Telemetry monitoring is a powerful tool for real-time monitoring of heart rhythm. Telemetry beds are limited in number and expensive\(^1\), therefore, their use should be evidence-based\(^{5,6}\). The 2004 American Heart Association (AHA) practice standards for electrocardiographic (ECG) monitoring are often not followed and rigorous criteria for inpatient telemetry admissions are often not systematically used, resulting in overcrowding in emergency departments and inpatient monitored beds\(^{1,3,6-9}\) (Table 1). Monitored beds are often occupied by patients who require only frequent nursing care rather than cardiac monitoring\(^{5,6}\). Few studies have been done to determine whether inpatient telemetry monitoring is beneficial\(^{3}\) and accurately confirms the initial clinical impression.

**Table 1**

2004 American Heart Association practice standards for electrocardiographic monitoring in hospital settings

<table>
<thead>
<tr>
<th>Class</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>All patients at significant risk of an immediate, life-threatening arrhythmia. Cardiac monitoring is indicated in most, if not all, patients in this group.</td>
<td>Cardiac arrest; early phase of acute coronary syndrome (ACS); unstable ACS/newly diagnosed high-risk coronary lesions; acute heart failure/pulmonary edema; atrioventricular block; arrhythmias complicating Wolff-Parkinson-White syndrome; long QT syndrome and ventricular arrhythmias; hemodynamically unstable arrhythmias in children/adults; procedures requiring conscious sedation or anesthesia; cardiac surgery; nonurgent percutaneous coronary intervention (PCI) with complications; implantation of automatic defibrillator/pacemaker lead or pacemaker dependent; temporary pacemaker or transcutaneous pacing pads; intra-aortic balloon counterpulsation</td>
</tr>
<tr>
<td>II</td>
<td>Cardiac monitoring may be of benefit in some patients but is not considered essential for all. Cardiac monitoring often takes place in intermediate care (telemetry) unit.</td>
<td>Postacute myocardial infarction; chest pain syndromes; uncomplicated, nonurgent PCI; subacute heart failure; syncope evaluation; arrhythmias that cause discomfort in patients with do-not-resuscitate orders; antiarrhythmic drug or dose adjustment for rate control with chronic atrial tachyarrhythmias; implantation of pacemaker lead or not pacemaker dependent; uncomplicated ablation; routine coronary angiography</td>
</tr>
<tr>
<td>III</td>
<td>Cardiac monitoring is helpful in clinical management but it is not expected to save lives. Cardiac monitoring is not indicated because a patient’s risk of a serious event is so low that monitoring has no therapeutic benefit.</td>
<td>Obstetric patients without heart disease; permanent rate-controlled atrial fibrillation; stable patients with chronic ventricular beats; postoperative patients at low risk for arrhythmias; hemodialysis (except for patients with other Class I or II indications, or those undergoing dialysis in the hospital setting)</td>
</tr>
</tbody>
</table>

Based on information from Drew et al.\(^8\)

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doi: http://dx.doi.org/10.4037/ajcc2015270
facilitating ongoing treatment plans. The PICO (problem, intervention, control, outcome) question crafted for this review was, “For hospitalized adults, what criteria are used for admission to a telemetry unit and/or telemetry monitoring?”

Search Methods

A comprehensive search strategy was used to identify evidence reported between January 2000 and August 2014 or open search if few results were obtained. The Figure outlines the databases, key search terms, and relevant articles matching the inclusion and exclusion criteria. The final evidence matrix included 1 expert consensus statement, 3 retrospective studies, 2 prospective observational studies, and 1 randomized clinical trial (Tables 2 and 3).

About the Authors

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Figure Preferred Reporting Items for Systematic Reviews (PRISMA) diagram of criteria for admission to telemetry unit.

Table 2 American Association of Critical-Care Nurses evidence-leveling system

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>No. of relevant articles</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Meta-analysis of multiple controlled studies or metasynthesis of qualitative studies with results that consistently support a specific action, intervention, or treatment</td>
<td>6</td>
<td>2,5,7,9,10,11</td>
</tr>
<tr>
<td>B</td>
<td>Well-designed controlled studies, both randomized and nonrandomized, with results that consistently support a specific action, intervention, or treatment</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Qualitative studies, descriptive or correlational studies, integrative reviews, systematic reviews, or randomized controlled trials with inconsistent results</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Peer-reviewed professional organizational standards, with clinical studies to support recommendations</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Theory-based evidence from expert opinion or multiple case reports</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Manufacturer’s recommendation only</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

From Armola et al, with permission.
Results

Although the 2004 AHA practice standards were groundbreaking, few studies have validated their effectiveness. In most of the studies\(^5,7,9,11\) in this review, researchers reported that patients who had telemetry ordered did not meet class I and class II indications. Furthermore, arrhythmic events were infrequent and clinically insignificant. Table 4 shows common diagnoses used in ordering telemetry. These results suggest that the practice standards do not address several noncardiac conditions that physicians often monitor on telemetry units\(^5,6,8\) and thus may not apply to patients with primary medical diagnoses.\(^5\) For example, in a randomized controlled trial by Funk et al,\(^9\) 28.2% of patients admitted to cardiac units from 17 hospitals had a noncardiac primary diagnosis; these patients may not be appropriate for monitoring for arrhythmia, ischemia, and increased QT interval.

Table 3

<table>
<thead>
<tr>
<th>Reference</th>
<th>Design and sample</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drew et al(^8)</td>
<td>Scientific consensus statement from multiple professional organizations</td>
<td>Provided guidelines for class I, II and III indications (Table 1), time frames, and strategies to improve diagnostic accuracy of cardiac arrhythmia, ischemia, and QT-interval monitoring in adults and children</td>
</tr>
<tr>
<td>Benjamin et al(^2)</td>
<td>Retrospective (N = 4) urban academic medical centers</td>
<td>Fewer than 1/3 telemetry days (in a 3-week period) did not meet American Heart Association (AHA) indications. Arrhythmia incidence on nonindicated days low (3.1/100 days of monitoring per nonindicated day); detected arrhythmias were clinically insignificant. Eliminating nonindicated days could save $53/patient day</td>
</tr>
<tr>
<td>Curry et al(^11)</td>
<td>Retrospective cohort (N = 236 admissions) to determine rate of events in “tele-indicated” vs “not indicated” patients (based on modified 1991 American College of Cardiology (ACC) practice standards)</td>
<td>29% admissions never met indications on any day; only 17% met on any day 95% events (n = 162) occurred on 400 tele-indicated days; 5% occurred on 345 non-tele-indicated days (n = 9 minor events required no therapy)</td>
</tr>
<tr>
<td>Dhillon et al(^7)</td>
<td>Retrospective (N = 562) telemetry unit admission comparisons against modified electrocardiographic (ECG) monitoring guidelines (“telemetry indicated” vs “not indicated”)</td>
<td>Significantly more arrhythmia events in “telemetry indicated” vs “not indicated” group. No clinically significant arrhythmias required change in patient management in “not indicated” group</td>
</tr>
<tr>
<td>Falun et al(^10)</td>
<td>Prospective observational (N = 1194)</td>
<td>Most patients met class I (18%) or class II (71%) indications (vs 11% who met class III); high total adherence rate (89%). Arrhythmia event rate/change in patient management: Class I: 43%/25%; Class II: 28%/14%; Class III: 47%/29%; More accurate distribution of class I and class II indications using discharge rather than admission diagnoses</td>
</tr>
<tr>
<td>Funk et al(^9)</td>
<td>Multisite randomized controlled trial of 2744 observations (N = 1816) on adult cardiac units in 17 hospitals to evaluate implementation of AHA practice standards for ECG monitoring (28.2% of patients had noncardiac primary diagnosis)</td>
<td>Inappropriate monitoring included undermonitoring for ischemia and QTc prolongation, and overmonitoring for all 3 types, particularly arrhythmia monitoring: 99% with arrhythmia indication vs 85% with no indication; 35% with ischemia indications vs 26% with no indication; 21% with QT-interval indication vs 18% with no indication had QTc documentation</td>
</tr>
<tr>
<td>Najafi and Auerbach(^5)</td>
<td>Prospective observational (N = 100) noncardiac medical service patients</td>
<td>11% of patients met AHA class I indications; 10% had management changes due to telemetry events (9 diagnostic tests, 8 medication changes, 7 intravenous fluids, 2 transfers to critical care who did not meet criteria for class I). Concerns for patients’ condition deteriorating was reason for 50% telemetry use, although few patients had clinically meaningful cardiac events (4 patients who did not meet criteria for class I had a new atrial fibrillation/flutter develop)</td>
</tr>
</tbody>
</table>
formula calculations. Furthermore, a method to easily identify low-risk patients (class III) within the current AHA practice standards does not exist.

Other authors reviewed earlier publications for evidence of the need to monitor specific diagnoses. Five diagnoses were highlighted as having no evidence for telemetry monitoring (Table 5). Further research is needed for telemetry utilization and understanding nuances for overmonitoring and undermonitoring of cardiac and noncardiac patients. Research could further the validation and revision of current AHA practice standards and promote an evidence-based approach to clinical practice.

**Recommendations for Practice**

Most institutions and clinicians use the 2004 AHA practice standards to structure monitoring decisions. However, these practice standards are 11 years old and may need to be updated to address primary noncardiac conditions often monitored on telemetry units or patients often considered “low risk.” A stratification tool, coupled with telemetry guidelines and admission criteria, can increase efficient resource utilization and reduce unnecessary admissions and telemetry use. Goldman and colleagues developed the most widely studied risk stratification protocol for chest pain, stratifying patients with suspected acute coronary syndrome into high, moderate, low, and very low risk on the basis of 5 variables. Other tools include the Acute Cardiac Ischemia Time-Insensitive Predictive Instrument and Thrombolysis in Myocardial Infarction risk scores. The assessment of high-risk patients without the benefit of a risk stratification protocol may result in allocation of more high-risk patients to unmonitored beds. However, wide variability remains in management decisions and resource utilization via the use of risk stratification protocols.

### Table 4
**Common diagnoses of telemetry unit admissions**

- Acute cerebrovascular disease
- Acute coronary syndrome
- Arrhythmia
- Chest pain
- Congestive heart failure
- Electrolyte disorders
- Febrile illness/sepsis
- Hemorrhage
- Pulmonary disease, respiratory distress (chronic obstructive pulmonary disease or pneumonia)
- Syncope

**Top 10 diagnoses of hospital admissions via the emergency department**

- Pneumonia
- Congestive heart failure
- Chest pain
- Atherosclerosis, other heart disease
- Acute coronary syndrome
- Acute cerebrovascular disease
- Chronic obstructive lung disease
- Arrhythmias
- Fluid and electrolyte disorders
- Affective or mood disorders

### Table 5
**Clinical considerations**

1. Increase clinicians’ awareness of 2004 American Heart Association (AHA) practice standards.
2. Incorporate 2004 AHA practice standards into academic curriculum and continuing education, including nurses and emergency medicine staff.
3. Supplement existing 2004 AHA practice standards to reflect current practice environment, including indications, exclusion, and discharge criteria for telemetry monitoring, particularly for patients with noncardiac conditions.
4. Reduce telemetry overmonitoring and undermonitoring by adhering to specific indicated criteria to promote an evidence-based approach and safely reduce unnecessary testing, treatment, and health care costs.
5. Telemetry monitoring may not be indicated for the following diagnoses:
   - Minor blood transfusion (2 units or less of packed red blood cells)
   - Chest pain with normal or nonspecific electrocardiographic findings
   - Acute exacerbation of chronic obstructive pulmonary disease
   - Stable patients with anticoagulation for pulmonary embolism
   - Blunt chest trauma in the emergency department with normal electrocardiographic findings and blood pressure, and no dysrhythmias
6. Telemetry should not replace frequent observation and assessment of vital signs, nor should it influence nurse staffing levels.
7. Encourage nurses to review the need for telemetry on a daily basis and confer with interprofessional team to determine if the current patient diagnosis warrants continued monitoring.
8. Incorporate the use of simple risk-stratification instruments such as the Goldman risk assessment tool to ensure that telemetry is reserved for patients who receive the most benefit.
and tools. The threat of litigation represents a formidable obstacle to the widespread implementation of standardized risk-stratification methods and appropriate criteria for telemetry monitoring.2

Another issue uncovered in this review is the monitoring of patients in deteriorating condition. These patients are often placed on telemetry simply to ensure frequent nurse surveillance, rather than for dysrythmias that require ECG monitoring.1,5-6 Researchers in multiple studies1,4 have reported that widespread monitoring does not change medical management or produce a substantial survival benefit, even in cardiac arrest patients. (However, the high-risk subset of patients did show potential benefit.) The time and effort required to monitor “non-indicated” patients takes nurses away from other patients’ needs and caring for telemetry-indicated patients.2,9

Telemetry does not replace frequent observation and vital signs, nor should it be used to influence nurse-to-patient staffing ratios through inappropriate use.9 Over-monitoring increases the risk of artifacts and false alarms and the risk of their misinterpretation, and it also desensitizes monitor watchers, leading to missed meaningful alarms and errors in clinical management.1,3,4,2 Additional safety concerns include alert fatigue and interruptions that adversely affect patient care and outcomes.2,9 The overall clinical value of ECG monitoring is often overestimated1,4 and may lead both nurses and physicians to feel a false sense of security about monitoring of patients.5

The simple recognition of low-risk patients not needing monitoring has both clinical and financial implications related to reduced adverse outcomes for patients, increased monitoring capacity, and effective use of limited resources.1,4,6 Clinicians must ensure consistency between initial symptoms and final diagnoses.10 Additionally, current patient diagnosis should be used to determine if telemetry monitoring is indicated each day.10 It must be noted that class II indications give clinicians the opportunity to examine and uniquely evaluate each patient to decide whether continued ECG monitoring is warranted. Some institutions have reexamined best evidence and enlisted the consensus of clinical experts to supplement the existing 2004 AHA practice standards to reflect the current practice environment and include populations not specially addressed. This work includes indications, exclusion criteria, and discharge criteria for telemetry monitoring.2,7 These supplements to practice may minimize ECG overmonitoring and undermonitoring, prevent overcrowding in the emergency department and ambulance diversion, and enhance clinical outcomes.1,6,7

 Determining appropriate admission, monitoring, and discharge of patients on telemetry units ultimately depends on interprofessional teamwork. Nurse involvement is key for the ideal functioning of modified criteria systems.2 Nurses play a pivotal role in reviewing the need for telemetry on a daily basis and consulting with the treatment team.7 Physicians are uniquely positioned to determine which patients need ECG monitoring, as supported by nursing staff, evidence-based tools and guidelines, and their own clinical expertise.1,3,6,4,10 Eight clinical considerations1,2,5,6 (Table 5) have the potential to influence decision making by nurse-physician interprofessional teams as they collaboratively provide the best possible care for patients, whether or not those patients are being monitored.

FINANCIAL DISCLOSURES
None reported.

eLetters
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REFERENCES

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