Intrahospital transfers and adverse patient outcomes: An analysis of administrative health data

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Aims and objectives: To determine whether there was an association between intra-hospital transfers and adverse outcomes.

Background: Transfers between clinical units and between beds on the same unit are routine aspects of an episode of care in acute hospitals. The rate of these transfers per episode has increased in response to high occupancy levels, a decline in bed numbers, and increased demand for hospital services. The impact of the number of transfers between both wards and beds on patient outcomes is not widely explored.

Design: Retrospective cross sectional design using hospital administrative data.

Method: Data were extracted from existing hospital administrative datasets for one large metropolitan hospital for the financial year 2008–09 in Australia (n = 14,133). Descriptive analyses and logistic regression models were developed for each of 3 selected patient outcomes.

Results: Nearly one-tenth of patients (9.2%) experienced a fall with injury, 3.8% of surgical patients a wound infection and 0.1% a complication from medication errors. For each bed or ward transfer, the odds of falls and wound infections increased. Medication errors were not associated with either bed or ward moves.

Conclusion: Hospitals should minimise the number of bed and ward transfers per episode of care in order to reduce the likelihood of adverse patient outcomes. Current bed management policies and practices should be evaluated and further refined to address this need. Additional strategies include improving coordination and communication during and after transfer.

Relevance to clinical practice: Nurses must consider the potential cost of intrahospital transfers on patients, length of stay and bed availability.

KEYWORDS
adverse patient outcomes, international classification of diseases, intrahospital transfers, patient transfer, quality of health care

INTRODUCTION

Hospitals are continuing to experience high occupancy levels due in part to a decline in the number of available beds, an increased demand for hospital services associated with an ageing population and increased levels of chronic disease (ABS, 2015; AIHW, 2014, 2016). At the same time, the number of patients being treated on a day-only basis has increased and overnight stay patients are remaining in hospital for shorter periods of time (AIHW, 2016). In response to increased levels of throughput, hospitals have introduced a range
of bed management strategies such as short-stay units and discharge lounges and chairs, designed to improve patient flow and ease pressure on hospital beds (Blay, Duffield, & Gallagher, 2012). However, these strategies have dramatically increased patient throughput resulting in “patient churn” within and between units (Angus et al., 2006; Duffield, Diers, Asbitt, & Roche, 2009), potentially leading to adverse consequences for patients (Bapoe, Gaudiani, Narayanan, & Albert, 2011; Beckmann, Gillies, Berenholtz, Wu, & Pronovost, 2004; Escobar et al., 2011).

There is little evidence of the impact of increased patient movements on health outcomes, but there is now growing recognition that they interrupt continuity of care, potentially resulting in a reduction in the quality of care (AIHW, 2015a; OECD, 2012; Royal College of Physicians, 2012). The purpose of this study was to determine whether there is a relationship between the number of ward and bed transfers a patient experiences and adverse consequences for them. “Bed transfer” was defined as patient movement from one bedspace to another within the same ward or clinical unit. “Ward transfer” included any transfer or movement between clinical units, wards or departments during an episode of care.

2 BACKGROUND

Care transitions have long been associated with healthcare errors, often attributed to miscommunication between staff (Hughes & Clancy, 2007; Li, Stelfox, & Ghali, 2011), resulting from constricted time available to provide care on each ward (Horwitz, Krumholz, Green, & Huot, 2006). For many years, interorganisational patient transfers have been acknowledged to be a risk factor in the spread of micro-organisms (Safdar & Maki, 2002; Spelman, 2002; Strausbaugh, Jacobson, & Yost, 1993; Tacconelli, 2006). However, what is different today and less well understood is the frequency of intrahospital movements: patient transfers between both beds and wards within the same institution, and the impact this might have for patient safety.

In Australia, the number of public hospital beds has declined by 0.9%/1,000 population since 2008–2009 (AIHW 2014). This factor combined with bed management strategies mentioned earlier and increased demands for care, particularly through the emergency department (ED), have placed great pressure on hospital beds. The result is that patients admitted through the ED are often admitted to any available bed and transferred later (Alameda & Suárez, 2009; Audit Commission, 2003; Goulding, Adamson, Watt, & Wright, 2012). Patients are often therefore “outliers” or “boarders”; cared for on wards described as “clinically inappropriate” (Goulding et al., 2012) and moved when a more suitable location becomes available, leading to an increase in patient transfers referred to as “churn” (Duffield et al., 2009; Hughes, Bobay, Jolly, & Suby, 2013). While some transfers are clinically necessary and appropriate, such as transfer to an intensive care unit (ICU), it has been estimated that as many as 15% of patients in the UK experienced a ward transfer which was not clinically justified (West, 2010), while others have found that over a quarter of patients were admitted to short-stay units inappropriately, requiring later transfer to longer-stay wards (Hartley, Hood, Bashir, & Zahir, 2010). These strategies can contribute to patients being moved between or within wards up to seven times in a single stay (Cooper, Paul, & O’Reilly, 2002).

Patients can therefore be moved frequently between wards during a single hospital admission and often stay in wards not focused on the specific care they require (Alameda & Suárez, 2009; Blay, Roche, Duffield, & Gallagher, 2017; Blay et al., 2012; Williamson, Ghazaly, Bhatt, & Nehra, 2015). Placement on nonspecialist wards has been associated with negative outcomes including increased falls and delirium in older patients (Ellis, Whitehead, Robin, O’Neill, & Langhorne, 2011; Goldberg, Straus, Hamid, & Wong, 2015; Royal College of Physicians of Edinburgh, 2012) and increased lengths of stay (LOS) for cardiology patients (Alameda & Suárez, 2009). These outcomes have been linked to ineffective coordination of care across wards (Gilligan & Walters, 2008; Goulding et al., 2012; Woods et al., 2008), a lack of specialist expertise, unsuitable ward environments and lower prioritisation of outlier patients (Goulding et al., 2012).

Adverse events have also been associated with the number of ward movements. For example, patients treated on three to four wards had a 1.8 times greater risk of falling than those treated on one ward; this rose to 2.4 times when treated on five or more wards (Kanak et al., 2008). One study identified an average of four errors per patient transfer, the most common being inadequate handover, no patient identification check, insufficient patient preparation for transfer and inadequate infection control precautions (Ong & Coiera, 2010). Internationally, the incidence of nosocomial infection was significantly and positively associated with the number of wards per hospitalisation, with studies showing up to a fivefold increase in risk compared with patients who did not undergo a ward transfer (Cooper et al., 2002; Eveillard, Quenon, Rufat, Mangeol, & Fauvelle, 2001; Kanak et al., 2008; Nixon, Jackson, Varghese, Jenkins, & Taylor, 2006).

Similar results are found for medication errors. Adverse drug effects as the result of medication change were seen in 20% of transfers in one study (Boockvar et al., 2004), and two-thirds of all

What does this paper contribute to the wider global clinical community?

- Globally, patients are increasingly being transferred within and between wards for nonclinical reasons. This study has identified that transferring patients between wards and beds within the same ward is not without clinical risk.
- Clinicians and health service managers should consider the impact of these findings on hospital costs, occupancy, bed management processes and length of stay.
- The findings can be used to support the argument for acuity-adaptable rooms.
medication errors occur during patient transfer (The Joint Commission, 2006). Most concerning are data from The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) in the U.S.A. which reported in 2006 that 66% of medication errors were associated with transfers or “care transitions.” This is very high relative to medication errors related to hospital admission (22%) and 12% associated with the discharge process (Joint Commission on Accreditation of Healthcare Organizations, 2006). A Canadian study of interhospital transfers identified that 6.5% of patients missed one or more key medications following transfer (at the receiving hospital) and 2% of patients missed doses prior to departure from the sending hospital (Stolte, Iwanow, & Hall, 2006). Recent work has identified different rates of adverse medication events for different drug classes, with higher rates for analgesics and metronidazole (Boockvar et al., 2009). Medication issues are associated with prolonged transfer times, particularly with long waits for transport or clinical assessment (Stolte et al., 2006). These errors have been linked to disrupted continuity of care (Blay et al., 2012; Royal College of Physicians, 2012; Williamson et al., 2015). That is, frequent patient moves can result in a potential breakdown in continuity of care, leading to a duplication of care or missed activities, potentially causing errors (Blay et al., 2012).

Studies that explore the impact of intraward bed transfers on adult patient outcomes are limited. One small investigation examined neonatal beds pace moves subsequent to an infection outbreak (McGrath et al., 2011). That study found a high rate of movement: the six neonates experienced 24 beds each move, with one individual experiencing six moves, over a 3-month period. These infants had been moved in response to space on the ward and nurse staffing limitations, suggesting similar drivers to that identified for transfers between wards, with outcomes similar to those found by Ong and Coiera (2010).

Patient transfers are an integral component of nursing work, and the impact of this type of work has been assessed in nursing workload studies (Douglas et al., 2013). Increased nursing workload is associated with higher patient mortality, but also associated with the higher risk of accidental falls (particularly for older patients), medication error and infection (Blay et al., 2012; Duffield et al., 2011; Nishizaki et al., 2010). However, the association between the frequency of both bed and ward movements and adverse outcomes has not been widely explored.

3 METHODS

3.1 Aims

The aim of this study was to explore the relationship between bed and ward movements, specifically to determine the rate of selected adverse outcomes in patients who stayed in hospital for 48 hours or more.

To identify the association between the movement of patients, between wards and between beds on the same ward, and selected adverse outcomes.

3.2 Design

Retrospective cross-sectional analysis of hospital administrative data using the Classification of Hospital Acquired Diagnoses (CHADx) approach.

3.3 Data collection

Data were extracted from existing hospital administrative data sets for one large tertiary metropolitan hospital for the financial year 2008–2009. Data systems included the Admission, Transfer and Separation (ATS) database and the iSoft Patient Management (iPM) system. Variables were in coded format consistent with the National Health Data Dictionary (AIHW, 2015b) and included ward characteristics, patient demographic and episode of care variables, and bedspace and ward movements. Diagnoses and procedures were coded in International Classification of Diseases, 10th revision, Australian Modification, 6th edition (ICD-10-AM), and Australian Refined Diagnosis Related Groups version 6.0 (AR-DRGs).

The initial data extract contained individual de-identified records for 22,172 overnight patient admissions, 20,780 patient separations and 79,657 transfers for the 2008–2009 financial year. Day-only admissions and short-stay admissions of less than 48 hr were excluded (n = 7,433). Patients admitted for a primary DRG of haemodialysis treatment(s), mental health disorders, obstetric and gynaecological conditions, and patients under the age of 18 years were also excluded (n = 293). As 98.4% of patients experienced 12 or fewer transfers per episode of care, and those with many transfers (up to 132) were extreme outliers in terms of length of stay, the decision was made to exclude all episodes of care with 13 or more transfers (n = 313). Following these exclusions, 14,133 patients were included in the analysis (Figure 1).

3.3.1 Identification of hospital-acquired diagnoses

Administrative data are increasingly used in health service research and outcome studies because of the ability to examine large sample sizes at relatively low cost, resulting in greater generalisability. There are many ways to measure patient outcomes using administrative data, such as using ICD codes to measure hospital-acquired complications (Michel, Nghiem, & Jackson, 2009) and adverse medication events (Parikh et al., 2014), the Nursing Sensitive Outcomes approach (Needleman, Buerohaus, Mattke, Stewart, & Zelevinsky, 2002; Needleman et al., 2011) or the Elixhauser and Charlson comorbidity indices to measure comorbidity (Chu, Ng, & Wu, 2010; van Walraven, Austin, Jennings, Quan, & Forster, 2009). In this study, we adopted the Classification of Hospital Acquired Diagnoses (CHADx) approach (Jackson, Duckett, Shephered, & Baxter, 2006; Jackson, Michel, Roberts, Jorm, & Wakefield, 2009; Michel et al., 2009). This system was initially developed by the Australian Centre for Economic Research on Health, under sponsorship from the Australian Commission on Safety and Quality in Health Care, to provide hospitals with a mechanism to identify complications of care using
routinely collected data from the medical record (Jackson et al., 2006, 2009). The CHADx uses data coded according to ICD-10-AM to group complications into 17 classes (e.g., adverse drug events and postprocedural complications) and 145 subclasses. The approach avoids duplication and distinguishes between hospital-acquired complications and comorbidities present on admission and those acquired in hospital (Michel et al., 2009).

We selected three CHADx outcomes for analysis because they are plausibly hospital-acquired and they are more readily identifiable as a likely consequence of the quality of care, particularly nursing care. They are also identified in the almost 70% of adverse outcomes in health care that are considered to be preventable (Classen et al., 2011; James, 2013; Levinson, 2010). These three outcomes were as follows: “fall with injury,” “wound infection (for all patients and surgical patients)” and “medication error” (Table 1).

3.3.2 | Other variables

Ward and bed transfers although conceptually related were treated and analysed as distinct variables. “Ward transfer” included any transfer or movement between clinical units, wards or departments during an episode of care. “Bed transfer” was defined as a patient move from one bedspace to another within the same ward or clinical unit. To avoid including the bedspace immediately following a ward transfer in bed transfer calculations, only subsequent bed transfers within the same ward or unit were included in analyses.

The Charlson comorbidity index (CCI) was calculated for each hospitalisation. This index has been widely used in previous studies to control for the risk of adverse outcomes from comorbid conditions (Charlson, Pompei, Ales, & MacKenzie, 1987; Mnatzaganian, Ryan, Norman, & Hiller, 2012).

3.3.3 | Ethical considerations

Ethics committee approval was granted from the relevant Area Health Service and university. Approval included access to the health administrative data set and de-identified patient data.

3.4 | Analysis

Mean and standard deviation (SD) were used to present patients’ age and ward characteristics (bed and ward transfers and length of stay). Multiple regression models, one for each CHADx outcome, were used to assess the likelihood of that outcome for a one-unit change in the number of bed and ward transfers. Additional variables were added to the models to control for age, gender, admission urgency, Charlson comorbidity index, intensive care stay, LOS and readmission status (Table 1). For multiple comparisons, the Bonferroni adjustment was used with an adjusted significance level of $p < .01$. All analyses were conducted in STATA/SE 13.1 (StataCorp, USA).

4 | RESULTS

As noted above, the original data set of 22,172 patients was reduced to 14,133 for analysis. Table 2 shows the patient and episode characteristics of the data analysed. Of these 14,133 patients, 50.1% were male and 49.9% were female. Average age of patients was 67.5 (SD 19), although this was somewhat skewed with the median 72 and oldest patient 103. The average LOS was 8.7 days with a median of 5.

More than three quarters (78%) of patients had been admitted as an emergency, and 22.1% of patients had an intensive care stay. Transfers were frequent in the original data set with 92.3%
(n = 20,462) patients being transferred during their hospitalisation. On average, patients in the analysed data set experienced 2.5 ward transfers and 1.9 bed transfers per episode of care (Table 2).

A quarter of patients (25.9%) had a CCI of greater than 1. For the selected three CHADx complications, 9.2% of patients had fallen with injury, followed by wound infection for surgical patients (3.8%) and wound infection for all patients (1.6%). Only 0.1% patients had a complication as a consequence of a medication error (Table 3).

Table 4 shows the odd ratios for complications for either bed or ward transfers after adjustment. With each move between beds, the odds of falls increased by 13% (OR = 1.31) and the odds for wound infections increased by 25% (OR = 1.250) for all patients and by 26% (OR = 1.264) for surgical patients. With each transfer between wards, the odds of falls increased by 9.5% (OR = 1.095) and the odds for wound infections increased by 28% (OR = 0.277) for all patients and by 25% (OR = 1.249) for surgical patients. Medication errors were not associated with either bed or ward moves.

5 | DISCUSSION

Study findings revealed that the proportion of medication errors was relatively low and not associated with either bed or ward moves. However, both bed transfer and ward transfers were associated with wound infection, consistent with the study of neonatal bed moves by McGrath et al. (2011), and that of ward transfers by Ong and Coiera (2010). Falls with injury also echoed the results from previous studies (Boockvar et al., 2004; Kanak et al., 2008; Ong & Coiera, 2011), although in the present study, the odds of a fall were higher with more bed moves rather than ward transfers, perhaps suggesting an issue of patient disorientation with the new bed location. Both of these outcomes (falls and infections) can lead to more serious complications and consequences, including significant disability and death (Needleman et al., 2002, 2011). At the very least, they will increase LOS in hospital, thus impacting throughput and costs of care (Twigg, Geelhoed, Bremner, & Duffield, 2013). A systematic review of falls and falls-related hospitalisation suggests each fall costs up to USD $42,840 depending on the severity of the injury (Heinrich, Rapp, Rissmann, Becker, & König, 2010), while the excess cost (above the typical cost of hospitalisation) for wound infections has been estimated at USD $10,497 (Boltz, Hollenbeak, Julian, Ortenzi, & Dillon, 2011).
Complications resulting from fall-related injuries are a leading cause of death in older people (Hartholt et al., 2011). Older patients, such as many of those in this study, who experience longer LOS and are thus more likely to experience multiple moves, have a potentially higher risk of falls. For example, previous work has found that among those aged 90 years or over, ~50% were unable to get up without assistance (Fleming & Brayne, 2008). Nurses play an important role in preventing falls, particularly for the older patients, and nurse-led interventions can significantly reduce falls (Lightbody, Watkins, Leathley, Sharma, & Lye, 2002). However, these interventions depend on nurses having sufficient time to get to know their patients and abilities.

Recent Australian analyses identified that there are over 175,000 cases of healthcare-acquired infections annually, leading to a loss of 854,000 bed-days per annum (Graves, Halton, Paterson, & Whitby, 2009). Costs associated with healthcare-acquired infections vary considerably. In US, the direct cost is high, ranging from US$28 billion to 45 billion. Recent Australian estimates indicate that the cost of healthcare-acquired infections could be Au$1 billion per annum (Graves et al., 2009). Financial savings from the prevention of infection(s) and bed-day reductions form a component of the calculation process, but are notoriously difficult to predict (Graves et al., 2010).

As the rate of patient transfers has not been comprehensively studied in this country, the risk of infection associated with interdepartmental transfers is unlikely to form a component of the costing figures.

Fortunately, rates of medication errors were low in this study. Most medication errors are linked to “slips in attention” when staff are busy or distracted (Nichols, Copeland, Craib, Hopkins, & Bruce, 2008) as when transfers are arranged at short notice. In hospitals, medication errors are most likely to occur at breakfast time and in the evening (Australian Commission on Quality & Safety in Health Care, 2008) which are time periods recognised to be ones of intense activity for nursing staff (Walker, Donohue, & Mitten-Lewis, 2007) and possibly when transfers are most likely to occur.

As noted earlier, frequent patient moves can impact the continuity of care putting patients at risk (Blay et al., 2012). The duration of patient education and discharge planning declines with each subsequent transfer challenging the concept of continuity of care (Kanak et al., 2008); too little time is available in one clinical area. Shortened lengths of stay within a unit, coupled with the frequent turnover of nursing staff, reduce the available time for concise assessment of patients’ needs. Clinical staff may also assume that the subsequent (or previous) clinical area will attend to (or had attended) the patients’ individual educational or discharge needs.

It should be noted that all clinical staff may be impacted by frequent patient movements as their transfer handover may be rushed and incomplete. One study of physician handover following patient transfer from the ICU to a ward found that a verbal handover was provided by the ICU physician in 25% of cases and a written handover for 61% (Li et al., 2011). Singer and Dean (2006) observed that some ED doctors nearing the end of their shift decrease their workload by avoiding complex patients or will transfer patients without having completed a full assessment. The authors are critical of the variability in medical handover and documentation practices for patients’ transferring from the ED to wards. They advise medical officers to update clinical parameters immediately prior and post-transfer or change of shift in order that a complete history is available and continuity of care is maintained.

The impact on other patients when nurse(s) leave the ward to accompany transferring patients could also raise concerns. Gianguilio et al. (2008) report that patients awaiting transfer from the ED to the wards often felt neglected if nurses were attending new presentations. Despite these fears, as a general rule, patients and families transferring to wards were either neutral or expressed satisfaction with the transfer process (Odell, 2000). However, a lack of information about the transfer process and future expectations was associated with patient and/or family dissatisfaction and negative perceptions (Li et al., 2011). Staff time constraints or transfers at short notice did not always ensure that the patient and family members were adequately prepared (Beard, 2005; Chaboyer, Kendall, & Foster, 2005) challenging the notion of continuity of care. Compared to patients whose recall capacity is often poor, family members were more aware of the transfer process (Paul, Hendry, & Cabrelli, 2004); therefore, unless family members were present at the time of transfer, the process and new environment could be daunting for patients.

Hospitals that have introduced acuity-adaptable rooms, sometimes called universal rooms, whereby the patient remains in the one room throughout their admission irrespective of clinical status, have significantly reduced the rate of transfers, hospital-acquired infections, medication errors and patient falls (Chaudhury, Mahmood, & Valente, 2009; Hendrich, Fay, & Sorrells, 2004). Others suggest a multifaceted approach to bed and nursing management: redistribution of beds following detailed analysis of patient needs, greater continuity and integration across wards through regular review by a senior medical clinician, and a reduction in bed numbers per ward to improve nurse-to-patient staffing ratios, and thereby facilitate effective transfer communication (Gilligan & Walters, 2008).

### Table 4: Logistic regression models: adjusted odds ratios of CHADx complications

<table>
<thead>
<tr>
<th></th>
<th>Fall (OR 99% CI)</th>
<th>Wound infection (all patients) OR (99% CI)</th>
<th>Wound infection (surgical patients) OR (99% CI)</th>
<th>Medication error OR (99% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed transfers</td>
<td>1.131 (1.08–1.19)</td>
<td>1.250 (1.15–1.36)</td>
<td>1.264 (1.139–1.40)</td>
<td>0.995 (0.68–1.46)</td>
</tr>
<tr>
<td>Ward transfers</td>
<td>1.095 (1.02–1.18)</td>
<td>1.277 (1.15–1.42)</td>
<td>1.249 (1.09–1.43)</td>
<td>1.048 (0.64–1.71)</td>
</tr>
</tbody>
</table>

OR, odds ratio (relative to no fall, wound infection or medication error; 99% CI, 99% confidence interval.

*aAdjusted for age, gender, admission urgency, Charlson comorbidity index, intensive care stay, length of stay, readmission status.

*bNumber of bed or ward transfers significant at p < .001 or better (incorporates Bonferroni adjustment).
5.1 LIMITATIONS

Previous studies note the limitations of using administrative data, such as potential misclassification, lack of socio-demographic information and the likely underreporting of diagnoses and procedures (Grosse, Boulet, Amendah, & Oyeku, 2010). Additionally, although CHADx outcomes have been used in several previous studies and found to be a reliable measure (Michel et al., 2009; Trentino, Swain, Burrows, Sprivulis, & Daly, 2013), their reliance on coded administrative data potentially exacerbates these issues and analyses should be viewed accordingly. In addition, other factors such as nurse staffing and skill mix, found in previous studies to be important predictors of patient outcomes (Duffield et al., 2011; Roche, Duffield, Aisbett, Diers, & Stasa, 2012), were not measured.

6 CONCLUSION

In conclusion, while some transfers are necessary for clinical reasons, patient transfers are occurring with increasing frequency, often at short notice. They usually involve a variety of health professionals and are disruptive to continuity of care and the development of trusting patient-provider relationships. The study is unique in that the CHADx was utilised to examine the relationship between transfers and adverse events. Results determined that intrahospital transfers increased the risk of wound infections and falls with injury but did not increase the risk of a medication error.

7 RELEVANCE TO CLINICAL PRACTICE

Results from this study have implications for clinical and managerial nurses globally, in that the rate of patient transfers results in an increase in adverse events for patients, potentially increasing lengths of stay, costs of care and further compounding the issue of a lack of beds.

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CONTRIBUTIONS

Study design: NB, MR, CD; data collection and analysis: NB, MR, XX; and manuscript preparation: NB, MR, CD.

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