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Multisite analysis of the timing and outcomes of unplanned transfers from subacute to acute care

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Abstract

Objective. The aim of the present study was to examine the timing and outcomes of patients requiring an unplanned transfer from subacute to acute care.

Methods. Subacute care in-patients requiring unplanned transfer to an acute care facility within four Victorian health services from 1 January to 31 December 2010 were included in the study. Data were collected using retrospective audit. The primary outcome was transfer within 24 h of subacute care admission.

Results. In all, 431 patients (median age 81 years) had unplanned transfers; of these, 37.8% had a limitation of medical treatment (LOMT) order. The median subacute care length of stay was 43 h: 29.0% of patients were transferred within 24 h and 83.5% were transferred within 72 h of subacute care admission. Predictors of transfer within 24 h were comorbidity weighting (odds ratio (OR) 1.1, $P = 0.02$) and LOMT order (OR 2.1, $P < 0.01$). Hospital admission occurred in 87.2% of patients and 15.4% died in hospital. Predictors of in-hospital mortality were comorbidity weighting (OR 1.2, $P < 0.01$) and the number of physiological abnormalities in the 24 h preceding transfer (OR 1.3, $P < 0.01$).

Conclusions. There is a high rate of unplanned transfers to acute care within 24 h of admission to subacute care. Unplanned transfers are associated with high hospital admission and in-hospital mortality rates.

What is known about the topic? Subacute care is becoming a high acuity environment where many patients are at significant risk of clinical deterioration. Systems for recognising and responding to deteriorating patients are well developed in acute care, but still developing in subacute care.

What does this paper add? This is the first Australian multisite study of clinical deterioration in patients situated in subacute care facilities. One-third of unplanned transfers occur within 24 h of admission to subacute care. Patients who require unplanned transfer from subacute to acute care have unexpectedly high hospital admission rates and high in-hospital mortality rates. The frequency and completeness of physiological monitoring preceding transfer was low.

What are the implications for practitioners? Patients in subacute care require regular physiological assessment and early escalation of care if there are physiological abnormalities. Risk of clinical deterioration should be a factor in the decision to admit patients to subacute care after an acute illness or injury. There is a need to improve systems for recognising and responding to deteriorating patients in subacute care settings.

Additional keywords: clinical deterioration, patient safety, rapid response, risk management, transitions in care.

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Introduction

Subacute care is a vital component of the Australian healthcare system. During 2010–11, 313 795 episodes of care occurred in rehabilitation or Geriatric Evaluation and Management (GEM) units in Australia.[1] Nationally, almost 19 000 (5%) episodes of subacute care result in transfer to another hospital for treatment.[1] Studies from two major Australian health services show that, per health service, there were 70–181 ambulance transfers from subacute to acute care during a 12-month period.[2,3] Acute and subacute care facilities are on geographically separate sites in most Australian health services. Consequently, access to on-site medical staff is usually limited, with an on-call service out of hours.[2] In many subacute care facilities, particularly out of hours, ambulance transfer to an acute care facility is a common emergency response to clinical deterioration. Entry to acute care typically occurs via the emergency department (ED).

The only Australian study of transfers from subacute to acute care was a single-site pilot study of 136 patients[2] that showed 25% of transfers occurred on weekends and 46.3% occurred out of hours when there was no medical staff cover.[2] Hospital admission occurred for 75% of patients and in-hospital mortality was 14.7%, fourfold greater than the general in-patient mortality rate of 3.7% for patients aged 65 years. The reason for this unexpectedly high mortality rate is unclear and it is unknown whether these single-site results are representative of patient outcomes following unplanned transfer from subacute to acute care across the sector. Further, it is unknown whether patients are requiring return to acute care early in their subacute care admission, therefore raising questions of suitability of admission to subacute care.

The primary aim of the present study was to examine the timing of, and outcomes for patients requiring, an unplanned transfer from subacute to acute care from a multisite perspective. A secondary aim of the study was to establish the degree of physiological assessment and the prevalence of physiological abnormalities in the 24 h preceding transfer.

Methods

A retrospective medical record audit was conducted. The study was approved by the Human Research and Ethics Committees at Deakin University and each study site.

Setting and sample

The study was conducted in four major publicly funded Victorian health services with geographically separate subacute and acute care facilities. Participants were included in the study if they met the following inclusion criteria: (1) they were receiving in-patient care in rehabilitation or a GEM unit at one of the study sites, and (2) they required an unplanned transfer from subacute care to the ED of an acute care facility within the same health service between 1 January and 31 December 2010.

For the purposes of the present study, an unplanned transfer was defined as an ambulance transfer from subacute to acute care for clinical deterioration or an acute adverse event, such as a fall. Transfers for scheduled investigations and appointments were considered planned and were excluded from the study. Patients receiving palliative care and patients transferred to other health services were also excluded. Sample size estimates were based on the requirement of at least 10 cases for every independent variable entered into a regression model.[4] In order to enable up to 40 predictor variables to be tested, a minimum of 400 patients was required.

Data collection and analysis

Data were collected from the medical record and health service information systems and included: (1) patient characteristics (i.e. age, gender, diagnostic category, limitation of medical treatment (LOMT) orders and comorbidities); (2) clinical characteristics in the 24 h preceding transfer (i.e. physiological parameters and frequency of physiological assessment); (3) transfer data (i.e. date and time of transfer, reason for transfer, subacute care length of stay (LOS) and ED triage category); and (4) outcome data (i.e. ED discharge destination, ED LOS, hospital LOS, serious in-hospital adverse events, and in-hospital mortality).

Comorbidity status was calculated using the Charlson index.[5] Comorbidity groups were assigned based on International Classifications of Diseases (ICD)-10-AM (Australian Modification) codes[6,7] using a methodology published by Frost *et al*.[8] where weightings varied from 1 (e.g. acute myocardial infarction, peripheral vascular disease, cerebral vascular disease, chronic pulmonary disease) to 6 (e.g. metastatic solid tumour, human immunodeficiency virus/acquired immunodeficiency syndrome). A score of 0 meant no comorbidities. Normal physiological parameters were defined as respiratory rate 12–22 breaths min^{-1}, oxygen saturation $\geq$95%, heart rate 60–100 b.p.m., systolic blood pressure (SBP) 90–140 mmHg and temperature 35–37.9°C.[9] 'Severe hypoxaemia' was oxygen saturation <90%: patients with oxygen saturation <90% were classified in both the hypoxaemia and severe hypoxaemia groups. Normal blood glucose was defined as 4–9 mmol L^{-1}.[10]

Study data were analysed using SPSS Version 21.0 (IBM Corp, Armonk, NY, USA)[11] and summarised using descriptive statistics. Where data were not normally distributed, median values and the interquartile range (IQR) are presented. Relationships between variables were examined using Chi-squared and Mann–Whitney *U*-tests. Binary logistic regression was used to examine predictors of transfer with 24 h of subacute care admission and in-hospital mortality. Two-sided $P < 0.05$ was considered significant.

Results

In all, 442 patients were identified who met the study inclusion criteria and medical record data were available for 431 patients.

The median (IQR) age was 81 years (73–85 years) and 46.6% were male ($n = 201$). English was the preferred language for 79.6% of patients ($n = 343$) and 15.8% of patients ($n = 68$) required an interpreter. Common diagnostic groups were hip fractures ($n = 46$), stroke ($n = 45$), respiratory illnesses ($n = 47$), cardiac issues ($n = 27$), falls ($n = 27$) and infective processes such as cellulitis and urosepsis ($n = 29$). The median (IQR) comorbidity score was 1 (0–3) and 43.9% of patients had no comorbidities. An LOMT order was in place for 37.8% of patients ($n = 163$); however, these orders varied widely and only four included details about transfer to an acute care facility. Assessment of nursing care plans showed that recommendations regarding frequency of physiological assessment varied from hourly to weekly. The major reasons for transfer were neurological ($n = 82$), respiratory ($n = 81$) and gastrointestinal ($n = 60$) issues (Table 1).

Transfer timing

The median (IQR) LOS in subacute care preceding transfer was 43 h (18–64 h): 29.0% of patients ($n = 125$) were transferred within 24 h and 83.5% of patients ($n = 360$) were transferred within 72 h of subacute care admission. Weekend transfers occurred in 21.3% of patients ($n = 92$) and 15.3% of patients ($n = 66$) were transferred overnight. Patients transferred within 24 h were 10.8% less likely to have an LOMT order ($P = 0.04$), were slightly older ($P = 0.05$) and had marginally higher comorbidity scores ($P = 0.01$; Table 2). There was no difference in the number of physiological abnormalities identified in the 24 h preceding transfer. Patients transferred within 24 h of subacute care admission had threefold the rate of bradycardia than those transferred later (14.3% vs 4.6%; $P = 0.04$), but there were no other physiological differences. For the 324 patients with ED data, there was no difference in triage category on ED arrival. For patients admitted to hospital, patients with a subacute care LOS <24 h had a longer hospital LOS ($P = 0.05$), but there were no differences in in-hospital mortality or serious adverse events (MET activations, unplanned intensive care unit (ICU) admissions or cardiac arrests).

Table 1. Major reasons for transfer

Reason for transfer	n	%
Respiratory (shortness of breath, aspiration)	81	18.8
Cardiac (chest pain, arrhythmias)	44	10.2
Neurological (altered conscious state, confusion, stroke)	82	19.0
Gastrointestinal (abdominal pain, vomiting, gastrointestinal bleeding)	60	13.9
Genitourinary (haematuria, urinary retention, renal failure)	18	4.2
Febrile illness or sepsis (fever, wound infection)	41	9.5
Fall or injury	35	8.1
Musculoskeletal (joint pain, back pain, limb pain)	25	5.8
Wound management issues	10	2.3
Other[A]	35	8.1

[A]Other included anaemia, hyper- and hypoglycaemia, electrolyte imbalances, medication error requiring medical review, medication toxicity and epistaxis.

Patient outcomes

Most patients (87.2%; $n = 376$) were admitted to hospital: seven patients were admitted from the ED to ICU and three died in the ED. Return to subacute care occurred in 10.2% ($n = 44$) of patients. The in-hospital mortality rate among admitted patients was 15.4% ($n = 58$). During their hospitalisation, 10.3% of patients ($n = 39$) had a Medical Emergency Team (MET) activation, 1.9% of patients ($n = 7$) suffered an in-hospital cardiac arrest and 2.1% of patients ($n = 8$) required an unplanned ICU admission, three of which followed an MET activation.

The 58 patients who died in hospital following transfer from subacute care had more physiological abnormalities in the 24 h preceding transfer (median 3 vs 2; $P < 0.01$) and had a higher incidence of tachypnoea ($P < 0.01$), hypoxaemia ($P < 0.01$), severe hypoxaemia ($P < 0.01$), tachycardia ($P = 0.02$) and hypotension ($P = 0.05$) in the 24 h preceding transfer than patients who survived (Table 3). In-patient mortality was higher in patients transferred on weekends ($P = 0.03$), with an LOMT order in place ($P < 0.01$) and who experienced MET activation ($P < 0.01$) or an unplanned ICU admission ($P < 0.001$) during their hospital admission. Cardiac arrest occurred in 3.6% of patients who died and 0.6% of patients who survived hospital admission; however, the difference was not significant due to the small number of events.

Predictors of transfer within 24 h of subacute care admission and in-hospital mortality

Binary logistic regression was performed to identify predictors of transfer within 24 h of subacute care admission and in-hospital mortality (Table 4). Based on the results of the univariate analyses, the following predictor variables were included in the models: age, comorbidity weighting, weekend transfer, LOMT order and number of physiological abnormalities in the 24 h preceding transfer. Transfer within 24 h of subacute care admission was added to the model examining in-hospital mortality.

Using transfer within 24 h of subacute care admission as the independent variable, a test of the full model with 419 patients against a constant-only model was statistically reliable (omnibus $\chi^2 = 18.307$, d.f. = 58, $P < 0.01$). The model explained 6.1% (Nagelkerke R^2) of the variance in transfer timing and correctly classified 70.6% of cases. The significant predictors of transfer within 24 h of subacute care admission were comorbidity weighing (odds ratio (OR) 1.1, $P = 0.02$) and the presence of an LOMT order (OR 2.1, $P < 0.01$; Table 4).

Using in-hospital mortality as the independent variable, a test of the full model with 364 admitted patients against a constant-only model was statistically reliable (omnibus $\chi^2 = 31.664$, d.f. = 6, $P < 0.01$). The model explained 14.3% (Nagelkerke R^2) of the variance in mortality and correctly classified 84.1% of cases. Significant predictors of in-hospital mortality were comorbidity weighing (OR 1.2, $P < 0.01$) and the number of physiological abnormalities in the 24 h preceding transfer (OR 1.3, $P < 0.01$; Table 4).

Physiological assessment and abnormalities in the 24 h preceding transfer

In the 24 h preceding transfer, the median frequency of assessment of physiological parameters was 3 for oxygen saturation

Table 2. Factors associated with transfer within 24 h of subacute care admission

Data are presented as the number of patients in each group, with percentages in parentheses, or as the median (interquartile range), as appropriate. LOMT, limitation of medical treatment; ED, emergency department; LOS, length of stay; RR, respiratory rate; HR, heart rate; SBP, systolic blood pressure; BSL, blood sugar level; ATS, Australasian Triage Scale; MET, Medical Emergency Team; ICU, intensive care unit

	Transfer ≤24 h of subacute care admission ($n = 126$)	Transfer >24 h of subacute care admission ($n = 305$)	P-value[A]
Transfer/patient characteristics			
Male gender	58 (46.0%)	143 (46.9%)	0.87
Weekend transfer	20 (15.9%)	72 (23.6%)	0.08
Overnight transfer	14 (11.1%)	52 (17.0%)	0.14
LOMT order	38 (30.2%)	125 (41.0%)	0.04
Interpreter required	16 (12.7%)	52 (17.0%)	0.31
Age (years)	82 (74.75–86)	81 (72–84)	0.05
Comorbidity score	1 (0–3)	1 (0–2)	0.01[B]
No. physiological abnormalities in 24 h preceding transfer	2 (1–3)	2 (1–3)	0.91[B]
No. physiological abnormalities on ED arrival	1 (0.5–2)	1 (0–2)	0.13[B]
ED LOS (h)	7.4 (5.6–11.3)	8.3 (6.0–14.1)	0.08[B]
Hospital LOS (days; admitted patients)	8.3 (5.0–14.4)	7.6 (3.0–12.4)	0.05[B]
Clinical status 24 h preceding transfer			
Bradypnoea (RR <12 min^{-1})	0 (0.0%)	0 (0%)	N/A
Tachypnoea (RR >22/min^{-1})	36 (28.6%)	81 (26.6%)	0.48
Hypoxaemia (S_pO_2 <95%)	63 (50.0%)	157 (51.5%)	0.98
Severe hypoxaemia (S_pO_2 <90%)	18 (14.3%)	61 (20.0%)	0.20
Bradycardia (HR <60 b.p.m.)	18 (14.3%)	14 (4.6%)	0.04
Tachycardia (HR >100 b.p.m.)	37 (29.4%)	96 (31.5%)	0.91
Hypotension (SBP <90 mmHg)	17 (13.5%)	29 (9.5%)	0.18
Hypertension (SBP >140 mmHg)	44 (34.9%)	107 (35.1%)	0.53
Hypothermia (temperature <35°C)	9 (7.1%)	20 (6.6%)	0.71
Hyperthermia (temperature >37.9°C)	13 (10.3%)	35 (11.5%)	0.88
Hypoglycaemia (BSL <4 mmol/L)	2 (1.6%)	7 (2.3%)	0.96
Hyperglycaemia (BSL ≥10 mmol/L)	17 (13.5%)	65 (21.3%)	0.78
Clinical status on ED arrival	$n = 71$	$n = 253$	
Triage category			
ATS 1	4 (5.6%)	5 (2.0%)	0.09
ATS 2	18 (25.4%)	60 (23.7%)	0.78
ATS 3	39 (54.9%)	138 (54.5%)	0.95
ATS 4	9 (12.7%)	49 (19.4%)	0.19
ATS 5	1 (1.4%)	1 (0.4%)	0.39
In-hospital adverse events (admitted patients)	$n = 116$	$n = 260$	
Cardiac arrest	2 (1.7%)	2 (0.8%)	0.59
MET	7 (6.0%)	30 (11.5%)	0.10
Unplanned ICU admission	2 (1.7%)	6 (2.3%)	0.72
In-hospital mortality	19 (16.4%)	39 (15.0%)	0.73

[A]Chi-squared test.
[B]Mann–Whitney *U*-test.

and SBP, 2 for respiratory rate, pulse rate and temperature, and 0 for both conscious state (IQR 0–2) and blood glucose (IQR 0–2). The Australian Commission on Safety and Quality in HealthCare (ACSQHC) recommends that physiological observations should include respiratory rate, oxygen saturation, heart rate, blood pressure, temperature and level of consciousness, and be measured at least once per 8-h shift for patients in acute care.[12] Only 10.4% of patients ($n = 45$) in the present study had all six parameters documented in the 24 h preceding transfer and 29.4% of patients ($n = 127$) had at least 8-h physiological assessments. No physiological data were documented for 12 patients in the 24 h preceding transfer; however, 84.9% of patients ($n = 366$) had least one documented physiological abnormality. The most common abnormalities were hypoxaemia (51%; $n = 220$), hypertension (35%; $n = 151$), tachycardia (30.0%; $n = 133$) and tachypnoea (27.1%; $n = 117$). The median (IQR) number of physiological abnormalities documented was 2 (1–3) and 36% of patients ($n = 155$) had three or more physiological abnormalities documented in the 24 h preceding transfer.

Discussion

There are three major findings of present study. First, one-third of patients requiring re-admission to acute care were transferred

Table 3. Factors associated with in-hospital mortality (*n* = 376 admitted patients)
Data are presented as the number of patients in each group, with percentages in parentheses, or as the median (interquartile range), as appropriate. LOMT, limitation of medical treatment; ED, emergency department; LOS, length of stay; RR, respiratory rate; HR, heart rate; SBP, systolic blood pressure; BSL, blood sugar level; ATS, Australasian Triage Scale; MET, Medical Emergency Team; ICU, intensive care unit

	In-hospital mortality (n = 58)	No in-hospital mortality (n = 318)	
Transfer and/or patient characteristics			*P*-value[A]
Male gender	26 (44.8%)	147 (46.2%)	0.84
Weekend transfer	18 (31.0%)	28 (8.8%)	0.03
Overnight transfer	9 (15.5%)	43 (13.5%)	0.66
LOMT order	32 (55.2%)	114 (35.8%)	<0.01
Interpreter required	7 (12.1%)	47 (14.8%)	0.67
Subacute care LOS ≤24 h	19 (32.8%)	97 (30.5%)	0.73
Subacute care LOS ≤48 h	37 (63.8%)	185 (58.2%)	0.42
			P-value[C]
Age (years)	83 (77.7–85.2)	78.0 (73–85)	0.09
Comorbidity score	2.5 (1–4)	2 (1–3)	0.17
No. physiological abnormalities in the 24 h preceding transfer	3 (2–4)	2 (1–3)	<0.01
No. physiological abnormalities on ED arrival	2 (1–2)	1 (1–2)	<0.01
Subacute LOS (h)	40.5 (12.7–55.2)	43.4 (18–63.1)	0.38
ED LOS (h)	7.9 (5.6–11.0)	8.0 (5.8–13.6)	0.65
Hospital LOS (days)	8.1 (2.0–14.1)	7.8 (4–13.0)	0.49
Clinical status 24 h preceding transfer	n (%)	n (%)	*P*-value[A]
Bradypnoea (RR <12 min^{-1})	0 (0.0%)	0 (0.0%)	N/A
Tachypnoea (RR >22 min^{-1})	30 (51.7%)	76 (23.9%)	<0.01
Hypoxaemia ($S_{p}O_2$ <95%)	44 (75.9%)	155 (48.7%)	<0.01
Severe hypoxaemia ($S_{p}O_2$ <90%)	21 (36.2%)	57 (17.9%)	<0.01
Bradycardia (HR <60 b.p.m.)	4 (6.9%)	25 (7.9%)	0.73
Tachycardia (HR >100 b.p.m.)	27 (46.6%)	94 (29.6%)	0.02
Hypotension (SBP <90 mmHg)	11 (19.0%)	30 (9.4%)	0.04
Hypertension (SBP 140 mmHg)	18 (31.0%)	106 (33.3%)	0.46
Hypothermia (temperature <35°C)	4 (6.9%)	21 (6.6%)	1.00
Hyperthermia (temperature >37.9°C)	9 (15.5%)	37 (11.6%)	0.54
Hypoglycaemia (BSL <4 mmol/L)	1 (1.7%)	5 (1.6%)	1.00[B]
Hyperglycaemia (BSL ≥10 mmol/L)	14 (24.1%)	54 (17.0%)	0.75
Clinical status on ED arrival	n (%)	n (%)	*P*-value[A]
Triage category			
ATS 1	5 (8.6%)	4 (1.3%)	<0.001
ATS 2	13 (22.4%)	56 (17.6%)	0.26
ATS 3	19 (32.8%)	132 (41.5%)	0.29
ATS 4	4 (6.9%)	46 (14.5%)	0.14
ATS 5	0 (0.0%)	1 (0.3%)	1.00[B]
In-hospital adverse events	n (%)	n (%)	*P*-value[A]
Cardiac arrest	2 (3.4%)	2 (0.6%)	0.05
MET	13 (22.4%)	24 (7.5%)	<0.01
Unplanned ICU admission	6 (10.4%)	2 (0.6%)	<0.01

[A]Chi-squared test.
[B]Fisher's exact test.
[C]Mann–Whitney *U*-test.

within 24 h and >80% of transfers occurred within 72 h of admission to subacute care. Patients transferred within 24 h of subacute care admission were older (median 1 year), with more comorbidities (IQR 0–3 vs 0–2) and had a longer acute care LOS following re-admission than patients transferred later, suggesting they may have been sicker. However, the timing of transfer did not appear to make any difference to in-hospital adverse event rates or in-hospital mortality. Comorbidity weighting was a significant predictor of transfer within 24 h of subacute care admission and, clinically, it makes sense that patients with more comorbidities may be more likely to deteriorate and need higher-level care.[13] The presence of an LOMT order (OR 2.1) was also a significant positive predictor of transfer within 24 h of subacute care admission; however, the reasons for this finding are unclear, particularly given that on univariate analysis 10.8% fewer patients transferred within 24 h had an LOMT order.

The reason for the high number of transfers early in the subacute care episode is not clear, however there are several propositions. First, recognising and responding to deteriorating

Table 4. Results of logistic regression analysis for variables predicting transfer within 24 h of subacute care admission and in-hospital mortality

OR, odds ratio; CI, confidence interval; LOMT, limitation of medical treatment

	Independent variable: transfer within 24 h of subacute care admission			Independent variable: in-hospital mortality		
	OR	95% CI	*P*	OR	95% CI	*P*
Age	1.020	1.000, 1.040	0.05	1.003	0.974, 1.033	0.84
Comorbidity weighting	1.152	1.024, 1.295	0.02	1.244	1.073, 1.441	<0.01
Weekend transfer	1.729	0.984, 3.039	0.06	0.566	0.290, 1.103	0.09
LOMT order	2.139	1.314, 3.484	<0.01	0.563	0.300, 1.056	0.07
No. physiological abnormalities in 24 h preceding transfer	1.010	0.866, –1.177	0.90	1.356	1.104, –1.667	<0.01
Transfer within 24 h of subacute care admission	–	–	–	1.269	0.668, 2.411	0.47

patients may be delayed due to variability in the frequency and completeness of physiological assessments. In subacute care, there is a lower nurse : patient ratio, as well as a lower proportion of registered nurses than in acute care hospitals and, after hours, access to medical staff is via an on-call service.[14] The individual and combined impacts of these factors warrants further research. The comorbidity and diagnostic profile of patients in the present study showed several conditions that are associated with high mortality rates, such as stroke, respiratory illness, cardiac disease and hip fractures. It may be that for patients with these conditions, recurrent acute care episodes during their recovery are unavoidable.[15,16] If this is the case, then better strategies are needed to manage episodes of acute illness within the subacute care environment.

The second major finding was that patients experiencing unplanned transfer from subacute to acute care had high hospital admission and in-hospital mortality rates. The hospital admission rate in the present study was 87.2%, slightly higher than the 75% reported in the single-site pilot study[2] and much higher than the admission rates reported in Australian studies of transfers from residential aged care facilities to acute care, which range from 45.5% to 68.6%.[17,18] In the present study, the in-hospital mortality rate was 15.4% and similar to the 14.7% in-hospital mortality rate reported in the pilot study.[2] It may be argued that high mortality rates are expected in a cohort of older patients with comorbidities; however, data from other sources show much lower mortality rates in older hospital patients. Nationally, 1% of episodes of care in Australian public hospitals end with in-hospital death.[1] Victorian data show that the in-hospital mortality rate is 1.0% for patients aged $\geq$65 years and 3.2% for patients aged $\geq$80 years.[19] Therefore, the in-hospital mortality rate in the present study was much higher than expected for older hospital patients.[2] One-third of patients in the present study had an LOMT order in place; however, none of these patients was receiving palliative care and all patients in the study were from rehabilitation or GEM units, therefore were expected to be discharged home.

The significant predictors of in-hospital mortality were comorbidity weighting (OR 1.2) and number of physiological abnormalities before transfer (OR 1.3). The relationship between physiological abnormalities and hospital mortality has been well described in hospital patients.[20–22] In the present study, 84.9% of patients had at least one documented physiological abnormality in the 24 h preceding transfer, which is higher than the reports of abnormal observations in other studies. Studies of adult ward patients show 15%–67.9% of patients have one or more abnormal observation[20,22] and 3%–9% of ward patients fulfil rapid response system activation criteria at any point in time.[23–25] Whether the high rates of physiological abnormalities in the present study cohort is a function of the older patient group, clinical deterioration or both warrants further investigation. These findings raise questions about the need for context-specific systems for identifying and responding to deterioration in subacute care akin to rapid response systems in acute care settings.[26] Further, there is an urgent need for more accurate data. Organisational incident reporting systems should be used to track unplanned transfers from subacute to acute care in the same manner that cardiac arrests and MET activations are monitored to better understand the magnitude, potential preventability and outcomes of unplanned transfers.

Finally, the frequency and completeness of physiological assessment in the 24 h preceding transfer was low. Only one in 10 patients had all six elements of physiological observations recommended by ACSQHC[12] documented, despite deterioration significant enough to warrant ambulance transfer to an acute care facility. The ACSQHC[12] recommend that every patient has a clear monitoring plan, that the frequency of observations depends on the patient's clinical status and that physiological observations are measured at least once per 8-h shift. Although these ACSQHC recommendations[12] pertain to acute care, the low levels of physiological assessment, high incidence of physiological instability and poor outcomes in this patient cohort suggest that these national guidelines should be trialled in other healthcare contexts, including subacute care.

Several limitations should be considered when interpreting the study findings. First, the study data were collected by medical record audit; therefore, it is not possible to determine whether some elements of assessment were performed but not documented. Second, the study sample included all patients transferred within the same health service and excluded patients transferred to other health services. In order to address these limitations, participants were recruited from four different sites in order to minimise bias from a single-site approach. According to Victorian Government Department of Health data, of the 45 279 admissions to GEM or rehabilitation in subacute care facilities during 2010, 5.7% required transfer to a public hospital with a designated ED.[27] Rehabilitation GEM and admission data from the study sites shows the 431 transfers were from 6962 subacute care admissions, giving a transfer rate of 6.2%. This suggests that the study sample is representative of Victorian transfer rates. Finally, the study was located in Victoria, Australia, so the generalisability of the study findings to health services in other states or countries is not known.

Conclusions

Patients who require an unplanned transfer from subacute to acute care have high rates of early transfer (within 24 h of subacute care admission), hospital admission and in-hospital mortality. Physiological assessment was infrequent and incomplete in most patients who had an unplanned transfer from subacute to acute care. Our analysis of the subacute to acute care interface has highlighted the need to improve systems for recognising and responding to deteriorating patients in subacute care settings.

Competing interests

The authors have no competing interests.

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