Impact of Adverse Events on Hospital Disposition in Community-Dwelling Seniors Admitted to Acute Care

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Abstract

Older adults (≥65 years) have been identified as a high-risk group for the occurrence of adverse events (AEs) in hospital. The purpose of this paper is to describe the association between AEs and disposition for a population of hospitalized seniors.

All community-dwelling seniors admitted to an acute care in-patient unit were eligible for inclusion in this retrospective cohort study conducted at an adult tertiary care facility in Atlantic Canada between July 1, 2005, and March 31, 2006. AEs were identified from administrative data using validated screening criteria derived from the International Classification of Diseases (ICD) diagnosis and external cause of injury codes.

Of the 982 eligible patients, 140 (14%) had evidence of at least one AE. There were 136 in-hospital deaths (14%). There was no significant difference in the proportion of deaths between those who experienced an AE and those who did not. However, of the 29 patients who were discharged to a long-term care facility, a significantly higher proportion had an in-hospital AE (6% versus 2%, $p < .009$). The potential contribution of an AE to the subsequent placement in a long-term care facility offers a compelling reason to develop prevention strategies for hospitalized seniors.

Background

International patient safety studies of adverse events (AEs) have consistently identified older patients as a high-risk population (Brennan et al. 1991; Baker et al. 2004; Davis et al. 2002; Wilson et al. 1995). The increased risk has been attributed to more complicated diseases, co-morbid conditions, less physiological reserve and an increased risk of falls and fractures (Brennan et al. 1991). Other reasons for the higher incidence of AEs in older adults have been suggested, including prolonged time at risk and being sicker on admission to hospital (Brennan et al. 1991; Gawande et al. 1999; Steel et al. 1981). In 2000, a report was commissioned by the American Association of Retired Persons (AARP) to synthesize the literature on "medical injury" in older adults. The authors gained access to unpublished data from a number of studies including the Harvard Medical Practice Study. Based on those data, they concluded that older patients were twice as likely to experience "diagnostic mishaps," four times as likely to experience "therapeutic mishaps" and nine times as likely to fall in hospital compared with their younger counterparts. Drug complications were two and a half times more common in older adults (Rothschild and Leape 2000).

The potential impact of an AE in older patients is complicated by the aging process itself. In any population of older adults, there is a spectrum of health and physiological resiliency. However, illness and hospitalization can threaten the functional independence of even the most resilient. Creditor (1993) has suggested that the interplay between natural aging processes and

hazards of hospitalization may create a "cascade to dependency" or irreversible functional decline. One consequence of this type of decline is a new need for support or long-term care (LTC) services. In Canada, seniors are admitted to hospital and stay longer than any other age groups; thus, knowing more about the incidence and effects of AEs in this population is critical for long-term planning and resource management (Statistics Canada 1999). The purpose of this paper is to describe the association between AEs and disposition for a population of seniors admitted to hospital after presenting to the emergency department (ED).

Methods

The study was conducted at the Queen Elizabeth II Health Sciences Centre (QEII HSC), in Halifax, Nova Scotia. With approximately 1,000 beds, the QEII HSC is the largest academic health sciences facility for adults in Atlantic Canada. The study was approved by the Capital District Health Authority Research Ethics Board.

In an effort to restrict the study population to a group of relatively healthy, community-dwelling seniors, all persons 65 years and older who were admitted to an acute in-patient bed from the ED at the QEII HSC from July 1, 2005, to March 31, 2006, and who had no hospital admission or ED visit within the previous six months were eligible for inclusion. Patients who were transferred to an alternative level of care (i.e., non-acute care) unit at any time during their stay in the hospital were excluded from the study; therefore, the results focus only on acute care patients.

AEs were identified by screening criteria developed by the Wisconsin Medical Injury Prevention Program (WMIPP). In summary, the WMIPP screening criteria are composed of a combination of AE-relevant International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM), diagnostic and external cause of injury codes that are applied to hospitalization administrative data. A validation study determined that the screening criteria identified approximately 60% of events found by physician reviewers, using the currently accepted gold standard retrospective health record review (Layde et al. 2005). Geriatric-specific screening criteria were also employed in this investigation to identify, using administrative data, infections, delirium, fall-related injuries and pressure sores that were acquired in hospital.

The study population was identified through the computerized ED Information System. The ED data were linked to data on hospital admissions from the Discharge Abstract Database. The hospitalization data included information on diagnoses, in-hospital procedures, admitting service, admission to the intensive care unit (ICU), length of stay (in-hospital and ICU) and the discharge status or disposition of the patient. The in-patient diagnostic data were coded using International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canadian Enhancement (ICD-10-CA). The Canadian coding system uses diagnosis *type* indicators that allow for the identification of pre-existing conditions and conditions that arise after hospital admission that influence either the length of stay or patient management while in hospital, as well as the diagnosis considered to be "most responsible" for the patient's stay in hospital (Canadian Institute for Health Information 2004). All descriptive statistics and logistic regression modelling were performed using STATA statistical software (STATA Corp., College Station TX, Version 9).

Results

A total of 9,373 persons 65 years or older visited the centre's ED during the study period. Of the 3,408 patients who were admitted to hospital from the ED, 982 were eligible for this study. This represents 10% of older adults who presented to the ED during the study period and 29% of those who were admitted to hospital from the ED. Table 1 describes the characteristics of the patients.

Table 1. Characteristics of the study population *n* = 982

Parameter	Average
Demographic	
Average age in years (*SD*)	78 (8)
% female (*n*)	52 (512)
Clinical condition	
Average number of pre-existing co-morbidities (*SD*)	0.3 (0.6)
% surgical procedure (*n*)	26 (256)
% admitted to ICU (*n*)	11 (104)
Average ICU LOS in days (*SD*)	4 (5.4)
Average hospital LOS in days (*SD*)	11 (14.1)

ICU = intensive care unit; LOS = length of stay; *SD* = standard deviation.

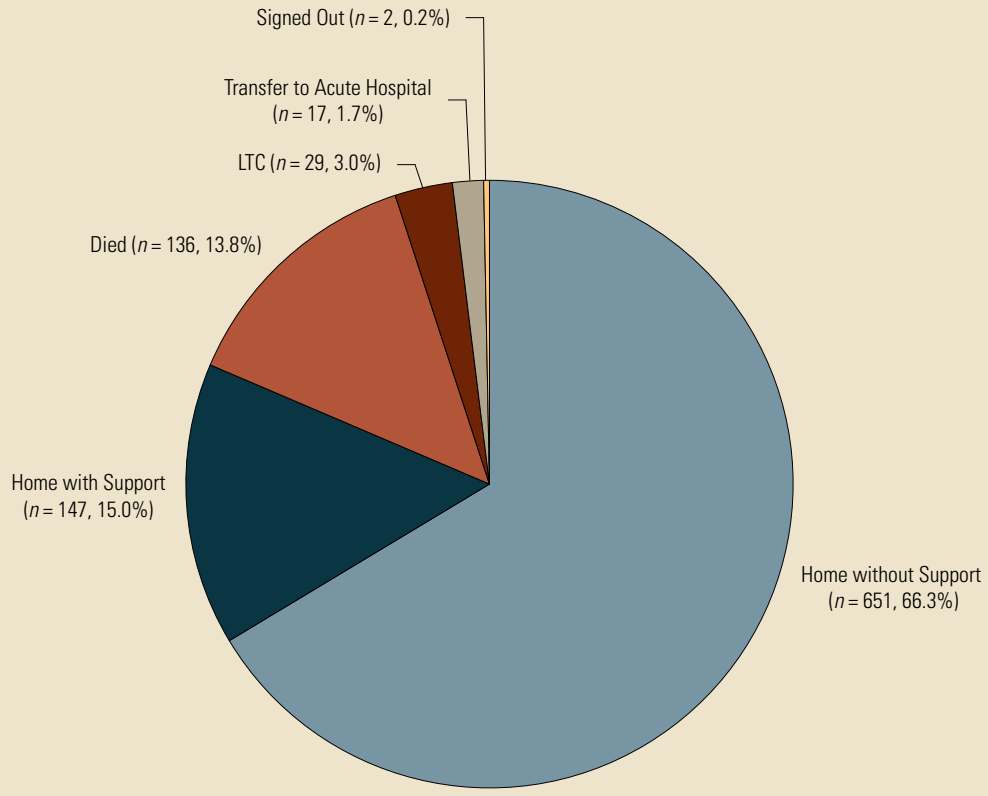
The majority of patients (95%) had conditions that were considered to be emergent or urgent, as defined by the Canadian Triage and Acuity Scale (Division of Emergency Medicine 2005), although the average number of co-morbid conditions per patient was less than one. Fewer than 4% of presentations were considered to be less urgent or non-urgent. Approximately 30% of patients were initially admitted to a surgical unit. Admissions to non-surgical services were highest to medicine (29%), cardiology (21%) and neurology (10%).

Hospital Disposition

Most of the patients were discharged home, including those

who were provided with some support services. There were 136 in-hospital deaths (14%), and 29 patients (3%) were discharged to an LTC facility (Figure 1). The differences between those patients who were discharged to LTC and those who were not are outlined in Table 2. Of 29 patients discharged to LTC, nine (31%) had a "most responsible" diagnosis of stroke. There were two patients (7%) with predominantly respiratory conditions (acute respiratory failure and chronic obstructive pulmonary disease) and two (7%) with fractures (humerus and hip).

Figure 1. Hospital disposition for all patients (*n* = 982)



LTC = long-term care.

There was a marginally significant difference in the proportion of patients in the LTC group who used a ventilator during a portion of their hospital stay (7% versus 2%, $p = .05$), although there was no significant difference in those who had to undergo a resuscitative procedure during their hospitalization. Those patients discharged to LTC had more than double the length of stay in hospital (27 days versus 11 days, $p < .0001$).

AEs and Disposition

Of 982 eligible patients, 140 (14%) had evidence of an AE. The most common AEs were related to procedures (42%), devices or grafts such as catheters or coronary artery bypass grafts (28%) and medications (19%). There was no significant difference in the proportion of deaths between those who experienced an AE and those who did not (Figure 2). However, significantly *fewer* patients who experienced an AE were discharged home (51% versus 69%, $p < .0001$), and significantly *more* were discharged to an LTC facility (6% versus 2%, $p < .009$). Those patients discharged to LTC were more than twice as likely to have experienced an in-hospital AE compared with those who were not (31% versus 14%, $p = .009$). A total of nine patients who were ultimately discharged to LTC experienced an AE while in hospital. Two patients experienced two different AEs each during their hospital stay. In addition to the procedure-related AEs they experienced, one developed a urinary tract infection and the other contracted *Clostridium difficile* (Figure 3). There were also two patients in the LTC group for whom an AE was determined to be the "most responsible" condition for their hospital stay (infection and complication due to a cardiovascular device and a procedure, respectively). In a logistic regression model that controlled for differences in age, gender, pre-existing co-morbidities, use of a ventilator, hospital length of stay (LOS) and occurrence of an AE, the only independent predictor of discharge to LTC was hospital LOS (odds ratio 1.04, 95% confidence interval 1.02–1.06).

Table 2. Demographic and clinical differences† between patients discharged to an LTC facility and those not discharged to LTC

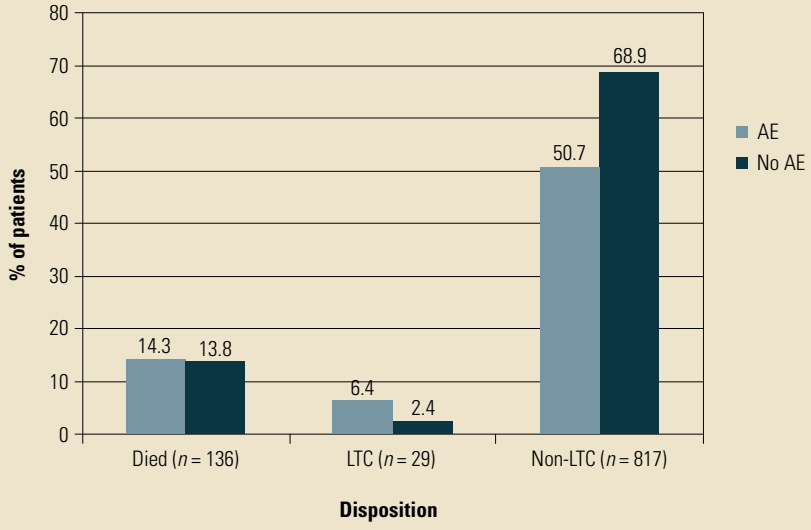
Characteristic	Non-LTC (*n* = 953)	LTC (*n* = 29)
Demographic		
Average age in years	77.8	77.8
% female	52.5	41.4
Clinical condition		
% surgical procedure	25.9	31.0
% admitted to ICU	10.5	13.8
Average ICU LOS in days (*SD*)	4.3 (5.5)	5.0 (5.0)
Average hospital LOS in days (*SD*)**	10.8 (13.4)	26.6 (25.6)
% experiencing an adverse event*	13.8	31.0

ICU = intensive care unit; LOS = length of stay; LTC = long-term care.

†Differences between the groups were compared using the chi-square test for categorical data, an unpaired *t*-test for normally distributed continuous data and a Mann-Whitney *U* test for non-parametric data.

*$p < .05$; **$p < .0001$.

Figure 2. Adverse events by hospital disposition (*n* = 140)



LTC = long-term care.

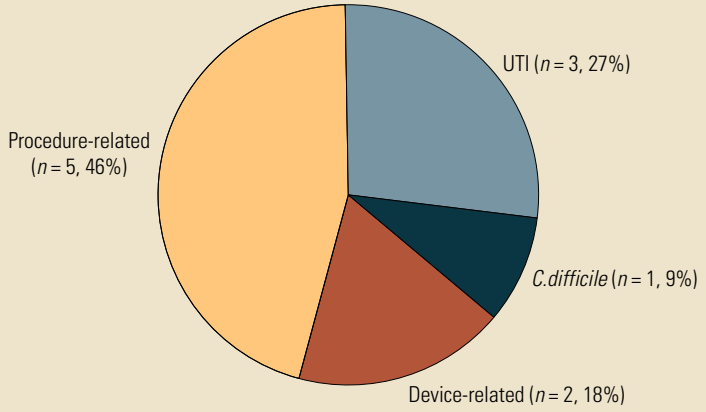
Discussion

Older adults have been consistently identified as a high-risk group for the occurrence of an AE (Baker et al. 2004; Brennan et al. 1991; Davis et al. 2002; Rothschild and Leape 2000; Wilson et al. 1995). In the current study, 14% of relatively healthy older patients experienced an AE while in acute care. This is nearly double the overall rate identified in the Canadian Adverse Events Study (Baker et al. 2004). However, the results reported by Baker et al. included patients over 18 years of age, and the current study was restricted to a select group of older patients (≥65 years) who had not had any hospitalizations or visits to the ED in the six months prior to the study. Although only 3% of study patients were eventually discharged to an LTC facility, this happened more often in patients who experienced an AE while in hospital. In addition, those patients who were discharged to LTC had more than double the hospital LOS. This has important policy and planning implications for the healthcare system. As Canada's population ages, more seniors will be admitted to hospital. In a system that is already struggling with overcrowding and lack of beds in acute and long-term care, it will be critical to examine all factors that may contribute to the occurrence of an AE.

One factor to consider is the length of time a patient stays in hospital. Patient safety studies have consistently demonstrated that patients who experience an AE spend more time in hospital (Schimmel 1964; Vincent et al. 2001; Wilson et al. 1995). If an AE contributes to LOS, then it may also indirectly influence hospital disposition, as has been demonstrated in the current study. Programs aimed at maintaining the mobility and function of older patients admitted to hospital for acute conditions may help to mitigate the negative contributions that an AE may have on their ability to return to independent living, either directly or indirectly through prolonged stays in hospital.

In the current study population, a discharge to an LTC facility is potentially indicative of the "cascade to dependence" described by Creditor (1993) because all of the patients were living in the community prior to hospitalization. Although a discharge to LTC may not be attributed entirely to the occurrence of an AE, the significantly higher proportion of patients in the LTC group who experienced an AE is of concern, especially since these were relatively healthy adults prior to their hospitalization. The immensity of the personal impact of such a change in living situation for an older patient cannot be overstated; neither can the poten-

Figure 3. Types of adverse events in patients discharged to LTC (*n* = 11)



C. difficile = *Clostridium difficile*; LTC = long-term care; UTI = urinary tract infection.

tial impact on healthcare costs and demand for LTC services. Further research is needed to understand those AEs that are more likely to contribute to changes in function that necessitate transfer to an LTC facility.

While it is important to understand the impact of AEs on hospitalized seniors, one of the challenges of studying AEs in older patients is the difficulty in distinguishing between an event and the primary disease process (Reichel 1965). The diagnosis type indicators used in the current study help to differentiate between the event and the primary disease process, although they are imperfect (Canadian Institute for Health Information 2004). For instance, an accidental puncture or laceration during a surgical procedure is clearly an AE that is not part of the disease process. On the other hand, it is more difficult to differentiate whether a post-procedural infection is a true AE or a potentially expected outcome in a frail, immunocompromised oncology patient.

The immensity of the personal impact of such a change in living situation for an older patient cannot be overstated; neither can the potential impact on healthcare costs and demand for LTC services.

Conclusion

As Canada's aging population grows, it is increasingly important to understand factors that are associated with AEs in healthcare for seniors. The potential contribution of AEs to subsequent placement in an LTC facility offers a compelling reason to develop prevention strategies for hospitalized seniors. In addition to personal costs, the economic burden of AEs, particularly those associated with extended lengths of stay, need further study. HQ

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