MEDICAL UNIVERSITY OF SOUTH CAROLINA
VALUE INSTITUTE
Evidence-Based Practice Brief
Risk Stratification of Motion Alarms to Prevent Accidental Falls

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ASK THE QUESTION
Question(s): For hospitalized patients in the acute care setting, does risk stratifying motion alarm use (i.e., bed exit alarms, chair alarms) reduce the future risk of accidental falls while minimizing alarm fatigue?

SEARCH FOR EVIDENCE
Databases: PubMed, CINAHL, Scopus

PubMed search strategy: (inpatients OR hospital*) AND (alarm* OR alerts) AND (fall OR falls) with or without “alarm fatigue”

Filters: Humans, English, Published last 10 years

CRITICALLY ANALYZE THE EVIDENCE
There were three articles (Chiu-ai et al., 2015; Hubbartt et al., 2011; Melin, C., 2017) found addressing how to target motion alarm use to best balance alarm fatigue and falls prevention in acute care patients. Only one study (Melin, C., 2017) directly incorporated risk stratification of motion alarms based on patient-specific factors.

Chiu-ai et al. (2015) systematically reviewed 17 articles to determine the effectiveness, usability and acceptability of health technology in falls detection in older adults. Four of these studies were specific to motion sensors. Chiu-ai and colleagues found that while the evidence for sensor technologies was lacking, the two RCTs that had been published showed no significant improvements in fall rates when using motion sensors. Additionally, there is minimal published data on the attitudes and beliefs of healthcare professionals regarding health technology applications for falls prevention. However, nurses have expressed issues with false alarms and interference with usual clinical care due to motion sensors. Hubbartt et al. (2011) evaluated nurses’ patterns of use, their experiences and beliefs about bed alarms in two acute care units at a single hospital in North Carolina. The option of portable bed alarms was added to the existing falls prevention protocol as part of a quality improvement initiative. Hubbartt and colleagues found that nurses chose to use alarms on patients who had a psychiatric diagnosis or experienced confusion, dementia, or alcohol or substance withdrawal. A qualitative evaluation found that most nurses were ambivalent about the effectiveness of the alarms and felt that alarms would not improve patient safety, largely because of excessive false alarms and existing regular rounding processes. Melin, C. (2017) evaluated fall rates in a single med-surg unit before and after incorporating risk-stratified use of motion alarms. Hospitalized patients were provided motion alarms for fall prevention if both of the following criteria were met: 1) a Morse Fall Risk assessment score of at least 45, and 2) patient identified as ‘forgets limitations’ in the mental status portion of the Morse Fall
**Risk assessment.** As a result of this initiative, the average monthly pre-intervention fall rate decreased by 44.5% (8.67 falls/1000 patient-days vs 5.07 falls/1000 patient-days).

This literature review establishes that consistent criteria for determining which patients will benefit from a bed exit alarm does not exist. However, patients who have delirium or cognitive impairment, those who cannot walk unsupported, and patients with an unsafe gait may benefit from a motion alarm. Nursing-related barriers, like false alarms, must also be acknowledged during the decision-making process regarding motion alarms in falls prevention for hospitalized patients.

<table>
<thead>
<tr>
<th>Author/Date/ Journal</th>
<th>Purpose of Study</th>
<th>Study Design</th>
<th>Sample&amp; Setting</th>
<th>Outcomes</th>
<th>Design Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chiu-ai et al., 2015, International Journal of Evidence-Based Healthcare</td>
<td>To analyze the evidence on the effectiveness, usability and acceptability of health technology in falls detection and prevention among older adults</td>
<td>Systematic review</td>
<td>17 articles divided by technology type (SRs, RCTs, observational) Sensors (n=4)</td>
<td>The evidence for sensor technologies in falls prevention is lacking -2 RCTs showed no significant improvements in fall rates with motion sensor use There is little published data on the attitudes and beliefs of healthcare professionals in the use of health technology in falls detection and prevention -issues with false alarms for sensor technologies noted -nurses need compact sensors, with refined technology, few instances of false alarms, and for sensors not to interfere with their usual clinical care</td>
<td>Study Limitations = None Systematic Review Review did not address focused clinical question Search was not detailed or exhaustive Quality of the studies was not appraised or studies were of low quality Methods and/or results were inconsistent across studies</td>
</tr>
<tr>
<td>Melin, C., 2017, International Journal of Evidence-Based Healthcare</td>
<td>To introduce and assess a process change to potentially reduce fall rates on an inpatient medical–surgical unit</td>
<td>Quality Improvement</td>
<td>Fall rate assessment in a 38-bed med-surg unit (community hospital in Southeastern US; 2016) before and after updates to an existing evidence-based falls prevention program -Pre: bed alarm based</td>
<td>The average monthly pre-intervention fall rate was 8.67 falls/1000 patient days, as compared with 5.07 falls post-intervention, an overall decrease of 44.5% in the average number of falls per month</td>
<td>Study Limitations = None Quality Improvement (pre-post, controlled pre-post, historical comparison, time series) Intervention not evidence-based Improvement method was not clearly identified or the need for improvement was not described</td>
</tr>
</tbody>
</table>
on nurse discretion
-Post: bed alarm
based on 1) Morse Fall
score of at least 45
and 2) identified in the mental
status assessment as
‘forgets limitations’
Brief 20-minute
education and regular
rounding

| Stakeholders, organizational
culture, patients, or interventions
were not clearly described or
appropriate |
| Interventions were not
described in
enough detail to be replicated by
others |
| Baseline and outcome data
were not collected and reported
appropriately or in the same
manner |
| Data collection tools were not
validated to measure intended
outcomes |
| Any modifications made to the
intervention were not based on
pilot studies |

Publication Bias
(e.g. pharmaceutical
company sponsors study on
effectiveness of drug)

Increase Quality Rating if:
Large effect
(When the relative risk of
association between two
factors is large or very
large)

Dose response
(When the dose-
response relationship
increases the confidence
than an effect is real and
substantial)

Plausible confounders
(When plausible residual
confounding is directly
impacting the magnitude
effect)

Hubbartt et al.,
2011,
Rehabilitation
Nursing
To pilot the use
of bed alarms in a Level I trauma
center and evaluate nurses’
patterns of use, their experiences
and beliefs about bed alarms

Quality Improvement
Nurses working on two
nursing units at a Level
I trauma center (Wake
Forest, NC)
-portable bed alarms
were available, but not
required and inconsistently used
(n=15 patients)
-focus group
evaluation (n=15
nurses)

At the time the bed
alarms were instituted, the hospital’s overall
hospital fall rate was
3.8 falls per 1,000
patient days

Nurses chose to use alarms
on patients who had a
psychiatric diagnosis or
experienced confusion,
dementia, or alcohol or
substance withdrawal
(mobility impairment or
dementia)
Nurses’ comments during the
focus group revealed
ambivalence about the
effectiveness of the alarms:
Cons
- could not hear the alarm -
bed alarms represented only
one type of alarm to which
nurses must respond
- “you have to make routine
rounds anyway”
- excessive false alarms
Pros
- “patient undergoing alcohol
withdrawal, the alarm was
effective and we didn’t need a
one-on-one sitter”
- alarms worked best with
“patients who are more

Study Limitations =
None

Quality Improvement (pre-post,
controlled pre-post, historical
comparison, time series)

Intervention not evidence-based

Improvement method was not
clearly identified or the need for
improvement was not described

Stakeholders, organizational
culture, patients, or interventions
were not clearly described or
appropriate

Interventions were not
described in enough detail to be
replicated by others

Baseline and outcome data
were not collected and reported
appropriately or in the same
manner

Data collection tools were not
validated to measure intended
outcomes

Any modifications made to the
intervention were not based on
pilot studies

Level of evidence for studies as a
whole:

- High
- Moderate
- Low
- Very Low
restless, seem to magically move quickly”

Bed alarms often were not used until a patient demonstrated a need by attempting to get out of bed without assistance

Nurses’ experiences led them to believe the alarms would not improve patient safety

REFERENCES


Appendix A: GRADE criteria for rating a body of evidence on an intervention
Developed by the GRADE Working Group

**Grades and interpretations:**
<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Further research is very unlikely to change our confidence in the estimate of effect.</td>
</tr>
<tr>
<td>Moderate</td>
<td>Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.</td>
</tr>
<tr>
<td>Low</td>
<td>Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.</td>
</tr>
<tr>
<td>Very Low</td>
<td>Any estimate of effect is very uncertain.</td>
</tr>
</tbody>
</table>

**Type of evidence and starting level**

<table>
<thead>
<tr>
<th>Evidence Type</th>
<th>Starting Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomized trial</td>
<td>High</td>
</tr>
<tr>
<td>Observational study</td>
<td>Low</td>
</tr>
<tr>
<td>Any other evidence</td>
<td>Very Low</td>
</tr>
</tbody>
</table>

**Criteria for increasing or decreasing level**

**Reductions**
- Study quality has serious (−1) or very serious (−2) problems
- Important inconsistency in evidence (−1)
- Directness is somewhat (−1) or seriously (−2) uncertain
- Sparse or imprecise data (−1)
- Reporting bias highly probable (−1)

**Increases**
- Evidence of association† strong (+1) or very strong (+2)
- Dose-response gradient evident (+1)
- All plausible confounders would reduce the effect (+1)

†Strong association defined as significant relative risk (RR 2-5 or 0.5-0.2) based on consistent evidence from two or more studies with no plausible confounders; Very strong association defined as significant relative risk (RR >5 or <0.2) based on direct evidence with no threats to validity.