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Hospital Ward Alarm Fatigue Reduction Through Integrated Medical Device Instruction and Hospital System Policy

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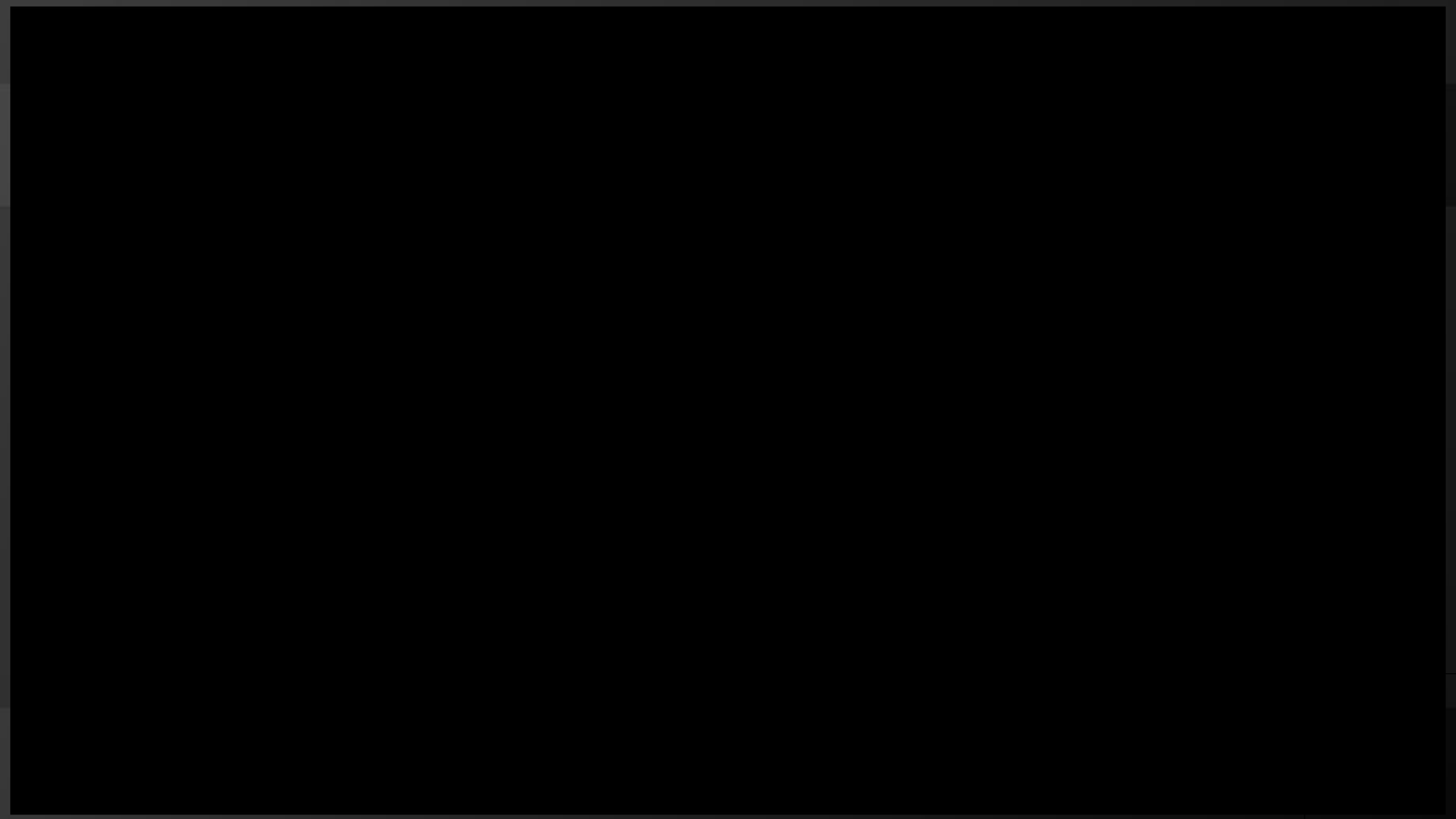

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Hospitals excited about new monitors for patients that were developed in 1960’s, 70s and 80’s

Medical devices with alarms were considered aides to nurses and patient care

Rise of private rooms

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Listen

Focus

Listen to patients

Concentrate

Deliver care

Make Decisions

Improve quality

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Imagine if you or a loved-one were to enter the hospital.

What would be your expectations?

- Excellent care?
- Attentive and focused caregivers?
- Authority to provide care?
- The most sophisticated technology?
- Clear focus on policy?

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Imagine a product that would deliver:

Knowledge about medical device settings

Authority to make decisions based on policy

Content in a mobile, secure timely system

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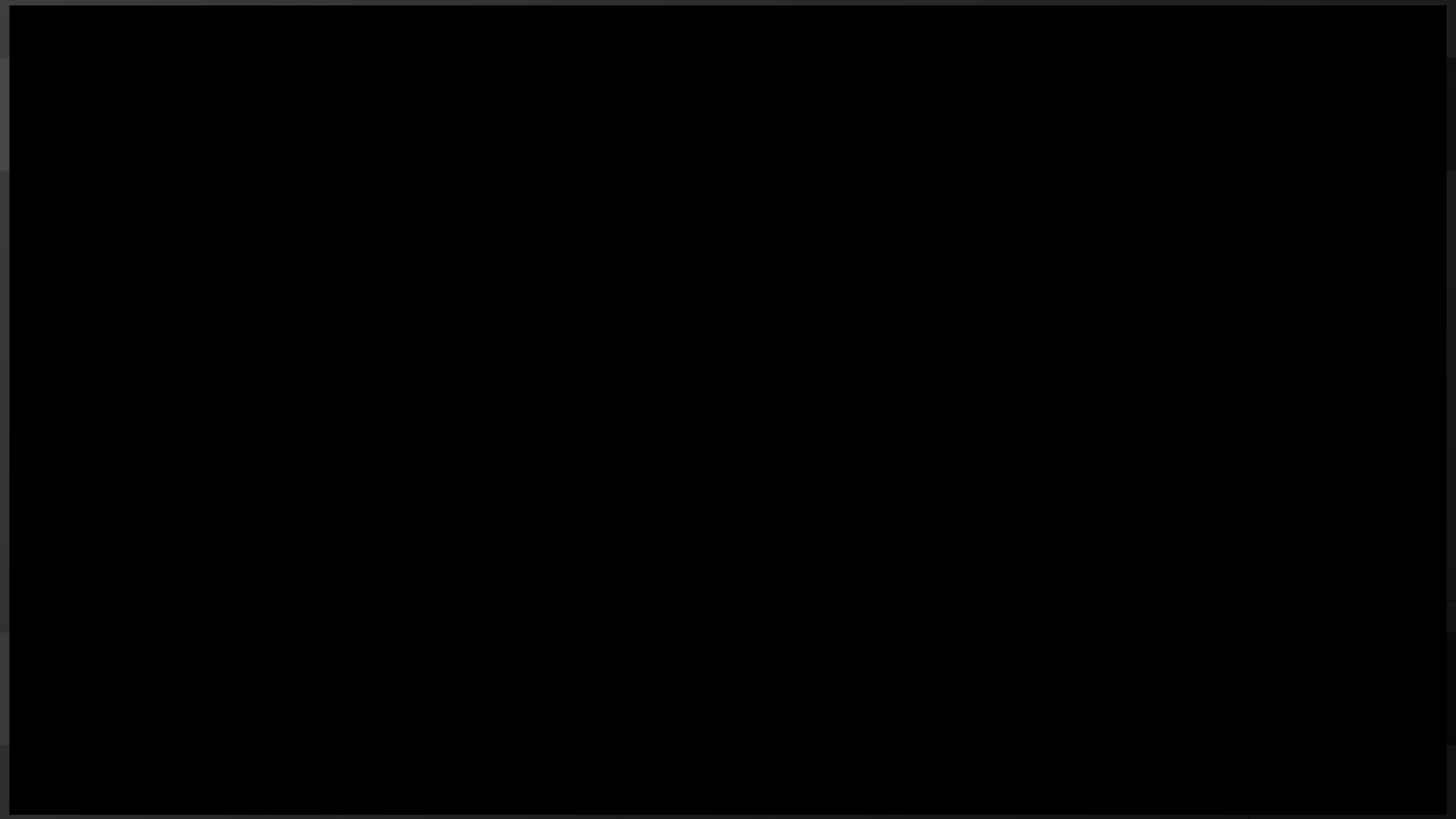
Where are we now?



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1 in 5

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400,000

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Medical mistakes are the third greatest cause of death in the United States after Heart Disease and Cancer

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In the 1990’s Visual and Audible alarm standards beginning as “flashing lights and beeping sounds”

Narrow scope of standards meant not wide adoption

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Phillips Healthcare/CGA, Regulations and Standards, D. Osborn, Sept. 19, 2011, ISO 9703-1 1992 and ISO 9703-2: 1994

IEC 60601-1-8 published in 2003 included new standards including:

- High, Medium and Low priority sounds, colors and rhythms
- Inconsistent use of terminology such as alarm signal, alarm limit, mute, silence, suspend
- Devices may have a service life of 10 years or more

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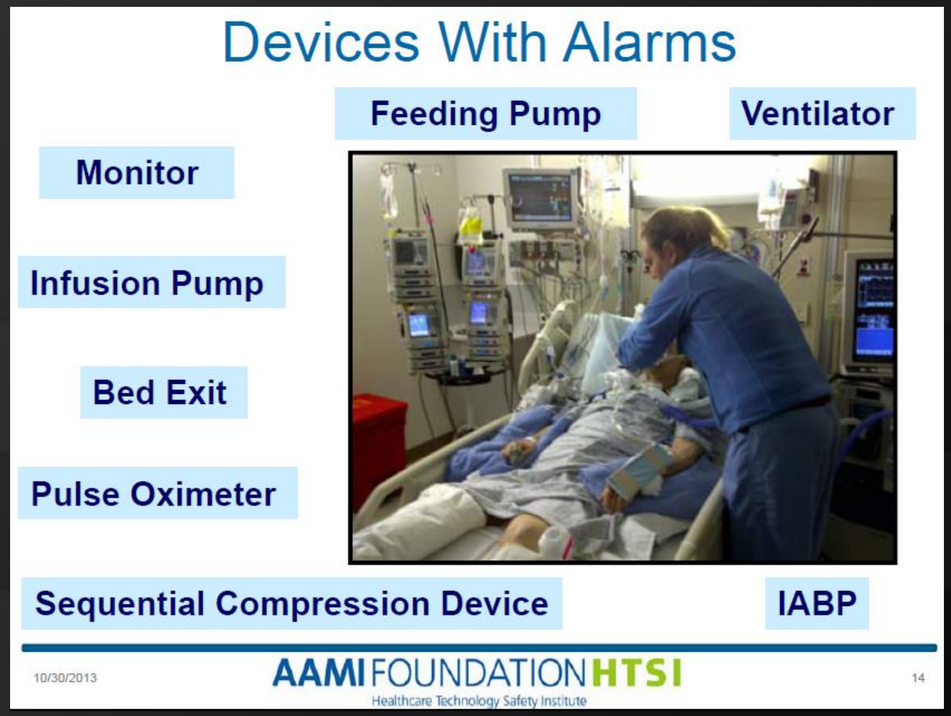
Phillips Healthcare/CGA, Regulations and Standards, D. Osborn, Sept. 19, 2011, ISO 9703-1 1992 and ISO 9703-2: 1994

Today as many as 14 devices with alarms monitor a single patient in Intensive Care Units

Ventilators, pumps, patient activity, and devices that measure vital signs such as pulse, heart rhythms, blood oxygen saturation and respiration



A recent study at the University of California, San Francisco examined 5 ICU wards over 31 days with 461 patients

2,557,760 audible and non audible alarms,
Averaged 187 audible alarms per patient/bed/day

80-99% of alarm signals false or non-actionable

Drew BJ, Harris P, Zègre-Hemsey JK, Mammone T, Schindler D, et al. (2014) Insights into the Problem of Alarm Fatigue with Physiologic Monitor Devices: A Comprehensive Observational Study of Consecutive Intensive Care Unit Patients. PLoS ONE 9(10): e110274. doi:10.1371/journal.pone.0110274

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Stress on care providers results in “Alarm Fatigue”

- Missed alarm signals
- Delay in response
- Devices adjusted to silence or decrease volume
- Fatigue that may contribute to non-alarm related mistakes

It is estimated that between 85 and 99 percent of alarm signals do not require clinical intervention, such as when alarm conditions are set too tight; default settings are not adjusted for the individual patient or for the patient population

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http://www.pwrnewmedia.com/2013/joint_commission/medical_alarm_safety/downloads/SEA_50_alarms.pdf

Joint Commission Top 10 list

The List for 2015

1. Alarm Hazards: Inadequate Alarm Configuration Policies and Practices
2. Data Integrity: Incorrect or Missing Data in EHRs and Other Health IT Systems
3. Mix-Up of IV Lines Leading to Misadministration of Drugs and Solutions
4. Inadequate Reprocessing of Endoscopes and Surgical Instruments
5. Ventilator Disconnections Not Caught because of Mis-set or Missed Alarms
6. Patient-Handling Device Use Errors and Device Failures
7. "Dose Creep": Unnoticed Variations in Diagnostic Radiation Exposures
8. Robotic Surgery: Complications due to Insufficient Training
9. Cybersecurity: Insufficient Protections for Medical Devices and Systems
10. Overwhelmed Recall and Safety-Alert Management Programs

Source: Health Devices 2014 November. ©2014 ECRI Institute - www.ecri.org/2015hazards

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Technical Solutions

Central Monitoring	Escalation of alarms to additional care providers	Interconnect all alarm devices
Remote location by expensive technicians	Escalation may increase quantity of alarm signals	Not all devices compatible – no standard protocol

National Patient Safety Goals

NPSG.06.01.01: Improve the safety of clinical alarm systems:

- **Phase I**, January 2014
  - Hospitals to establish alarm safety as an organizational priority
  - Identify the most important alarms to manage based on their own conditions
- **Phase II**, January 2016
  - Develop hospital-specific policies and procedures
  - Educate clinical staff about alarm management

Hospitals working to measure and adjust:

Boston Medical studied audible cardiac alarms, captured data:

- **Alarm Levels** - Crisis, Warning and Advisory
- **Findings**
  - Warning alarms sometimes missed. Staff often delayed responding
  - Audible alarms with self reset capability were most excessive and contributed to clinical alarm fatigue.
  - Changes to alarm settings were safe and reduced non-actionable alarms
  - Reduced weekly alarms to 1/8 of pre-study levels

Imagine the ideal nursing care situation:

- Calm and organized environment
- Knowledge about hospital priorities
- Clear understanding on roles and responsibilities
- Well trained on settings for monitoring devices

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ASIM - Alarm Signals Instruction Manual

- Secure web-delivery
- Mobile-device compatible
- Knowledge base of hospital-specific inventory
- Hospital-specific policy for authority

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ASIM - Alarm Signals Instruction Manual

- Patient bed-side
- Onboarding
- Continuing education
- Provides proper alarm settings based on:
  - Patient population
  - Individualized
  - Match hospital policy

American Association of Critical-Care Nurses. (2013). *Alarm management* (AACN Practice Alert). Aliso Viejo, CA: Author.

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ASIM - Alarm Signals Instruction Manual

- May reduce false and non-actionable alarms
  - Improved parameter ranges
  - Alarm signal delays for self-resetting conditions
  - Improves nurse confidence
    - Who can adjust settings
    - When settings may be adjusted
    - Inclusion in Electronic Health Record

Best Practices for Alarm Management: Kaiser Permanente, Children's National Medical Center, and The Johns Hopkins Hospital, March 5, 2014

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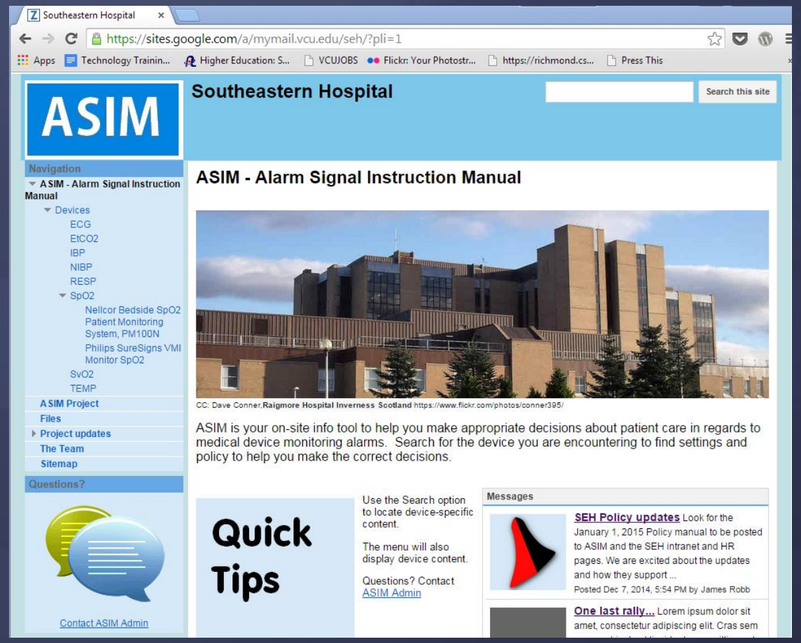
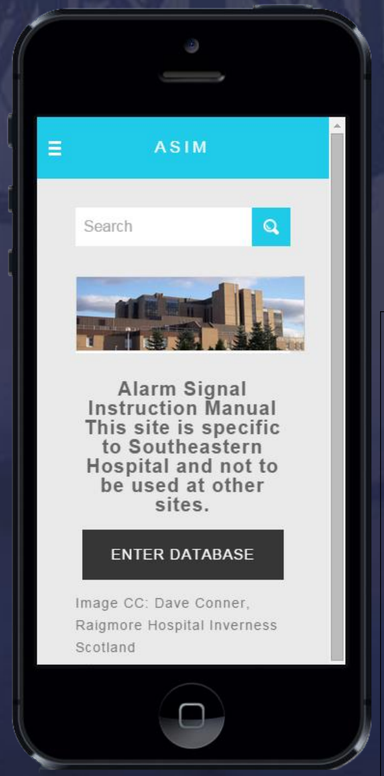
ASIM - Alarm Signals Instruction Manual

See it in action:

- https://sites.google.com/a/mymail.vcu.edu/seh/
- http://seh2014.weebly.com/





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ASIM - Alarm Signals Instruction Manual

See it in action:

- Wikitude – Image recognition app
- Clickable Paper by Ricoh

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QUESTIONS?

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APPENDIX

The Innovation Canvas	Project Title	Project Leader/Team	Date:
	ASIM - Alarm Signal Instruction Manual	**Jim Robb**	**Oct 2014**

Form

Web Application with database and secure sign-on by hospital organization.
Responsive design accessible via browsers on desktop, tablet and handheld devices.
National database tailored to organization' s inventory.

Technology

HTML, JAVA and Access database.
Photographs and diagrams of device controls and parameters. text instructions supported by photographs and diagrams.

Features

Online knowledge base database supporting images, diagrams and instructions designed to teach proper medical device parameter settings tied to Organization's alarm device policies.
Functions include choosing organization (hospital system) User Id and Password for secure access.
Once in the system the nurse/technician selects the desired medical device category, then the model number. Optional id tag or scan code of device supported.
Once the device is selected appropriate instructions are displayed for device parameter settings and configuration.
The system acts as a giant owner's manual or Instruction manual keyed to the specific policies of the Organization. This online manual supplants printed documentation allowing instant access to current policies and settings in the patient room or off site. Access to accurate device settings result in Organization-wide compliance to policy. Proper settings improve patient care by reducing false alarms, ensure compliance to industry regulations and reduced fatigue by caregivers.
The organization must be able to set policy to comply with Joint Commission requirements including maintaining written equipment inventory.
An additional optional feature may include defective/problem reporting for devices needing service.

Benefits

Nurses and Technicians are well informed at all times of the policy around alarm device settings and procedures. This information is available at the patient location on mobile, tablet or cart workstations. The secondary benefit to nursing staff is reduced alarm events, reduced fatigue or "Cry Wolf" nuisance alarms. Additional benefits include patient and nurse confidence in alarm quality. Instructions for all staff are updated in a central database across the Organization reducing paper manual printing costs and distribution.

Disadvantages

Initial inventory of Organization policy and alarm device components will require resources to properly deploy. Ongoing Username/Password services must be managed. Change orders for new equipment and staff is both a revenue stream and a disadvantage.

Value

By January 2016 hospital Organizations must implement The Joint Commission "National Patient Safety Goal" Part 3, establishing policies and procedures for managing alarms to include settings, disablement, change, off and monitoring rules and policies about whom may perform such duties.

Organizations must educate staff by the same Jan. 2016 deadline. This product addresses the education component with a repeatable, scalable and cost-effective platform.

Feasibility

Off-the shelf web-based design and database components may be employed with little development innovation, Web-based technology is designed to be delivered via web browsers on a variety of device platforms. The timing is quick to meet Jan. 2016 implementation.

Cost/Price

Estimates $25k-$50k per installation for setup, inventory assessment, policy and first year fee.

Outcomes Reduced false and non-actionable alarm signals through proper settings reduce alarm fatigue and improve patient care.

Timeline Implementation in test hospitals by January 2016

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APPENDIX

The Business Model Canvas

The Alarm Signal Instruction Manual (ASIM) - Jim Robb

Key Partners

Knowledge base software vendors. Off the shelf web-app

ECRI Institute. Policy

Association for the Advancement of Medical Instrumentation AAMI - List of manufacturers and equipment models, makes, manuals

Accreditation organizations such as the American Medical Association and the American Nurses Association

Key Activities

Custom database of customer medical devices married with Organization policy deliver proper parameter settings and operational instructions in a platform/device independent web app. Organization-wide licensing and maintenance contracts.

Key Resources

Distributed via secure, password protected website. Data includes medical device operational content, Custom content keyword searchable; hospital policy.

Teams include sales, content management and policy analysts.

Value Propositions

Quality, scalable web-app training for nurses and technicians to provide hospital organization-specific policy for accurate medical device parameter control.

Proper settings create reduced false or nuisance alarm signals potentially reducing alarm fatigue conditions.

Policy instructions for alarm control clearly communicated at patient bed-side eliminating potential sentinel events (patient harm)

Accurate, scalable, up to date, specific to local policy.

Consumer Relationships

Sales, service and helpdesk support for product creation, deployment and updates. Close tie to CTO and Health Technicians.

Channels/ Communication

Trade shows, trade magazines direct sales. Annual contracts following database creation to include maintenance updates for new database entries.

Consumer Segments

B to B value through improved patient safety, reduced alarm fatigue and reduced risk.

Segments may include:

- Large multi-facility organizations
- Small hospitals
- Regional associations where medical device alarms are used.

Cost Structure

- Initial consultation, inventory assessment and policy assessment
- Knowledge base build
- Annual Subscription (hosting, user management)
- Change orders Policy and Inventory updates
- Estimates $25-50k per installation

Revenue Streams

- Database creation based on Organization policies and equipment inventory
- Subscription fees for annual contract based on bed-count and equipment structure (volume dependent.)
- Change orders

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APPENDIX

The Insights Canvas

Project Title
ASIM - Alarm Signal Instruction Manual

Project Leader/Team
Jim Robb

Date:
Oct 2014

Opportunity

Bring knowledge to nursing staff about medical devices including the proper settings, controls and operation to match their Organization's policy.

Alarm Fatigue is a serious problem in America's hospitals. Over-abundance of alarm signals, especially nuisance alarms may be reduced with prompt and ongoing training on a per-device level. This solution uses off-the shelf knowledge base software to provide current policy-specific instructions at the patient bedside.

Market-Customers

There are 3300 Joint Commission accredited hospitals in the US. (5730 AHA Registered Hospitals.) representing $830B expenditures.

Market-Competition

clinical alarm training

Many middleware solutions including Phillips, Extension Healthcare

User Persona

Users are nurses, medical technicians and biotechnicians and c-suite Organization directors. "Do no harm" is the mantra of the medical industry and placing patients on monitored medical devices seemed like the best insurance. However, inadequate training, staffing and policy have created a system fraught with overload, rogue management of devices often resulting in error, sentinel events and more.

Needs

Educate staff about alarm policies and procedures.

Improve quality of alarm signal events to the end the "Cry Wolf" syndrome.

Technology

The current technology reflects loose guidelines for audible and visible medical monitoring devices. Many middleware vendors are suggesting alarm integration and communication systems but these do not address the training issue. The ultimate goal would be personal mobile telemetry systems on newly developed protocols.

Problem

It is estimated that between 85 and 99 percent of alarm signals do not require clinical intervention, such as when alarm conditions are set too tight; default settings are not adjusted for the individual patient or for the patient population; ECG electrodes have dried out; or sensors are mispositioned.1 As a result, clinicians become desensitized or immune to the sounds, and are overwhelmed by information – in short, they suffer from "alarm fatigue." http://www.pwnewmedia.com/2013/joint_commission/medical_alarm_safety/downloads/SEA_50_alarms.pdf

The Joint Commission (TJC) has proposed 2014 National Patient Safety Goal (NPSG) related to alarm management:

- Establish alarm safety as a priority.
- Prepare an annual inventory of device alarms and identify default settings.
- Identify the most important alarms to manage.
- Establish policies for managing important alarms, including clear guidelines regarding when alarms can be disabled, when alarm parameters can be changed, who has the authority to make these decisions, how to monitor and respond to alarms, and when to check alarms for accuracy.
- Educate staff about alarm policies and procedures.

http://www.ismp.org/Newsletters/acutecare/showarticle.aspx?id=44

Outcomes

Timeline

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