EP 33: The structures(s) and process(es) used by the organization to allocate and/or reallocate resources to monitor and improve the quality of nursing and total patient care. The nurse has the responsibility for ensuring the coordination of care among other disciplines and support staff.

There are a number of structures and processes used at MGH to allocate and, when necessary, reallocate resources to monitor and improve the quality of nursing care. These include processes that ensure a sufficient amount of nursing care hours for patient care needs; patient care delivery models based on a high percentage of Registered Nurse hours to support the role of the Staff Nurse as central to coordination of care; a strong, unit-based, nursing leadership team that focuses on quality nursing care; mechanisms to reallocate resources when necessary to promote quality care; support from departments focused on quality; and resources that allow and promote Staff Nurse participation in performance improvement activities.

In addition, the support and educational programs provided by The Norman Knight Center for Clinical & Professional Development, described in OOD 10, provide nurses the educational support needed to engage in quality improvement activities in the organization, and the Center for Innovations within the Institute for Patient Care, described in NK 8, provides an additional structure to meet quality patient care needs, and foster, study, and promote innovations in care.

Sufficient Amount of Direct Nursing Care Hours

The ongoing measurement of nursing workload is the primary mechanism used to ensure adequate nurse staffing. Nursing workload for a nursing unit/department is a function of both the number of patients and the nursing care needs (i.e., acuity) of patients. In addition, other factors, such as the work of admission, discharge and transfers, impact a unit’s workload and must be considered. For the 38 MGH inpatient care units, this is accomplished using data from the QuadraMed® AcuityPlus™ Productivity, Benchmarking and Outcomes System (AcuityPlus™ System) in determining the operational budget and monitoring the ongoing performance in relation to the established budget targets. In addition, external benchmarks are used as a comparison for internally developed staffing targets.

EP 8 describes how nursing leadership uses trended data to develop the operational budgets for nursing units which create the planned staffing and necessary resources for the MGH Care Delivery Model. It details the process used to develop the operational budgets for nursing departments, including quantification of workload to determine the required personnel, salary expenses and non-salary resources.

EP 12 discusses how nurses analyze data to guide decisions regarding budget formulation, implementation, monitoring, and evaluation. The information included for monitoring and evaluation of budgeted resources, also applies here to the allocation and reallocation or resources to improve total patient care. The close monitoring of workload/productivity data assists in quick identification of patient care units who may be experiencing issues with adequate staffing levels, based on both the volume and acuity of patient care. This occurs on the unit level where Staff Nurses functioning in the resource nurse role have the authority to alter staffing for a shift or day, as well when a longer trend indicated the need for a more permanent change. As in the example described in TL 2 and EP 8 involving the Hematology/Oncology Unit (Lunder 9 - formerly Philips House 21), the monitoring of Workload/Productivity data indicated the need for a mid-year correction of the number of nurses that could be hired for the unit so as to staff adequately for the unexpectedly high census.

Typically Nursing Directors and Associate Chief Nurses are involved in these types of decisions, involving a relatively small variance from an approved budget, and the CNO is kept
apprised during routine meetings. During some fiscal years these changes to budgeted FTEs are made mid-year, and during others the approved variance is noted and then budget adjustments are made for the next budget cycle. In the example provided above, Lunder 9 was allowed to hire Staff Nurses beyond FY’12 budgeted FTEs and the budget created for FY’13 included an increase of 4.0 FTEs direct care FTEs.

Variances that are larger and expected to continue over time are typically due to some previously unpredicted factor and generally involve the Nursing Director, Associate Chief Nurse and the CNO in determining the best course of action. An example of this type of a need for additional, unbudgeted resources also occurred with the opening of the Lunder Building and involved a change in Post Anesthesia Care Units (PACUs). Three units were previously located on one floor of the hospital. After the move in September 2011, five PACUs were located on three floors. Despite months of planning, the PACU staff experienced unexpected challenges in patient flow which could not be managed by the previous existing staff. There was an immediate increase in the percentage of PACU delays, which indicates that the PACUs could not accommodate a patient that has completed surgery.

This issue was quickly identified by the PACU Nursing Director and Clinical Nurse Managers, who communicated the issue to the Associate Chief Nurse for Perioperative Services. The issue was also substantiated in the monthly metrics monitored by Perioperative Administration. Senior Vice Presidents were made aware of the issue and the PACU Nursing Director was allowed to hire additional Staff Nurses to accommodate the work. This immediately improved throughput and the percentage of PACU Delays was reduced for the next month – an improvement that has been sustained. An additional 12.0 Staff Nurse FTEs for the PACUs were then approved during the formal FY’13 budget process.

Occasionally, there is the need to allocate and reallocate resources on a much larger scale and this always involves decisions the Senior Vice President level where the Senior Vice President for Patient Care Service and Chief Nurse advocates for the staff needed to provide quality nursing care. One example of this was the plans to use vacated space on Bigelow 7 for a new Short Stay Unit, as described in TL 2. This was first proposed at the Senior VP level by the CNO when the space became available in January 2012. Once the Senior VPs agreed to explore this, leadership of the departments that would be involved were brought in to propose the necessary human, non-salary, and capital resources. The Associate Chief Nurse and the Nursing Director for the Emergency Department (Ellison and Lunder 1) and the Emergency Department Observation Unit (Bigelow 12) participated in developing a staffing plan for the proposed 18-bed unit. The unit was considered during the planned budget cycle that occurred April through June 2012. As the space was available and the need for this unit was supported as one immediate strategy to reduce boarder patients in the Emergency Department, the Senior Vice President Team supported the plans for the unit and provided approval for the unit to open at the end of summer 2012, representing a significant mid-year allocation of resources and variance from planned budgets.
A significant allocation or reallocation may also occur in response to a quality concern or sentinel event. Although a rare occurrence, the MGH reporting and quality structures support the need for resource allocation and reallocation needed to resolve these events. An example of a sentinel event that occurred at MGH and resulted in unplanned allocation of resources is provided at the end of this section.

![% PACU Delayed Cases & Actual PACU FTEs Used](image)

External benchmarks are also used by MGH nursing leadership to evaluate the appropriateness of internal budget targets and staffing adequacy. Submission of data to the National Database of Nursing Quality Indicators (NDNQI) and to the state of Massachusetts through PatientCareLink ([www.patientcarelink.org](http://www.patientcarelink.org)) allows for comparison of staffing based on Worked Hours Per Patient Day (WHPPD). Although a limited indicator in that it only uses the number of patients in a time period, that is patient days, as a denominator, it is one of the few metrics available for comparison on a national basis.

The following table shows that MGH actual staffing for FY 2011 compares favorably in almost all categories to staffing provided by other hospitals submitting data to NDNQI that have 500 beds or more, and to hospitals that are classified as Academic Medical Centers (AMCs):
National Database of Nursing Quality Indicators
Total Nursing Hours (WHPPD)

<table>
<thead>
<tr>
<th></th>
<th>&gt; 500 Beds</th>
<th>Average</th>
<th>AMCs</th>
<th>Average</th>
<th>MGH FY’11 Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean*</td>
<td># Units</td>
<td>Mean*</td>
<td># Units</td>
<td></td>
</tr>
<tr>
<td>Adult Critical Care</td>
<td>18.0</td>
<td>524.0</td>
<td>18.2</td>
<td>489.4</td>
<td>22.4</td>
</tr>
<tr>
<td>Adult Surgical</td>
<td>9.1</td>
<td>514.6</td>
<td>9.4</td>
<td>488.8</td>
<td>9.7</td>
</tr>
<tr>
<td>Adult Medical</td>
<td>8.9</td>
<td>363.0</td>
<td>9.1</td>
<td>350.5</td>
<td>10.2</td>
</tr>
<tr>
<td>Adult Medical Surgical</td>
<td>9.1</td>
<td>277.8</td>
<td>9.3</td>
<td>322.8</td>
<td>9.8</td>
</tr>
<tr>
<td>Pediatric Critical Care</td>
<td>18.1</td>
<td>57.8</td>
<td>20.3</td>
<td>71.9</td>
<td>23.1</td>
</tr>
<tr>
<td>Pediatric Medical Surgical</td>
<td>10.5</td>
<td>86.6</td>
<td>11.0</td>
<td>107.1</td>
<td>10.2</td>
</tr>
<tr>
<td>Neonatal Critical Care</td>
<td>12.2</td>
<td>75.8</td>
<td>12.7</td>
<td>86.4</td>
<td>14.0</td>
</tr>
<tr>
<td>Adult Psychiatric</td>
<td>7.8</td>
<td>95.6</td>
<td>7.8</td>
<td>97.4</td>
<td>8.4</td>
</tr>
</tbody>
</table>

* Average of 8 quarters of data from CY 2010 Q2 through CY 2012 Q1

MGH is also able to compare WHHPD on a state level through its participation in PatientCareLink where all hospitals in the state submit budgeted staffing plans and actual staffing provided on an annual basis. The following table shows that MGH actual staffing compares favorably in almost all categories to staffing provided by other hospitals in the state that have more than 500 beds and 60,000 Emergency Department visits.

PatientCareLink FY’11 Staffing Data
(WHPPD)

<table>
<thead>
<tr>
<th></th>
<th>#Units</th>
<th>Average</th>
<th>Planned Median</th>
<th>Actual Median</th>
<th>MGH FY’11 Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Critical Care</td>
<td>32</td>
<td>20.7</td>
<td>20.2</td>
<td>21.9</td>
<td>22.4</td>
</tr>
<tr>
<td>Adult Surgical</td>
<td>27</td>
<td>9.6</td>
<td>9.7</td>
<td>9.7</td>
<td>9.7</td>
</tr>
<tr>
<td>Adult Medical</td>
<td>49</td>
<td>9.8</td>
<td>9.6</td>
<td>9.9</td>
<td>10.2</td>
</tr>
<tr>
<td>Adult Medical Surgical</td>
<td>21</td>
<td>8.9</td>
<td>8.8</td>
<td>9.0</td>
<td>9.8</td>
</tr>
<tr>
<td>Pediatric Critical Care</td>
<td>9</td>
<td>21.0</td>
<td>19.9</td>
<td>22.3</td>
<td>23.1</td>
</tr>
<tr>
<td>Pediatric Medical Surgical</td>
<td>26</td>
<td>13.9</td>
<td>11.0</td>
<td>11.5</td>
<td>10.2</td>
</tr>
<tr>
<td>Neonatal Critical Care</td>
<td>11</td>
<td>12.9</td>
<td>11.7</td>
<td>12.7</td>
<td>14.0</td>
</tr>
<tr>
<td>Behavioral Health Adult</td>
<td>25</td>
<td>6.7</td>
<td>6.7</td>
<td>6.9</td>
<td>8.4</td>
</tr>
</tbody>
</table>

Emergency Departments with > 60,000 visits

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Average</th>
<th>Median</th>
<th>Median</th>
<th>FY’11 Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Department</td>
<td>11</td>
<td>2.4</td>
<td>2.4</td>
<td>2.6</td>
<td>3.3</td>
</tr>
</tbody>
</table>

A number of reports are available to nursing leaders that assist in monitoring the utilization of personnel resources and ensuring the utilization is consistent with established staffing plans and schedules, which consider both patient care needs and models of care. These include full-time equivalent (FTE) utilization, filled positions/vacancy, financial performance, workload/productivity and flexible budget reports.
Nurse “Rich” Patient Care Delivery Models

The patient care delivery models for the 38 MGH inpatient units also support the central role of the Staff Nurse in quality and coordination of care. For example, MGH staffing is planned with a much higher mix of Staff Nurses to unlicensed personnel than in most academic medical centers. This is purposeful in promoting the critical role of the Staff Nurse in Patient Care Delivery Model described in OOD 11:

Within the Patient Care Delivery Model, the nurse is depicted as leading a variety of initiatives within the delivery of patient care. Multiple elements contained within a nursing role (e.g. accountability, autonomy, authority, advocacy, cultural competency) are implemented in creative ways responsive to the practice setting, thus promoting the optimization of professional practice across settings.

Five units have a model based on a 100% RN staff:

- Pediatric Intensive Care Unit (Bigelow 6)
- Neonatal Intensive Care Unit (Blake 10)
- Family/Newborn Unit (Ellison 13)
- Family/Newborn Unit (Blake 13)
- General Medicine Unit (Bigelow 11)

The staffing models for these two pediatric critical care and two obstetrical units were planned to be 100% RN due to the complexity of care for high risk mothers and infants. The all-RN model on General Medicine Unit (Bigelow 11) began several years ago as a pilot to determine if staff nurse requirements would be reduced and care become more efficient when the Staff Nurse responsibility of delegation was eliminated. These are all considered successful models for the patient population cared for on these units, and although they are evaluated on an annual basis, have been supported as part of a long term strategy for ensuring quality care.

The six adult critical care units are planned with an RN percent of 89%, and the remaining 24 inpatient units have an RN percent of approximately 83%. Again, these budget targets are purposefully higher than that experienced in other hospitals. The RN mix targets are reviewed at least annually as part of the formal operational budgeting process and includes input from the Associate Chief Nurses and Nursing Directors.

### National Database of Nursing Quality Indicators

<table>
<thead>
<tr>
<th></th>
<th>Percentage of Total Nursing Hours Supplied by RNs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median* # Units</td>
</tr>
<tr>
<td>&gt; 500 Beds</td>
<td>Adult Critical Care 88.9% 492.1</td>
</tr>
<tr>
<td></td>
<td>Adult Surgical 69.0% 518.1</td>
</tr>
<tr>
<td></td>
<td>Adult Medical 70.5% 366.3</td>
</tr>
<tr>
<td></td>
<td>Adult Medical/Surgical 69.4% 279.6</td>
</tr>
<tr>
<td></td>
<td>Pediatric Critical Care 94.2% 58.5</td>
</tr>
<tr>
<td></td>
<td>Pediatric Med/Surg 78.6% 87.1</td>
</tr>
<tr>
<td></td>
<td>Neonatal Critical Care 95.9% 78.3</td>
</tr>
<tr>
<td></td>
<td>Adult Psychiatric 55.8% 97.6</td>
</tr>
</tbody>
</table>

* Average of 8 quarters of data from CY 2010 Q2 through CY 2012 Q1
Unit Leadership

To support quality patient care, MGH also supports a strong nursing leadership team at the unit level, which includes both a Nursing Director and a unit-based Clinical Nurse Specialist. Again, in regards to the MGH patient delivery model (OOD 11), “decisions about care and the environment of care are made at the practice level by clinical staff and unit leadership”. At a time when many hospitals are reducing the number of leadership positions and increasing the scope of front line managers, MGH continues to justify and increase nursing leadership positions. The following presents the number of budgeted FTEs for Nursing Directors by fiscal year:

<table>
<thead>
<tr>
<th></th>
<th>FY'09</th>
<th>FY'10</th>
<th>FY'11</th>
<th>FY'12</th>
<th>FY'13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing Director FTEs</td>
<td>44.70</td>
<td>45.70</td>
<td>46.70</td>
<td>47.70</td>
<td>49.70</td>
</tr>
</tbody>
</table>

The increase in FTEs usually occurs for one of two reasons; a planned change to reduce the scope of a Nursing Director’s responsibilities, or the purposeful inclusion of a Nursing Director when planning a new clinical area. The scope of each Nursing Director is evaluated at least annually. Attachment EP 33.a contains a portion of the summary document created during the FY’13 budget process to review Nursing Director scope based on the FY’12 FTE budget. The section highlighted in yellow shows that in the Surgical Nursing service, two Nursing Directors each have responsibility for covering two inpatient nursing units (i.e. 0.5 FTE attributed to each unit). One Nursing Director covers the Plastic Surgery, Burn and Burn Intensive Care Unit (Bigelow 13) and the Transplant Unit (Blake 6), totaling 95.5 budgeted FTEs. Another Nursing Director covers General Surgery (White 7) and General Surgery (Ellison 7), totaling 133.6 budgeted FTEs. A decision was made in the budget process for FY’13 to add 1.0 of a Nursing Director FTE to allow the two general surgery units to have dedicated Nursing Directors. Likewise, the budget process for FY’13 also included a proposal for a new Short Stay Unit to be created on vacated space on Bigelow 7. As presented in TL 2, a nursing leadership team consisting of a Nursing Director and Clinical Nurse Specialist were included and approved for that purpose.

The changes that occurred in budgeted FTEs from FY 2009 through FY 2013 were due to the following:

- FY’09 – FY’10 – Added 1.0 FTE to allow General Medicine (Phillips House 20) and Hematology/Oncology Unit (Phillips House 21) dedicated Nursing Directors
- FY’10 – FY’11 – Added 1.0 FTE for Nursing Director in Oncology due to expansion of Radiation Oncology into the Lunder Building
- FY’11 – FY’12 – Added 1.0 FTE for Nursing Director for new Surgical ICU (Blake 12)
- FY’12 – FY’13 – Added 1.0 FTE for Nursing Directors to allow General Surgery (White 7) and General Surgery (Ellison 7) dedicated Nursing Directors, and 1.0 for a Nursing Director for new Short Stay Unit (Bigelow 7).

In addition to Nursing Directors, the operational budgets include 62.7 FTEs of Clinical Nurse Specialists, providing almost all units with a dedicated clinical expert. Clinical Nurse Specialists are an invaluable resource to Staff Nurses as they engage in quality improvement activities. As clinical experts and nursing leaders, the CNSs mentor the Staff Nurse as they participate in quality improvement activities. Attachment EP 7.a includes an extensive table describing the qualifications of these CNSs, as well as their areas of clinical expertise.

The job descriptions for both of these nursing leadership roles includes performance expectations around clinical quality (see attachments TL.2 b and TL.2.c). The Nursing Director is
“accountable for the delivery of consistent, high quality patient care”, “providing operating efficiencies and insuring compliance with hospital and regulatory policies and standards of practice”; providing “an environment for effective patient-focused nursing care” and “high quality care with positive patient outcomes”; evaluates “the outcomes of patient care”; “participates in planning and carrying out to completion projects to improve the physical environment”; and leads and/or participates in performance improvement activities.” Likewise, the CNS job description includes the expectation of “continually evaluates quality and safety performance, identifies improvement opportunities, and plans and implements programs for improvement”.

**Structures and Resources that Support Staff Nurse Quality Improvement**

MGH and PCS Departments and structures, most that have been previously described, support nurses in providing quality care and in performance improvement activities. These include:

- **MGH Center for Quality and Safety -** The MGH Center for Quality and Safety (CQS) manages the Safety Reporting System, RL Solutions® and provides monthly and quarterly reports that aggregate the safety reports for each nursing unit. The CQS team, as described in EP 30 and EP 32, triage all safety reports and work with unit-based nursing leadership to perform root-cause analyses, develop action plans, and monitor success.

- **Patient Care Service Office of Quality and Safety -** Engaging nurses in quality improvement activities is the key to successful programs and initiatives that support quality patient care at MGH. The infrastructure described in OOD 25 is in place to facilitate participation and provide the resources, education and support needed for nurses to lead and contribute to organizational and unit level quality improvement initiatives. The nurses in this department manage the data for nursing sensitive indicators, disseminate the results to nursing leadership, and assist unit staff with quality improvement initiatives.

- **Collaborative Governance Practice and Quality Committees -** As described in SE 1, Collaborative Governance also provides an infrastructure of resources, education and support to facilitate staff involvement in quality improvement activities, both at the departmental and unit level. Staff Nurse members of Collaborative Governance committees receive formal orientation and training and ongoing mentoring and support from coaches.

- **Center for Innovations in Care Delivery -** The Center for Innovations in Care Delivery, presented in NK 8 is a component of The Institute for Patient Care, which offers resources and support to bring nursing and interdisciplinary teams together to identify opportunities to improve care, evaluate the impact of care and implement changes to improve the delivery of care.

**Paid Time**

Paid time is another resource that enables nurses to participate in departmental and unit-based quality improvement activities. As described in SE 1 and SE 2, 4.75% indirect time is added to the worked hours needed for each Patient Care Services nursing unit operating budget specifically for non-patient care activities; such as Staff Nurse orientation, education, administrative and project work. This allows Nursing Directors the flexibility to provide staff time to participate in quality
improvement activities and attend Collaborative Governance committees, without impacting patient care. The actual paid indirect time for the 38 inpatient units is estimated to be 5.8%, July 2012 YTD.

Performance Improvement Activities Supported by the PCS Center for Innovations

NK 8 describes MGH’s involvement in the Transforming Care at the Bedside (TCAB) initiative, an effort to provide nurses at the bedside with tools to improve efficiency in bedside patient care. Medical Unit (White 10) participated in the third round of TCAB hospitals. The model involves frontline, staff-generated ideas for process improvement and rapid cycle testing to determine if the ideas resulting in efficiencies, improved care, or staff satisfaction. During the two year study, this TCAB unit tested thirty-three tests of change and adopted eleven.

As part of the contract for involvement, MGH commits to items that impact financial and operational resources, such as funding of staff time for training and development; support for staff involvement on an on-going basis; conference attendance for unit leadership and Staff Nurses, data collection resources, and external data reporting. In addition, a Staff Specialist from the Institute for Patient Care’s Center for Innovation provided support to the unit to coach them in applying principles of rapid cycle improvement.

Since this unit’s involvement, some of these changes have been disseminated to other MGH units, including patient care supplies being available closer to the bedside, changes to Staff Nurse participation in morning multi-disciplinary rounds (TL 10 EO), and maximization of Staff Nurse break and lunch periods.

In 2010, AONE built on its success with TCAB and launched the Center for Care Innovation and Transformation (CIT). As described on the AONE website (www.aone.org/ccit), the CIT initiative “improves patient care, hospital performance, and employee satisfaction through the empowerment of frontline staff, innovation and leadership development.” MGH applied for this program and is again participating in the two-year initiative. The staff of the Gynecology/Oncology Unit (Phillips House 21) are currently actively engaged in the process and are working to improve care for patients while lowering costs by creating efficiencies. Here again, participation by MGH includes a commitment from nursing and hospital administration to support four face-to-face meetings (including travel related expenses), monthly conference calls, attendance and participation in CIT webinars, and data collection and submission.

As included in TL 4 and TL 4 EO, MGH Care Redesign has resulted in creation of twelve Innovation Units a new direct care delivery model. The model is based on enhancing the patient’s journey throughout the continuum of care, and involves the four components of:

- Relationship-Based Care
- Nurse Attending Role
- Enhancing Handover Communication
- Patient Welcome Packets

Successful change in the MGH care delivery model will require the involvement of the entire Hospital community, and commitment and cooperation from staff in varied departments throughout the hospital.

The following example is offered to demonstrate a recent event that involved allocation and reallocation of resources in response to a sentinel event:
Example - Reallocation of Resources in Response to a Quality Event - Physiological Alarm Monitoring

The MGH mission includes the endeavor to deliver the very best health care in a safe and compassionate environment, guided by the needs of patients and their families. Despite these efforts and commitment to safety, a tragic and unfortunate incident occurred at MGH in January 2010. This event required reallocation of personnel resources from multiple hospital departments to ensure an immediate response, a vigorous internal review, and then a longer term improvement process for physiologic alarm monitoring.

This event involved an 89-year-old male patient found unresponsive and apneic lying in his hospital bed. The patient had been continuously monitored by a bedside cardiac monitor. His bedside monitor did not announce or alarm for a lethal arrhythmia, and the lethal arrhythmia alarms and the bedside cardiac monitor alarm audio/volume were found to be off. The alarms were known to be functioning at the time of the patient’s admission two days earlier.

The patient had been progressing well and on a post-operative general care unit, he was out of bed with physical therapy and ambulating in the hall with nursing assistance, his diet had been advanced and he had visited with his family within an hour of this event.

At approximately 10:15 am on post operative day # 4, the patient was found pulseless and apneic and a Code Blue was called. The code team, consisting of medical and surgical residents, the surgical on-call attending, staff nurses and the clinical nurse supervisor, made every effort to resuscitate the patient, however, the efforts were unsuccessful.

Immediately following the code, nursing staff and code team members discovered, after reviewing the central monitoring station that the lethal arrhythmia alarms had inadvertently been turned off on this patient. The MGH Center for Quality and Safety (CQS) was immediately notified and a thorough investigation began. On the day of the event, a biomedical engineer was consulted to collect information from the bedside cardiac and central monitors, and nursing and biomedical engineering staff obtained logs from the central monitor.

The biomedical engineer confirmed that the lethal arrhythmia alarm setting (a default setting) had been turned off at the central station. In addition, the biomedical engineer discovered that the audible volume alarm on the bedside monitor had also been turned off. Immediately, all cardiac monitors on this surgical unit were checked for active functionality of lethal alarm settings and audibility of alarm volumes. In addition, biomedical engineering staff completely disabled the ability to suspend alarms.

Biomedical engineering’s initial review of the central monitor log demonstrated that two alarm notifications sounded for this patient before and during this event. The first audible alarm was a lower level sounding (2 beep warning) alarm that signaled for low oxygen saturation and had signaled before the event. This was followed by an audible alarm annunciating for bradycardia that rang for a prolonged period of time prior to the code. This bradycardia alarm has the same sounding 2 beep warning audible alarm that had been sounding for the low oxygen saturation alarm. Staff were unaware of and did not respond to these lower level alarms.

The OQS convened an emergency leadership meeting, which included leadership from nursing, hospital administration, and biomedical engineering, to discuss the event. They reviewed the findings and identified who would lead the investigation. A second meeting was held that afternoon to assess the status of the investigation. Biomedical engineering staff immediately began a unit to unit evaluation of alarm default settings and alarm audibility for the over 1100 monitoring devices within MGH. CQS staff interviewed, debriefed and offered support for the clinicians involved in the event. All Staff Nurses interviewed denied hearing the two beep warning alarm signal or announcement of the alarm situation on the visible alarm display units. Nursing
Leadership and the Employee Assistance Program were present to support staff during this time of crisis.

A Critical Alert email message was sent to the nursing leadership of all patient care units requesting that they verify that all bedside alarms were activated with audible volume and lethal arrhythmia default settings on. They were also asked to verify that the default alarm setting “off” option was disabled. The subsequent review by biomedical engineering department staff confirmed arrhythmia alarm default settings. They also performed a unit by unit review of the audibility of alarm volumes within hallways arrhythmia alarm default settings (i.e., distributed speaker systems) and reviewed the functionality of the hallway visible Alarm Display Units (ADU’s) on each floor. The audibility of volume annunciation for all bedside monitors alarms was set at a standard default setting of 50% of the full alarm volume. For the long term, the Biomedical Engineering Department developed a quality control review and audit process of default settings for future central monitoring installation or any systems upgrades.

The root cause analysis of the event revealed the following:

- Arrhythmia default alarms setting were discovered off (we were unable to determine when turned off or by whom).
- The ability to turn “OFF” the lethal arrhythmia default setting was unknown prior to this event.
- Staff held a false belief that the monitoring system would always alarm/signal for lethal arrhythmias.
- The monitoring system on this unit had been installed just eight months previous to this event and staff had educational gaps related to the system’s full functionality.
- The message displayed on central and bedside monitor indicating that arrhythmia alarms were off went unrecognized by nursing staff.
- The patient’s bedside monitor alarm volume had been silenced.
- Staff experienced alarm desensitization/ fatigue.
- The two-beep “warning” alarm notification sounded for prolonged period of time and the visible alarm notification on alarm display units (3 ADUs on the unit) went unrecognized by the staff.

This critical event highlighted the complexity of MGH monitoring systems, such as two different types of central monitoring systems, seven unique monitor models and multiple software versions. In addition, the review revealed the large number of patients on physiologic monitors without consistent standards for monitoring practices across all clinical areas. The event also raised awareness about the impact of alarm fatigue and desensitization related to multiple devices, equipment and noise levels within clinical settings. As reported in a recent study on alarm fatigue: “When alarm frequency is high, nurses are at risk for becoming desensitized to the alarms that are intended to protect their patients”.

The event was immediately reported to the Department of Public Health. During the continued investigation, the Centers for Medicaid and Medicare Services (CMS) arrived for an unannounced post-Joint Commission verification survey. CMS thoroughly reviewed this sentinel event, approved the initial actions and strongly encouraged the immediate implementation of the entire corrective action plan. A hospital-wide educational program on physiologic monitoring and alarms settings was developed and, based on the review conducted by Biomedical Engineering, additional Alarm Display Units (ADUs) and distributive alarm speakers were installed on select
patient units. An additional component of the short-term corrective action plan included the assignment of qualified Staff Nurses to continuously observe central monitors on every general care unit 24 hours a day until the distributive speakers were fully installed.

In March 2010, MGH launched a multidisciplinary Physiologic Monitoring Tiger Team with representation from Medicine, Emergency Department and Critical Care services, which included physicians, nursing leadership, clinical nurse specialists, biomedical engineering quality personnel, clinical engineers, administrators and ancillary staff members. The task of the Physiologic Monitoring Tiger Team was to focus on the development of clinical decision making tools for use when choosing to monitor a patient and to identify the key components of education and communication regarding the use of these tools. In addition, the team oversaw the development of practice standards related to the transport of the monitored patient from the patient care unit to a testing site and addressed alarm response.

The major outcomes from the Physiologic Monitoring Tiger Team included the development of standards for initial and daily assessment of ongoing need for electrocardiogram (ECG) and/or monitoring of pulse oximetry based on patient-specific risk assessments. The following monitoring risk assessment categories were identified:

- **High Risk**: continuous monitoring;
- **Moderate Risk**: continuous monitoring with supervised removal;
- **Low Risk**: intermittent monitoring; and
- **No risk**: monitoring not clinically indicated.

Clinical guidelines for ECG and pulse oximetry monitoring call for daily risk assessment of patients using three risk categories: high, moderate, low. The risk assessment category drives the requirement for monitoring and patient placement. For example, patients assessed at high risk require continuous monitoring, must travel accompanied by a licensed professional, and be cared for on a critical care or step-down unit (attachment EP 33.b). Whereas for patients assessed at low risk, medical and nursing staff collaborate to determine the monitoring requirements, the most appropriate clinical placement for the patient, and travel monitoring requirements. Enhancements were made to the provider order entry (POE) order screens for ECG and Pulse Oximetry Monitoring to support and guide this clinical decision making (attachment EP 33.c).

Alarm default settings were also reviewed by the Tiger Team and decisions were made to adjust some default settings for less clinically relevant settings in an attempt to lower the number of nuisance alarm situations for the clinical practice setting. A Physiologic Monitoring Tiger Team progress report presented in October 2010 is attached as attachment EP 33.d. In addition, an update on the educational program, branded “Every Alarm Warrants Action”, focused on the technical competency needed to support a culture of alarm awareness and responsiveness, was included in the January 6, 2011 Caring Headlines (attachment EP 33.e).

This event required immediate action and allocation of resources to address a serious safety concern. Action began at the unit level, was communicated through the Quality & Safety programs, and ultimately involved and hospital leadership and staff at all levels. The significant reallocation of employees in several departments, additional nursing staff initially used in the roles of RN monitors, the purchase of new monitoring equipment, and the ongoing resources required for long term performance improvement, such as the tiger team members’ involvement and the educational program development was approved at the hospital’s Senior Vice President level. The perspective of the CNO in providing leadership during this challenging time was included as EP 13.c.

---

## FY'12 FTE Budget by Role Group - Surgical and Medical Nursing Services

<table>
<thead>
<tr>
<th>Unit Name</th>
<th>Nursing Director</th>
<th>CNS</th>
<th>Other RN</th>
<th>Staff Nurse</th>
<th>Non RN Direct</th>
<th>Other Providers</th>
<th>OM</th>
<th>OA</th>
<th>USA</th>
<th>Total</th>
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<tbody>
<tr>
<td>Surgical ICU (Ellison 4)</td>
<td>1.0</td>
<td>1.0</td>
<td>0.0</td>
<td>76.8</td>
<td>11.3</td>
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<td>Transplant Unit (Blake 6)</td>
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<tr>
<td>General Surgery (White 7)</td>
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<td>0.8</td>
<td>0.0</td>
<td>39.9</td>
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<tr>
<td>General Surgery (Ellison 7)</td>
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<td>0.0</td>
<td>51.7</td>
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<td>26.2</td>
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<td>Medical ICU (Blake 7)</td>
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<td>7.0</td>
<td>6.0</td>
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<td></td>
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<td>5.0</td>
<td></td>
<td>55.8</td>
</tr>
<tr>
<td>General Medicine (White 9)</td>
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<td>1.0</td>
<td>1.0</td>
<td>37.0</td>
<td>7.5</td>
<td></td>
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<td>5.3</td>
<td></td>
<td>58.1</td>
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<td>0.0</td>
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<td>6.3</td>
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<td>59.7</td>
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<td>5.4</td>
<td></td>
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<td>General Medicine (White 11)</td>
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<td>1.0</td>
<td>1.0</td>
<td>35.4</td>
<td>7.4</td>
<td></td>
<td>6.3</td>
<td>5.5</td>
<td></td>
<td>57.6</td>
</tr>
<tr>
<td>Clinical Research (White 13)</td>
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<td>0.4</td>
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<td>Hemodialysis Unit (Bigelow 10)</td>
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<td>3.7</td>
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<td>2.5</td>
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<tr>
<td>Anticoagulation Service (POB 1)</td>
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<td>0.0</td>
<td>9.5</td>
<td></td>
<td>4.0</td>
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<td>15.3</td>
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<tr>
<td>Medical Nursing</td>
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<td>10.6</td>
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<td>387.9</td>
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<td>4.4</td>
<td>0.0</td>
<td>60.1</td>
<td>53.3</td>
<td>601.4</td>
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</tbody>
</table>
Clinical Guidelines for ECG Monitoring  
(Adapted from AHA guidelines)

Assess patient risk for life-threatening arrhythmia, ischemia, or hemodynamic instability in the next 24 hours, using the 3 risk categories:

<table>
<thead>
<tr>
<th>Monitoring Requirement</th>
<th>High Risk</th>
<th>Moderate Risk</th>
<th>Low Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continuous Monitoring</td>
<td>Continuous Monitoring with Supervised Removal – may be removed in presence of licensed clinical personnel</td>
<td>Intermittent – may be removed without supervision</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Travel Requirement</th>
<th>With monitor Accompanied by MD or RN</th>
<th>With monitor Accompanied by MD or RN</th>
<th>Determined by Care Team</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Patient Placement</th>
<th>ED/ Critical Care units/ Step-down units</th>
<th>ED/Critical Care units/ Step-down units/General Care units</th>
<th>ED/Critical Care units/ Step-down units/General Care units</th>
</tr>
</thead>
</table>

| Examples Include: | s/p cardiopulmonary arrest, early phase of acute coronary syndromes/STEMI, major trauma, major surgery, acute respiratory failure, sepsis | Syncope, chest pain syndromes, actual/risk for widening QT interval, improving/stabilizing previously high risk patients, complicated alcohol withdrawal, continuous narcotic infusion | Rate controlled atrial fibrillation, uncomplicated alcohol withdrawal, post-op, hemodialysis Intermittent monitoring may be used to guide therapy or make a diagnosis |
POE Screen Shot: Adult/Pediatric

- **ECG Monitoring**
  - **High Risk**
    - Continuous monitoring.
    - Travel with monitor and licensed personnel.
  - **Moderate Risk**
    - Continuous monitoring with supervised removal.
    - Travel with monitor and licensed personnel.
  - **Low Risk**
    - Intermittent monitoring - may be removed without supervision. Care team determines travel needs.

- **Pulse Oximetry Monitoring**
  - **High Risk**
    - Continuous monitoring.
    - Travel with monitor and licensed personnel.
  - **Moderate Risk**
    - Continuous monitoring with supervised removal.
    - Travel with monitor and licensed personnel.
  - **Low Risk**
    - Intermittent monitoring - Check with VS per unit standard and/or change in condition. Care team determines travel needs.

- **Pulse Volume Recording (PVR)**
  - **Frequency:**
  - **Site:**
Physiologic Monitoring
Interdisciplinary Tiger Team
Recommendations

October 26, 2010

Background
- Jan 2010 - Critical incident
- Feb 2010 - CMS visit
- Short-term response
  - Standardized alarm volume defaults at the bedside and centrally
  - Installed distributed speaker systems ($350,000)
  - Implemented a review approval process for any variation requests from institutional standards
  - Implemented RN re-education
- Awareness raised:
  - Large number of patients on physiologic monitors
  - Excessive monitor alarms → alarm fatigue / desensitization
  - Confusion regarding monitoring system technology
  - Lack of consistent standards for monitoring practices (i.e. MD orders, alarm response, patient transport)
- Need identified for comprehensive review of physiologic monitoring program

Physiologic Monitoring Tiger Team Initiative
- Initiated by Greg Myers, MD, Jeanette Ives Erickson, RN
- March 2010
- Multi-disciplinary team led by Theresa Gallivan, RN, Chris Coley, MD
- Charge
  - Critically review MGH practice standards, evidence-based practice and research on physiologic monitoring and alarm management
  - Make recommendations regarding criteria for and management of physiologic monitoring
  - Review recommendations for patient placement standards/criteria
- Goal
  - Develop recommendations to improve physiologic monitoring systems and responses to ensure a safe, evidence-based, and reliable monitoring program for patients.

Framing Tiger Team Work
Clinical alarms a national safety concern
- 2002 JC NPSG to improve effectiveness of clinical alarms
- 2004 Incorporated into JC Environment of Care standards
- 2005 AHTF identified opportunities to enhance clinical alarm design
- 2010 ECRI Institute identified alarms as #2 of the top ten health technology hazards
- Majority of alarms “nuisance” or false-positive alarms
  - 10% of alarms clinically relevant
  - 1% require intervention

Johns Hopkins’ experience
- 2005 - began alarm safety initiative following critical event
- Found 16,934 alarms in a 15 bed progressive care unit across an 18 day period
- 940 alarms each day / 40 alarms per hour
- Remains a work in progress
- 2010 - Have decreased critical alarms by 43%

MGH Monitor Utilization and Alarm Data
- No system to capture #’s of patients on physiologic monitors
  - POE orders for monitoring will provide excellent data source
- No system to capture alarm frequency
  - Biomed to purchase software to capture alarm frequency on a pilot unit in fall

ECG Monitoring
- Additional 248 Monitored ICU / step-down beds, plus ED, procedural and recovery bays
Supporting Work

Physiologic Monitoring Tiger Team

Transport Monitors
- Anticipate increase in the number of patients who will require monitoring during transport to diagnostic/interventional areas and between care units
- Developed recommendations for minimal availability of transport monitoring equipment (one dedicated transport monitor per 25 beds)
- Cardiac Units (Ellison 8, 10, 11) will require additional transport monitors:
  - 7 Recorders
  - 4 Pulse Oximetry Monitors
  - 5 Defibrillator/Monitors
  - 18 GE Dash 3000 Monitors

Supporting Work

Recommendation for Ongoing Oversight
- Create a multi-disciplinary committee of experts reporting thru CQS and Medical Policy to provide ongoing oversight for physiologic monitoring
- Advise on application, purchasing and institutional monitoring standards
- Review and evaluate quality and utilization data (Examples: code calls, rapid response, safety reports, POE)
- Make recommendations relative to resource allocation (transport monitors and staffing)

Clinical Guidelines for ECG Monitoring
(Adapted from AHA guidelines)

Assess patient risk for life-threatening arrhythmia, ischemia, or hemodynamic instability in the next 24 hours, using the 3 risk categories:

- **High Risk**
  - Syncope, chest pain, acute coronary syndrome/STEMI, major trauma, major surgery, acute respiratory failure, sepsis

- **Moderate Risk**
  - Rate-controlled atrial fibrillation, uncomplicated alcohol withdrawal, post-op hemodialysis

- **Low Risk**
  - Anticipated monitoring may be used to guide therapy or make a diagnosis

**Monitoring Requirement**
- Continuous Monitoring with Supervised Removal – may be removed in presence of trained clinical personnel

**Transmit Requirement**
- 3rd monitor
  - Accompanied by MD or RN

**Patient Placement**
- ED Critical Care units/Step-down units
  - ED/Critical Care units/Step-down units/General Care units
  - ED/Critical Care units/Step-down units/General Care units
Assess patient risk for hypoxia / respiratory distress in the next 24 hours, using the 3 risk categories:

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Examples</th>
<th>Monitoring Requirement</th>
<th>Travel Requirement</th>
<th>Patient Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Risk</td>
<td>Increased ventilatory resistance, high risk airway, acute respiratory distress or decompensation, respiratory arrest.</td>
<td>Continuous Monitoring</td>
<td>With monitor accompanied by MD, RN or RRT</td>
<td>ED/Critical Care units/Step-down units/General Care units</td>
</tr>
<tr>
<td>Moderate Risk</td>
<td>Chronic cardiopulmonary disease, obstructive sleep apnea, post-operative/post-procedural, respiratory arrest</td>
<td>Continuous Monitoring with Supervised Removal — may be removed in presence of competent clinical personnel</td>
<td>With monitor accompanied by MD, RN or RRT</td>
<td>ED/Critical Care units/Step-down units/General Care units</td>
</tr>
<tr>
<td>Low Risk</td>
<td>Change in clinical condition</td>
<td>Intermission — oxygen saturation readings may be performed per MD order, until standards or with change in patient’s clinical condition</td>
<td>Determined by Care Team</td>
<td>ED/Critical Care units/Step-down units/General Care units</td>
</tr>
</tbody>
</table>

**Recommendations for Patient Status Alarm Default Settings**

**DECIDE**

- **A**rrhythmia: Reduce alarm levels
- **R**educe from “Advisory” to “Message”
- **E**ducate clinicians on the importance of reducing false alarms
- **C**linically Relevant Alarm: Reduce nuisance alarms
- **D**etermination of risk: Adjust alarm settings based on patient risk
- **E**nact policy changes

**GE Healthcare Patient Status Alarms Legend: Audio & Visual Display**

<table>
<thead>
<tr>
<th>Level</th>
<th>Tone</th>
<th>Visual</th>
<th>Auto Graph</th>
<th>Alarm History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crisis</td>
<td>3 Beeps</td>
<td>Flashing Text</td>
<td>Unit Based</td>
<td>Yes</td>
</tr>
<tr>
<td>Warning</td>
<td>2 Beeps</td>
<td>Flashing Text</td>
<td>Unit Based</td>
<td>Yes</td>
</tr>
<tr>
<td>Advisory</td>
<td>1 Beep</td>
<td>Flashing Text</td>
<td>NA</td>
<td>Yes</td>
</tr>
<tr>
<td>Message</td>
<td>No Sound</td>
<td>Flashing Text</td>
<td>NA</td>
<td>No</td>
</tr>
</tbody>
</table>

**Definitions – Common Language**

- **ADU (Alarm Display Unit)**: visual display of alarms, receives alarms from networked monitors and broadcasts to overhead ADU signs, allows all concurrent alarms without prioritization.
- **Alarm Fatigue**: inability to attend to alarms due to the high numbers of alarms a high percentage (>90%) of which are not clinically relevant.
- **Alarm Sensitivity**: establishing a narrow limit default setting will increase the likelihood of detecting clinically relevant events, but will result in a greater number of total alarms increasing the risk of alarm fatigue.
- **Alarm Specificity**: establishing a wide limit default setting will increase the detection rate of clinically relevant events, increasing the number of total alarms but may increase the possibility of missing a clinically relevant alarm.
- **Bedside Monitor**: multi-parameter physiological monitor for in-room monitoring.
- **Central Station**: receives, stores, and displays data from bedside or telemetry monitors.
- **Clinically Relevant Alarm**: an alarm for which a diagnostic or therapeutic decision is required to resolve or reduction in a technical problem is necessary.
- **CSS (Distributed Speaker System)**: audio broadcast of alarms, receives alarms from central monitor and broadcasts to overhead speakers, sounds all concurrent alarms without prioritization.
- **Nuisance** defines an alarm which occurs when a default limit has been exceeded for which no clinical intervention is necessary.
- **Parameter** defines the physiologic function (i.e., HR, NPB, RR, SpO2, PVC, etc.).
- **Parameter Limits**: physiologic range of a parameter.
- **Patient Status Alarms**: triggered by change in patient condition (i.e., exceed a parameter limit, arrhythmia event).
- **System Status Alarm**: triggered by mechanical or electrical problem (e.g., ECG lead fall, arrhythmia suspend, SpO2 probe off, no telemetry signal).
- **Telemetry**: wireless monitor for in-unit ambulation.
- **Transport Monitor**: portable monitor for off-unit transport.

**Next Steps (pending approvals)**

- Vet recommendations at CPC, Cardiology Division meeting, CQS Oversight Committee, GEC, PCSEC (mid-Oct)
- Complete MGH approval process for new/revised policies/guidelines: Nursing, CPR committee, Medical Policy committee (mid-Nov)
- Activate POE upgrades (Dec)
- Work with Center for Quality & Safety to enhance safety reporting fields to more accurately capture physiologic monitoring events (in progress)
- Develop & roll-out comprehensive communication / education plan for staff (in progress)

**Alarm Group**

- Reviewed MGH Physiologic Monitoring Systems
  - 2 monitoring systems - GE HealthCare and WelchAllyn
  - Monitors
    - Bedside: 9 models, 23 software versions
    - Telemetry
    - Transport
  - Communication of alarms: visual and auditory
  - Source of alarms: system and patient status alarms
- Reviewed Alarm Default Settings
  - Goals:
    - Minimize false-positive alarms
    - Make alarms relevant & actionable
    - Recommend changes to 25 of 117 patient status alarm default settings

Developed common language/definition of terms
Physiologic monitoring: Every alarm warrants action

Look for this campaign in January

— by Gino Chisari, RN, director, The Knight Nursing Center for Clinical & Professional Development

Every Alarm Warrants Action is the motto for the upcoming hospital-wide education initiative related to physiologic monitoring. But more than a motto, it’s what all care providers should think when they hear an alarm. Alarm-management, especially alarms associated with ECG and Pulse Oximetry monitors can be challenging. Some alarms may not require clinical intervention, but unanswered alarms result in increased, unnecessary noise and can cause clinicians to become desensitized to alarms when intervention is called for.

The Every Alarm Warrants Action campaign is designed to build on our culture of Excellence Every Day by reminding clinicians to respond whenever an alarm is heard. It may be something as simple as a disconnected lead or a probe intentionally removed by a patient so he/she can eat breakfast. Every alarm warrants immediate action, first to determine whether clinical intervention is required, and second (but equally important) to minimize noise and desensitization to alarms.

Beginning in January and running through March, The Knight Nursing Center for Clinical & Professional Development in collaboration with the Physiologic Monitoring Tiger Team will introduce a three-phase curriculum on alarm-management.

Phase 1 is geared toward nurses and provides alarm-management principles for the two monitoring systems used at MGH (GE Healthcare Dash/Solar and WelchAllyn Propaq). Phase 2 will introduce revisions to nursing-practice guidelines and provide a companion course for patient care associates. Phase 3 is designed for all care providers, including physicians and allied health professionals, and will provide important information related to whether it’s necessary for certain patients to be monitored electronically.

Each phase will be disseminated via HealthStream augmented by unit-based posters, a pocket reference guide, and a faculty-facilitated simulation exercise.

For the first time in a HealthStream education module, the course for Phase 1 alarm-management will incorporate video. We look forward to hearing your feedback. Every Alarm Warrants Action is more than a motto; it is literally—a call to action.

For more information about the alarm-management campaign, call the Knight Center at 3-6530.