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Timing of emergency interhospital transfers from subacute to acute care and patient outcomes: A prospective cohort study

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ABSTRACT

Background: Australian and international data show that transfer from inpatient rehabilitation to acute care hospitals occurs in one in ten patients. Early unplanned transfers from subacute to acute care hospitals raises questions about the safety of patient transitions between health sectors.
Objectives: To explore the characteristics of early and late emergency interhospital transfers from subacute to acute care. The investigators defined early transfers as occurring within 1 day and late transfers occurring after 1 day after subacute care admission.
Design: This prospective, exploratory cohort study is a subanalysis of data from a larger case-time-control study.
Setting: Twenty-two wards of eight subacute care hospitals in five major health services in Victoria, Australia. All subacute care hospitals were geographically separate from their health services' acute care hospitals.
Participants: All patients with an emergency transfer from inpatient rehabilitation or geriatric evaluation and management wards to an acute care hospital within the same health service were included. Patients receiving palliative care were excluded.
Methods: Data were collected between 22 August 2015 and 30 October 2016 by record audit. To compare patient and admission characteristics between early and late transfers Cochran-Mantel-Haenszel test (CMH) or logistic regression were used to account for health service clustering effect.
Results: There were 602 transfers: 54 early (48 patients) and 548 late transfers (505 patients). There was no difference in median age (79.5 vs 80, $p = 0.680$) or Charlson Comorbidity index (both groups = 3, $p = 0.933$). Early transfer patients had lower functional independence measure scores on subacute care admission (median 45 vs 66, $p < 0.001$). Prior to transfer, fewer early transfers had a limitation of medical treatment order in place during their subacute care admission (25.9% vs 48.7%, $p < 0.001$). The majority of both early and late transfers resulted in acute care hospital readmission (85.1% vs 77.7%, $p = 0.204$). For patients admitted to acute care, there was no difference in median acute care length of stay (6.5 vs 8 days, $p = 0.367$). Early transfer patients had fewer in-hospital deaths than late transfer patients (3.8% vs 16.1%, $p = 0.004$).
Conclusions: The high rates of acute care readmission in both groups suggest that transfer was warranted. Early transfer patients had lower in-patient mortality so emergency interhospital transfers, while resource intensive, appear to have a safety benefit. Early transfer patients were less likely than late transfer patients to have limitation of medical treatment orders, so the influence of resuscitation status and patient goals of care on transfer decisions warrants further investigation.

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What is already known about the topic?

- Despite the important role of subacute care in the Australian healthcare system, there is a dearth of research related to the care and outcomes of patients in the subacute care sector
- Approximately 10% of rehabilitation care admissions result in transfer to an acute care hospital, however issues related to transition between acute and subacute sectors and patient movement between acute and subacute care hospitals is poorly understood
- Unexpected transfers from inpatient rehabilitation hospitals to acute care hospitals are not uncommon and many occur during the first few days of subacute care admission.

What this paper adds

- Patients with early and late emergency interhospital transfers from subacute to acute care had similar demographic and comorbidity profiles and similar acute care admission characteristics prior to subacute care admission
- Readmission to acute care hospital was the most common transfer outcome in both groups suggesting that transfer was warranted and the lower mortality in early transfer patients suggests emergency interhospital transfers have a patient safety benefit
- Early transfer patients had lower levels of functional independence on subacute care admission so the relationship between functional status and clinical deterioration or recovery should be a focus of future work.

1. Introduction

There is significant and increasing demand on the Australian healthcare system. In 2015-16 there were over 6.2 million public hospital and 4.3 million private hospital admissions; the average length of stay was 5.7 days in public and 5.2 days in private hospitals; 25% of hospitalisations involved a surgical procedure; and 41% of patients were aged ≥65 years (Australian Institute of Health and Welfare, 2017a). In addition there were 7.5 million emergency department (ED) attendances, 29% of which resulted in hospital admission and 20% of which involved patients aged ≥65 years (Australian Institute of Health and Welfare, 2017b). The flow on effect of increased demand for healthcare services is pressure on bed access and availability that is exacerbated by increasing demand and decreasing bed numbers over time. Between 2011-12 and 2015-16, emergency department presentations increased by an average of 2.7% *per year* and hospitalisations increased by an average of 3.3% *per year;* however the number of public hospital beds decreased by 0.4 per 1000 population over this time (Australian Institute of Health and Welfare, 2017a, 2017b).

Subacute care is pivotal to the function of the Australian healthcare system. Subacute care incudes rehabilitation, geriatric evaluation and management, psychogeriatric and palliative care (Green et al., 2016). The aim of subacute care is to restore or maximise patients' functional status in order to enable patients and their carers to live as independently as possible with a high quality of life (Davis et al., 2016). The majority of public sector subacute care admissions (84%) occur following an episode of acute care (Victorian Government Department of Health, 2012), therefore subacute care is a key interface between acute care and community-based care or care provided in patients' homes (Davis et al., 2016). The majority of patients in subacute care settings are receiving care following an episode of acute illness or injury. Thus patients in subacute care hospitals may experience clinical deterioration or events requiring escalation of care. Approximately 10% of rehabilitation care admissions result in transfer to an acute care hospital (Australian Institute of Health and Welfare, 2016). Ambulance transfer to the emergency department of an acute care hospital is a common response to clinical deterioration in subacute care hospitals because acute and subacute care hospitals are geographically separate in many Australian health services. Little is known however, about the timing of, and reasons for transfer of patients from subacute to acute care.

A recent Victorian study of 603 emergency interhospital transfers from inpatient rehabilitation or geriatric evaluation and management wards to acute care hospitals, on which this subanalysis is based, showed that 8.9% (n = 54) occurred within one day of subacute care admission (Considine et al., 2018). A study of acute care rehospitalisation in patients discharged from acute care to inpatient rehabilitation care also showed a trend towards early readmission (12.6% within 4 days, 27.5% within 7 days and 49.5% within 14 days) (Burke et al., 2016). Early unplanned transfers from subacute to acute care hospitals raises questions about whether patients are clinically stable prior to their transfer from acute to subacute care hospitals or whether patients are admitted prematurely to subacute care as a result of the pressure on acute care beds.

Despite the key role of the subacute care sector in the care of older people and supporting the function of the Australian healthcare system, subacute care has been described as "the missing link" in Australian healthcare by a number of commentators (Davis et al., 2016; Green et al., 2016). This perception is due to the dearth of research related to the care and outcomes of patients in the subacute care sector as well as the issues related to transition between acute and subacute sectors and patient movement between acute and subacute care hospitals (Davis et al., 2016).

1.1. Aim

The aim of this study was to explore the characteristics of early and late emergency interhospital transfers from subacute to acute care. An early transfer was defined as transfer occurring within 1 day following subacute care admission and late transfers were those occurring greater than 1 day after subacute care admission. The definitions of early versus late transfers using one day as the differentiating feature was determined by the investigators based on two key factors. First, other studies have reported that between 8.9% and 29% of emergency interhospital transfers from subacute to acute care occur within one day of subacute care admission (Considine et al., 2015, 2018). Second, unplanned readmission to acute care within one day could be considered an adverse event and adds weight to the hypothesis that the patient was not clinically stable enough to leave acute care. Emergency interhospital transfers refer to unplanned transfers due to clinical deterioration where patients' care needs could not be met by the subacute care facility.

2. Method

This prospective, exploratory cohort study is a subanalysis of data derived from a larger case-time-control study (Suissa, 1995) conducted across 21 wards of eight subacute care facilities located within five major health services in Victoria, Australia (Considine et al., 2018). All subacute care hospitals in this study were geographically separate from their health services' acute care hospitals. The inclusion criterion was all patients with an emergency interhospital transfer from inpatient rehabilitation or geriatric evaluation and management wards to an acute care hospital within the same health service. Patients receiving

palliative care were excluded from this study. Study data were collected between 22 August 2015 and 30 October 2016.

2.1. Data collection

The following data were collected via medical record audit for each emergency interhospital transfer: patient characteristics; transfer characteristics (e.g. transfer day and time, mode of transfer) and transfer outcomes (e.g. hospital admission), and patient outcomes (health service length of stay, serious adverse events and mortality during health service admission). Co-morbidity status was calculated using the Charlson index; a score of zero means no comorbidities and risk of one-year mortality is 85% when scores are ≥5 (Charlson et al., 1987). Functional status was measured using the Functional Independence Measure, calculated on admission to subacute care. The Functional Independence Measure score ranges from 18 to 126 and the higher the score, the more independent the patient (Bernard et al., 2016). Serious adverse events were defined as unplanned intensive care unit admission(s), rapid response system call(s) or cardiac arrest team call(s).

2.2. Data analysis

The study data were analysed using SPSS Version 24.0 (IBM Corporation, 2016). Descriptive statistics were used to summarise data and explore the factors associated with early and late emergency transfers from subacute to acute hospital care. Where data were not normally distributed, medians and interquartile ranges (IQR) are presented. To compare patient and admission characteristics between early and late emergency transfers while accounting for health service clustering effect, Cochran-Mantel-Haenszel test or logistic regression (when potential confounder was continuous) were used. Cochran-Mantel-Haenszel test was also used to compare health service outcomes following time of emergency transfer until discharge or death between early and late emergency transfers groups. Cochran-Mantel-Haenszel model adjusted odds ratios (AORs) and 95% confidence intervals (95% CI) were reported. Proportional differences between early and late transfer characteristics were examined using Chi-Square test and where appropriate Fishers exact test (2-sided). P-values less than 0.05 were considered statistically significant.

3. Results

There were 54 early transfers in 48 patients (four patients had two transfers and one patient had three transfers) and 548 late transfers in 505 patients (39 patients had two transfers and two patients had three transfers) and there was one transfer in which the exact timing could not be accurately determined, leaving a sample of 602 transfers. The median length of stay in subacute care prior to transfer time was 16.3 h for early transfers and 211 h (8.8 days) for late transfers. The patient characteristics are summarised in Table 1. Patient characteristics including age and comorbidity profile were similar. Fewer patients with early transfers had limitation of medical treatment orders or enduring (medical) power of attorney at some point during their health service stay. In both early and late transfers, few patients had limitations of medical treatment orders during their first acute care admission and there was a marked increase in completed limitation of medical treatment orders during their subacute care admission (Tables 2 and 3). The early transfer group also had lower Functional Independence Measure scores on subacute care admission (median 45 vs 66) suggesting relatively high levels of dependency.

3.1. First acute care admission

For early and late transfer patients, the characteristics of the acute care admission preceding subacute care admission are detailed in Table 2. The most common acute care admission diagnoses for both groups were neurological or neurosurgical (27.8% early and 20.1% late transfers), musculoskeletal (25.9% early and 30.5% late transfers) and cardiac related (16.7% early and 8.2% late transfers) (Supplemental Data Table S1). In both groups, the majority of admissions were emergency admissions and two thirds were medical unit admissions. There were no statistically significant differences in serious adverse events in acute care or acute care length of stay between early and late transfer groups (Table 2).

3.2. Subacute care admission

The characteristics of the subacute care admission prior to transfer are detailed in Table 3. In both groups, there were few subacute care admissions on weekends. Fewer patients in the early transfer group had a limitation of medical treatment order in place

Table 1
Patient characteristics by group (n = 602).

	Early transfers (n = 54)		Late transfers (n = 548)		p[a]
	n	%	n	%	
Male gender	32	59.3	281	51.3	0.186
Country of birth non-English speaking	22	40.7	181	33.0	0.204
Preferred language other than English	8	14.8	76	13.9	0.861
Interpreter required	2	3.7	62	11.3	0.108
Type of subacute care admission					
• Geriatric Evaluation & Management	19	35.2	240	43.8	0.439
• Rehabilitation	35	64.8	307	56.0	
Limitation of medical treatment order during health service stay	24	44.4	343	62.6	0.009
Medical Power of Attorney during health service stay	4	7.4	103	18.8	0.034
	Mdn	IQR	Mdn	IQR	p[b]
Age (years)	79.5	71 - 83	80	70 - 80	0.680
Charlson Comorbidity index	3	2-4	3	2-3	0.933
Functional independence measure (FIM) on admission to subacute care	45	19-81	66	48-82	<0.001

[a] CMH = Cochran-Mantel-Haenszel test.
[b] logistic regression adjusted for health service.

Table 2
First acute care admission characteristics.

	Early transfers (n = 54)		Late transfers (n = 548)		p[a]
	n	%	n	%	
Type of acute care admission					
• Emergency	43	79.6	424	77.4	0.411
• Elective	8	14.8	100	18.2	
Acute care admitting unit					
• Medical	34	63.0	328	59.9	0.446
• Surgical	17	31.5	195	35.6	
Limitation of medical treatment orders during admission	4	7.4	84	15.3	0.276
Serious adverse events during admission					
• Unplanned ICU admission (n = 145)	4	8.2	62	11.9	0.741
• Cardiac arrest team call (n = 14)	1	2.0	13	2.5	0.863
• Rapid Response Team call (n = 114)	10	20.4	104	20.0	0.610
	Mdn	IQR	Mdn	IQR	p[b]
Acute care length of stay (days)	8.5	4.75-14	10	6-17	0.906

[a] CHM = Cochran-Mantel-Haenszel test.
[b] logistic regression stratified by health service.

Table 3
Subacute care admission characteristics.

	Early transfers (n = 54)		Late transfers (n = 548)		p[a]
	n	%	n	%	
Day of subacute care admission					
• Monday	7	13.0	81	14.8	0.905
• Tuesday	9	16.7	103	18.8	0.752
• Wednesday	8	14.8	108	19.7	0.412
• Thursday	13	24.1	104	19.0	0.334
• Friday	15	27.8	104	19.0	0.152
• Saturday	1	1.9	25	4.6	0.467
• Sunday	1	1.9	23	4.2	0.584
Subacute care admission overnight (1800-0759)	4	7.4	61	11.3	0.353
Limitation of medical treatment orders during admission	14	25.9	267	48.7	<0.001
Serious adverse events during admission					
• Cardiac arrest team call (n = 29)	4	7.5	25	4.6	0.192
• Rapid Response Team call (n = 191)	18	33.3	173	31.6	0.880

[a] CHM = Cochran-Mantel-Haenszel test.

during their subacute care admission (25.9% vs 48.7%). There were similar proportions of patients who had a rapid response call during their subacute care admission (33.3% vs 31.6%) and although not statistically significant, a greater proportion of early transfer patients had a cardiac arrest call during subacute care admission (7.5% vs 4.6%).

3.3. Transfer characteristics and outcomes

There were 602 emergency interhospital transfers from subacute care to acute hospital care in 557 patients; 9.0% were early (n = 54) and 91.0% (n = 548) were late transfers. The transfer characteristics are presented in Table 4. In the early transfer group, the most common reasons for transfer were cardiac complaints (22.2%), sepsis or febrile illness (22.2%), and neurological or neurosurgical issues (18.5%) (Supplemental Data Table S1).

In both groups, approximately one in six transfers (16% early vs 18% late transfers) occurred overnight. The early transfers occurred more commonly on Fridays (33.3% early vs 14.6% late transfers, $p < 0.001$) and least commonly on Sundays (1.8% early vs 10.8% late transfers, $p = 0.036$). In both groups, the majority of transfers occurred via emergency ambulance and required care in the emergency department. The majority of patients in both groups were triaged as requiring emergency care in 30 min or less (Australasian Triage Scale 1, 2 or 3) (87.1% early vs 76.9% late transfers). The median emergency department length of stay was

Table 4
Transfer characteristics (n = 602).

	Early transfers (n = 54)		Late transfers (n = 548)		
	n	%	n	%	p[a]
Health service					
• Health service 1	12	22.2	89	16.2	0.160
• Health service 2	17	31.5	116	21.2	
• Health service 3	11	20.4	119	21.7	
• Health service 4	5	9.3	102	18.6	
• Health service 5	9	16.7	122	22.3	
Overnight transfer (2200-0759)	8	16.0	93	18.0	0.848
Day of Week of transfer					
• Monday	5	9.3	73	13.6	0.365
• Tuesday	5	9.3	105	19.6	0.062
• Wednesday	10	18.5	78	14.6	0.439
• Thursday	8	14.8	86	16.1	0.810
• Friday	18	33.3	78	14.6	<0.001
• Saturday	7	13.0	57	10.7	0.645
• Sunday	1	1.8	58	10.8	0.036
Mode of transfer					0.130[e]
• Emergency ambulance	44	81.5	403	73.5	
• Private ambulance	9	16.7	127	23.2	
• Other	1	1.7	6	1.1	
• Missing	0	0.0	12	2.2	
First contact in acute care					0.907[e]
• Emergency Department	43	79.6	416	70.3	
• Direct admission to ward	10	18.5	104	19.5	
• Direct admission to ICU / CCU	0	0.0	1	0.2	
• Outpatients	0	0.0	7	1.3	
• Other	1	1.9	10	1.9	
Triage Category if admitted via the ED (n = 369)					0.304[e]
• ATS 1	2	6.5	20	5.9	1.000[e]
• ATS 2	12	38.7	78	23.1	0.052
• ATS 3	13	41.9	162	47.9	0.522
• ATS 4	4	12.9	74	21.9	0.241
• ATS 5	0	0.0	4	1.2	1.000[e]
ED length of stay ≤4 hours (n = 421)	12	31.6	123	32.1	0.946
Transfer outcome					0.735[e]
• Died in ED	0	0.0	8	1.5	0.625[e]
• Hospital readmission: ward or short stay unit	46	85.1	426	77.7	0.204
• Hospital readmission: ICU / CCU	1	6.3	15	14.6	1.000[e]
• Transfer to another hospital	0	0.0	4	0.8	1.000[e]
• Transfer to palliative care	0	0.0	2	0.4	1.000[e]
• Return to subacute care	4	7.8	67	12.8	0.295
Acute care admission outcomes (n = 488)	Early transfers (n = 47)		Late transfers (n = 441)		
• Transferred to subacute care	36	76.6	290	65.8	0.146[e]
• Home or usual residence	6	12.8	54	12.2	1.000
• Death (excluding deaths in ED)	1	2.1	49	11.1	0.072[e]

Table 4 (*Continued*)

	Early transfers (n = 54)		Late transfers (n = 548)		
• Residential aged care	0	0.0	12	2.7	0.392[e]
• Transition care program	3	6.4	7	1.6	0.062
• Palliative care	1	2.1	7	1.6	1.000[e]
• Transfer to another hospital	0	0.0	6	1.4	0.649[e]
• Other / missing	0	0.0	6	1.4	0.421[e]

ICU = intensive care unit; CCU = coronary care unit; ED = emergency department; ATS = Australasian Triage Scale; GEM = Geriatric Evaluation and Management; TCP = transition care program; HITH = hospital in the home.
[a] Chi-Square [e] Fishers exact test – 2 sided.

6 h in both groups (IQR = 4–15 hours for early transfers and 4-11 h for late transfers). In both groups, an emergency department length of stay of four hours or less was achieved in one third of transfers (31.6% early vs 32.1% late transfers, p = 0.946).

When immediate transfer outcomes were examined, the majority of both early and late transfers resulted in acute care hospital readmission (85.1% vs 77.7%, p = 0.204). The early transfer group had fewer deaths in the emergency department (0 vs 1.5%) and fewer critical care admissions (6.3% vs 14.6%, p = 1.000). For 7.8% of early transfers and 12.8% of late transfers, patients were returned to subacute care without an acute care admission (p = 0.295). Of the 488 transfers resulting in hospital admission, return to subacute care at the conclusion of the acute care admission occurred in 77.6% of the early transfers and 65.8% of late transfers (p = 0.146). In both groups, one in eight patients were discharged from acute care to home or their place of usual residence (12.8% early vs 12.2% late transfers, p = 1.000) and the early transfer group had fewer in-hospital deaths (2.1% vs 11.1%, p = 0.072). (Table 4). For patients admitted to acute care, the median length of acute care stay following transfer was 6.5 days (IQR = 4–13.7) in the early transfer group compared to 8 days (IQR = 4–14) in the late transfer group (p = 0.367).

3.4. Patient outcomes

Patient outcomes from the time of the emergency interhospital transfer until health service discharge or death within the health service was examined for both early and late transfers. In-hospital cardiac arrest calls were uncommon and the frequency of unplanned intensive care admissions and rapid response team calls were similar in both groups (Table 5). For mortality analyses results are reported per patient rather than per transfer; each patient was only counted once and only the last transfer was included for patients who were transferred more than once. Early transfer patients appeared to have fewer in-hospital deaths than late transfer patients (3.8% vs 16.1%, p = 0.044) overall. When patients with a limitation of medical treatment order were excluded from mortality analysis, there were fewer deaths in the early transfer patients but the difference was not significant (3.3% vs 8.3%, p = 0.418) (Table 5).

4. Discussion

In this study, two transitions in care: subacute care admission (planned movement of the patient from an acute care to a subacute care hospital) and emergency interhospital transfer from the subacute care to an acute care hospital were analysed in relation to time of emergency interhospital transfer from the subacute care facility. Key differences between early and late transfer patients were that early transfer patients were less likely to have a limitation of treatment order at any time during their admission, had lower Functional Independence Measure scores at the time of acute to subacute care transfer and lower in-hospital mortality than late transfer patients. There were no differences in comorbidity scores.

There were few subacute care admissions overnight or on weekends which may be viewed as a positive finding if acute care hospital teams are deliberately selective about which patients move between levels of care on weekends. In Victoria, nurse-to-patient ratios are legislated (Department of Health and Human Services. State Government of Victoria Australia, 2015) therefore bedside nurse staffing is largely unaffected by day of the week. However, senior nurses such as directors of nursing, nurse managers and nurse educators do not typically work outside of

Table 5
Health service outcomes following emergency transfer until health service discharge or death.

Outcomes	Early transfers		Late transfers		AOR	95% CI	p[a]
	n	%	n	%			
Serious adverse events							
• In-hospital cardiac arrest	0	0.0	12	2.3	N/A	N/A	N/A
• Unplanned ICU admission	2	3.7	23	4.3	0.91	0.21 – 4.03	0.907
• Rapid Response Team call	9	16.7	112	21.1	0.79	0.37 – 1.71	0.553
Mortality							
• In-patient mortality for all patients (52 early transfer patients & 497 late transfer patients)	2	3.8	80	16.1	0.22	0.05 – 0.96	0.044
• In-patient mortality excluding patients with LOMT (30 early transfer & 193 late transfer patients)	1	3.3	16	8.3	0.42	0.05 – 3.48	0.418

[a] CHM = Cochran-Mantel-Haenszel test.

business hours, so access to senior nursing resources is limited overnight and on weekends in both acute and subacute care settings. In subacute care hospitals, access to medical staff is reduced outside of business hours and there is no overnight access to allied health staff and limited allied health services on weekends.

Early and late transfer patients had similar demographic and comorbidity characteristics but early transfer patients had lower Functional Independence Measure scores on subacute care admission. In Australia, Functional Independence Measure scores are calculated on admission to, and discharge from, rehabilitation units as a measure of rehabilitation outcome and are used for benchmarking (Bernard et al., 2016; Brown et al., 2015). However the Functional Independence Measure score is not calculated at all during acute care admission and the rehabilitation admission Functional Independence Measure score is only used as a baseline against which the rehabilitation Functional Independence Measure score is compared. The use of Functional Independence Measure scores as a tool to inform nursing care and particularly surveillance warrants further investigation to determine whether patients with Functional Independence Measure scores below a specific point are more likely to deteriorate in subacute care and thus may benefit from frequent monitoring and more aggressive management. Further, the Functional Independence Measure score may be a useful tool in determining suitability for planned transition from acute to subacute care hospitals and the use of measures of function in acute care needs to be better understood.

The lower subacute care admission Functional Independence Measure scores in early transfer patients indicate a higher degree of dependency which may be expected given they had left acute care within the previous day and were likely to be more dependent after an episode of acute illness. The case-time-control study on which the subanalysis presented in this paper is based, also showed a dose effect, with increasing odds of emergency transfer from subacute to acute care as Functional Independence Measure scores decreased (Considine et al., 2018). Functional status at the time of subacute care admission, whether measured using Functional Independence Measure score or Barthel Index has predictive value in determining need for acute care readmission (Burke et al., 2016; Hoyer et al., 2014) adding further weight to the need to explore whether functional status is an under-utilised indicator of patient safety.

Early transfer patients were less likely to have a limitation of medical treatment in subacute care, which may be explained in part by the short subacute care length of stay in the early transfer group or that the risk of deterioration and patient trajectory was still unclear in the early transfer patients so therefore decisions about limitation of medical treatment had not been made. In our study, limitation of medical treatment orders were in place for 46.7% of patients during their subacute care admission (25.9% of early transfer patients and 48.7% of late transfer patients). This finding is similar to the findings of the only other Australian study of patients experiencing unplanned transfer from subacute to acute care hospitals, which reports 37.6% of patients had a limitation of medical treatment order in place (Street and Considine, 2016). Other Australian studies report that 14% of Australians have an advanced care directive (White et al., 2014) and 40% of patients from inpatient and outpatient rehabilitation services had appointed a surrogate decision maker or had an advance care directive (Mador, 2001). It should however be noted that completion of limitation of medical treatment orders was more common in subacute care for both groups, perhaps as a function of more time for conversations about limitations of medical treatment or the goal directed nature of rehabilitation and geriatric evaluation and management care.

Early and late transfer patients had similar acute care admission characteristics and there were no vital sign data or adverse event data to support that patients in whom an early emergency interhospital transfer occurred were prematurely transferred from acute to subacute care and were too unstable to be managed in a subacute care setting. There are two possible interpretations of this finding. First, there may be another factor that was a key influence in early transfers that was not revealed by the data collected in this study. Our study data were derived by medical record audit so it was not possible to quantify patient characteristics such as frailty, which has a known association with mortality (Hubbard et al., 2017; Kahlon et al., 2015; Wallis et al., 2015) and a variable relationship with hospital readmissions (Hubbard et al., 2017; Kahlon et al., 2015; Wallis et al., 2015). As discussed, functional status is a key predictor of acute care readmission (Burke et al., 2016; Hoyer et al., 2014) however in our study, functional status was measured using a single score calculated on subacute care admission. The impact of functional status during the first acute care admission was not captured or it may be that a single score calculated on subacute care admission was not a true reflection of functional status. It is possible that vital sign abnormalities are not as pronounced in this patient cohort of largely older patients, due to the effects of altered physiology, comorbidities and medications, thus vital sign changes may be a less reliable indicator of clinical deterioration.

Second, the lack of significant difference in vital sign data or adverse event data may be a reassuring finding but little is known about how decisions to move patients between levels of care are made. One driver for patient movement within the healthcare system is demand for acute care beds in order to meet time based targets, such as the National Emergency Access Target that aims for a 4-hour emergency department length of stay in the majority of patients, and the National Elective Surgery Target that aims to have 100% of patients treated within clinically recommended times (Baggoley et al., 2011). Further, funding models such as activity based funding, whereby a predetermined amount is paid to hospitals per episode of patient care, irrespective of length of stay or actual resources used, also increase the pressure to decrease length of stay and move patients quickly through the healthcare system (Palmer et al., 2014). Some of these drivers aimed at increasing access to acute care beds may be major influences on decisions to move patients from acute to subacute care.

In both acute and subacute care hospitals, patient care is delivered by a multidisciplinary team but it is nurses who are responsible for coordinating patient care 24 h a day. Further, nurses have the most direct contact with patients and families. It is through nurses that patient goals and preferences; care provided by medical, allied health and support staff; the environment; and systems of care are connected (Considine and Currey, 2015). Further work is needed to understand who is involved in decisions to move patients from acute to subacute care, what data are used to inform those decisions, and whether decisions about the care trajectory are shared decisions involving the patient, their family and all care providers.

Early transfers were more likely on a Friday which is logical given that subacute care admissions commonly occurred on Thursday and Friday and the focus of this subanalysis was comparing emergency interhospital transfers within one day of subacute care admission with later transfers. It may be hypothesised that Friday transfers back to acute care hospitals were driven by concern about patient safety and clinical stability over the weekend and that this was prudent decision making on the part of the subacute care staff. The staffing profile in subacute care wards is different to that in acute hospital wards. In subacute care the nurse-to-patient ratios are one nurse to five to six patients on morning and afternoon shifts and one nurse for ten patients

overnight; so nurses are responsible for more patients than in acute care (one nurse to four patients on morning and afternoon shifts and one nurse for eight patients overnight) (Department of Health and Human Services. State Government of Victoria Australia, 2015). In acute general medical and surgical wards, there can be no more than 20% enrolled nurses (Department of Health and Human Services. State Government of Victoria Australia, 2015); however, there are no skill mix legislative requirements in rehabilitation and geriatric evaluation and management wards settings (Department of Health and Human Services. State Government of Victoria Australia, 2015), which typically have higher proportions of enrolled nurses in relation to registered nurses.

The majority of patients in both groups were transferred by emergency ambulance, required care in the emergency department, were triaged as requiring emergency care in 30 min or less and had a median emergency department length of stay of 6 h. Further, acute care hospital readmission was the transfer outcome for 85.1% of early transfers and 77.7% of late transfers. These results strongly suggest that the transfers were appropriate, patients had high levels of clinical urgency, and their care needs could only be provided in an acute care setting. Admission to acute care hospital was the most common transfer outcome in both groups and few patients were transferred from the emergency department back to subacute care suggesting that the original transfer was warranted. Other studies also report high hospital readmission rates, ranging from 75% to 87.2%, in patients unexpectedly transferred from subacute care to acute care hospitals (Considine et al., 2013, 2015). One in 12 early transfers and one in seven late transfers resulted in the patient being able to return to subacute care from the ED. These patients are of particular interest, they are the patients in whom the original transfer may have been avoidable. A better understanding of the reason for transfer and patient care requirements is necessary to determine whether the transfer was unavoidable or whether the care required could be made available within in a subacute care environment.

When patient outcomes were examined, a greater proportion of late transfers resulted in death in the emergency department (0% vs 1.5%) and in-hospital deaths (3.8% vs 16.1%). The low mortality rate in early transfer patients may be interpreted as a positive finding, if subacute care staff are identifying deteriorating patients and transferring them to acute care hospitals where their care requirements can be better matched to patient needs. Further work is needed to understand why the mortality rate in late transfer patients is so high, even with the removal of patients with limitation of medical treatment from the analysis (8.3%). Specifically, whether mortality is related to the patient's medical condition or a preventable event such as a fall or healthcare associated infection warrants further investigation. It may also be surmised that the higher mortality in late transfer patients could be a function of delayed recognition or response to clinical deterioration given that the patient characteristics were similar for the two groups and the late transfer group had better FIM and so were less dependent on subacute care admission.

Other studies of unplanned readmissions to acute care from subacute care or post-acute care hospitals also report high mortality rates ranging from 15.4% in-hospital mortality (Considine et al., 2015) to 18.9% mortality at 30 days and 39.9% mortality at 100 days post discharge (Burke et al., 2016). In our study, the profile of serious adverse events was similar, with few patients in both groups. In acute care hospitals in Australia and New Zealand, cardiac arrest occurs in 0.13% to 0.61% of hospital admissions and is an infrequent occurrence (Fennessy et al., 2016). In our study, cardiac arrest team calls occurred in 2.0% to 2.5% of patients in acute care and 4.6% to 7.5% in subacute care. The increased frequency of cardiac arrest calls in subacute care is an area for further study to determine whether it is a function of the emergency responses available on subacute care sites or whether there is a higher incidence of true cardiac arrest in this patient population.

It is estimated that approximately 1% to 3% of acute care hospital patients will require at least one rapid response team review during their hospitalisation (ANZICS-CORE MET dose investigators, 2013; Le Guen et al., 2015; Westacott et al., 2017). Rapid response team activations have been studied in detail in acute care hospital populations, yet the profile of clinical deterioration and rapid response team use in subacute care settings is largely absent from the literature. In a recent systematic review and meta-analysis of rapid response teams involving 19 studies of over 2 million patients, all studies were conducted in academic or community acute care hospitals (Maharaj et al., 2015), highlighting a major gap in the patient safety literature. The rate of adult rapid response team activations in the Maharaj meta-analysis was 16.3 per 1000 hospital admissions (95%CI: 9.0–23.7) (Maharaj et al., 2015). In our study, 20% of patients from both groups had a rapid response team call during their first acute care admission and one third of patients from both groups had a rapid response team call in subacute care. The high use of rapid response teams may be considered reassuring as clinicians are recognising and responding to clinical deterioration in the subacute care environment. However, the in-hospital mortality of acute care hospital patients who have received a rapid response team review is approximately 25% (Jones et al., 2012) and is as high as 35% in patients who receive repeated rapid response team reviews (Calzavacca et al., 2010); so a counter argument is that rapid response team activation occurs late in the deterioration trajectory.

There were study limitations that should be considered when interpreting our findings. First, the study used organisational data from patient records and so there was potential for data error and missing data. However, this limitation was moderated by a prospective approach and multisite design. The relatively small sample size for early transfers limited the statistical analyses, and particularly some of the subanalyses regarding transfer characteristics, so future studies with larger samples are warranted. The study was conducted in Victoria, Australia, so the generalisability of the study findings to health services and systems in other states or countries is not known.

5. Conclusion

Patients with early and late emergency interhospital transfers from subacute to acute care had similar demographic and comorbidity profiles and similar acute care admission characteristics prior to transition to subacute care hospitals. Acute care hospital readmission was the most common transfer outcome in both groups suggesting that transfer was warranted. Further, early transfer patients had lower in-patient mortality so emergency interhospital transfers, while resource intensive, appear to have a safety benefit. The issue of clinical stability and indicators of patient suitability to move from acute to subacute care hospitals warrants further investigation to ensure safe patient transition through multiple healthcare sectors. The lower functional status on subacute care admission in early transfer patients suggests higher levels of dependency at the point of care transition from acute to subacute settings. The relationship between functional status and clinical deterioration or recovery, and the role of functional status as an indicator for care transitions should be a focus of future work. Early transfer patients were less likely than late transfer patients to have limitations of medical treatment so the influence of resuscitation status and patient goals of care on transfer decisions also warrants further investigation.

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Competing interests

There are no conflicts of interest to declare. No author had any financial or professional relationships which may pose a competing interest to the study or decision to submit the manuscript for publication.

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Appendix A. Supplementary data

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