, processes, protocols and technology all need to be considered and integrated [Combine with #11]

20. Nurse/patient ratio has become worse

21. Culture of desensitization; too many alarms; many that are minor

Environmental Factors:

- 1. Surrounding noises in the environment; if noise is louder, the signal has to be louder**
 - Causes alarms to have to get louder
 - Solution needs to involve industries outside of health care and alarms (e.g. noise absorbing materials that can be used in health care settings)

2. Different vendors produce different ventilator alarms, and they all sound different. There is inconsistency among vendors' products
 - Hard to recognize alarms even if same type of device
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SESSION V: Industry Can Help: Alarm Design

David Barash, MD, GE Healthcare

Michael Wiklund, PE, CHFP, Wiklund Research & Design

Julian Goldman, MD, Massachusetts General Hospital

Session goals:

- a. Identify ways that alarm design can help solve current problems
- b. Identify and if possible gain consensus on issues that might be addressed by standardization

Alarm Design Solutions:

1. Multi-parameter analysis--Looking at more than one parameter to make an analysis
 - This is already available, but is not used
 - What do we need to encourage adoption?
 - Barrier is lack of integration of equipment/systems
 - Technology used is often outdated due to cost and lack of investment in state-of-the-art equipment routinely
 - There is a hazard associated with multi-parameter solutions
 - We need decision-support; data that turns into decisions that results in action
 - We want more than information; we want wisdom from the devices (e.g. smart devices);
 - Information has to come from other systems and be integrated with alarms. Idea of "knowledge management"
 - Need to look at larger system that involves temporal data; multi-spectral sensory equipment???
 - Provide the data and the context along with the multi-parameter solution
 - Current clinical state vs. future state (predicting the future condition of the patient)
2. A national database of physiologic data to identify algorithms that can lead to solutions and improved outcomes
 - In a critical care environment, this would help; in non-critical care, it wouldn't have much effect
 - This information is powerful in any setting
 - See the MIT database

- We need evidence that the innovation works
 - Access to full clinical data streams
3. Using human voice instead of warning sound
 - This has been tried in clinical setting and failed
 - This did work with automatic defibrillators
 - Human voice is instead of using commands
 - Is there a difference if the human voice provides additional data detected
 - Air Force study showed that female voice warnings are most effective
 - In aviation, most alarms are typical alarms, not human voice; only those that are critical are human voice [See the alarm standard]
 - If we eliminated nuisance alarms, we would have less noise overall and might pay attention more to alarms. We have to look at the whole system, not just one part.
 4. Ask, "can I rely on alarms?" Solution is to try to avoid alarms.
 - Notification systems may also be flawed
 5. You have to go through multiple screenings from various monitors; what's important for alarms in one unit is different than for another unit. Bundle alarms across units.
 6. Sensors are important. We need a quick way of saying "left arm electrode has lost contact."
 7. System should detect the specific conditions of the patient and set the alarms accordingly.
 8. Could the alarm tell you the information you need without having to look at something else?
 9. Information needs to be immediately available or intuitive
 10. Industry needs to invest in the people who know how to do this (human factors expertise) and run the process.
 11. Redevelopment of the equipment--In the design process you need input from human factors expertise as well as clinicians who are experienced in the process. In addition to research/engineering, you need clinicians and human factor expertise.
 - Industry needs to invest in the care providers who know how to do this and can run the process.

Standardization Solutions:

1. Ventilators from various vendors sounding different--could there be standardization of types of alarms regardless of the vendor?
 - Pavlovian response mechanism (i.e. direct association with a particular sound that invokes a response); a barrier is multiple alarms going off simultaneously

Frank Block, MD
Oliver Christ, Prosystem AG
David Osborn, Philips Healthcare

Session goals:

- a. Identify challenges associated with adopting current standards and ideas on how to overcome them
- b. Identify additional standards that may be needed to standardize alarm design and/or related terminology

Challenges to adopting standards:

1. Adopting standards is thought of as reducing creativity
2. Customization of standards to particular environment/equipment vs. general standards [Combine with #5]
 - Alarms to work consistently (the same way) across all of my equipment; not sound alike
3. We don't understand what the future state should be. We want alarms to tell us what to do next instead of crafting standards for bells and whistles and lights and sounds.
4. If there could be a guidance document (toolkit) of methodology where customers learn how to optimize their alarm settings; We need a standardized method to determine what is too broad and what is too narrow.
 - Barrier is not having the right people on the standards committee.
5. Modifications to the particular standards (measurement standards) contradict what is in general standards. [Combine with #2]
 - Narrow requirements
6. Borrow from sound and acoustic engineers on sensitivity to what the alarms are reading (e.g. sound studio analogy)
7. This topic is huge and complex
8. Integrating devices--challenge if trying to combine devices from different vendors
9. Are they globalized standards?
10. Educational standards
11. Inadequate clinician participation in the development of the standards.
12. Level of evidence to show an equivalent degree of safety.
13. Defaults that lock out variability; but create more false alarms

Additional standards needed:

1. Guidance documents for institutions on how to set up alarms [combine with 3-5]

2. Minimum standards by location and that are evidence-based
3. Clinical practice guidelines[combine with 1and 4-5]
4. Guidance documents on patient age, diagnosis, disease state, alarm validation periods
5. Standards by institution type[combine with 1and 4-5]
6. Guidance documents for high-fidelity clinical simulation
7. Framework for each hospital (e.g. management) [combine with 1and 4-5]
8. Standard that requires hospitals to establish policies on alarms
9. Finalized semantics standards terminology and models
10. Central repository (website) where all of this information resides
11. User interface--Do users know the implications of de-activating the alarm? How does the operator know the state of the machine relative to alarm inactivation? ~~what you need to do to de-activate the alarm;~~ [combine with #2 on previous list]
12. How do I do an alarm de-activating action?
13. Validation methods
14. Standardize best practices that have been validated

Do we want research to validate these areas or are we saying this is what we want?

- Start doing best-practice research that results longer-term in standards

SESSION VII: First Day Wrap-up

Aha's from today:

- multi-sensored data fusion
- more contextual information
- open access to patient data from the manufacturers
- human factors
- Effect of noise on healing

Wednesday, October 5, 2011

SESSION VIII: Learning From One Another: Sharing Compelling New Approaches and Best Practices

Maria Cvach, MS, RN, CCRN, Johns Hopkins Hospital

Ana McKee, MD, The Joint Commission

Jim Piepenbrink, Boston Medical Center

Linda Talley, MS, BSN, RN, NE-BC, Children's National Medical Center

Session goals:

- a. Learn “what’s working out there” from one another
- b. Give audience members “take away ideas” for improving alarm challenges in their own facilities
- c. Create opportunities to replicate innovative solutions

Facilitated Discussion:

What have you learned that's working and what are key take-away's for improving alarm challenges in your own facility?

1. Changing the electrodes every 24 hours. [not possible in peds]; Do a good skin prep (ensure you are looking at the best literature; best practice is soap and water). Proper lead placement. Alarms team that incorporates CQI. Pull knowledge from other fields to help improve use of electrodes.
2. Setting the use of default alarms in the units.
3. One-step way to tailor alarm parameters around the patient where they start at baseline. Look closely at trending of a patient, not just alarm values.
4. Hospitals and clinicians need an easy way to save all the alarm information from their full disclosure cardiac monitor devices so they can tell whether they are true or false and they can try different interventions to see if they work.
5. Need to broaden and diversify the multi-disciplinary approach in solving these problems. Include the acoustical community. [combine with #7]
6. Evidence we have that anything we're doing is obsessed with reducing alarms, but we're not focused on improving care of patients; need randomized multi-center trials that show that reducing alarms improves or maintains patient care.
7. Organizational commitment to alarms strategies. Leadership at the top.
8. Summary of best practices
9. In-depth analysis of your hospital's culture, infrastructure, practices and technology.
10. Reduce the noise level in the units.
11. Having telemetry alarms on the patient unit.
12. Use a central monitor-type concept to screen out false positives and only notify clinicians of true positives. Need input from human factors people about appropriate number of monitors for one person (usually technician) to watch. Need to rotate people on the monitors every 90 minutes.
13. It's not just cardiac alarms, but all of the many alarms.
14. Vendors--better communication strategy; we hear what you're saying and there are many things you can already do. We don't want to recreate the wheel because capabilities are there now.
15. We have a device with view, with wave forms and all info needed.

16. Sharing learnings, challenges, best practices in an interdisciplinary way. We need to figure out how to share our stories and success across disciplines and industries.
17. Make problems visible, collect alarm rate metrics baselines.
18. Staff competency and house staff competency is huge.
19. Standardized naming of alarms.
20. Collect more information.

SESSION IX: What Don't We Know? Essential Research on Alarms

Mathias Basner, MD, PhD, MSc, University of Pennsylvania School of Medicine

Joseph Frassica, MD, Philips Healthcare

Marjorie Funk, PhD, RN, FAHA, FAAN, Yale University School of Nursing

J. J. Persesnky, PhD, Idaho National Laboratory

Session goals:

- a. Identify current, useful research related to alarm management
- b. Identify key gaps in existing research and prioritize ways to close them
- c. Explore a coordinated approach to performing, validating, and sharing research related to medical device alarms

Gaps in the research that need to be addressed:

1. Risk analysis of patient populations within acute care facilities to question who should not be monitored rather than who should be monitored. If patients should be monitored, what should be monitored? Look at earlier indicators of patient deterioration.
 - respirator rates
 - pulse rate/heart rate
 - systolic blood pressure
 - pulse oximetry
 - other
2. Include in research additional equipment that alarms in patient care systems (e.g. infusion pumps, bed alarms and call bell systems)
3. Consolidation of research on alarms management
4. Human reliability of clinicians response to alarms
5. Work with vendors to ensure you have most recent technology and proper configurations
6. Medical devices that live in out-patient and home settings--we need to understand the different challenges

7. Look at patient outcomes, not just decreasing the number of alarms
 8. Look at the staff if we're driving them away; what's the effect of alarms on staff turnover and performance.
 9. Better techniques and measurement for monitoring respiratory rates
 10. Determine whether auditory signal should be by priorities and/or type of equipment.
 11. Trials are appropriately designed with appropriate team; Ensure trials are designed to generate highest level of evidence; Establish good surrogate outcome measures at the front end
 12. Sleep studies that look at optimal volume of alarms relevant to ambient noise and time of day.
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SESSION X: Have We Gone Too Far? The Role of Secondary (Remote) Notification Systems

Shawn Forrest, MS, U.S. Food and Drug Administration

Tim Gee, Medical Connectivity Consulting

Linda Talley, MS, BSN, RN, NE-BC, Children's National Medical Center

Session goals:

- a. Identify common practices among hospitals in the use of secondary notification systems associated with medical alarms
- b. Gain consensus on the role these systems should have in monitoring patients' conditions.
- c. Identify and prioritize areas for improvement to ensure that these devices are used correctly

Common practices in use and role of secondary (remote) notification systems:

1. Disconnect between secondary alarms regulated as secondary, but they are used as primary alarms
2. Whether or not the alarm signal is intended to notify as secondary or primary
3. IHE ACM (alarm communication management); secondary alarm notification solution
4. Alarms are sounds coming from the primary devices; Alerts are the sounds going to secondary devices

How can we ensure these devices are used correctly?

1. Avoid use of color alone because of color-blindness; put visual notification next to a light
2. Active patient monitoring is excluded from MDDS

3. Need for hospitals to validate, verify the transmission of data; ensure right data sets get to the end-users
 4. When using public mobile wireless communication solution, pay attention to delivery timeframes and quality of services
 5. Determine the cause of the failure (e.g. human use, equipment)
 6. Should have complete journaling database capabilities; it needs to be exportable for duration within legal guidelines
 7. Make sure we have primary alarms in place before we implement secondary notification systems.
 8. Don't implement a secondary notification system assuming it's going to fix all the problems.
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SESSION XI: Core Competencies: Training and Competency Requirements in Alarm Management

Laurie Groesbeck, BS, RN, CRRN, CRNI , Complete Infusion Services, LLC

James Piepenbrink, Boston Medical Center

Kathy Puglise, MSN/ED, RN, CRNI , Home Choice Partners

Session goals:

- a. Identify core competencies required to safely and reliably address medical alarms
- b. Identify common disparities among clinical staff's readiness to manage alarms
- c. Identify required or essential training and experience for managing or responding to alarms
- d. Set priorities for the criteria or requirements for training

Core Competencies / training/ and experience needed to safely and reliably address medical alarms issues:

1. Risk management expertise [need to define what Risk Management means] "risk management" expertise with regard to patient safety, workflow effectiveness and data and system security.
2. Understand the workflow; be workflow focused
3. Ongoing continuing education
4. Incorporate all of the technology changes and new staff coming on board with refresher training by vendor.
5. Standardize training content; Formalize the training development process; Should be training by doing--hands on; in environment where there is no possibility of harm to patients. Interactive training

6. Look at history of alarm-related problems to identify what you should include/incorporate in your training
7. Maintain a master list of alarms available to clinicians; Keep focus on physiology as relates to the alarm. It will help nurses understand the importance of the alarms.
8. Communicate on the problems that you find at the front line so vendors can address the problems.
9. Vendors develop a website to share best practices with the medical community that is using their equipment. [Simulation training already exists]
10. Look at other industries (e.g. medical record); training and implementation are separate issues. During implementation you need to have "super users" who have greater level of knowledge.

Note: Training is probably not going to resolve the problems. It's more likely that staffing changes (e.g. shift lengths, rotations) will improve alarm issues.

Common disparities among clinical staff's readiness to manage alarms:

1. Huge disparity between ICU nurses and their understanding of importance of alarms and how to deal with them, and the understanding by general floor staff. Staff responsibilities/workload interfere with managing alarms, regardless of position. Generational gaps; disparities in terms of when individual people are trained
2. Overload of technology. The problem is lack of understanding of the conceptual model how disparate alarm and communication systems work together.
3. Be careful that the fix doesn't cause another problem.
4. Protect the time for training, orientation.
5. Look at the practice; E.g. study at our facility indicated that 50% of alarms were related to occlusions.
 - Consider that the number of alarms is really just fewer alarms that continue to sound.
 - Distinguish between alarms and alerts
6. Disparity between leadership and staff. Message needs to be that this is a priority. E.g. holding 1/2 hour training over lunch doesn't convey priority.
7. We're using the technology to drive the process, but should use the process to drive technology.
8. Closed loop of our need to know from trainers and their need to know from trainees.
9. People who do training aren't natural trainers, but more technically oriented.
10. Consider variety of learning styles

SESSION XII: It Takes a Village: The *Audience* Sets Priorities and Action Plans

Session Goals:

- a. Review the “Master List” of problems and issues from Day 1 and Day 2 discussions;
- b. Identify the top 15 priorities on the Master List according to its importance and impact on patient safety;
- c. Identify the potential timeframe of “addressing” or “fixing” each issue;
- d. Identify stakeholders who should be involved in addressing the priorities.

SESSION: Summit Wrap-Up and Closing Remarks

Next Steps: