

Continuum of Care Monitoring — Its Time Has Come

by Kathy Pelczarski

Hospitals are faced with increasing pressure to reduce the overall cost of patient care and to shorten hospital stays. At the same time, hospitals are caring for more acute care patients, many of whom have specialized patient monitoring needs. In response to this, patient monitoring device manufacturers have focused on developing patient monitoring systems that can easily meet a patient's monitoring needs through the "continuum of care." Continuum of care monitoring systems are designed to meet a patient's changing clinical needs by optimizing system adaptability whether the patient is moved throughout the hospital or remains in the same hospital bed.

ECRI prepared a survey in coordination with the American Association of Critical-Care Nurses (ACCN) to explore the extent to which continuum of care monitoring has been implemented and to assess its impact on patient care, operations, patient mix, costs, staffing, staff training, etc. Specifically, this survey focuses on the expansion of patient monitoring (i.e., bedside monitors, telemetry transmitters) outside traditionally monitored areas (e.g., critical care areas, stepdown or intermediate care areas) and issues associated with its implementation. We will use the term "continuum of care monitoring" to refer to patient monitoring being provided outside traditionally monitored areas.

Survey results contrast sharply with the monitoring status of hospitals less than a decade ago, when the vast majority of hospitals provided monitoring capabilities exclusively in critical care, stepdown, or intermediate care areas. At that time, critically ill patients typically progressed during their hospital stay from critical care bed to stepdown bed to med/surg bed to discharge. Highlights from the survey results reveal both surprising and anticipated trends. To summarize some of the more significant results:

- 63.8% of hospitals currently provide continuum of care monitoring.
- 57.5% of hospitals that do not currently provide continuum of care monitoring are either discussing or planning for implementation of continuum of care monitoring.
- 85.7% of hospitals indicated that implementation of continuum of care monitoring has reduced the demand for high-cost beds. Paradoxically, 80.7% of hospitals indicated "no impact" on the actual number of beds in traditionally monitored areas. In addition, 10.8% of the hospitals indicated an increase in the number of beds in traditionally monitored areas.
- Reduction or elimination of patient transfers between care areas was a significant benefit realized by hospitals with continuum of care monitoring (66.8% of hospitals indicated this benefit).
- Only 7.5% of hospitals locate central station displays for continuum of care monitoring in a centralized remote location (e.g., central surveillance area).



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- When asked about the required training for nurses in continuum of care monitoring areas, only 65% of the hospitals require clinical training regarding monitor use (e.g., setting alarm limits, using alarm recall functions). Only 71.2% require training regarding alarm awareness and response protocols. A somewhat higher 81.2% require clinical training regarding understanding monitoring information (e.g., recognizing arrhythmias) and appropriate intervention.
- Only 48.2% of the hospitals indicated that their nurses had “good acceptance, good adaptation” to continuum of care monitoring system implementation.

This survey was sent to 1,287 vice presidents/directors of nursing or patient care services. A total of 141 responses from 38 different states were received. We included one response per hospital (138 responses total) in our survey results database. We assume that many of the respondents gave approximate or estimated answers because some of the requested data is not typically tracked at most facilities. Therefore, these survey results are generally useful in demonstrating trends but may not precisely represent actual practices. The following graphs illustrate the percentage of responses per region and the bed size distribution of responding hospitals.

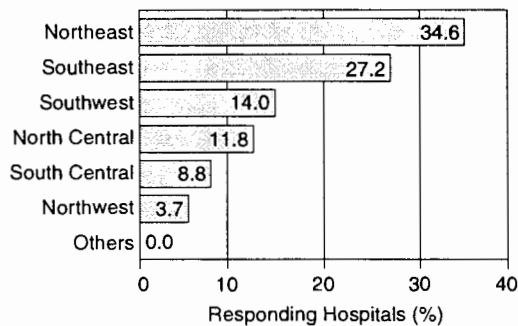


Figure 1: Responses by Region

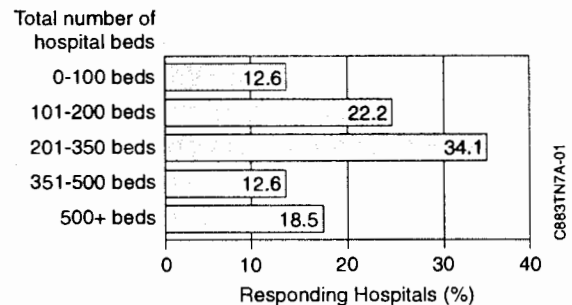


Figure 2: Responses by Hospital Bed Size

These survey results are organized as follows:

- Patient monitoring expansion
- Objectives for implementing continuum of care monitoring
- Continuum of care monitoring selection
- Continuum of care monitoring implementation issues

Patient Monitoring Expansion

Survey Results

1. Figure 3 displays the percentage of responding hospitals that currently provide patient monitoring outside traditionally monitored areas.
2. Figure 4 summarizes how the Figure 3 responses were further categorized by hospital bed size. Figure 5 represents how these responses were categorized by region.

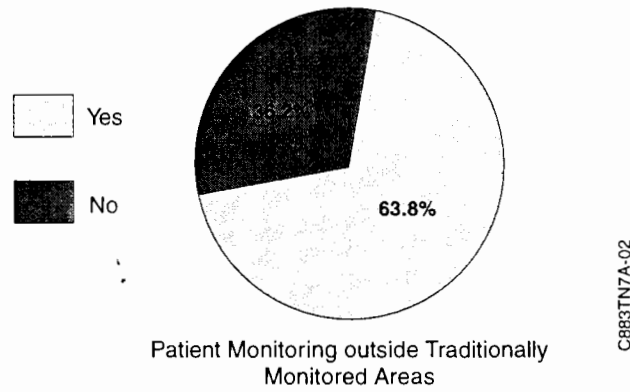


Figure 3: Hospitals Providing Continuum of Care Monitoring

Patient Monitoring outside Traditionally Monitored Areas	Overall (%)	Total Number of Hospital Beds				
		0-100 beds (%)	101-200 beds (%)	201-350 beds (%)	351-500 beds (%)	500+ beds (%)
Yes	63.8	81.2	66.7	69.6	52.9	52.0
No	36.2	18.8	33.3	30.4	47.1	48.0
Totals	100.0	100.0	100.0	100.0	100.0	100.0

Figure 4: Patient Monitoring Expansion/Hospital Bed Size

	Patient Monitoring outside Traditionally Monitored Areas		
	Yes	No	Totals
Overall	63.8%	36.2%	100.0%
Northeast Region	53.2%	46.8%	100.0%
Southeast Region	63.9%	36.1%	100.0%
North Central Region	75.0%	25.0%	100.0%
South Central Region	58.3%	41.7%	100.0%
Northwest Region	80.0%	20.0%	100.0%
Southwest Region	73.7%	26.3%	100.0%

Figure 5: Patient Monitoring Expansion by Region

- When responding hospitals (36.2% of total) that currently do not provide patient monitoring outside traditionally monitored areas were asked if they had definite plans to do so in the future, they responded as follows:
 - 42.4% — No plans; not considering patient monitoring expansion
 - 30.3% — Ongoing discussions; no definite plans
 - 21.2% — Yes, at some bedsides
 - 6.1% — Yes, at every bedside
- Figure 6 demonstrates the extent to which patient monitoring is provided by responding hospitals in terms of the percentage of total hospital beds that provide patient monitoring capabilities.

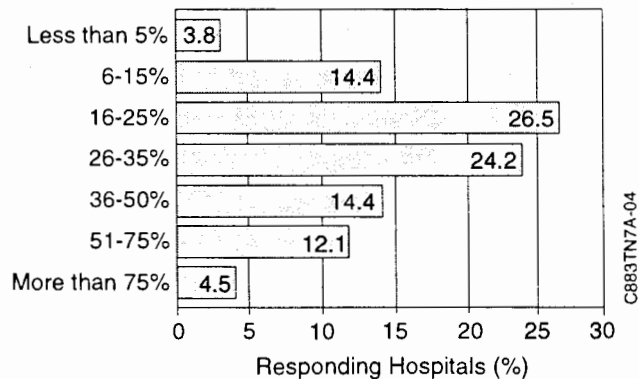


Figure 6: Percent Monitored Beds per Hospitals Responding

5. Figure 7 represents the percentage of total monitored beds that are located in traditionally monitored areas.

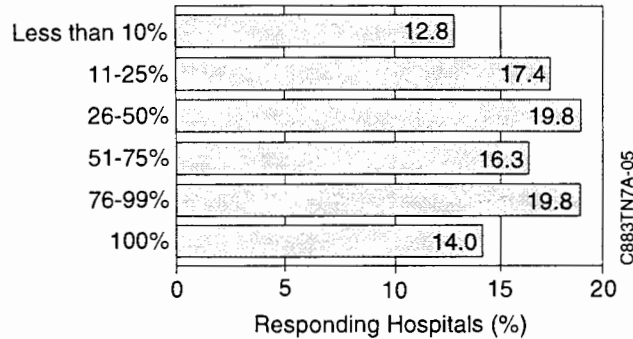


Figure 7: Percent Monitored Beds in Traditionally Monitored Areas

6. For responding hospitals that provide patient monitoring outside traditionally monitored areas, only 19.8% indicated that it was an ultimate hospital goal to provide patient monitoring at every bedside.

Discussion

Hospitals throughout the United States have expanded the use of patient monitoring in recent years, with the majority of hospitals, regardless of the hospital size or regional location, currently providing or planning to provide continuum of care monitoring. Regionally, the northwest and north central regions lead in the percentage of hospitals indicating expansion of patient monitoring outside traditionally monitored areas. Despite this patient monitoring expansion, the majority of responding hospitals still provide patient monitoring at less than 50% of their total hospital beds. However, a significant percentage of hospitals (16.6%) do provide patient monitoring at over 50% of their hospital beds. In addition, there has been a significant shift from hospitals providing patient monitoring primarily in traditionally monitored areas to hospitals providing continuum of care monitoring. According to the survey, 50% of responding hospitals indicated that the percentage of continuum of care monitored beds was greater than 50% of the total monitored beds. This trend represents a paradigm shift from previous years when the provision of patient monitoring was typically associated with only high-cost areas, such as critical care or stepdown areas, which also typically have a higher nurse-to-patient ratio.

Objectives for Implementing Continuum of Care Monitoring

Survey Results

1. Figure 8 represents the patient care objectives for considering implementation of continuum of care monitoring. Figure 9 represents the patient care benefits resulting from implementation of continuum of care monitoring.
2. Figure 10 represents the cost objectives for considering implementation of continuum of care monitoring. Figure 11 represents the cost benefits resulting from implementation of continuum of care monitoring.

Patient Care Objectives	
Ensure that patient monitoring is available for an increasing number of patients whose clinical condition requires it	79.0%
Keep patients in diagnosis-specific care areas where specialized nursing care is available (e.g., orthopedics, oncology, renal)	61.3%
Reduce or eliminate patient transfers between care areas	47.1%
Total	*

* Note: Multiple answers can total more than 100%.

Figure 8: Patient Care Objectives for Expansion of Patient Monitoring

Patient Care Benefits	
Ensured that patient monitoring is available for an increasing number of patients whose clinical condition requires it	78.3%
Reduced or eliminated patient transfers between care areas	66.3%
Patients remained in diagnosis-specific care areas where specialized nursing care is available (e.g., orthopedics, oncology, renal)	56.6%
Total	*

* Note: Multiple answers can total more than 100%.

Figure 9: Patient Care Benefits from Expansion of Patient Monitoring

Cost Objectives	
Reduce demand for patient placement in high-cost care areas	81.6%
Reduce cost associated with transferring patients between care areas	59.6%
Shorten length of stay	44.7%
Reduce nursing staff	15.8%
Total	*

* Note: Multiple answers can total more than 100%.

Figure 10: Cost Objectives for Expansion of Patient Monitoring

Cost Benefits	
Reduced demand for patient placement in high-cost care areas	85.7%
Reduced cost of transferring patients between care areas	62.3%
Shortened length of stay	28.6%
Reduced nursing staff	13.0%
Total	*

* Note: Multiple answers can total more than 100%.

Figure 11: Cost Benefits from Expansion of Patient Monitoring

3. 21.9% of responding hospitals indicated that it was an ultimate goal to keep patients in the same hospital bed throughout their entire hospital stay, even as their acuity level changed.

4. The following pie chart demonstrates whether responding hospitals focused more on patient care objectives or cost objectives when considering the implementation of continuum of care monitoring.

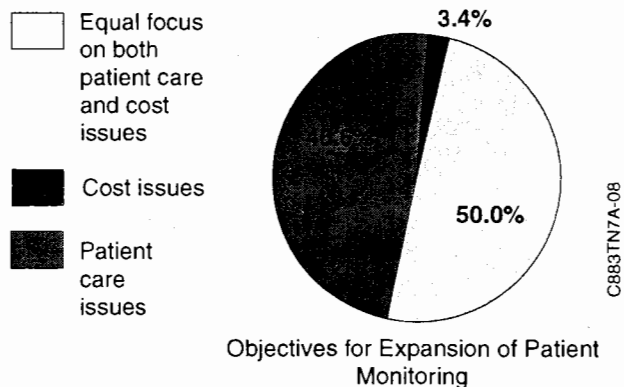


Figure 12: Patient Care versus Cost Objectives

5. When hospitals were asked whether the expansion of patient monitoring outside traditionally monitored areas affected the total number of beds in traditionally monitored areas, the responses were as follows:
- 80.7% — No impact on number of beds in traditionally monitored areas
 - 10.8% — Number of beds in traditionally monitored areas has increased
 - 8.4% — Number of beds in traditionally monitored areas has decreased
6. Figure 13 represents the clinical conditions for which patient monitoring is provided outside traditionally monitored areas.

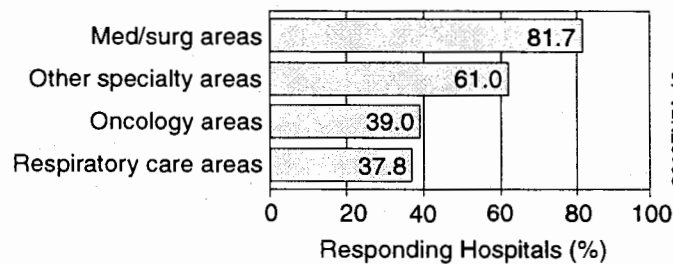
Patient's Clinical Condition	
Underlying cardiac condition	82.1%
Congestive heart failure	70.2%
Administered drugs that may alter physiologic parameters perversely	69.0%
Respiratory distress/COPD	67.9%
Other	32.1%
Total	*

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* Note: Multiple answers can total more than 100%.

Figure 13: Clinical Reasons for Providing Patient Monitoring

7. Figure 14 illustrates the variety of care areas where continuum of care monitoring is provided.



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* Note: Multiple answers can total more than 100%.

Figure 14: Continuum of Care Monitoring Availability

Discussion

The increasing number of patients whose clinical conditions warrant patient monitoring is the overwhelming reason that most hospitals have considered implementation of continuum of care monitoring. Keeping patients in diagnosis-specific care areas where specialized nursing care is available and reducing or eliminating transfers between care areas are other significant reasons that hospitals consider continuum of care monitoring. These objectives are fairly consistent with the continuum of care benefits noted by responding hospitals. However, a significantly higher percentage of hospitals noted continuum of care monitoring resulted in the benefit "reduce or eliminate patient transfers between care areas" than the percentage of hospitals that indicated this reason as a patient care objective.

When comparing cost objectives with cost benefits, the overwhelming cost objective and benefit for implementing continuum of care monitoring is reduction in demand for patient placement in high-cost areas. The majority of hospitals also indicated that reduction of costly patient transfers between care areas was a significant objective/benefit. However, only 21.9% of responding hospitals indicated that it was an ultimate goal to keep patients in the same hospital bed throughout their entire stay, even as their acuity level changes. The goal of keeping patients in the same hospital bed presents significant operational challenges, since staffing levels would have to be continuously adjusted to meet each patient's changing acuity level. These operational challenges and associated expenses may be the reason that more hospitals do not have this ultimate goal. Although 44.7% of hospitals indicated that shortening length of stay was another cost objective, only 28.6% of hospitals indicated that implementation of continuum of care monitoring resulted in this benefit. While it seems likely that reducing the need to transfer patients between care areas would contribute to reduced length of stay, this correlation is not evident from survey results. In addition, since numerous variables contribute to length of stay, it may be difficult for hospitals to discern the actual impact of continuum of care monitoring on length of stay. From the perspective of respondents, both patient care and cost objectives seem to drive the implementation of continuum of care monitoring.

Interestingly, the overwhelming majority of responding hospitals (91.5%) indicated that the total number of beds in traditionally monitored areas either was not affected or increased as a result of implementation of continuum of care monitoring. This contrasts sharply with the survey results in which 85.7% of responding hospitals indicated that reduced demand for placement in high-cost areas was a benefit of continuum of care monitoring implementation. There are three potential explanations for this contrast, of which the latter two seem most likely:

- Hospitals have not reduced the number of beds in traditionally monitored areas in correspondence with utilization demand.
- The acuity level of patients has increased significantly in correspondence with the aging population and the shorter lengths of stay mandated by payers.
- Before implementation of continuum of care monitoring, monitored beds were unavailable for a significant number of patients who needed monitoring. These patients were placed in monitored beds only as these beds became available, and significant patient flow problems were precipitated as a result. As continuum of care monitoring has been implemented, the monitoring needs of many of these patients have been satisfied through providing a continuum of care monitor, rather than transferring these patients to traditionally monitored areas.

Cardiac-related conditions (i.e., underlying cardiac condition, congestive heart failure) constitute the most prevalent clinical conditions for providing continuum of care monitoring.

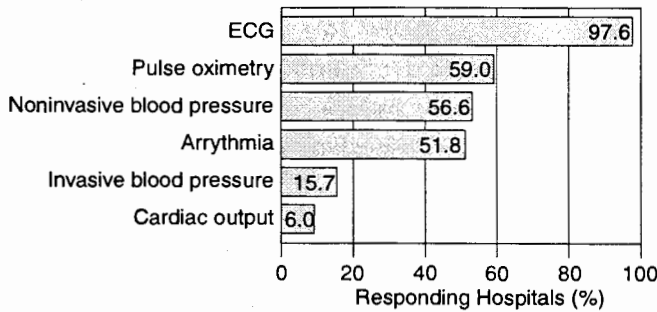
Continuum of care monitoring is frequently provided for patients receiving drug therapy that may alter their physiologic state or for patients in respiratory distress or with chronic obstructive pulmonary disease (COPD). Other clinical indicators for providing continuum of care monitoring include overdose, stroke, stem cell transplant, trauma complications, hypertension associated with renal disorders, and ventilator dependency. Some postsurgical patients may also require continuum of care monitoring. All of the above clinical conditions do not always warrant the level of care provided in traditionally monitored areas. Therefore, continuum of

care monitoring provides the opportunity to effectively care for patients in lower-cost areas. Correspondingly, continuum of care monitoring is typically provided in med/surg areas, specialty care areas (e.g., orthopedics, renal), oncology areas, and respiratory care areas.

Continuum of Care Monitoring Selection

Survey Results

- Figure 15 illustrates the monitoring requirements specified by hospitals when selecting a monitoring system for use outside traditionally monitored areas. Figure 16 represents the actual physiologic parameters being monitored via bedside monitors or telemetry transmitters outside traditionally monitored areas.



*Note: Multiple answers can total more than 100%.

Figure 15: Required Continuum of Care System Capabilities

Noninvasive parameters (i.e., ECG, noninvasive blood pressure, pulse oximetry)	35.7%
ECG only	34.5%
ECG only or noninvasive parameters, depending on the patient's clinical needs	20.2%
ECG only, noninvasive parameters, or invasive parameters (e.g., invasive blood pressure)	9.5%
Total	100%

Figure 16: Required Continuum of Care Monitoring Parameters

- Figure 17 demonstrates the monitoring modalities currently being used by responding hospitals for continuum of care monitoring.

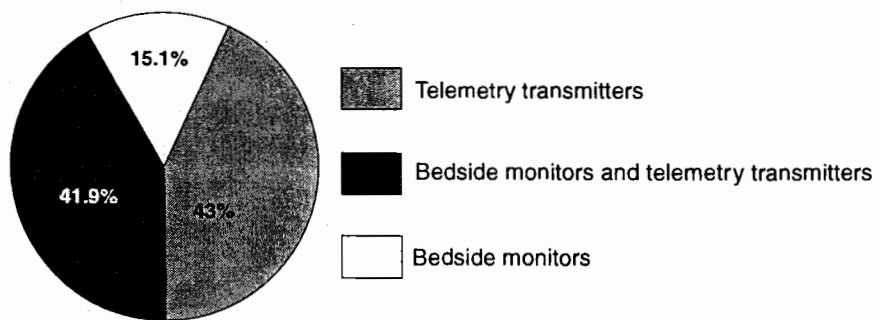


Figure 17: Monitoring Modalities In Use outside Traditionally Monitored Areas

- Figure 18 illustrates the prioritization of selection criteria in choosing a continuum of care monitoring system.
- Figure 19 illustrates the networking requirements specified by hospitals when selecting a continuum of care monitoring system. Figure 20 represents the actual network being used by responding hospitals for bedside monitors outside traditionally monitored areas.

Top Selection Criteria

Ease of use	73.7%
Small, lightweight	31.6%
Good screen visibility	30.3%
Configured with all capabilities integral to monitor	25.0%
Modular; can change modules as needed to modify monitoring parameters	25.0%
Battery operated, suitable for transport	23.7%
Total	*

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*Note: Multiple answers can total more than 100%.

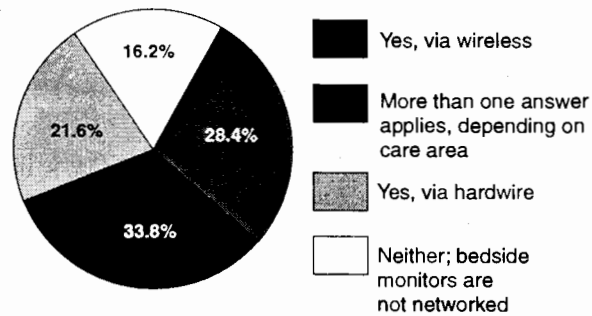
Figure 18: Top Selection Criteria for Continuum of Care Bedside Monitors

Top Selection Criteria

Monitoring system must be networked to monitoring system in traditionally monitored areas	43.4%
Networking must be accomplished via wireless network	40.8%
Monitoring system must interface with existing or planned bedside charting information system	36.8%
Networking must be accomplished via hardwire network	17.1%
Total	*

*Note: Multiple answers can total more than 100%.

Figure 19: Top Selection Criteria for Continuum of Care Monitoring Networks



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Figure 20: Networked via Hardwire versus Wireless Network

- With regard to standardization, 76.8% of responding hospitals indicated that the selected continuum of care monitoring system was standardized to the patient monitoring system used in traditionally monitored areas.
- Figure 21 illustrates the variety of manufacturers' systems used by responding hospitals for continuum of care monitoring.

Supplier Selection

Hewlett-Packard	59.0%
SpaceLabs	13.3%
Marquette	12.0%
Datascope	8.4%
Protocol	7.2%
Criticare	3.6%
Fukuda-Denshi	3.6%
Medical Data Electronics	3.6%
Siemens	3.6%
Mennen	1.2%
Nihon-Kohden	1.2%
Others	8.4%
Total	*

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*Note: Multiple answers can total more than 100%.

Figure 21: Selected Suppliers

Discussion

Considering the clinical conditions for providing continuum of care monitoring, it seems logical that the noninvasive capabilities of ECG, pulse oximetry, and noninvasive blood pressure are most frequently required by hospitals when they select a continuum of care monitoring system. Invasive capabilities, such as invasive blood pressure and cardiac output, are required much less frequently. Actual parameters monitored through continuum of care monitoring seem to be consistent with these requirements. In most hospitals, patients requiring invasive monitoring capabilities are still cared for in traditionally monitored areas. Correspondingly, these patients require a higher level of nursing care.

Telemetry transmitters, which typically monitor ECG only, are used most prevalently for meeting continuum of care monitoring needs. While telemetry satisfies the prevalent cardiac-related reasons for providing continuum of care monitoring, it falls short for a subset of patients (e.g., those who have been administered drugs that may adversely alter physiologic parameters, those with respiratory distress/COPD) who would benefit from other noninvasive monitoring capabilities. However, telemetry monitoring has led bedside monitors in being used for continuum of care monitoring applications. From a historical perspective, this becomes easier to understand:

- Telemetry was previously less expensive, both in acquisition and installation costs, than networked bedside monitors.
- Telemetry antenna coverage could be easily installed throughout large areas or multiple care areas, enabling telemetry transmitters to be easily used in different locations.
- Telemetry transmitters, because of their size, were easier to bring to the patients.
- Telemetry enables patient ambulation.

More recently, the use of bedside monitors for continuum of care monitoring has come to the forefront for the following reasons:

- Most manufacturers have released small, lightweight bedside monitors designed to meet continuum of care monitoring needs. These monitors can be easily moved from room to room. Many of these bedside monitors can be operated on battery power and used for transport.
- Network flexibility has improved such that multiple care areas can be hardwired and bedside monitors can be moved to any hardwired location. Wireless networks have also been introduced, which allow bedside monitors to be moved anywhere within the transmission range and still remain on the network.
- Some bedside monitors are small enough to be easily mounted on an IV pole, enabling patient ambulation within the room. Patient ambulation in the hallways is enabled if the network is wireless.
- Bedside monitors provide the advantage of visual verification of physiologic waveforms and data at the bedside. In addition, other monitoring capabilities such as pulse oximetry, noninvasive blood pressure, and invasive blood pressure can be integrated into the bedside monitor. These added capabilities are often required to meet the clinical needs of some patients and provide greater adaptability as a patient's clinical condition changes.

- Some monitoring systems allow integration of both telemetry and bedside monitors such that a patient can remain on telemetry transmitter for ECG monitoring and, when needed, be monitored for additional parameters (e.g., pulse oximetry, noninvasive blood pressure) by a bedside monitor.

It should be noted that some telemetry systems now also provide pulse oximetry capabilities. Both telemetry and bedside monitors are suitable alternatives for addressing continuum of care monitoring needs. However, each modality has certain advantages that make it more suitable for specific patient subsets (e.g., telemetry best meet the needs of post-myocardial-infarction patients; bedside monitors best meet the needs of COPD patients). The hospital should select appropriate modalities to meet utilization demands. It is likely that most hospitals will require a mix of telemetry transmitters and bedside monitors to meet continuum of care monitoring needs.

In response to the survey, hospitals most frequently noted “ease of use” as one of the top selection criteria in selecting bedside monitors for continuum of care monitoring needs. “Small, lightweight” and “good screen visibility” were also important selection factors.

When asked about networking selection criteria, 43.4% of hospitals indicated that the continuum of care monitoring system must be networked to traditionally monitored areas. This can likely be attributed to the added security provided by networking to traditionally monitored areas, since nurses with extensive experience in the interpretation of physiologic monitoring data and waveforms would be available to use as a resource for questions concerning critical alarm events. Wireless networks were also noted as a high-priority selection criterion, probably because of the inherent flexibility this type of network provides.

An overwhelming 76.8% of responding hospitals indicated that the selected continuum of care monitoring system was standardized to the patient monitoring system in traditionally monitored areas. This response is not surprising, considering that 43.4% of all hospitals require that continuum of care monitoring be networked to traditionally monitored areas. Standardization also provides the following advantages:

- User error is minimized because the user interface is standardized between care areas. This is particularly important when there is crossover of staff between care areas.
- Implementation of a bedside charting system may be facilitated, since negotiations regarding a monitoring interface involve only one monitoring manufacturer.
- Negotiating leverage is increased through large-volume purchases.
- Service support is facilitated.
- Cable/disposable compatibility is ensured.

However, many hospitals are considering or have chosen two levels of standardization for monitoring equipment or two-tiered standardization, in which one primary manufacturer is chosen for traditionally monitored areas and an alternative manufacturer is selected for continuum of care monitoring needs. Both manufacturers are selected on the basis of their ability to best meet the needs of each designated application. In some cases, an alternative manufacturer may offer more competitive pricing than is offered by the primary manufacturer.

Two-tiered standardization is an acceptable, and sometimes preferable, approach, depending on how well the primary monitoring manufacturer can meet the hospital's continuum of care monitoring needs.

This survey by no means represents an actual market analysis regarding manufacturer selection. However, the fact that Hewlett-Packard, SpaceLabs; and Marquette were the manufacturers most often selected by responding hospitals for continuum of care monitoring systems seems to further substantiate the importance hospitals give to standardization to a primary manufacturer. However, other manufacturers typically well known for their small, portable monitors, such as Datascope and Protocol, seem to be making significant penetration in the marketplace. As manufacturers continue to introduce innovations aimed at competing for the continuum of care marketplace, it will be interesting to see which will become the suppliers of choice.

Continuum of Care Monitoring Implementation Issues

Survey Results

1. The following table describes how continuum of care monitoring is distributed in each care area.

A par level of bedside monitors/telemetry transmitters reside in specific care areas and can be moved within those care areas as needed (answer 2)	38.1%
Answers 2 and 3 (answer 4)	28.6%
Bedside monitors/telemetry transmitters reside in a centralized location and can be brought to care areas as needed (answer 3)	22.6%
Bedside monitors reside permanently at specific bedsides (answer 1)	10.7%
Total	100.0%

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Figure 22: Continuum of Care Monitoring Distribution

2. The following table describes where central station displays for continuum of care monitoring are located in reference to the patients being monitored.

Within the same area as the patients being monitored (answer 1)	38.8%
Remote from the care area where the patients are being monitored, at a traditionally monitored area (e.g., ICU, CCU, stepdown area) (answer 3)	32.5%
Combination of answers 1, 2, and 3, depending on the care area where the monitored patients reside (answer 4)	21.2%
Remote from the care area where the patients are being monitored, at a centralized location (e.g., central surveillance room) (answer 2)	7.5%
Total	100.0%

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Figure 23: Continuum of Care Monitoring Configuration

3. Outside traditionally monitored areas, 43.7% of responding hospitals indicated that someone is assigned to watch the central station displays at all times if the central station displays are located in the same care area as the patients being monitored. Figure 24 illustrates the variety of staff that are assigned to watch these central station displays.

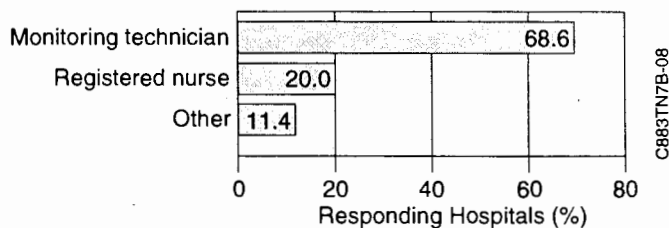


Figure 24: Staff Assigned to Watch the Central Display

4. Figure 25 summarizes the variety of staff that are required to continuously watch central station displays when the central station displays are located in an area remote from the care area where the patients are being monitored.

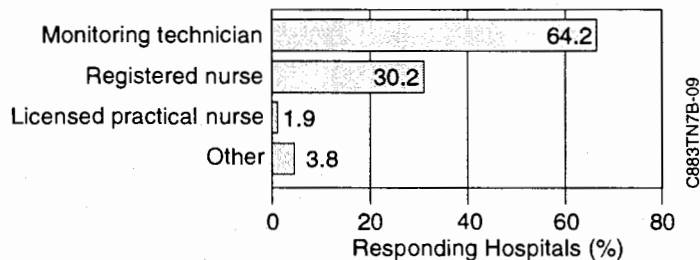


Figure 25: Staff Assigned to Watch Remote Central Display

5. Figure 26 describes the means of communication used for alerting primary care nurses to critical alarm situations if the central station displays are remote from the care areas where the patients are being monitored. Figure 27 illustrates how responding hospitals rate their methodology for alerting primary care nurses of critical alarms.

Methodology for Alerting the Primary Care Nurse

Staffperson watching central station display uses a phone to call nurses' station in the patient's care area and asks that the patient's primary care nurse be alerted	76.0%
Staffperson watching central station display pages primary care nurse via beeper system	12.0%
Staffperson watching central station display calls primary care nurse via interhospital cellular phone system	6.0%
Other	6.0%
Total	100.0%

Figure 26: Critical Alarm Communication

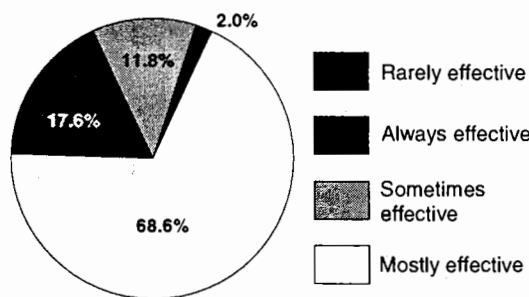


Figure 27: Effectiveness of Alarm Coverage

6. Figure 28 represents the type of training required for nurses in monitored care areas outside traditionally monitored areas.

Clinical training regarding understanding monitoring information and appropriate intervention (e.g., recognizing arrhythmias)	81.2%
Training regarding alarm awareness and response protocols	71.2%
Clinical training regarding monitor use (e.g., setting alarm limits, using alarm recall functions, etc.)	65.0%
Advanced Cardiac Life Support (ACLS) training	40.0%
Total	*

*Note: Multiple answers can total more than 100%.

Figure 28: Nurses' Training Levels for Continuum of Care Monitoring

7. The following table demonstrates how nurses have accepted and responded to the implementation of continuum of care monitoring in their care areas.

Good acceptance, good adaptation	48.2%
Good acceptance, fair adaptation	31.3%
Fair acceptance, fair adaptation	15.7%
Good acceptance, poor adaptation	1.2%
Fair acceptance, poor adaptation	1.2%
Poor acceptance, fair adaptation	1.2%
Poor acceptance, poor adaptation	1.2%
Total	100.0%

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Figure 29: Nurses' Reaction to Continuum of Care Monitoring Implementation

Discussion

The majority of responding hospitals distribute continuum of care monitoring either by keeping par levels (specific numbers based on anticipated utilization) of bedside monitors or telemetry transmitters within specific care areas, to be moved within those care areas as needed, or by keeping the bedside monitors or telemetry transmitters in a centralized location, to be brought to the care areas as needed. When par levels are kept within the care area where the monitors or transmitters will be used, the devices are readily accessible for use as needed. However, if there are significant fluctuations in the number of bedside monitors/telemetry transmitters required within a given care area, this approach is more costly because there may be periods of time during which equipment sits unused.

In contrast, when bedside monitors/telemetry transmitters are kept in a centralized location for distribution, they can be easily redistributed throughout the hospital as requirements for monitoring in various care areas fluctuate up and down. However, this approach requires a central location to store monitoring equipment when not in use and staffing time to transport equipment to care areas as needed.

A combined approach that incorporates par levels and centralized distribution seems the best solution. This maximizes the cost-effectiveness of continuum of care monitoring implementation because the hospital can more closely match the number of bedside monitors or telemetry transmitters purchased to the actual utilization demands throughout the entire hospital. Par levels in each care area can be based on the average number of monitored patients in that care area at any given time. As the demand for additional telemetry transmitters/bedside monitors fluctuates upward, the devices can be distributed from a centralized reserve.

The hospital may also be able to negotiate with the manufacturer or distributor to share risk such that the hospital purchases continuum of care monitoring equipment based on meeting an average to high monitoring demand. In the event that monitoring demands exceed this average-to-high number, additional monitoring equipment can be rented at low cost or no charge from the manufacturer or distributor. This arrangement typically must be negotiated at the time of purchase. Any of these approaches are generally preferable to having the bedside monitors

reside permanently at specific bedsides, because patients do not have to be moved to the monitored bed; the monitoring modality can easily be brought to the patient.

The location where continuum of care monitoring central stations reside varies considerably, with the majority of hospitals either locating central stations in the same care area as the patients being monitored or in a traditionally monitored area that is remote from patients being monitored. Only 7.5% of responding hospitals locate the central stations at a centralized location remote from the patients being monitored (e.g., central surveillance rooms). The decision of where to locate central stations with regard to monitored patients may be influenced by the number of patients typically monitored within a designated care area. If the number is typically small (e.g., four or fewer patients) or fluctuates significantly, it may be difficult for nurses in that care area to remain proficient in interpreting critical alarm waveforms and information. Placing central stations in remote locations, where primary or backup support is available from staff more experienced in interpreting monitoring information, may be a logical alternative for low-monitoring-utilization care areas.

A large percentage (43.7%) of responding hospitals assign someone to continuously watch central station displays at all times if the central station displays are located in the same care area as the patients. This requirement may be attributed to the historical practices of the hospital, stemming from a time before sophisticated arrhythmia detection systems and other technology aids were available. More likely, it may be due to the size of the care area, the architectural layout of the care area, staffing levels, or geographic proximity of patient assignments. This approach, while sometimes necessary to ensure adequate alarm coverage, adds significantly to staffing costs, especially when a registered nurse is used. Some hospitals have eliminated the need for someone to continuously watch central stations that reside in the same care area as the patients being monitored by placing slave scopes in strategic locations throughout the care area to increase alarm awareness of the staff as they work throughout the area. Other hospitals have been able to assign nursing staff to patients in close geographic proximity and to correspondingly locate central station displays at nearby substations to maximize alarm awareness. However, these approaches may not be feasible if monitoring utilization is low and the hospital has the goal of not moving the patients. More recently, some hospitals have used beeper systems interfaced to central monitor displays and hallway message panels to alert nurses of critical alarm situations.

Hospitals should select the monitoring system configuration that best meets their utilization demands, staffing patterns, architectural layout, etc. The decision to have someone continuously watch central station displays should be based on the same factors.

When central stations are remote from the care area where the monitored patient resides, most hospitals (76%) indicated that the staffperson watching the central station display uses a phone to call the nurses' station in the patient's care area and ask that patient's primary care nurse be alerted. Some hospitals (12%) indicated that a beeper system is used for alarm coverage communication. Regardless of the monitoring system configuration, it is essential that critical alarm coverage protocols be established to ensure efficient and effective alarm response

and optimum patient care. Clear lines of responsibility and accountability must be established for all involved staff. The following questions must be addressed when developing protocols:

- How will the primary care nurse be alerted when critical alarm situations occur — directly (e.g., via hearing the alarm in hallway, via a beeper) or indirectly (e.g., through a chain of communication originating with the monitor technician watching the central station display)?
- If a chain of communication is required to alert the primary care nurse, what are the steps in that chain, and who is responsible for carrying out each step? What measures have been taken to ensure prompt and accurate communication?
- How can the primary care nurse verify critical alarm information?
- What backup support is in place in the event that the primary care nurse is unavailable to respond to the alarm?
- How will the primary care nurse alert other staff if intervention assistance is needed?

Effective alarm coverage is essential for the successful implementation of any continuum of care monitoring system. This can only be accomplished when the hospital establishes alarm coverage protocols that ensure a prompt and appropriate response to critical alarm situations. According to the survey, 17.6% of responding hospitals indicated that their methodology for alerting a primary care nurse of a critical alarm if the central stations were located remote from the patient being monitored was “always effective.” Another 68.6% indicated that their methodology was “usually effective.” Needless to say, all hospitals should set up protocols that ensure an “always effective” response.

Only 65% of responding hospitals indicated that nurses in continuum of care monitoring areas have received clinical training regarding monitor use. More alarmingly, only 71.2% of responding hospitals have indicated that nurses have received training in alarm awareness and response protocols. The primary care nurse must be able to effectively use the monitoring system and interpret critical alarm information and know how to intervene appropriately. Ultimately, monitoring information should enable nurses to better care for their patients. Based on these responses, it is not surprising that only 48.2% of responding hospitals indicated that their nurses have had “good acceptance and good adaptation” to implementation of continuum of care monitoring. Staff training and reinforcement are key to staff acceptance and good adaptation.

Conclusion

Continuum of care monitoring has come to the forefront as a means to effectively meet a patient’s changing clinical needs while reducing overall cost of care. Continuum of care monitoring has enabled hospitals to separate the decision of “whether to monitor a patient” from “what staffing level is required to effectively care for this patient.” However, the decisions on whether and how to implement continuum of care monitoring require thorough analysis and thoughtful planning by the hospital. ECRI suggests the following approach:

- Track and analyze utilization demands in traditionally monitored areas to determine whether and how many patients could be effectively cared for in lower-cost areas if continuum of care monitoring were available. Also, track how many patients in nonmonitored areas would benefit from continuum of care monitoring but are currently not monitored because of the

unavailability of monitored beds. Note the specific clinical needs of these patients during their hospital stay.

- Specify realistic patient care objectives and cost objectives for implementation of continuum of care monitoring, and develop a plan for achieving them.
- Based on projected utilization, determine the appropriate number telemetry transmitters or bedside monitors. In addition, determine the required physiologic parameters for each modality.
- Determine the continuum of care monitoring system configuration (e.g., remote monitoring versus central stations in same care areas as patients being monitored) that best meets the needs of your facility.
- Select a continuum of care monitoring system that is easy to use, competitively priced, and most closely meets a facility's specific needs. Standardization to a primary monitoring manufacturer or two-tiered standardization are both acceptable approaches.
- Develop an implementation plan that incorporates operational and staffing adjustments necessary to meet patient care and cost objectives.
- Establish alarm coverage protocols to ensure efficient and effective response to critical alarm situations.
- Provide sufficient training to all involved staff, as defined by their roles.
- Expand continuum of care monitoring capabilities in accordance with clinical needs and utilization requirements.

About the Author

Kathryn Pelczarski is a Senior Associate with the Health Systems Group at ECRI, where she has worked since 1987.

She has been instrumental in assisting hospitals and healthcare systems to address technology, operational, and staffing issues in relation to the changing healthcare environment. Specifically, she has worked with healthcare facilities in providing a variety of technology decision-making support, including developing technology assessment and planning processes; assessing technology needs and strategic technology planning; analyzing technology utilization issues; providing equipment planning services; and providing acquisition assistance.

While she has experience with a broad spectrum of healthcare technologies, her expertise has focused on cardiology equipment, physiologic monitoring systems, anesthesia systems, and other critical care devices. She has been instrumental in developing a telemetry utilization program that helps hospitals manage telemetry services. She has also worked extensively with hospitals in resolving patient monitoring alarm coverage issues.

She has also written articles for *Materials Management Quarterly*, the *American Journal of Nursing*, *Strategies for Healthcare Excellence*, *The Journal of Cardiovascular Management*, and *Society for Health Systems News*. In addition, she has written and contributed to articles for ECRI's publications, including *Health Devices*, *Healthcare Product Comparison System*, *Hospital Risk Control*, *Health Technology Assessment News*, and *Health Technology Trends*.

Ms. Pelczarski received a bachelor of science degree in biology from Penn State University.

About ECRI

ECRI is widely recognized as the world's leading independent organization committed to the assessment, evaluation, and continued improvement of healthcare technology. A nonprofit, tax-exempt institute chartered in 1955, ECRI provides a broad variety of services in support of better patient care to thousands of hospitals and other health-related organizations and agencies throughout the world. ECRI is dedicated to improving the safety, efficacy, and cost-effectiveness of healthcare technology, broadly defined to encompass devices, drugs, procedures, facilities, and related standards and guidelines. ECRI's health services research, publications, databases, and technical assistance programs are the benchmark for the health-care community.

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