Patient Alarm Management
March 3, 2014

Improving People's Lives
Through Innovations in
Personalized Health Care

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National Spotlight

SPECIAL REPORT

Patient alarms often unheard, unheeded

The incessant din of beeping monitors can numb or distract hospital staff; the consequences can be deadly   By **Liz Kowalczyk** | GLOBE STAFF   FEBRUARY 13, 2011

A *Boston Globe* investigation revealed that over 200 alarm-related patient deaths occurred between 2005 and 2010. In many of these cases, medical personnel either didn't notice the alarms or failed to react with the urgency required—both typical signs of alarm fatigue

2014 Top 10 Health Technology Hazards
ECRI Institute experts have identified clinical alarm hazards as the top potential danger area for 2014.

2014 TOP 10 HEALTH TECHNOLOGY HAZARDS

ECRI Institute

Alarm Safety Resource Site
https://www.ecri.org/forms/pages/Alarm_Safety_Resource.aspx
Screen clipping taken: 2/6/2014, 12:06 PM
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National Evidence: The Joint Commission

- Jan 2009-June 2012 sentinel events reported nationally to the Joint Commission
  - **98** alarm related events
  - **80** alarm related events have resulted in death
  - 13 resulted in permanent loss of function

- TJC issued a "Sentinel Event Alert" on medical device alarms and has added "Alarm Management" to their list of National Patient Safety Goals for 2014.

Sentinel Event Alert Issue 50: Medical device alarm safety in hospitals | Joint Commission
http://www.jointcommission.org/sea_issue_50/
Screen clipping taken: 2/6/2014, 11:45 AM

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Get clickers ready…..

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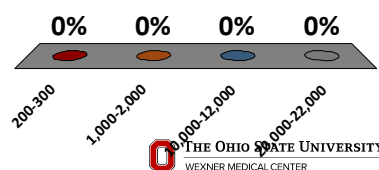
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How many cardiac alarms occur on a daily basis in the Ross?

A. 200-300
B. 1,000-2,000
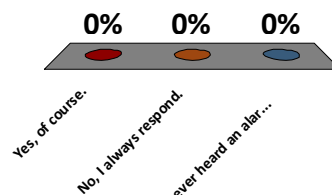C. 10,000-12,000
D. 20,000-22,000

0%   0%   0%   0%

200-300   1,000-2,000   10,000-12,000   20,000-22,000

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Have you ever heard an alarm and not responded?
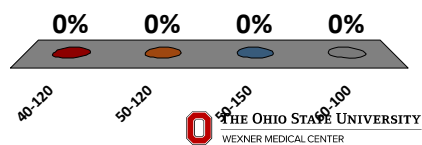
A. Yes, of course.
B. No, I always respond.
C. I've never heard an alarm before!

0%   0%   0%

Yes, of course.   No, I always respond.   I've never heard an alar...

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What are the default heart rate alarm limits in the OSUWMC policy?

A. 40-120

B. 50-120

C. 50-150

D. 60-100

0%   0%   0%   0%

40-120   50-120   50-150   60-100

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Have you ever customized alarm limits based on your patients condition?

A. Yes

B. No

0%   0%

Yes   No

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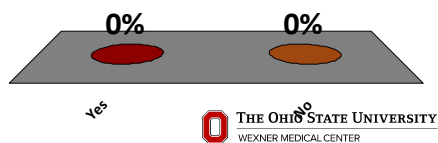
An order is required to <u>initiate</u> cardiac monitoring.

A. True
B. False

0%   0%

True   False

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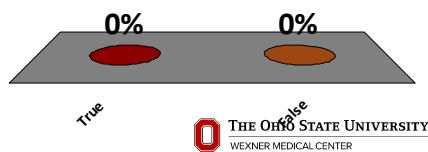
9

I feel that my patients are safer with continuous cardiac monitoring.

A. True
B. False

0%   0%

True   False

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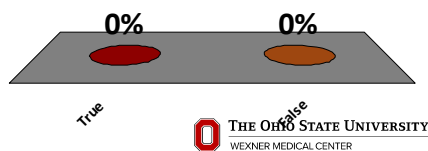
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With the new policy, cardiac monitoring continues until an order is placed to discontinue.

A. True
B. False

0%   0%

True   False

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Patient Story

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Training is not the (only) answer…

- "Telling nurses and doctors to be more careful and reeducating them isn't the solution."

- In Intensive Care Units, there are around 50 electronic pieces of equipment, and each of them has an alarm. Each individual device maker makes its alarms the most annoying. It's an 'arms race of alarms'.
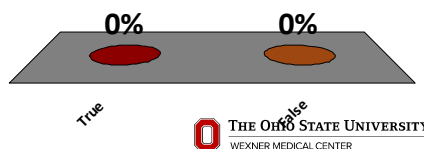 - Dr. Peter Pronovost, Director of the Quality & Safety Research Group at Johns Hopkins Hospital

- Central goal: Make every alarm mean something

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Human Factors of Alarm Fatigue

- In high-tempo workplaces, many tasks and signals (e.g., alarms) compete for attention

- Over time, clinicians determine (consciously and subconsciously) the informativeness of each of these signals

- Informativeness is the likelihood that a signal is signifying what it is meant to signify (i.e., not false), and that what is signified is worthy of directing attention to (i.e., actionable)

Non-actionable Alarm: Correctly identified by the system, but it has no clinical significance and/or results in no change in plan of *care—Asymptomatic Bradycardia*)

False Alarm: A triggered event that is invalid or incorrect—*Artifact; Asystole for a paced rhythm.*

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Informativeness

- Informativeness drops quickly when:
  - There are a lot of false alarms
  - There are a lot of non-actionable alarms
  - Group alarms
    - 1 signal meant to alarm for multiple different reasons
    - 1 signal meant to alarm for multiple different urgencies
- Drops in signal informativeness result in:
  - Proportional reduction in clinician response (i.e., 80% false alarms predicts 20% clinician response)
  - Lack of response examples include ignoring, overriding, and disabling alarms (turn off, lower volume)
    - NOTE: these responses are not due to a lack of vigilance or effort – similar responses have been seen in animals, machines, and proven mathematically

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How many cardiac alarms per day in Ross only?

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Ross Cardiac Alarm Volume by Day

10,000 per day

1650 per unit

60 per patient

Ross Heart Hospital Cardiac Alarm Volume by Day with Average

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Have you ever heard an alarm and not responded?

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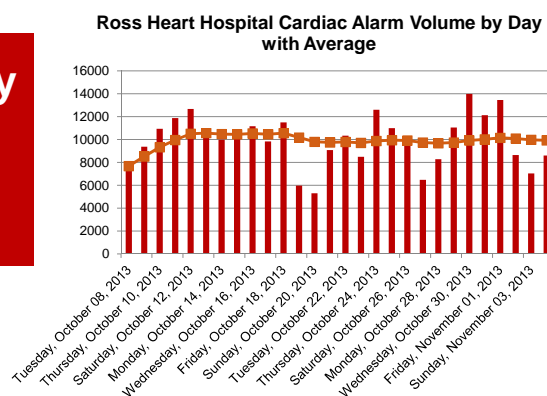
85-99% of clinical alarms do not require clinical intervention

- **Crisis:** triple tone
- **Warning:** double tone
- **Advisory:** single tone
- **Message:** visual only
- **System Warning:** fog horn

Alarm Totals by Week Ross Heart

Legend:
- Alarm Totals by Week
- Critical Cardiac Alarms

Chart x-axis: 8-Oct, 15-Oct, 22-Oct, 29-Oct
Chart y-axis: 0 to 80000
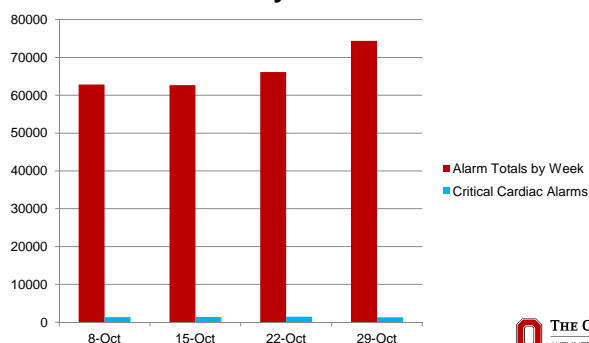
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OSUWMC's Approach to NPSG 6

- Reduce the harm associated with clinical alarm systems
- In Phase I (beginning January 2014), hospitals will be required to establish clinical alarm system safety as a hospital priority and identify the most important alarms to manage.
- Ohio State's Wexner Medical center has identified the following clinical alarms as the most important to manage in 2014:
  - Ventricular fibrillation
  - Ventricular tachycardia
  - Asystole
  - Leads off

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Patient Alarms Project

Patient Alarms Executive Steering Committee

Jerry Mansfield
Dan Eiferman
Dan Mertz
Brenda Vermillion**
Lisa King**

Traci Mignery
Susan Moffatt-Bruce
Ailene MacKay**
Mary Jean Girard**
Jodi Sheets
Kevin Jones**

**Group chair

Operational Oversight & Project Guidance

Physiological Monitoring Oversight Group

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Bob Howard
Mike Rayo
Debbie Ward
Jackie Lawless
Lyn Roush
Julie Aldrich
Todd Yamokoski
Todd Tussing
Susan Bejcly-Spring
Claire McIntyre
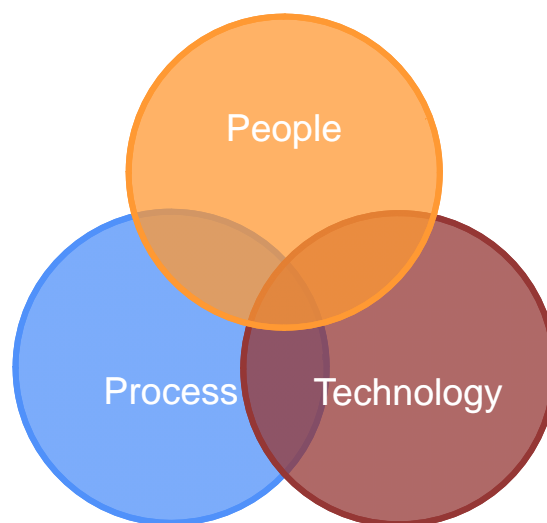*Physician Champions:*
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Clinical Engineering
Zach Powell

Business Continuity & Support, Sean Mazlarz

Nurse Call Acree, Dailey, Justin Collins

Vendors

Physiological Monitors, GE, Philips

Connexall, Edmund MacNeil, PM.

Project Implementation

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Three-pronged approach

People

Process   Technology

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Evidence-based Practice Recommendations

Hospitals

- Hospitals should engage an interdisciplinary alarm management committee to develop alarm settings and response protocols

- Systematic review of adverse events associated with clinical alarms

- Decrease the number of patients 'inappropriately' being monitored with telemetry in the Medical Center which will reduce overall alarms and potential alarm fatigue.

- Alarm defaults should be set to actionable limits and levels

- Staffing workload factors into alarm response time; as workload increases, time to alarm response increases

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Evidence-based Practice Recommendations

Clinicians

- Ensure that an active order exists for cardiac monitoring and update the physician service with changes in patient status or ECG rhythm

- Tailor alarms to a patient's actual needs to ensure that alarms are valid and provides an early warning to potential critical situations

- Reduce false alarms by suspending alarms for a short time period prior to patient manipulation

- Proper skin preparation, replacing ECG leads and electrodes, and routinely changing batteries decreases false alarms

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Evidence-based Practice Recommendations

Technology

- Use of alarm notification systems that provide context to the care provider and closed-loop communication

- Incorporates short delays that can decrease the number of ignored or ineffective alarms caused by patient manipulation or transient changes

- Standardize procedures for troubleshooting alarms would be helpful in assuring consistent patient management

- Smart alarms, which take into account multiple parameters, rate of change and signal quality, can reduce the number of false alarms.

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Risk Reduction Strategies/Implementation

Appropriate Application of Cardiac Monitoring
- New Continuous Cardiac Monitoring Policy
- IHIS Enhancement-Monitoring Orders

Reduce Non-Actionable Alarms
- Customize alarm settings to the individual patient.
- Note: Physician order required to change alarm parameter outside of policy ranges.

Reduce False Alarms
- Good skin prep and changing electrodes daily.

Secondary Alert Notification System (Connexall)
- **Ross, UH Med/Surg, East live**
- **James March 11**
- **8 PCU, 8 ICU, 10WR, 9ER March 25**
- **ED, CDU, MICU, NCCU, James SICU April 8**

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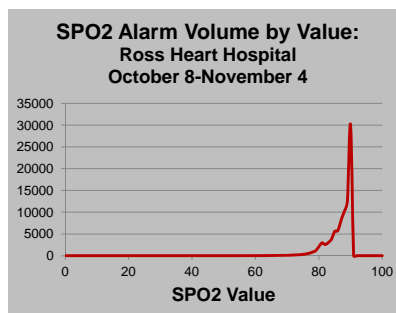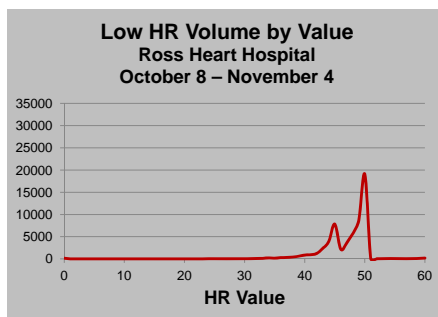WEXNER MEDICAL CENTER

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What are the default HR limits?

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Have you ever customized alarm limits based on your patient's condition?

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Reducing Non-actionable Alarms

- Tailor Alarm limits to your patient
- ST segment alarms
- QT interval alarms

Low HR Volume by Value
Ross Heart Hospital
October 8 – November 4

HR Value

SPO2 Alarm Volume by Value:
Ross Heart Hospital
October 8-November 4

SPO2 Value

Ross Alarm Data: October 15-21, 2013

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Appropriate Cardiac Monitoring

- Class I-Cardiac monitoring is indicated in most, if not all, patients in this group.
- Class II-Cardiac monitoring may be of benefit in some patients, but not essential for all.
- Class III-Cardiac monitoring is not indicated because the patient's risk is so low that monitoring is not of therapeutic benefit. *(Drew et al, 2004)*

Choosing Wisely
An initiative of the ABIM Foundation

Society of Hospital Medicine – **Adult Hospital Medicine**
shm
Society of Hospital Medicine
Five Things Physicians and Patients Should Question

4 **Don't order continuous telemetry monitoring outside of the ICU without using a protocol that governs continuation.**
Telemetric monitoring is of limited utility or measurable benefit in low risk cardiac chest pain patients with normal electrocardiogram. Published guidelines provide clear indications for the use of telemetric monitoring in patients which are contingent upon frequency, severity, duration and conditions under which the symptoms occur. Inappropriate use of telemetric monitoring is likely to increase cost of care and produce false positives potentially resulting in errors in patient management.

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IHIS Design – Cardiac Monitoring

5 New Cardiac Monitoring Orders will be created:

1. Class 1 - Cardiac Monitoring 72 hrs
2. Class 2 - Cardiac Monitoring 48 hrs
3. Class 3 - Cardiac Monitoring 36 hrs*
4. Cardiac Monitoring – ICU (no expiration)
5. Cardiac Monitoring – Chemotherapy (expiration will be determined by study or treatment plan requirements)
6. ED Cardiac Monitoring-6 Hours/ED only

Note: The Class 3 order will expire in 36 hours but the policy expiration for the order will remain at 24 hours. This will allow time for the physicians to renew the order prior to expiration during the next Rounds (if needed)

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Class I - Cardiac monitoring is indicated in most, if not all, patients. Patients in Class I include adult patients:

- **Resuscitated from Cardiac Arrest**
- **In early phase of Acute Coronary Syndromes (positive cardiac biomarkers or significant ECG changes)**
- **In early post-operative phase following Cardiac Surgery**
- **With High Degree AV Block**
- **With Acute Heart Failure/Pulmonary Edema**
- **Who have undergone Non-urgent Percutaneous Coronary Intervention WITH Complications**
- **Who have undergone Implantation of an Automatic Defibrillator Lead or a Pacemaker Lead AND are Considered Pacemaker Dependent**
- **New onset arrhythmias or Uncontrolled Chronic Atrial Fibrillation/Flutter**
- **With acute poisoning with drugs or chemicals at doses known or suspected to have cardiac arrhythmic toxicity**
- **In acute phase of Ischemic Stroke or Transient Ischemic Attach (TIA)**
- **All patients admitted to ICU level of care**

Order must be renewed after 72 hours (when clinically indicated or useful to continue telemetry monitoring), unless patient remains in ICU.

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Class II - Cardiac monitoring may be of benefit in some patients, but not essential for all. Patients in Class II include adult patients:

- **With Post-acute MI (>48 hours post-MI) or with Chest Pain Syndrome (negative biomarkers)**
- **Who have undergone Uncomplicated, Non-urgent Percutaneous Coronary Interventions**
- **Who are administered an Antiarrhythmic Drug or Who Require Adjustment of Drugs for Rate Control with Chronic Atrial Tachyarrhythmias**
- **Who are being Evaluated for Syncope**
- **With Subacute Heart Failure (during medication titration or device therapy)**
- **With Acute Phase of Pericarditis/Myocarditis**
- **In early post-operative phase following Non-Cardiac Surgery WITH history of CABG, PCI, or Valve Replacement**
- **Who are DNR WITH Symptomatic Arrhythmia**
- **Significant Electrolyte Abnormalities WITH ECG Changes**
- **With neurologic conditions with potential for autonomic dysfunction**

Order must be renewed after 48 hours (when clinically indicated or useful to continue telemetry monitoring)

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Class III - Cardiac monitoring is not indicated because the patient's risk is so low that monitoring is not of therapeutic benefit. Patients in Class III include adult patients:

- **In Early Post-operative Phase following Surgery WITHOUT Active Cardiac Disease**
- **Without Significant Cardiac Conditions during Labor and Delivery**
- **With Permanent, Rate-controlled Atrial Fibrillation**
- **Undergoing Hemodialysis WITHOUT Metabolic Derangements**
- **Stable patients with Chronic Ventricular Premature Beats**
- **With Chronic, Stable Angina**
- **With Terminal Illness who are NOT Candidates for Treatment of Arrhythmias**
- **Patients designated as DNR-CC (Comfort Care)**

If telemetry placed on Class III patients, telemetry monitoring is limited to 24 hours.

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ST/QT Monitoring is Not For Everyone

- **ST Segment Monitoring:**
  - Acute coronary syndrome or equivalent.
  - S/p coronary interventions
 - At High Risk for Ischemia After Cardiac or Non-cardiac Surgery

- **QT Interval Monitoring:**
  - With Risk for Torsades de Pointes OR Receiving an Antiarrhythmic Drug Known to Cause Torsades de Pointes
  - Who Overdose From a Potentially Pro-arrhythmic Agent
  - With High Degree AV block
  - With Severe Hypokalemia or Hypomagnesemia
  - With Acute Neurological Events

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SANS-Secondary Alert Notification System

Objective: Increase the ability of clinical staff to respond to critical physiologic monitoring alarms through closed loop communication.

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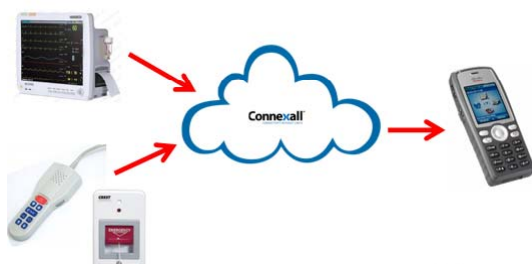
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Escalation Process

Primary Secondary Backup caregiver

Alerts transmitted to Cisco phones:

V Tach	(**RN ➔ RN ➔ Charge RN**)
V Fib	(**RN ➔ RN ➔ Charge RN**
Asystole	(**RN ➔ RN ➔ Charge RN**)
Leads off	(**PCA➔ RN ➔ RN**)
Low Battery/No Telem	(**PCA➔ RN ➔ RN**)

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Ross Alarm Data: October 15-21, 2013

Alarm	Total	Percentage
Asystole	290	0.54
V Fib	26	0.05
V Tach	812	1.51
Leads Off Total	3786	7.05
Brady	12147	22.62
Tachy	4205	7.83
HR HI	1338	2.49
HR LO	11306	21.06
SPO2 LO	19787	36.85
Total	**53697**	

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Impact on Resources

- Inappropriate use of telemetry beds can have untoward effects including:
  - increasing ED census leading to overcrowding and boarding
  - increasing overall demand for resources
  - creating a false sense of security and increased likelihood of alarm fatigue which may increase the risk of missing a meaningful alarm

Impact on Resource-Monitored Transports

Monitored Transportation Appointments by Week
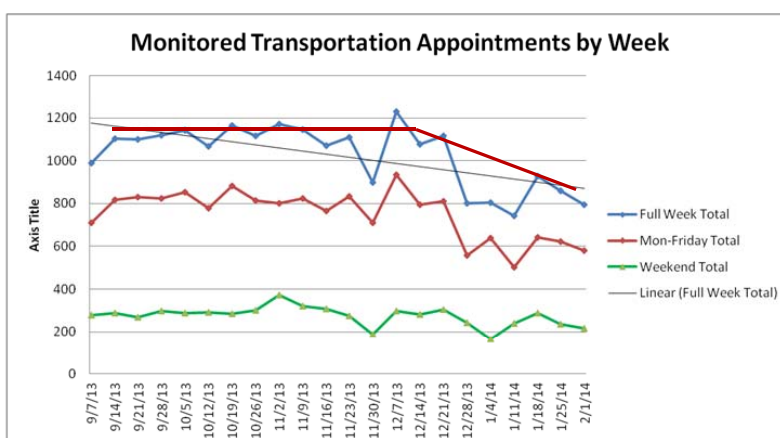
Policy Date 12-17

I feel that my patient is safer with continuous cardiac monitoring.

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Myths about Cardiac Monitoring

- *My patient is safer when on the monitor because staff will be alerted to a change in condition.*

- Clinical alarms designed to alert nurses to changes in their patients' conditions have become a continual stream of noise that poses a significant <u>threat to patient safety.</u>

- Fatigued clinicians may ignore alarms and/or take steps to reduce the noise.

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Myths about Cardiac Monitoring

- All Ross, PCU or Stepdown patients require continuous cardiac monitoring.

- Patient condition, <u>not unit location</u>, should be the driver for the monitoring order.

- Some patients may require a higher level of nursing care without needing continuous cardiac monitoring.

- The application of a cardiac monitor does not in itself increase the acuity level.

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NPSG 6 and Ongoing Initiatives

- EMR
  - Safety Fellowship

- Pulse oximetry

- Potential future projects
  - Smart alarms
  - Best practice alerts

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Take Aways-What can I do?

- Communication related to the new Policy
  - Ask daily on rounds if patient needs telemetry

- Customize alarms
  - Individualize

- Reduce noise be decreasing false alarms
  - Change patches
  - Batteries
  - Skin prep

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OSUWMC The medical center is committed to decreasing alarm fatigue and communicating the right alarms to the right individuals at the right time.

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Evaluation

Upon completion of this educational activity, you will receive an electronic evaluation from The Center for Continuing Medical Education (CCME). Please complete this evaluation as your feedback is imperative to the quality of this educational activity.

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A few reminders…

Please make sure the you have signed in out front.

If you do not already have an account on the CCME website, please go to http://ccme.osu.edu and create one.

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