

DISCURSIVE PAPER

Using multiple data sources to answer patient safety-related research questions in hospital inpatient settings: a discursive paper using inpatient falls as an example

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Aim and objectives. This education-focused paper presents a discussion of possible data sources used in patient safety issues specific to fall reduction in hospital inpatient care settings.

Background. Although hospitals and clinicians in the USA have been implored to improve care and reduce events that harm patients (falls), studies to date have failed to clearly address the facility system-level factors for falls. Making meaningful approaches to modify risk factors is clearly overdue.

Design. Discursive paper.

Method. Possible data sources for answering patient fall-related research questions in hospital settings are categorised as: (1) archived hospital data, (2) surveys of patients/families/clinicians, (3) interviews and focus groups of patients/families/clinicians, (4) publicly available data sets and (5) published legal cases. The complexities of research in fall prevention are illustrated using the conceptual models. Examples were included to illustrate the use of these data sources.

Discussion. Data-related issues include: (1) unit of analysis, (2) computer data processing capabilities, (3) merging data sets from different sources and (4) data abstraction, aggregation and data analytic techniques.

Conclusions. The trend to use multiple data sources to answer research questions is gradually emerging. To demonstrate effective fall prevention efforts across hospitals, publicly available data sets can be reliable sources for analyses to inform policymakers about meaningful fall prevention programmes that result in positive outcomes.

Relevance to clinical practice. Challenges to develop and evaluate any interventions to eliminate risk factors for falls often relate to selecting feasible interventions and whether staff members accept the interventions and adhere to adopting the intervention. Using multiple data sources with time factors to cross-validate the sufficiency of nurses' knowledge with their practice patterns may be more productive. This need further supports the importance of this paper about possible data sources used in the research on patient safety specific to fall reduction for adults in hospital inpatient care settings.

Key words: accidental falls, data collection, hospitals, intervention studies, patients

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Introduction

In the USA, hospitals and clinicians have been implored to improve care and reduce events that harm patients. Since

October 2008, Medicare no longer reimburses acute care hospitals for the costs of additional care required because of hospital-acquired injuries (injurious falls) (Centers for Medicare & Medicaid Services 2008). However, studies to date

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have failed to address the facility system-level factors that affect falls in hospitals clearly. Facility system-level factors (also called extrinsic or environmental factors) refer to the contributors that are not directly linked to individual patients' demographic characteristics and medical conditions (also called intrinsic factors), but are associated with hospital-wide and unit-based situations (e.g. hospital policies related to the fall prevention protocol and staffing patterns) (Currie 2008). Meaningful approaches to modifying facility system-level factors are clearly overdue.

Background

Brief literature review about risk factors for falls and fall prevention efforts is presented later. The causes of falls are multifactorial in nature and are associated with multiple medical, functional and cognitive factors along with facility system-level factors (e.g. physical environment, assistive equipment, staffing and nursing practice culture) (Joint Commission 2005, Gilewski *et al.* 2007, Tinetti & Kumar 2010). Factors and situations that increase the risk of falls and fall-related injuries include unsafe gait and transfer, difficulty in vision and visual perception, unsafe personal care (e.g. risk-taking behaviours in toileting and use of assistive device), cognition impairment and difficulty in understanding or following instructions, incontinence, medical conditions and related medication use, nutrition status and environment (e.g. high bed, lighting and delayed care) (Currie 2008, Tzeng & Yin 2008a, Aberg *et al.* 2009).

Fall prevention programmes are universally multidisciplinary but generally are nursing centred (Gutierrez & Smith 2008). Nurses can influence the health care delivery system if the nursing profession would pursue science-based, holistic and patient-centred care (Aiken 2008). However, fall prevention programmes for hospitalised patients have had limited success.

In the study conducted in 28 German hospitals (Raeder *et al.* 2010), patients in hospitals that were using guidelines were more likely to fall than patients in institutions that did not use any guidelines or were still in the guideline-developing stage. After controlling for the inpatient care unit and individual patient variables, the use of fall prevention guidelines significantly reduced the frequency of fall-related injuries at the inpatient care unit level. In another study performed at two hospitals in Singapore (Koh *et al.* 2009), a multifaceted strategy for the implementation of a fall prevention programme was effective in increasing nurses' knowledge and their compliance with fall risk assessment. However, the strategy did not have a significant effect on reducing the fall and injurious fall rates. In short,

the effect of fall prevention programme implementation on a reduction of total falls and fall-related injuries is still inconclusive.

The present paper

Aims

The purpose of this education-focused discussion paper is to discover possible data sources used in a programme of research on patient safety specific to fall reduction for adults in hospital inpatient care settings. Possible data sources to be used in answering questions about research related to patient falls are introduced. The complexities of research in fall prevention are illustrated. Study examples addressing facility system-level factors for falls are used to illustrate these data sources.

Data sources

The data sources, which have been used in studying issues related to patient safety and quality with a focus on fall reduction for adults in hospital inpatient care settings, are categorised as:

- Source 1: Archived hospital data (e.g. fall incident reports, call light tracking data, conducting chart review on the paper charts or electric health records, staffing/payroll, bed/patient management and insurance reimbursement database);
- Source 2: Surveys of patients, families or clinicians (e.g. patient satisfaction surveys conducted in person before being discharged or via e-mail/website, postal mail and phone);
- Source 3: Interviews and focus groups with patients, families or clinicians (e.g. interviews with nursing staff about the fall prevention-related care);
- Source 4: Publicly available data sets (e.g. American Hospital Association database, State Inpatient Database, Nationwide Inpatient Sample database and the inpatient satisfaction measures created by the Hospital Consumer Assessment of Healthcare Providers and Systems); and
- Source 5: Published legal cases (e.g. NexisLexis® Academic, Federal and State Cases).

Here, it is not intended to exhaust all the data sources that have been or may be used for studying falls. Some data collection methods may be categorised into more than one of the aforementioned sources. For example, observation and field studies may be grouped into Source 2, if a checklist or data collection tool is used, or Source 3, if the process is audio-taped or video-recorded for further content analysis.

In addition, published studies to inform readers on the state of science on fall prevention research (e.g. meta-analysis, synthesis studies) may be grouped into Source 4.

There are pros and cons to use each type of data source. For example, using existing data sets for research has limitations on the scope, depth and breadth of the research questions to be answered dependent on the variables available in the data sets. Also, using existing data sets for research often requires additional time and effort for data management and cleaning as well as often lacks methods to validate the accuracy of data if a concern arises. An example can be found in the study, entitled: *Pros and cons of estimating the reproduction number from early epidemic growth rate of influenza A (H1N1) 2009*, conducted by Nishiura *et al.* (2009). A common misconception is that using existing data sets for analyses is less time-consuming and labour intensive.

In contrast, when a project proposes to use archived hospital data, surveys or interviews/focus groups, researchers need to first address issues related to accessing the potential study sites and the possible mechanisms available to recruit subjects or retrieve data. Researchers may need to go through the same training (e.g. related to protection of human subjects and confidentiality) as that required for new staff members employed by the study sites. Depending on the scope of the study, the data collection process can be time-consuming and labour intensive for the researchers as well as the study site coordinators. Honoraria for the study sites and incentive for the study subjects may be needed. Some study sites may have policies that prohibit any incentives for study participants, including patients, families and clinicians.

Complexities of research in fall prevention

Depending on the research questions to be answered, often more than one data source is used in a single study. Three theoretical models developed by the author (Figs 1–3) illustrate the breadth, depth and complexity of the research related to fall reduction for adults in hospital inpatient care settings. Figure 1 illustrates the hierarchy of the risk factors for falls and levels of interventions related to fall reduction. The hierarchy includes: (1) adult patient, (2) support staff, (3) patient room, (4) hospital and (5) community at large. Figure 2 depicts a framework that is intended to clarify the determinants of falls and to develop interventions to prevent patient falls by adults in hospital inpatient care settings. Figure 3 is a patient-centred nursing model that is designed to promote positive patient outcomes (e.g. no hospital-acquired injurious falls). It shows that a successful fall prevention programme implementation may include the care environment, professional proficiencies of the nurses and the process of caring.

Two testable models (Figs 4 and 5) are presented to illustrate the possible scopes of fall prevention research. Figure 4 is the conceptual model of a project funded by the Agency for Healthcare Research and Quality, Rockville, MD (1R03 HS018258-01; study period: 30 September 2009–29 September 2011). This study examined the unique contribution of call light response time in predicting (1) total fall rates, (2) injurious fall rates and (3) patients' perceptions about call light responsiveness. Data were abstracted from the archived hospital data. The patient care unit-month was the unit of analysis defined as data aggregated by month for

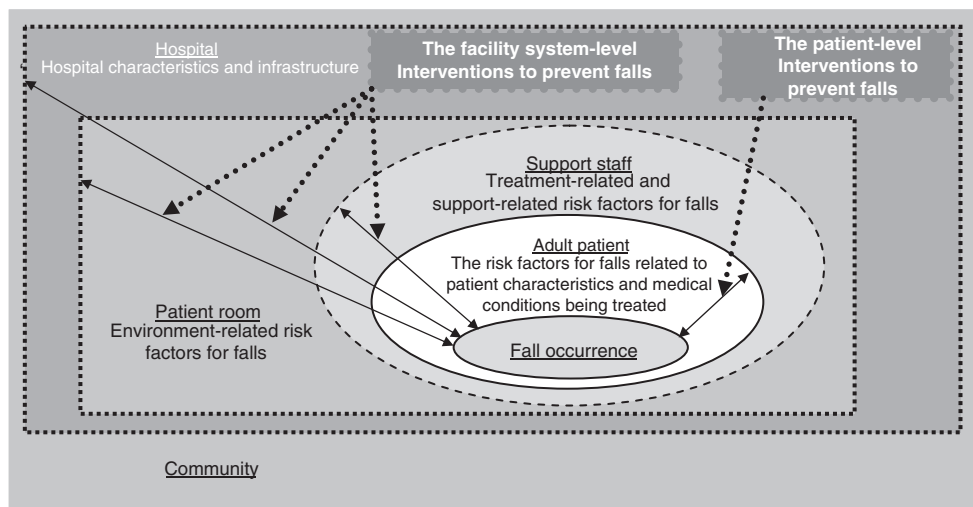


Figure 1 The box model for fall occurrence among adults in hospital inpatient settings. The model depicts the possible determinants of falls and the approaches to develop interventions to prevent adults from falling in these settings.

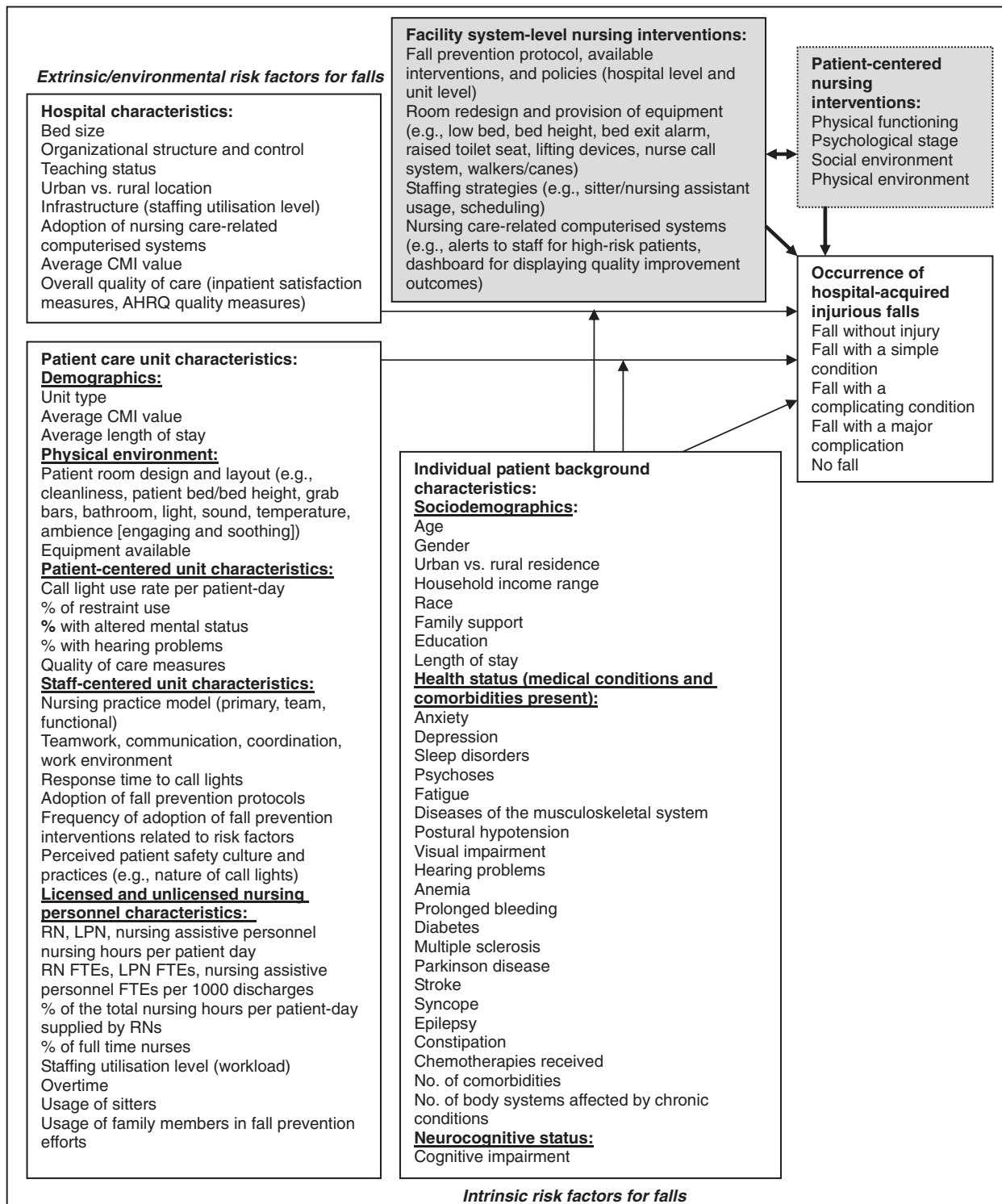


Figure 2 The conceptual model to understand the determinants of falls and to develop interventions at the facility system level (unit level and hospital level) as well as the individual patient level to prevent adults from falling in hospital settings. AHRQ, Agency for Healthcare Research and Quality; CMI, Case Mix Index; FTE, full-time equivalent.

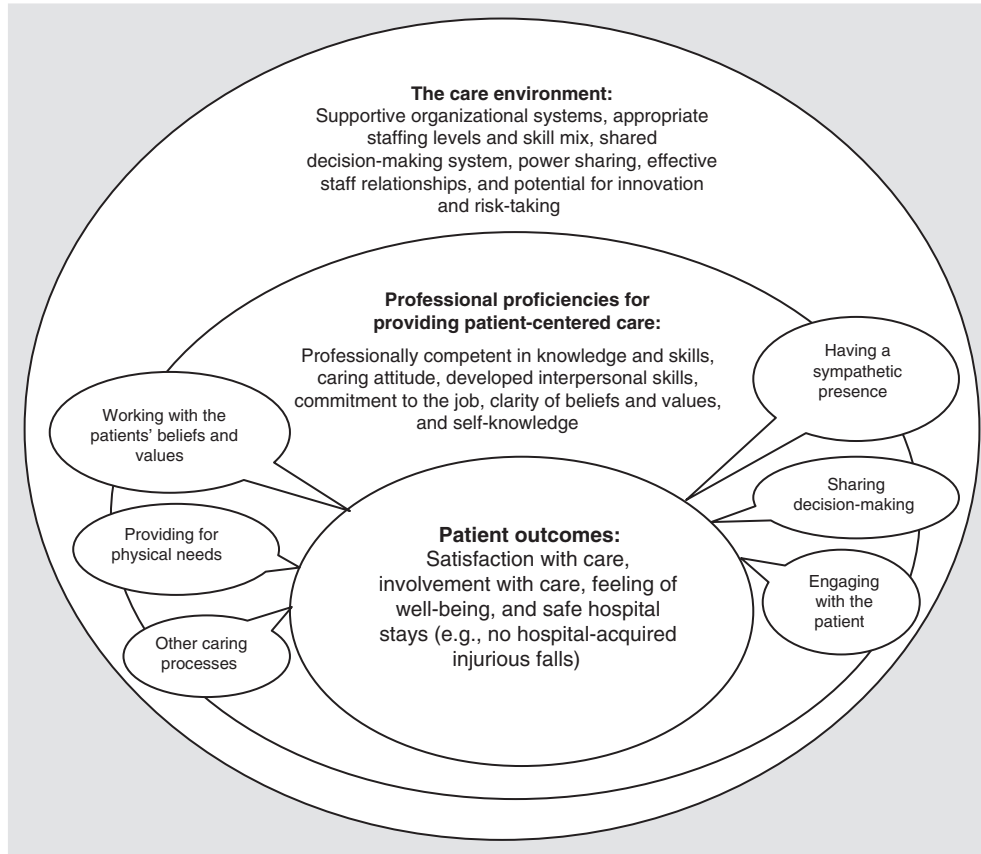


Figure 3 The patient-centred nursing model of promoting positive patient outcomes in hospital settings. Positive patient outcomes refer to patients' satisfaction with care, involvement with care and feeling of well-being as well as safe hospital stays (e.g. no hospital-acquired injurious falls). Notes: This model is developed by the author as a modified framework included in the report written by Tzeng (2011a). It is based on the person-centred nursing framework developed by McCormack and McCance (2006) and is a modified one. As for the modifications made, the hierarchical order of the three ovals (patient outcomes, professional proficiencies for providing patient-centred care and the care environment) is different from the one developed by McCormack and McCance (2006). The caring processes (in six callouts) include working with the patient's beliefs and values, providing for physical needs, having a sympathetic presence, sharing decision-making with the patient, engaging with the patient and other caring processes. The framework included in the report written by Tzeng (2011a) includes only a total of five callouts for the caring processes.

each patient care unit. This project is ongoing. Figure 5 is a conceptual model proposed by the author. All variables included in this model can be obtained from publicly available data sets.

Example of using each type of data source

For illustration purposes, one study example for each of the five mentioned data sources is provided in the following sections. Studies in press or under review can be obtained from the author.

Source 1 – archived hospital data

An exploratory study conducted by Tzeng and Yin (2009) used archived hospital data to determine whether the call light use rate and the average call light response time

contribute to the fall and the injurious fall rates in acute care settings. This study was conducted in a Michigan community hospital. The unit of analysis was the unit-week. The call light use rate per patient-day and the average response time to call lights in seconds were calculated based on information retrieved from the call light tracking system.

Source 2 – surveys

A cross-sectional survey study conducted by Tzeng (2011b) examined staff perspectives about call lights and the reasons for and the nature of call light use in four Michigan hospitals. It also identified significant predictors of the nature of call light use. A brief survey was used. All 2309 licensed and unlicensed nursing staff members who provided direct patient care in 27 adult care units were invited to participate; 808 completed surveys were retrieved.

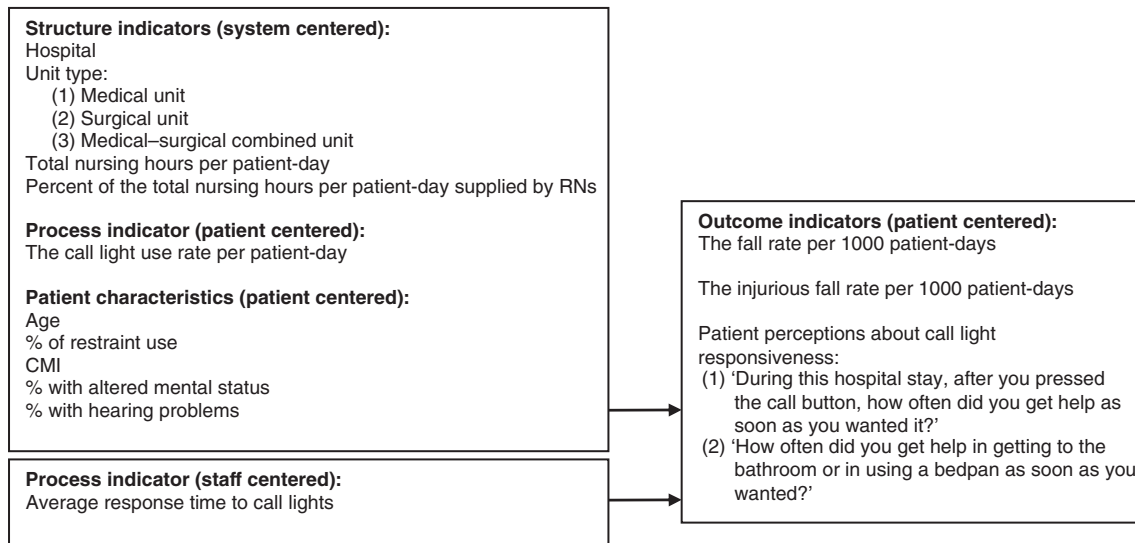


Figure 4 The conceptual framework with a focus on staff response time to patient-initiated call lights for adult acute inpatient care units. CMI, Case Mix Index.

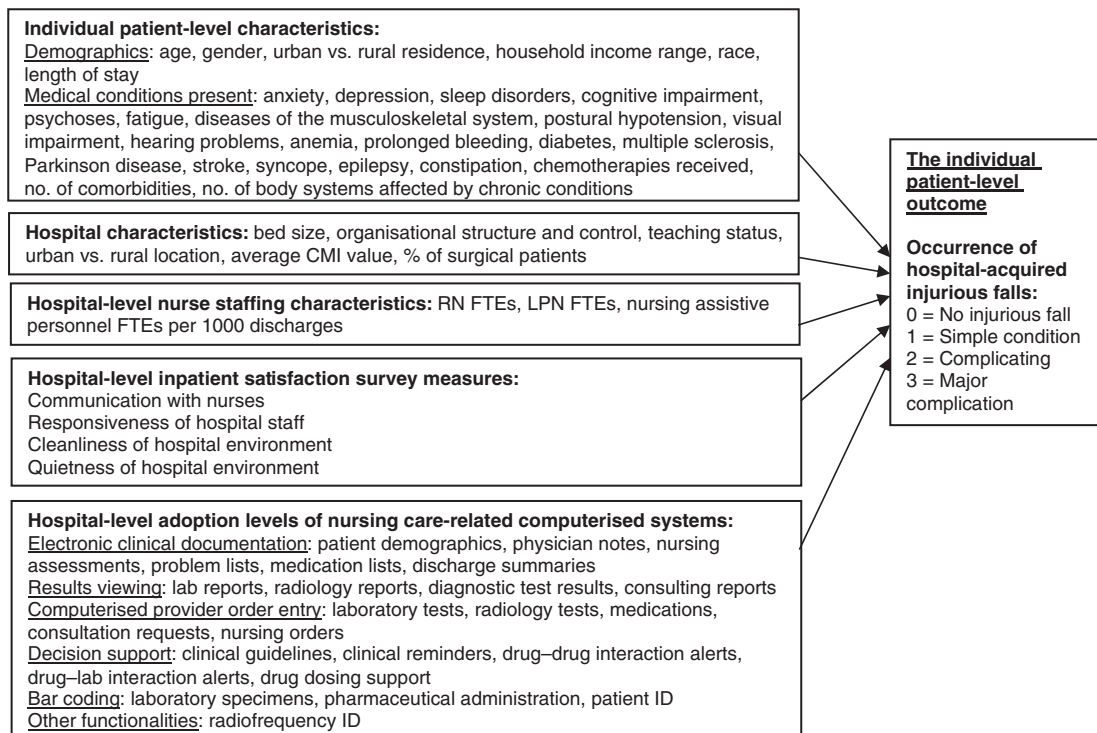


Figure 5 A conceptual framework for addressing the individual patient-level outcome, the occurrence of hospital-acquired injurious falls, in adult acute inpatient care settings. FTE, full-time equivalent.

Source 3 – interviews and focus groups

A qualitative study conducted by Tzeng and Yin (2008a) identified the extrinsic risk factors for inpatient falls in

hospital rooms from incident reports and from interviews with nurses and nursing attendants in an adult acute medical–surgical inpatient care unit at a Michigan medical centre. The

attributional theory of success and failure was adopted, and a proposed typology was used to elicit data, including three dimensions: (1) patient room setting and design, (2) hospital equipment and (3) manpower concerns.

Source 4 – publicly available data sets

A study conducted by Tzeng *et al.* (2011) investigated the relationship between inpatient satisfaction measures (created by the Hospital Consumer Assessment of Healthcare Providers and Systems) and hospital-acquired injurious fall rates in acute care hospitals in different age groups. This exploratory study used publicly available data sets, with the hospital as the unit of analysis. Hospital-acquired injurious falls were identified based on fall-related primary and secondary diagnoses and were not flagged as Present-on-Admission in FY2007 California, Florida and New York State Inpatient Database data. Correlation analyses were used. The analysis included 478 hospitals. The results showed that the higher the patient satisfaction levels with the responsiveness of hospital staff as well as the cleanliness and quietness of hospital environment, the lower the injurious fall rates.

Source 5 – published legal cases

One legal case summary is included in Table 1 to illustrate the richness of the verdict in writing and the possible consequences of a patient fall incident (Tzeng & Yin 2008b). In addition, the qualitative study conducted by Tzeng (2004) provides analyses of criminal judgments that investigated malpractice of nurses using the published lawsuit cases of the Supreme Court in Taiwan.

Discussion

Researchers need to consider four data-related issues. These four issues and corresponding examples are as follows:

- 1 Unit of analysis: a case as an individual patient, nurse/doctor, inpatient care unit, or hospital and data density related to time factors as daily, weekly, monthly, quarterly or annual data;
- 2 Computer data processing capabilities: publicly available data sets often are large in size, especially when individual patient/discharge-level data are obtained;
- 3 Merging data sets from different sources: triangulating data from different sources requires predetermined key variables for matching purposes and needs advance planning regarding possible variations on the unit of analysis across data sources; see the study of triangulating the extrinsic risk factors for inpatient falls from the fall incident reports and nurse's and patient's perspectives (Tzeng 2011c) as an example; and
- 4 Data abstraction, aggregation and data analytic techniques required based on the nature of the information: processing qualitative and quantitative data for further analyses, matching data by the predetermined unit of analysis to meet the needs for different data analysis approaches.

In addition, researchers need to consider that a patient may stay in more than one unit during a single hospital stay. Also, it is recognised that hospital environment is a dynamic one with constant changes. For example, a new administration or changes in hospital policies and structure may result in temporary or sustained changes in clinicians' awareness,

Table 1 A legal case summary related to an inpatient fall incident

Mrs X was admitted to Hospital A to undergo laparoscopic gastric bypass surgery 1 day in 2006. After surgery, Mrs X developed acute respiratory distress syndrome and was placed on a ventilator and was in a medically induced coma for approximately 4 weeks. During the period of the induced coma, she remained in a supine position in a surgical intensive care unit. Thirty-one days later, while being weaned off the ventilator and in preparation for bringing her out of the coma, Mrs X was transferred to a regular inpatient unit. The very next day, after bringing Mrs X out of the coma, Mrs X's bed was raised to a seating position for the first time since her surgery. Within a minute after the bed was put in the seating position, she gradually slid towards the floor and eventually fell out of her bed onto the floor. Mrs X sustained injuries to her right shoulder, arm and hand.

Nurse Y was Mrs X's nurse on the date and shift when the fall occurred. Before the fall occurred, Nurse Y documented the mental status of Mrs X as not being oriented times three ('oriented times three' refers to that a patient is awake, alert and fully oriented). In other words, Mrs X did not know who she was, where she was and the approximate time or date.

Mr X testified that he watched his wife fall and he was too far away to prevent the fall from happening. Mr X also mentioned that Nurse Y had raised the bed and then turned away.

After deliberation, the jury returned a verdict in favour of Mr and Mrs X. The jury awarded Mrs X \$1,000,000 for past non-economic loss for her pain and suffering, embarrassment and humiliation, disfigurement and loss of life's pleasures; \$3,000,000 for future non-economic losses; and \$30,000 per year for future medical and related expenses from and including 2006 until 2038. The jury also awarded Mr X \$50,000 for past non-economic losses.

Source: NexisLexis® Academic: Federal and State Cases (Case number: 005216; February 6, 2007, decided).

caring attitudes, practice patterns and quality of care. As a result, researchers often have no control over these issues but must recognise them.

Conclusions

The trend to use multiple data sources to answer research questions related to patient falls in hospital settings is gradually emerging. However, publicly available data sets have been used only sporadically. To demonstrate effective fall prevention efforts across hospitals, publicly available data sets could be a reliable source for analyses to inform policymakers about the meaningful fall prevention programmes that result in positive outcomes.

Relevance to clinical practice

There are challenges to develop, test and evaluate any facility system-level interventions to eliminate risk factors for falls. These challenges often relate to selecting feasible interventions and whether staff members accept the interventions and adhere to adopting the intervention. For example, as described in the feasibility study conducted by Tzeng (2011d), it took several months for the research team (including clinicians) to select acceptable and safe/steady equipment to be used as a raised toilet seat in patient

bathrooms. This equipment was meant to be used to reduce toileting-related falls in an inpatient care setting (Tzeng 2011d). A multifaceted strategy for implementing a fall prevention programme (e.g. use of change champions and education sessions) may effectively increase nurses' knowledge and their compliance with fall risk assessment but do not necessarily have a significant effect on reducing the fall and injurious fall rates (Koh *et al.* 2009, Raeder *et al.* 2010). It is arguable that education sessions for nurses may not both increase their knowledge and change their practice. If this is the case, using multiple data sources with time factors to cross-validate the sufficiency of nurses' knowledge with their practice patterns may be more productive. This need further supports the importance of this education-focused discursive paper, which discusses possible data sources used in the research on patient safety specific to fall reduction for adults in hospital inpatient care settings.

Contributions

Study design: H-MT; data collection and analysis: H-MT and manuscript preparation: H-MT.

Conflict of interest

The author declares that she has no competing interests.

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