

The occurrence of adverse events potentially attributable to nursing care in medical units: Cross sectional record review



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ABSTRACT

Background: Ensuring the safety of hospitalized patients remains a major challenge for healthcare systems, and nursing services are at the center of hospital care. Yet our knowledge about safety of nursing care is quite limited. In fact, most earlier studies examined one, or at most two, indicators, thus presenting an incomplete picture of safety at an institutional or broader level. Furthermore, methodologies have differed from one study to another, making benchmarking difficult.

Objectives: The aim of this study was to describe the frequencies of six adverse events widely considered in the literature to be nursing-sensitive outcomes and to estimate the degree to which these events could be attributed to nursing care.

Method: Cross-sectional review of charts of 2699 patients hospitalized on 22 medical units in 11 hospitals in Quebec, Canada. The events included: pressure sores, falls, medication administration errors, pneumonias, urinary infections, and inappropriate use of restraints. Experienced nurse reviewers abstracted patients' charts based on a grid developed for the study.

Results: Patient-level risk for at least one of these six adverse events was 15.3%, ranging from 9% to 28% across units. Of the 412 patients who experienced an event, 30% experienced two or more, for a total of 568 events. The risk of experiencing an adverse event with consequences was 6.2%, with a unit-level range from 3.2% to 13.5%. Abstractors concluded that 76.8% of the events were attributable to nursing care.

Conclusion: While the measurement approach adopted here has limitations stemming from reliance on review of documentation, it provided a practical means of assessing several nursing-sensitive adverse events simultaneously. Given that patient safety issues are so complex, tracking their prevalence and impact is important, as is finding means of evaluating progress in reducing them.

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What is already known about the topic?

- Almost 15 years into the current patient safety movement, hospital safety remains a major challenge. Rates of

adverse events are high, and these events clearly have negative impacts on patients' quality of life and healthcare system costs.

- There is no consensus on data collection approaches and indicators to evaluate nursing-sensitive adverse events, rendering benchmarking difficult, if not impossible.
- While there are many indicators for evaluating safety of care, there has been limited research on effective

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methods for tracking a set of nursing-sensitive safety indicators.

What this paper adds

- Our data suggest that one patient out of seven hospitalized on medical units experiences at least one nursing-related adverse event, a significant number in terms of quality of life and healthcare costs. This paper provides a fuller picture of care safety by tracking simultaneously six nursing sensitive safety indicators as opposed of most research that track one indicator at a time.
- Our reviewers found evidence in documentation that 76% of the events were attributable to nursing care processes. This result provides initial benchmarks regarding the attribution of six adverse events to nursing care from patients' charts.
- The results show that the risk of occurrence of an AE is at 15.3% and the risk of occurrence of an adverse effect with consequence at 6.2%. This distinction is important for highlighting risks to patient well-being of nursing-related safety problems and is crucial for properly assessing the costs of safety events to the healthcare system. If we should not take into account the risk of considering globally all the AE we would lack information on the cost of poor quality of care.
- The results show large variations between units as of the occurrence of AE and their attribution to nursing care. This result reinforces the need to have benchmarks in order to have a more realistic view.

1. Introduction and background

Improving hospital safety remains an ongoing challenge more than a decade after the beginning of the current wave of attention by policymakers, researchers, and clinicians (Agency for Healthcare Research and Quality 2009; Institute of Medicine, 2000, 2001; National Quality Forum, 2009). Obtaining an accurate sense of the magnitude of the problem has been difficult, especially with respect to safety outcomes potentially sensitive to nursing care, since progress in gauging the frequency and severity of events hinges on consensus around data collection methods and benchmarks. The objective of the present study was to develop a profile of the occurrence of six adverse events (AEs), determine the severity of these events and the degree to which they are attributable to nursing care, and develop a methodology that could foster benchmarking.

In Canada, a study by Baker et al. (2004) reviewed a random sample of charts for nonpsychiatric, nonobstetric adult patients in 15 Canadian hospitals in the year 2000. Out of 3745 patients' charts, and after adjustment for the sampling strategy, the AE rate was 7.5 per 100 hospital admissions (95% confidence interval [CI] 5.7–9.3). Among the AEs experienced by patients, 36.9% (95% CI 32.0–41.8%) were judged to have been preventable and 20.8% (95% CI 7.8–33.8%) resulted in death. While these data provide a general sense of the frequency of AEs, they do not speak specifically to issues particular to nursing care. To our

knowledge, the only study based on multiple indicators potentially attributable to nursing was conducted by Blegen and Vaughn (1998) in the United States, who reported an incidence rate of 13.2 per 1000 patient days for five types of AEs.

Brown et al. (2010) describe nursing-sensitive outcomes as those reflecting care that is mainly provided by nurses. Generally accepted assumptions about nursing's role in clinical care (Savitz et al., 2005) and empirical evidence linking nursing interventions with care outcomes (Doran, 2003) suggest these indicators are particularly related to nursing work. Other indicators that have an established association with nursing care include deep vein thrombosis and pulmonary embolism, inappropriate use of restraints, and medication administration errors (Needleman et al., 2007). These AEs have a serious impact on patient morbidity and mortality as well as on the use of resources, since the clinical issues that emerge prolong hospital stays and additional treatments often required to address them tend to increase the costs of care (Gallagher et al., 2008; Kohlbrenner et al., 2011).

Safety research in nursing has been characterized by several problems: (1) an absence of systematic strategies and methodologies for measuring outcomes related to nursing care; (2) the use of isolated indicators that provide only a fragmented sense of safety in practice; and (3) the inability to distinguish what is attributable to nursing care (Kurtzman, 2010), with the end result that we lack important information about the scope of risks associated with nursing care. Better understanding of the magnitude of the problem and of nursing's part in it could make it possible to acknowledge the problem openly, measure its complexity, identify the contributing factors, and most importantly, take action.

The present study examined the charts of nearly 3000 patients admitted to medical units in a major Canadian province. These units generally admit adult patients experiencing serious acute exacerbations of chronic illnesses as well as individuals with acute illnesses requiring close monitoring and/or intensive evaluation of serious signs and symptoms that cannot be managed on an outpatient basis.

2. Methods

This was a descriptive study of the occurrence of six adverse events (AE) based on a cross-sectional review of patients' charts. Three AE indicators were examined: all events, events with consequences, and events attributable to nursing care. An AE is generally defined as "an unintended injury or complication that results in disability at the time of discharge, death or prolonged hospital stay and that is caused by healthcare management" (Baker et al., 2004, p. 1679). To broaden this definition to include all events, even those with no consequence on the patient's health but with repercussions on nurses' work and on health system costs, we used the AE classification from the Common Terminology Criteria for Adverses Events (CTCAE) (US Department of Health & Human Services, 2009). In this classification, events without consequence correspond to Grade 1 on the CTCAE scale entitled

'Asymptomatic or mild symptoms; clinical or diagnostic observations only, intervention not indicated'. AEs with consequences correspond to Grades 2–5 on that scale. Categorizing AEs as being with or without consequences provides a more refined sense of their impacts. Indeed, many events may have no visible impact on the longer-term health status of patients yet still have implications for nursing activities and costs of care, since follow-up of the events requires extra interventions such as closer observation, additional diagnostic testing, or administration of medications.

One final aspect of events—*attribution to nursing care*—was also assessed. This variable relates to the reviewer's sense regarding the AE's links to nursing interventions and the potential preventability of the AE through better nursing care.

2.1. Sample/population

This study was conducted in 22 acute care medicine units (i.e., units providing care to acutely physically ill adults whose treatment plans did not involve surgical interventions) located in 11 hospitals in Quebec, Canada. We selected only medicine units to ensure greater uniformity of patients in the study. Units were purposefully selected to generate a stratified sample covering a variety of organizational contexts of nursing care: institutional teaching status (university and community), size, and location (urban, suburban, rural), as well as nursing workforce profiles (different proportions of nurses holding university degrees) and varying degrees of work reorganization in the recent past. This selection was informed by a preliminary survey sent to all hospitals in Quebec. Fifty hospitals (50%) replied to the survey. The units for study were chosen among 11 hospitals that showed variations on the criteria mentioned above (Dubois et al., 2013).

Archived charts of patients hospitalized on those units between July 2008 and August 2009 were reviewed retrospectively. The patients' charts were selected based on four criteria: (1) admission diagnosis typical of care provided on medicine units; (2) hospitalizations of at least 48 h; (3) patients aged 18 years and older; and (4) length of stay between 2 and 15 days. Charts were selected in the order of patients' admission to the unit until a total of 125 patients in each unit was reached. The chart analysis covered a maximum period of 30 days. Events that had occurred prior to the date of selection were not included in the abstraction.

2.2. Data collection instrument

Six AEs were studied: pressure sores, falls, medication administration errors (MAE), inappropriate use of restraints, pneumonias, and urinary infections. The choice of these AEs was based on the evidence from the literature review and the availability of data in patients' charts. Reports from the Agency for Healthcare Research and Quality, the National Quality Forum, the American Nurses Association (Savitz et al., 2005) and the Joint Commission (Rhie et al., 2007) were used to

identify a set of nursing-sensitive outcomes that reflect the unique contribution of nursing practice to patient safety. Of these indicators, we retained those for which there seemed to be the most consensus. We also took into consideration the availability of information from patients' charts (incident reports, discharge summaries, medications, lab results, nursing notes, physician progress notes, etc.). Based on this evidence and on the feasibility of collecting the data, we decided to examine a composite of six AEs. A three-part chart abstraction tool was developed to guide reviewers through the identification of these six AEs.

- (1) *The occurrence of AEs and their consequences*: A checklist for determining the severity of these six AEs by gauging their impacts on patients was developed based on the work of Baker et al. (2004) and Blais et al. (2004). Table 1 presents the checklist, which contains six ordinal scales with four, five, or six points depending on the AE. These scales were validated by a panel of three experts to ensure their clarity, relevance, and validity. For each AE, the experts also established the cut-off points separating events with consequences from those without (Table 1).
- (2) *The extent of attribution of AEs to nursing care*: Based on the work of Baker et al. (2004), a six-point scale was developed: 1 = virtually no evidence that nursing care was involved; 2 = minimal to slight evidence that nursing care was involved; 3 = not very likely that nursing care was involved (less than 50% likelihood); 4 = more likely than not that nursing care was involved (more than 50% likelihood); 5 = moderate to strong evidence that nursing care was involved; and 6 = virtually certain that nursing care was involved. After discussion, the experts decided an AE would be considered potentially attributable to nursing care when the score was 4 or higher.
- (3) *The characteristics of the patient and the admission*: The characteristics of interest were age, sex, number of diagnoses on admission, number of risk factors (e.g. obesity, smoking), number of comorbidities, and length of stay.

2.3. Rigor of data collection/inter-rater reliability

A template that drew upon tools developed in previous studies (Baker et al., 2004) was developed to ensure consistency in the chart reviews. Three experienced nurse research assistants with university degrees were recruited. They underwent four-hour training sessions in the use of this template; they were given a training manual containing directions and examples of different situations they might encounter.

The protocol for detecting and assessing safety-related events involved a two-stage review process. First, each chart was screened by one reviewer to check for the occurrence of at least one of the six events by systematically examining incident reports, discharge summaries, medications, lab results, nursing notes, physician progress notes, and other notes or comments. To evaluate inter-rater reliability with regard to detection of safety-related events,

Table 1
Checklist for assessing AE severity.

Adverse events	Severity of the event	Consequence (with/without)
Pressure sores	1 = Region of skin presenting persistent redness	Without
	2 = Partial loss of cutaneous layers	With
	3 = Deep craters in skin	With
	4 = Cutaneous lesions exposing muscle tissue or bone surface	With
	5 = Predominant necrotic bedsore (cannot be coded)	With
Inappropriate use of restraints	0 = No negative consequence for the patient	Without
	1 = Changes in the integrity of the regions of the body in contact with the restraint (redness, edema, pain, others)	With
	2 = Physiological problems requiring increased monitoring or an intervention (respiratory difficulties, circulatory problems, vomiting, others)	With
	3 = Worsening of the patient's status requiring a life-support intervention	With
	4 = Permanent disability	With
Falls	5 = Death	With
	0 = No noticeable impact and no intervention required	Without
	1 = No noticeable impact but intervention required (e.g. observation)	Without
	2 = Temporary worsening of the patient's health status requiring an intervention	With
	3 = Worsening of the patient's health status requiring a life-support intervention	With
Medication administration errors	4 = Permanent disability	With
	5 = Death	With
	0 = No noticeable impact and no intervention required	Without
	1 = No noticeable impact but intervention required (e.g. observation)	Without
	2 = Temporary worsening of the patient's health status requiring an intervention	With
Pneumonia	3 = Worsening of the patient's health status requiring a life-support intervention	With
	4 = Permanent disability	With
	5 = Death	With
	Urinary infections	1 = No noticeable impact but intervention required
2 = Temporary worsening of the patient's health status requiring an intervention		With
3 = Worsening of the patient's health status requiring a life-support intervention		With
4 = Permanent disability		With
5 = Death		With

the first seven charts of each unit were independently examined by a second reviewer. Quality control was thus performed for a sampling of 6% of charts ($n = 157$), which compared favorably with rates ranging from 1% to 5% in other studies (Brennan et al., 1991; Zegers et al., 2007).

If one or more safety-related events were identified in a patient's chart in the first-stage screening, the chart was reviewed a second time, more thoroughly and independently. In the second-stage review, assessors were also asked to rate the severity of each event and its attribution to nursing care. The two reviewers' results were compared. In cases of disagreement, the reviewers attempted to reach agreement through discussion. If they could not, a third reviewer did the arbitration. Only seven events out of 568 required arbitration.

3. Data analysis

The data were analyzed descriptively using SPSS software version 16.0. The results are presented in terms of risk of occurrence and incidence per 1000 patient days to enhance our ability to compare findings with other studies using one or another of these indicators with the same denominator.

The indicators calculated were:

1. *Occurrence of AEs*: the frequency, risk of occurrence of at least one AE, and AE incidence rate.
2. *Occurrence of AEs with consequences*: the frequency and proportion of AEs with consequences, the risk of occurrence, and the incidence rate.
For these two indicators, the risk of occurrence of an AE with or without consequences was calculated as the fraction of all patients with at least one AE. The incidence rate for AEs was measured by comparing the total number of AEs with the number of patient days spent in the units under study (expressed as AEs per 1000 patient days).
3. *The proportion of AEs potentially attributable to nursing care* in relation to the total number of AEs identified.

These indicators were calculated for each of the 22 units, as well as the coefficients of variation (CV = ratio between standard deviation and mean) measuring the extent of variability and relative dispersion across units. The higher the CV, the greater the dispersion around the mean. This is expressed as a percentage.

Table 2

Frequency of AE occurrence: risk and incidence.

Types of AE	Number of patients	Number of AEs	Risk of experiencing an AE (%)	Incidence (per 1000 patient days)
Pressure sores	51	52	1.9 (1.4–2.4) ^c	1.7 (0.1–3.2)
IUR ^a	23	24	0.9 (0.5–1.2)	0.8 (0.0–1.8)
Falls	160	230	5.9 (5.0–6.8)	7.5 (4.2–10.7)
MAE ^a	149	169	5.5 (4.7–6.4)	5.5 (2.7–8.3)
Pneumonia	23	23	0.9 (0.5–1.2)	0.7 (0.0–1.8)
Urinary infection	70	70	2.6 (2.0–3.2)	2.3 (0.5–4.1)
Total for six AEs	412 ^b	568	15.3 (13.9–16.6)	18.5 (13.4–23.5)

^a IUR: inappropriate use of restraints; MAE: medication administration errors.^b Note that 412 is the total number of patients who experienced at least one of the six AEs; some had more than one.^c Confidence interval of 5%.

4. Results

4.1. Patient characteristics

A total of 2699 patients' charts from 22 medical units in 11 acute-care hospitals were reviewed. The patients' average age was 71.1 years, and 56.4% were women. Average length of stay was 11.4 days. On average, 1.6 risk factors, 3.9 comorbidities, and 1.3 diagnoses on admission per patient were identified.

The Kappa coefficient for the measurement of inter-rater agreement for the quality control process on the detection of the events was 0.98. The Kappa coefficients for severity of events were .970 and .978 for attribution to nursing care.

4.2. Occurrence of AEs

Of the 2699 patients, 412 experienced at least one of the six AEs, a risk of occurrence of 15.3%, or one patient in seven. The incidence rate for the six AEs was 18.5 per 1000 patient days (Table 2). Altogether, 30% of the 412 patients experienced two or more AEs (up to a maximum of eight) for a total of 568 AEs. The most common AEs were falls and MAEs, with patient-level rates of 5.9% and 5.5%, respectively.

4.3. Occurrence of AEs with consequences

Of the 412 patients who experienced at least one AE, 167 experienced an AE with identified consequences, for

an overall population-based rate of AEs with consequences of 6.2%. In all, 184 AEs with consequences were identified (32.4% of all AEs). As such, the incidence rate for AEs with consequences was 6.0 per 1000 patient days. The AEs with the greatest likelihood of having identified consequences were pneumonias (100%), pressure sores (80%), and urinary infections (67.1%) (Table 3).

4.4. Variation in AEs among units

Unit-level per patient rates for the six AEs combined ranged from 8.9% to 28.0%, for a CV of 34.0% (Fig. 1). Unit-level per patient rates of occurrence for AEs with consequences ranged from 3.2% to 13.5%, for a CV of 54.3% across the 22 units. Individually, rates of each of the six AEs also showed variations across the units. The greatest variations were seen in the inappropriate use of restraints and in cases of pneumonia (Table 4).

4.5. Proportion of AEs potentially attributable to nursing care

The analysis of the attribution of AEs to nursing care showed that 76.8% of all the AEs combined were determined by the chart abstractors to be attributable to nursing care (Table 5), including 60% for which the level of certainty was very high. The AEs most often attributable to nursing care were MAEs (98.8%) and inappropriate use of restraints (100%) (Table 6). It should be noted that, in Quebec, it is the nurses who prescribe restraints. Three units stood out with very much lower rates of attribution.

Table 3

Frequency of AEs with consequences: risk and incidence.

Types of AE	Number of patients with consequences	Number of AEs with consequences	Risk of AEs with consequences (%)	Incidence of AEs with consequences ^c (per 1000 patient days)
Pressure sores	42	42	1.6 (1.1–2.0) ^d	1.4 (0.0–2.8)
IUR ^a	1	1	0.0 (0.0–0.1)	0.0 (0.0–0.2)
Falls	40	42	1.5 (1.0–1.9)	1.4 (0.0–2.8)
MAE ^a	29	29	1.1 (0.7–1.5)	0.9 (0.0–2.1)
Pneumonia	23	23	0.9 (0.5–1.2)	0.7 (0.0–1.8)
Urinary infections	47	47	1.7 (1.2–2.2)	1.5 (0.1–3.0)
Total for six AEs	167 ^b	184	6.2 (5.3–7.1)	6.0 (3.1–8.9)

^a IUR: inappropriate use of restraints; MAE: medication administration errors.^b 167 is the total number of patients who experienced at least one of the six AEs with consequences.^c The incidence is calculated on the total number of AEs, which was 568 (see Table 2).^d Confidence interval of 5%.

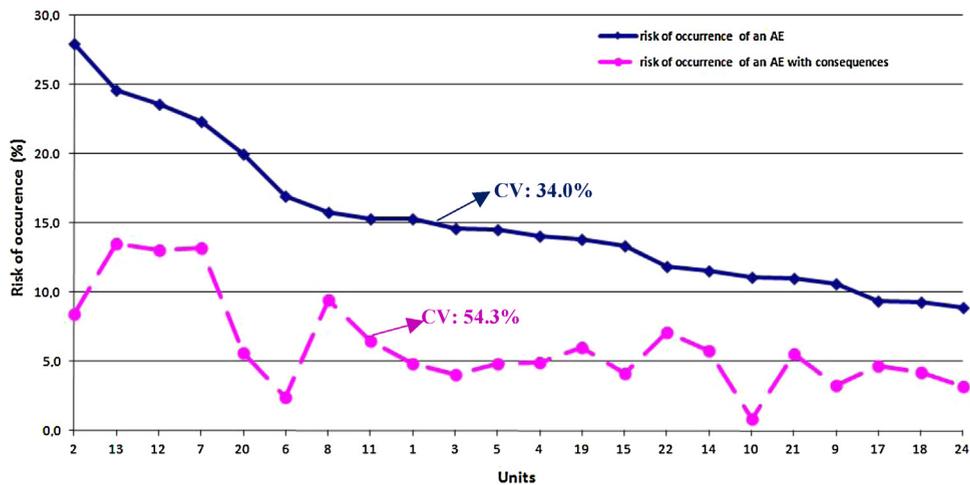


Fig. 1. Variation in the proportion of AEs among the 22 medical units.

Table 4

Variations in risk of occurrence of an AE and risk of occurrence of an AE with consequence among the 22 units, for each type of AE.

Types of AE	Coefficient of variation (%)	
	Risk of occurrence of an AE	Risk of occurrence of an AE with consequences
Pressure sores	89.2	99.4
IUR ^a	168.0	458.3
Falls	54.6	102.7
MAE ^a	48.0	109.6
Pneumonia	129.7	129.7
Urinary infections	75.9	67.3
Total for the six AEs	34.0	54.3

^a IUR: inappropriate use of restraints; MAE: medication administration errors.

Variation among the units ranged from 45.5% to 91.2%, and the CV was 16.1% (Fig. 2).

5. Discussion

In this study, the frequency of adverse events was assessed in a large sample of 2699 patients hospitalized on medical units through detailed chart review following a strict protocol. For our methodology, we adapted methods developed and rigorously tested by researchers

Table 6

Attribution to nursing care by types of AE.

Types of AE	Number of AEs attributable to nursing care	Total number of AEs	Proportion of AEs attributable to nursing care (%)
Pressure sores	41	52	78.8
IUR ^a	24	24	100.0
Falls	140	230	60.9
MAE ^a	167	169	98.8
Pneumonia	16	23	69.6
Urinary infections	48	70	68.6
Total for all AEs combined	436	568	76.8

^a IUR: inappropriate use of restraints; MAE: medication administration errors.

in other healthcare fields (Baker et al., 2004; Brennan et al., 1991) than the study of nursing care. Inter-rater agreement revealed particularly high in this study, in comparison to others, for the three parameters studied: the detection of the adverse events, their severity and their attribution to nursing. This may be in part due to the fact that the nurse researchers were following a detailed protocol for which they had been well trained. For the detection of events, the high rate of agreement is not surprising because they were looking for six specific

Table 5

Extent of attribution of AEs to nursing care.

Extent of attribution	Number of AEs	%	
1. Virtually no evidence that nursing care was involved	64	11.4	Not attributable to nursing care 23.2%
2. Minimal to slight evidence that nursing care was involved	44	7.5	
3. Not very likely that nursing care was involved (less than 50% likelihood)	24	4.3	
4. More likely that nursing care was involved (more than 50% likelihood)	44	7.7	Attributable to nursing care 76.8%
5. Moderate to strong evidence that nursing care was involved	53	9.3	
6. Virtually certain that nursing care was involved	340	59.8	
Total	568	100.0	

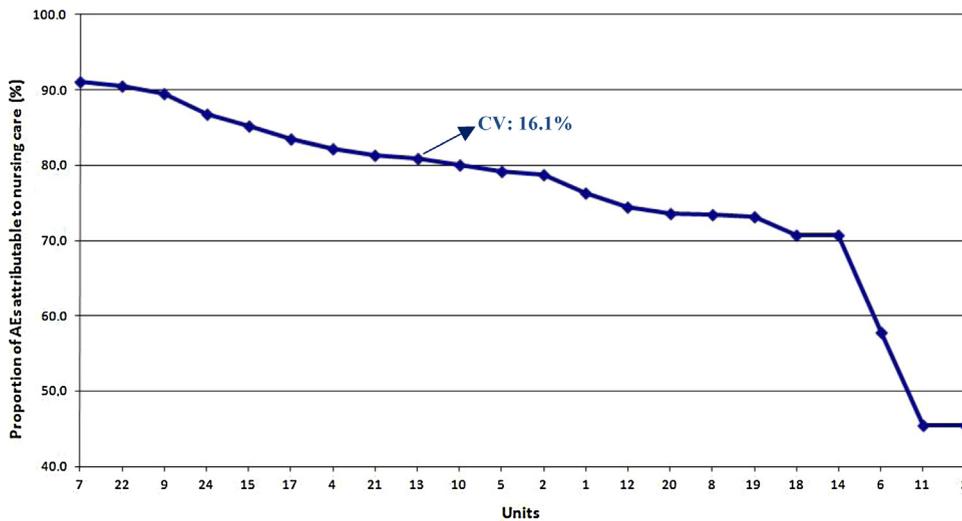


Fig. 2. Variation in the proportion of AEs attributable to nursing care among the 22 medical units.

events that were quite easily detectable from the patients' charts. For two of those events, both raters could draw on incident reports (falls, medication administration errors) while the four others could hardly be missed if there were explicit medical and nursing notes. With regard to the assessment of the severity of the incidents and their attribution to nursing, the high rate could be due to the fact that the scales used had well-defined categories and emphasis was put during the training session on discriminating between these categories. It is worthwhile noting that the raters tended to score at the two extremes of the 6-point scale used to assess the attribution to nursing care.

The data presented here are intended to provide updated benchmarks that we believe should renew concerns about the continuing unacceptably high rate of these events. The first step in remedying complex (or "wicked") problems is breaking organizational silence about the magnitude of the problem, so that institutions can undertake real action (Harris et al., 2009). Our work is in alignment with documents and indicator lists from the ANA, NQF, and AHRQ intended to stimulate research on nursing practices as they relate to care quality and safety.

5.1. The risk of occurrence for each of the six AEs was high and of comparable magnitude to other reports in the literature

The results of our study showed a 15.3% risk of occurrence of at least one AE, implying that one patient in seven experiences at least one of these six events. Since no other study has simultaneously assessed these six events that are potentially attributable to nursing care, it is difficult for us to compare our results. The study that comes closest is that of Blegen and Vaughn (1998), a correlational study aimed at understanding the links between nursing resources and AEs, which, like ours, was based on chart reviews. It examined the occurrence of six AEs: MAEs, falls, pressure sores, patient and family complaints, infections, and death. The results showed an

incidence of 13.2 per 1000 patient days for five of these events; MAEs were not included in that rate because they are counted based on the number of doses administered. This rate is very close to the incidence of 18.5 per 1000 patient days we report here, a rate that includes MAEs at 5.5 per 1000 patient days.

Like the Blegen and Vaughn study, most research on AEs takes the form of correlational studies in which researchers seek to understand the links between certain variables and their effects on the occurrence of one particular AE. Most such studies focus on one, or sometimes two, AEs. For example, the study by Schwendimann et al. (2008), based on reported falls in medical units, showed an incidence of 9.6 per 1000 patient days, while that of Shorr et al. (2008), based on observations in medical and surgical units, showed an incidence of 5.2 per 1000 patient days. The risk of falls in our study was 7.5 per 1000 patient days, midway between the estimates from those two studies.

With regard to MAEs, Biron (2009) reported an 11% per patient occurrence rate (28% when combined with errors due to timing of administration). Our study found an occurrence of 6.3%, lower than Biron's results but comparable to the study by Stratton et al. (2004), which showed a 5.7% risk of occurrence.

Most studies on pressure sores have analyzed prevalence by observation rather than by incidence obtained through chart analysis. For example, the study by Hurd and Posnett (2009) in 13 acute care hospitals in Canada, based on examination of patients, found a 22.9% prevalence of pressure sores. Lahmann et al.'s (2005) study based on examination of patients in several hospitals in Germany obtained a prevalence of 11.7%. Our study showed an incidence rate of 1.9%. It is likely that direct patient observation would have shown a higher prevalence than what we obtained through chart review.

We found lower rates of three AEs—falls, MAEs, and pressure sores—than those reported in earlier studies. While the difference could be related to the chart review methodology, it suggests that the true risk could be even

higher than one patient in seven—a risk we consider already disturbingly high.

5.2. *The risk of occurrence of AEs with consequences is high*

With respect to the severity of AEs, the results show a risk of 6.8% of occurrence of at least one AE with consequences; this means one patient in 15 is at risk of experiencing a consequence that temporarily or permanently worsens health status, requires additional interventions, or lengthens the hospital stay. Here again, it is difficult to compare our level of severity findings against other research results. However, the studies of [Schwendimann et al. \(2008\)](#) and [Shorr et al. \(2008\)](#) found results that were similar to ours with regard to the severity of falls. On the other hand, the study by [Lahmann et al. \(2005\)](#) on pressure sores showed higher levels of severity. Here again, we can conclude that the level of severity we found might have been higher if we had used a different method of data collection, such as direct observation. In addition to the pain, suffering, and dangers to patients they entail, AEs with consequences also have a significant impact on healthcare system costs ([Carrier and Budge, 2010](#); [Pappas, 2008](#); [Rothschild et al., 2009](#)).

5.3. *The percentage of potential attribution of the six AEs to nursing care is high*

The analyses showed that 76.8% of the AEs were potentially attributable to nursing care, i.e., abstractors assessed a greater than 50% likelihood that nursing was responsible in 76.8% of the AEs and judged that nursing care was virtually certainly responsible in nearly 60% of cases. Two of the six AEs were strongly attributable to nursing care: inappropriate use of restraints (100%) and MAEs (98.8%).

The attribution of AEs to nursing care contributes to the advancement of knowledge. Our results constitute empirical validation of the fact that these six AEs are potentially attributable to nursing care and that they could form part of a set of indicators that would help in further investigating nursing's role in patient safety. The reviewers' sense that nursing practice issues were responsible for the majority of these AEs supports considering them as nursing-sensitive and would suggest that broad consideration should be given to work environment issues, including but not limited to staffing levels, in terms of underlying causes.

5.4. *Complementarity of AE indicators and the value of concurrent tracking of multiple events*

Measuring several AEs simultaneously provides a richer sense of the safety of practice conditions because these various events differ in terms of their frequency, severity, and attribution to nursing care processes. For example, the most frequent AEs (falls, MAEs, and urinary infections) are not necessarily those with the most serious consequences (pneumonia, pressure sores, and urinary infections). Likewise, incidents of high frequency and severity are different from the AEs most attributable to nursing care (inappropriate use of restraints, MAEs, and pressure sores). None of the six AEs was high on all of these parameters, but each was

high on at least one. This suggests a need for using a combination of indicators when making nursing management decisions regarding investments in nursing practice and management strategies. Reducing the frequency of AEs in health facilities would be achieved mainly by reducing the frequency of falls, MAEs, and urinary infections. Reducing the consequences of AEs would entail reducing the number of cases of pneumonia, pressure sores, and urinary infections. Finally, the number of AEs directly attributable to nursing care would be reduced by better monitoring of inappropriate use of restraints, MAEs, and pressure sores. With in-depth analysis of several AEs, goals and trade-offs could be clarified.

5.5. *The variability in AE occurrence across nursing units was high*

Another observation was that there was considerable variability in AE occurrence in the 22 units. In some units, the frequency of occurrence was as much as four times higher than in others, with five units presenting a risk of more than 25% for the occurrence of at least one AE (i.e., one patient in four), and in two of those, that risk was more than 40%.

In addition, there was as much as a tenfold variance in the occurrence of AEs with consequences. In two of the 22 units, the risk of occurrence of AEs with consequences was more than 13%, or one patient in nine. Similarly, the extent to which AEs were attributable to nursing care showed significant variability, with some units having up to twice the rate of others. In three units, the percentage of attribution was below 60%. These observations show the need for a better understanding of the factors (systemic, organizational, and individual) underlying these disparities. Managers need this type of information to be able to compare their units with others.

6. Study limitations

While the approach was carefully developed using widely respected earlier work and checks on reliability were carried out, the results must be interpreted in light of specific methodological considerations. Data collection was based on chart review, and though intensive energy was invested in quality control, there were limitations related to quality of health professional documentation and the need for interpretation of the chart by reviewers. Incomplete documentation entails a risk of underestimating incidence rates, as compared with studies conducted by observation. Nevertheless, this method has the advantage of allowing several AEs to be considered at the same time, which would be too unwieldy, if not impossible, to do using observation. Another limitation stems from our use of archived rather than active charts for sequentially admitted patients. While using the latter might have allowed us to verify certain information directly with the nursing staff and patients, it would have created certain ethical difficulties, including a potential obligation of the reviewers to intervene in unfolding clinical scenarios. Caution is therefore advised when comparing our results with

others in the literature. Careful attention to AE operational definitions, data collection strategies (e.g. cross-sectional studies, chart abstraction, extrapolation), data sources (e.g. hospitalized patients, patients' charts, secondary data), and target populations (e.g. elderly, pediatric) is particularly important. Furthermore, although all caution was taken to ensure independent and rigorous assessments of the patients' charts, we cannot preclude that some informal discussions and mutual adjustments between the raters may have occurred during the process and contribute to inflate the interrater agreement.

7. Implications for management and research

The need for more attention to the safety of nursing practice is obvious, as is the need for more discussion and transparency around outcomes of care (Institute of Medicine, 2010; National Quality Forum, 2009). Managers should question the reasons behind this organizational silence, as it is called by Morrison and Milliken (2000). As Henriksen and Dayton (2006) observed, "one cannot address what does not get acknowledged and brought out into the open" (p. 1540). To make the situation more transparent, managers must adopt clear guidelines for performance and accountability (Clarke et al., 2008), as well as mechanisms that will hold nurses accountable for providing high-quality care. Our study constitutes an empirical validation of a set of indicators that can be used in research to further investigate the role of nursing in patient safety. Making a distinction between AEs with and without consequences can be useful for nursing managers, in that it offers two advantages: (1) making the potential risks visible; and (2) identifying the costs associated with increased patient monitoring or added interventions caused even by AEs without consequences. Furthermore, our findings reveal considerable variability among units, which leads us to stress the need for benchmarking, not only between healthcare facilities, but also across units. As well, our results would suggest that by using a variety of indicators, managers may be guided in their choices of organization/system-wide, unit-based, and individual clinician-specific interventions.

8. Conclusion

Our results suggest that issues related to quality and safety in nursing care remain a major concern, with significant consequences for patients, nurses' credibility, and health system efficiency. Nursing-sensitive adverse events are indeed a "wicked" organizational problem, requiring ongoing research as well as action by managers. While recognizing the complex and multifactorial nature of the problems, their magnitude must be acknowledged, and trustworthy, reliable data that speak to some of the subtleties involved must be collected and shared.

Conflict of interest

There are no conflicts of interest to report.

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Ethical approval

Ethical approval for the study was granted by a multi-institution ethics committee based at a university hospital.

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