Moving from Device Integration to Device Interoperability

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HiMSS

CENTRAL & SOUTHERN OHIO *Chapter*

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9 Multispecialty Centers

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1,500+ Physicians, 23,000+ Staff

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59,358 Inpatient Admissions

1,724,176 Outpatient Visits

130,680 Emergency Department Visits

Where we started

- A new EMR was installed at Ohio State October, 2011
  - No true device integration was available prior to that outside a few departmental systems (ED and ICU applications)
  - Installed integration with patient monitors and ventilators
- Overall, we standardized these devices and made the data available house-wide
- Device Integration Goal Accomplished (and presented at HIMSS13)
  - 81% decrease in time to enter vitals (25 seconds removed every time)
  - Data was captured real time and not entered hours later from scraps of paper
  - 95% of patients had vitals captured at least once an hour with remainder mostly travelling to procedures
  - 93% of vitals were captured from devices, reducing labor and data errors

Realizing Possibilities

- Now that we have a trusted set of discrete data, we started looking at how to actively use the data:

  – Implemented MEWS (Modified Early Warning Score)

  – Implemented Sepsis Alerts

  – Supplement raw device data with calculations

Cerebral Perfusion Pressure (CPP) Calculated Formula:
ICP Mean - (NIBP) MAP
This value is not interfaced via a device. This is a calculation done in IHIS based on slaved device ICP data measurements and the (NIBP) MAP variables from the patient bedside monitor. Value is not modifiable in flowsheet template.

	8/16/12						Last Filed Value
	0250	0300	0323	0342	0400	...	
Vitals ICU/PCU							
Temp	100.9 (3...	100.8 (3...		99 (37.2)	100.5 (3...	10	100.2 (37.9)
Temp source	Axillary	Axillary		Axillary	Axillary		Axillary
Core (Blood) Temperature							
Pulse (Heart Rate)	118	101		126	132		93
Heart Rate Source				Monitor			Monitor
Resp Rate	14	16		36	20		16
BP	137/82			130/83			128/77
MAP (mmHg)	103			101			94 mmHg
BP Method				Automatic			Automatic
BP Location				Right arm			Left arm
BP Position				Lying			Lying
Art Line (1) Monitoring							
Arterial Line (1) Location							radial artery (...
Arterial Line (1) BP	160/79	170/82		158/78	167/85		135/73
Arterial Line (1) MAP	104	107		106	110		95 mmHg
Art Line (2) Monitoring							
Arterial Line (2) Location							
Arterial Line (2) BP							
Arterial Line (2) MAP							
Neuro ICP/CPP Monitoring							
Ventric/Drain Location							Left
ICP Mean	24	22		20	23		22 mmHg
CPP (NIBP MAP calculated)	79			81			68 mmHg (ca...
CPP (Arterial Line MAP calc)	80	85		88	87		73 mmHg
Neuro ICP/CPP Monitoring 2							
Ventric/Drain Location 2							Right
ICP (#2) Mean	17	14			19		19 mmHg
CPP#2 (NIBP MAP calculated)	86						86 mmHg (ca...

Alarm Fatigue

Started to data mine for ways to reduce alarm fatigue

In 2013, an Alarm Management application was purchased to

- Reduce alarm fatigue
- Act as a secondary notification system when a caregiver did not hear an alarm
- Create a way to escalate alarms when the caregiver was not able to respond
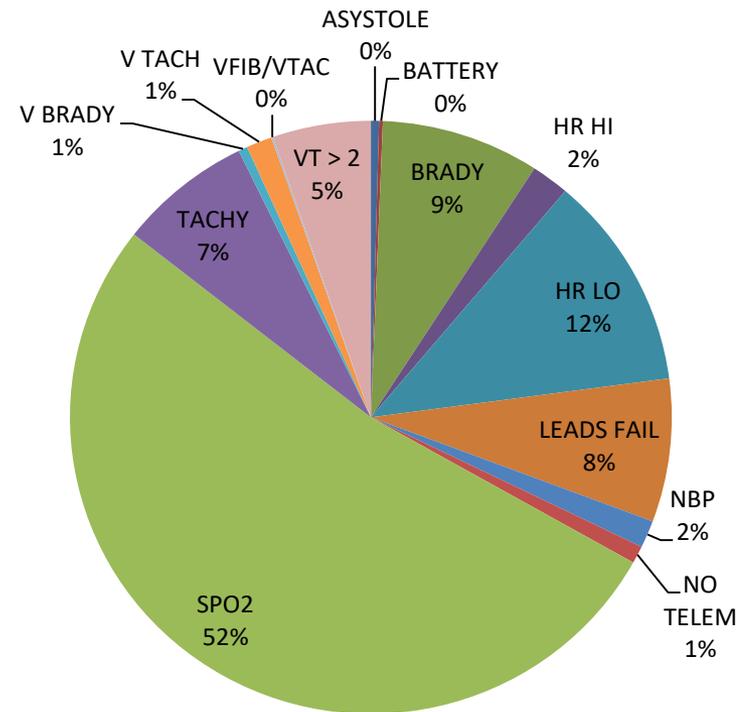- Capture alarms data to quantify issues

Data is Powerful!

It became very obvious that critical alarms were falling into the same category as "nuisance alarms"

A Patient Alarm Committee was formed to review this data and make data driven recommendations

This included:
- Categorizing alarms
- Determining which alarms need sent to nurse phones
- Distinguishing these alarms by varying ring tones
- Introducing 'suspensions'
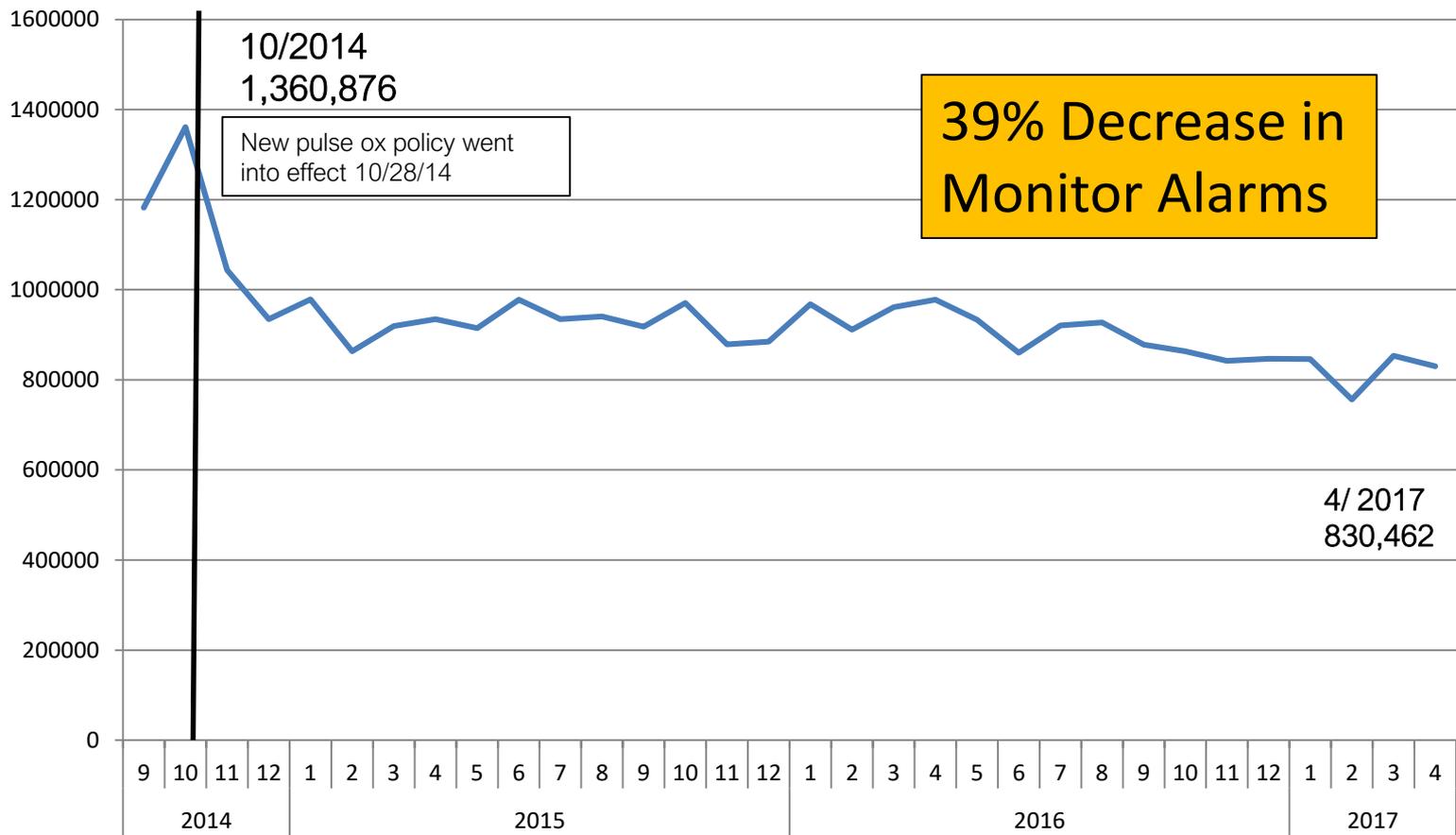- SP02 became the obvious outlier for patient monitor alarms

Clinical Alarm Breakdown
April 2017

ASYSTOLE 0%
V TACH 1%
VFIB/VTAC 0%
BATTERY 0%
V BRADY 1%
HR HI 2%
VT > 2 5%
BRADY 9%
TACHY 7%
HR LO 12%
LEADS FAIL 8%
NBP 2%
NO TELEM 1%
SPO2 52%

Is SPO2 a Valid Alarm

- A multidisciplinary Patient Alarm Committee started meeting to look at how to reduce the volume of alarms

- Peer review documentation, physician and nurse interviews and references all pointed to the same conclusion: Not interventions were being done when a SPO2 was 88, 89 or 90

  – So why were we setting an alarm when no interventions were being performed

- October 2014, OSUWMC set the threshold for 87

- Outcomes:

  – 39% decrease in the amount of overall alarms

  – Nurses were paying more attention to remaining SPO2 alarms

  – No adverse reactions were reported

Volume of Patient Monitor Alarms After SP02 Change
Sept 2014 – Apr 2017

10/2014
1,360,876

New pulse ox policy went into effect 10/28/14

39% Decrease in Monitor Alarms

4/ 2017
830,462

Alert counts for the James incomplete for Dec 2014 and Jan 2015 due to roll out issues.

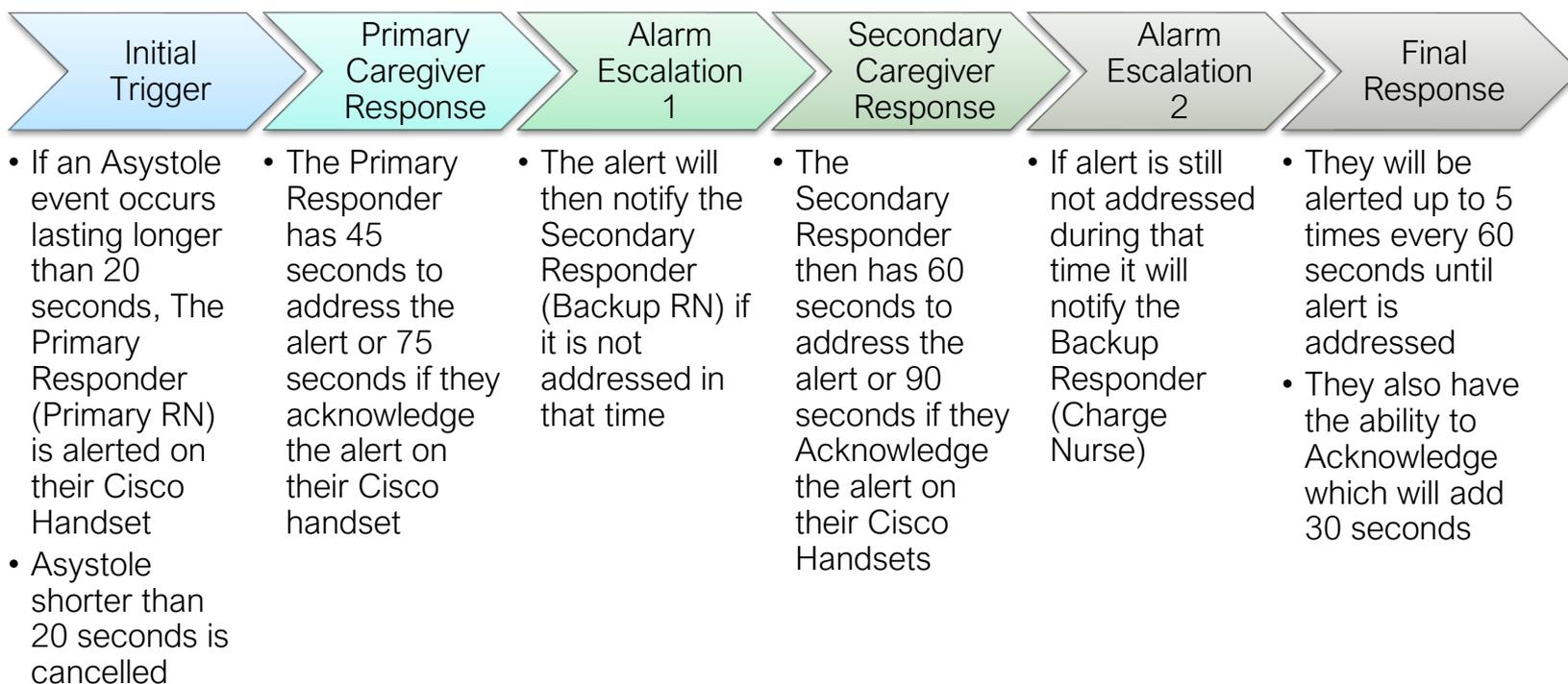*Alert counts for Brain and Spine incomplete for Jan 2017 due to roll out issues.*

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Alarm Categories

Alarm Category	Alarm Types	Alarm Reaction
Crisis Alarms	Asystole V Tach V Fib/V Tach	"Urgent" ring tone to catch nurses attention immediately
Standard Alarms	Leads Fail No Telemetry Change Battery	Leads fail have an intentional delay to cancel false alarms
Alarms not sent to the nurse's phone	SP02 Heart Rate Low/High Brady/ V Brady Tachy VT > 2 NBP	Alarms are NOT sent to caregiver phones but still alarm on the device and the central station

Alarm Management

- **Alarm Cancelations** – Hold sending an alarm to a phone unless the condition continues for a certain amount of time

    – Example: Do not send a 'Leads Off' alarm until they have been off for over 20 seconds

    – If the leads were returned before then, no alarm will be generated since the issue has been resolved

- **Escalations** – If an alarm is not acknowledged for x seconds, then a secondary contact is notified. If that isn't acknowledged for another x seconds, the charge nurse is notified

    – These escalations can be programmed to be quite elaborate and often in tandem with alarm cancelations

Example Alarm Notification - Asystole

Initial Trigger	Primary Caregiver Response	Alarm Escalation 1	Secondary Caregiver Response	Alarm Escalation 2	Final Response
• If an Asystole event occurs lasting longer than 20 seconds, The Primary Responder (Primary RN) is alerted on their Cisco Handset • Asystole shorter than 20 seconds is cancelled	• The Primary Responder has 45 seconds to address the alert or 75 seconds if they acknowledge the alert on their Cisco handset	• The alert will then notify the Secondary Responder (Backup RN) if it is not addressed in that time	• The Secondary Responder then has 60 seconds to address the alert or 90 seconds if they Acknowledge the alert on their Cisco Handsets	• If alert is still not addressed during that time it will notify the Backup Responder (Charge Nurse)	• They will be alerted up to 5 times every 60 seconds until alert is addressed • They also have the ability to Acknowledge which will add 30 seconds

Old School Nurse Call System

- Pull a cord, press a button, a light or sound is invoked

- No differentiation between a patient that has fallen in the bathroom versus a patient that needs ice

  - All alarms are treated as the same and therefore have a lower level of importance

- Reporting was limited with no data mining capability

 - Little accountability

  - No opportunity to improve operations

Next-Generation of Nurse Call[1]

- **Role Segregation** - Calls distinguished between nurses and PCAs
- **Direct Interaction** - The nurse or PCA if not readily available can talk to the patient
    - Patient: Clicks the "Need Nurse" button on the pillow speaker
    - Nurse: "Hi Mr Jones, I will be right in. Is this an emergency?"
    - Patient: "No, I just wondered if I could get some crackers?"
    - Nurse now knows a priority and walks in with crackers saving a trip
- **Coordination –** A normal alert can be sent to the front desk where they can talk with the patient to determine needs without bothering a caregiver
- **Alarm Management** - Alarms are routed through an alarm management system similar to patient monitors
    - Escalations and suspensions are highly customized
    - OSU has 74 workflows currently with additional being developed

1. Term coined by Gartner

Health System Volume of Nurse Calls by Type
April - 2017

Routing allows 86% of the alarms to be sent to the Unit Clerk or Patient Care Associate further reducing alarm fatigue and allowing for different escalation rules
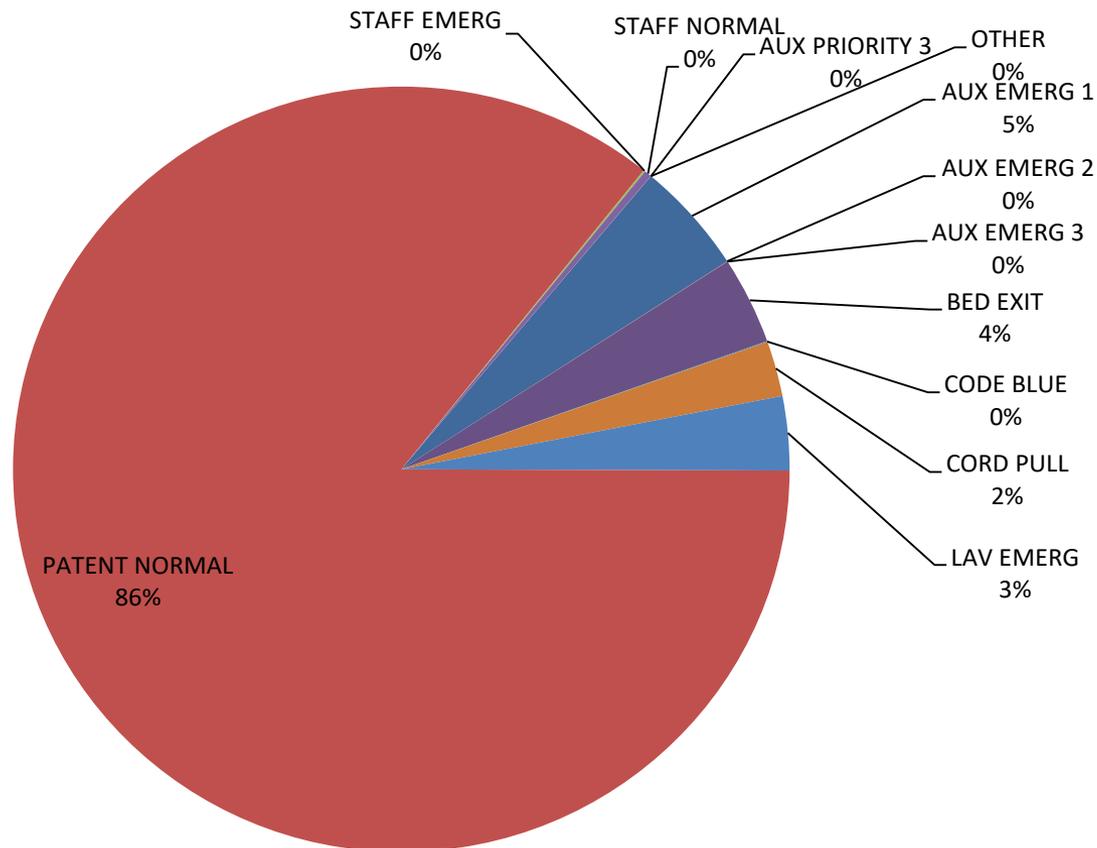
Source: rpt 560 workhorse query.

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Integrating Nurse Call with RTLS (Real-time Location Services)

- All nurses wear RFID tags during their shift
    - As soon as the nurse enters the room, the alarm is automatically silenced
    - They are now responding to the patient immediately and not to the alarm
    - Timestamps are accurate for critical events
- _All_ events of the nurse or PCA are recorded automatically by simply walking in the room

Integrating with the EMR

- A communication device is being installed in every room

- For simple documentation pieces like "patient sleeping", the nurse can click the button which sends a message to the EMR

    – The timestamp is when the nurse was in the room

    – The patient is not interrupted by starting a computer, logging in, added light/sound, etc

- Simple tasks like calling respiratory can be done with a single click

    – Soon this will be tied with our secured messaging system to avoid knowing who is on-call for a given department, floor, building, etc.

Device ~~Integration~~ Interoperability

Device Integration	Device Interoperability
• Data is sent from devices to the EMR or other systems	• Data from devices is used for event triggers, combined with other technologies such as RTLS to make a more accurate bigger picture and filtered/escalated to increase the effectiveness of the trigger and improve clinical outcomes

Next on the Radar

- Infusion Pump Integration – March, 2018
    - RTLS integration (asset tracking)

- Enterprise-wide device barcoding
    - Phones Live
    - Infusion Pumps with the March install
    - Vents, mobile patient monitors/telemetry, others following

- Centralizing nurse assignments in the EMR
    - Send to nurse call, alarm management, secure messaging and other systems

Discussion