Original Article

Rates and Reasons for Readmission after Hospitalisation on the Acute Medical Unit

E Belvoir, M Holland & D Green

Abstract

Introduction: Readmission after hospital discharge is an ongoing challenge that healthcare systems face worldwide, with multimorbidity increasing the readmission risk significantly. Identifying higher risk groups of patients allows for safety netting at discharge to be implemented to prevent harm. The aim of this study was to compare readmission rates and reasons across common diagnostic groups presenting to the acute medical unit.

Method: A retrospective analysis was performed on an anonymous dataset extracted from Salford Royal Hospital from 2014 – 2022 covering all non-elective inpatient admissions to AMU or medical same day emergency care where the patient survived to discharge. Episodes were grouped according to ICD-10 diagnostic codes, with readmission rates and reasons at 30 and 90 day calculated and compared using descriptive statistics. Further subgroups were evaluated according to demographic and co-morbid features.

Results: There were 89,897 admissions to AMU and SDEC where patients survived to discharge: age 68±19 years, 53% female. 5,880 episodes were excluded due to inpatient death.

The most common first admission reasons were pneumonia (n=9,121), COPD (4,800) and sepsis (3,440). The overall 30 day readmission rate was 12.3%, with the highest rates being found where first admission episode was due to liver disease (21.9%), chronic obstructive pulmonary disease (COPD, 21.1%), and falls (17.9%). 6% of all patients were readmitted within 30 days due to recurrence of the primary presenting illness, representing 49% of all readmissions. After primary illness recurrence, pneumonia was the second most common readmission reason in 17 of 22 diagnostic groups and accounted for 25% of all readmissions excluding primary illness recurrence.

Overall 90 day readmission rate was 24.2% with the same 3 most common diagnostic groups (liver disease 44%, COPD 39% and falls 34%). For 90 day readmission reasons according to specified comorbidities, the highest rates were seen in heart failures (34.1%) and COPD (33.1%). The highest readmission reason in the diagnostic groups was 41.4% of heart failure patients being readmitted with respiratory causes.

Heart failure was the most impactful co-morbid factor associated with higher likelihood of 90 day readmission in other disease presentations (34.4% with heart failure, 22.8% without).

Discussion: Readmission rates vary significantly between diagnostic and co-morbid groups meaning that targeting high risk groups for safety netting may be possible using only simple admission details.

Keywords

Readmission, readmissions, patients, acute, comorbidities

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Introduction

Readmission after acute hospitalisation is alarmingly common, with a high likelihood of readmission particularly in the setting of two or more medical conditions.[1]

Multimorbidity is defined as having two or more co-existing diseases at the same time, whereas co-morbidity is defined as a one or more diseases other than the index disease (index disease being the primary disease).[1,2] Multimorbidity is found to have a higher probability of readmission, creating greater demand for inpatient care, ambulatory healthcare and social services.[3,4] There is increasing prevalence of multimorbidity in the ageing population and earlier onset of diseases in younger people from socio-economically deprived areas, consequently increasing healthcare utilisation.[5] High impact users have been classed as patients having three or more urgent hospital admissions per year.[6] It is vital to identify potentially vulnerable high impact users in order to reduce readmission rates.[7]

Approximately 10% of patients with comorbidities have a potentially avoidable readmission,[1] while multimorbidity has a progressive linear correlation with preventable readmissions.[1]

In a study of 75,000 patients discharged following an acute coronary syndrome (ACS), nearly 3% were readmitted within 7 days, 25% were readmitted within 30 days and 60% of older patients were readmitted in the subsequent 12 months. Age and multimorbidity increased readmission risk, with 50% of readmissions due to cardiovascular events or bleeding episodes.[8]

Acute kidney injury (AKI) is an independent risk factor for readmission within 90 days.[9] Complications from the AKI or treatment are associated with a high likelihood of readmission, for example acute pulmonary oedema and hyperkalaemia.[10,11] Acute pulmonary oedema is a potentially avoidable readmission reason and is found in 30% of AKI patient readmissions.[12] Comorbidities with an AKI, such as heart failure, increase susceptibility to acute pulmonary oedema.[11,13] Patients with an AKI or an estimated glomerular filtration rate (eGFR) of <60 ml/min/1.73m^2 have greater readmission rates, morbidity and mortality.[12]

Outpatient follow-up within 2 weeks of discharge in high-risk patients reduced readmissions by 20% (CITE Jackson et al); however, only half of these complex multimorbidity patients received the optimal timing for their follow-up, with lower risk patients having more ability to attend the appointments. Factors associated with attending follow-up include better health ability, greater motivation to attend, better self-organisation skills, stronger social networks for help or less reliance on caregiver support daily needs, such as travel.[14]

Readmissions to hospital are often a measure of the quality of care that a hospital provides.[15] Their impact shifts significant light onto excessive healthcare spending and inefficient resource allocation. Reduced quality of life, morbidity and mortality are more common in patients readmitted to hospital.[16,17] Understanding the incidence of readmissions and highlighting high risk groups can direct teaching and staff awareness of risk as well as allow for targeted resource allocation to address these events.[17,18] Therefore, improved pre-emptive risk stratifying of patients at the time of discharge could optimise identification of potentially avoidable readmissions.[3,12,18]

The aims of this study were to establish the readmission rates and reasons at 30 days and 90 days in a large cohort of acute medical hospital admissions, and to compare readmission between diagnostic and co-morbid subgroups of patients.

Method

Data was collected from a single UK hospital, Salford Royal Hospital, part of the Northern Care Alliance NHS Foundation Trust. This hospital is a large hospital providing care in North West England. It provides tertiary care for stroke, renal medicine, dermatology and neurosciences for Greater Manchester, with a population of approximately 2.8 million.

Fully anonymous, non-identifiable data were extracted from the Trust's 'datawarehouse' for all non-elective inpatient admissions in adults aged ≥18 years under the acute medical team at Salford Royal Hospital from 1st April 2014 to 31st December 2021. This included episodes where the first ward was specifically the acute medical unit (AMU), same-day emergency care (SDEC) or the acute medical high care unit (mHCU). Outliers or boarders under specialty teams on these wards were excluded and only patients that survived to discharge were included. The dataset was inputted to a Microsoft Excel (v2019) spreadsheet for manipulation and analysis. Data included age, gender, clinical frailty score, ICD-10 diagnostic and co-morbid codes, OPCS4 procedural codes, inpatient AKI flags, and outcomes, including critical care admission, length of stay, death and time to readmission.

Primary admission ICD-10 codes were used to categorise patients into 22 common acute medical presentations based on clustered diagnoses. For example, admission due to coronary artery disease included ICD-10 codes I20.0 through to I25.9. Any ICD-10 other than those included in these diagnostic categories were termed as 'other' for analytical purposes. Secondary analyses were performed using the ICD-10 chapters as broad categories based on affected organ.

Readmission rates were calculated at 30- and 90-days post discharge and the readmission reason was determined to be the primary diagnostic ICD-10 code for the readmission episode. Descriptive statistics were used to present and compare rates and reason between groups.

Results

There were 89,897 acute medical admissions to AMU, mHDU and SDEC where patients survived to discharge. 5,880 episodes were excluded due to inpatient death. The mean age of patients surviving to discharge was 68 years (SD±19) and 53% were female. The most common first admission reasons were pneumonia (n=9,121), COPD (4,800) and sepsis (3,440).

The overall 30 day readmission rate was 12.3%, with the highest rates being found where first admission episode was due to liver disease (21.9%), chronic obstructive pulmonary disease (COPD, 21.1%), and falls (17.9%). 30 day readmission was least frequent in stroke (3%), pulmonary embolism (7%), COVID-19 infection (8%), and inflammatory bowel disease (9%). 6% of all patients were readmitted within 30 days due to recurrence of the primary presenting illness, representing 49% of all readmissions. This was most common in liver disease (12.7%) followed by COPD (10.5%) and poisoning (8.4%). After primary illness recurrence, pneumonia was the most common readmission reason overall, second most common after primary recurrence in 17 of 22 diagnostic groups, and third in the remaining 5 groups. Pneumonia accounted for 24% of all 30 day

Table 1. 30 day readmission rates and 3 most common reasons for acute medical presentations. % figures are percent of first admissions.

Acute Medical Presentation	Admissions	30 day readmission (%)	Reason 1	%	Reason 2	%	Reason 3	%
Liver disease	864	21.9	Liver disease	12.7	Pneumonia	0.3	AKI	0.3
Chronic Obstructive Pulmonary Disease (COPD)	4800	21.1	COPD	10.5	Pneumonia	3.7	Sepsis	0.5
Falls	1409	17.4	Falls	2.9	Pneumonia	1.6	UTI / Fracture	0.8
Malignancy	1489	16.5	Malignancy	7.7	Pneumonia	1.9	Sepsis	0.8
Hyperkalaemia	193	15.5	Hyperkalaemia	4.1	AKI	2.1	Sepsis	1.6
Gastrointestinal (GI) ulcer or varices	702	15	GI ulcer or varices	2.3	Liver disease	2.4	Pneumonia	0.9
Heart Failure (HF)	2150	14.4	HF	4.9	Pneumonia	1.2	AKI	0.9
Diabetes	1407	14.1	Diabetes	6.3	Pneumonia	1.2	UTI	0.5
Pneumonia	9141	13.9	Pneumonia	5.2	COPD	1.5	Sepsis	0.7
Urinary Tract Infection (UTI)	3179	13.8	UTI	3.1	Pneumonia	1	D/D	0.9
Dementia delirium (D/D)	1291	12.5	D/D	2.3	Pneumonia	1.1	UTI	0.9
Sepsis	3440	11.8	Sepsis	2.7	Pneumonia	1.7	UTI	0.8
Coronary artery disease (CAD)	2553	11.5	CAD	4	HF	0.6	Pneumonia	0.5
Acute Kidney Injury (AKI)	1342	11.4	AKI	1.9	Pneumonia	0.8	UTI	0.7
Poisoning	3285	11.2	Poisoning	8.4	Pneumonia	0.3	UTI	0.2
Arrhythmia and conduction	1904	11.1	Arrhythmia	4	Pneumonia	1.1	Sepsis	0.3
Other	45114	10.9	Other	6.8	Pneumonia	0.8	Sepsis	0.4
Asthma	1338	9.6	Asthma	5.4	Pneumonia	1	COPD	0.5
Fracture	1838	9.6	Fracture	1.8	Pneumonia	1.1	UTI	0.6
Inflammatory Bowel Disease (IBD)	524	9.5	IBD	4.6	Pneumonia	0.4	-	
COVID-19	906	7.7	COVID-19	3.6	Pneumonia	0.9	PE	0.2
Pulmonary embolism (PE)	588	7.5	Malignancy	0.9	Pneumonia	0.7	Sepsis	0.7
Stroke and Non-Traumatic Intracerebral Events	440	3.2	D/D	0.7	UTI	0.5	Pneumonia	0.2
Whole population	89897	12.3	Pneumonia	1.5	Sepsis	0.5	HF / UTI	0.4

readmissions excluding primary illness recurrence. This data is found in Table 1 alongside figures for all diagnostic groups.

The overall 90 day readmission rate was 24.2%, with the highest rates also being found where first admission episode was due to liver disease (44.6%), chronic obstructive pulmonary disease (COPD, 39.2%), and falls (34.1%). 90 day readmission was least frequent in stroke (10.7%), COVID-19 infection (12.6%), pulmonary embolism (15.8%), and inflammatory bowel disease (17.9%). 11% of all patients were readmitted within 90 days due to recurrence of the primary presenting illness, representing 45% of all readmissions. This was most common in liver disease (23.5%) followed by COPD (20.1%) and poisoning (13.2%), again following the same pattern as for 30 day readmission. After primary illness recurrence, pneumonia was the most common 90 day readmission reason overall. In stroke and fracture patients it was more common than primary illness recurrence as a readmission reason at 90 days, was second most common after primary recurrence in 16 of 22 diagnostic groups, and third in the remaining groups. Pneumonia accounted for 22% of all 90 day readmissions exclusion primary illness recurrence. This data is found in Table 2 alongside figures for all diagnostic groups.

Figure 1 shows that the pattern of cumulative readmission differs between diagnoses. Lower risk diagnoses tend to have a more cumulative risk of readmission whereas higher risk diagnoses see a far higher rate of early readmission. Figure 2 quantifies the amount by which each diagnosis is more or less common as a percentage of all diagnoses in 30 and 90 day readmissions compared to baseline admissions. Here, COPD and pneumonia see the greatest increase in representation in readmissions whereas cardiovascular diseases, with the exception of

Table 2. 90 day readmission rates and 3 most common reasons for acute medical presentations. % figures are percent of first admissions.

Acute Medical Presentation	Admissions	90 day readmission (%)	Reason 1	%	Reason 2	%	Reason 3	%
Liver disease	864	44.6	Liver disease	23.5	Pneumonia	1.2	AKI / Sepsis	0.9
Chronic Obstructive Pulmonary Disease (COPD)	4800	39.2	COPD	20.1	Pneumonia	6.7	Sepsis	0.9
Falls	1409	34.1	Falls	4.5	Pneumonia	2.8	D/D	1.3
Heart Failure (HF)	2150	31.3	HF	9.5	Pneumonia	2.9	COPD	1.4
Hyperkalaemia	193	30.1	Hyperkalaemia	5.7	AKI	2.6	HF / Pneumonia	2.1
Malignancy	1489	29.8	Malignancy	12.2	Pneumonia	3.8	Sepsis	2.1
Urinary Tract Infection (UTI)	3179	28	UTI	6.2	Pneumonia	2.4	Sepsis	2.4
Pneumonia	9141	27.5	Pneumonia	9.2	COPD	3.3	Sepsis	1.6
Diabetes	1407	26.9	Diabetes	10.9	Pneumonia	1.7	UTI	1.3
Sepsis	3440	26.7	Sepsis	5.7	Pneumonia	3.3	UTI	2
Gastrointestinal (GI) ulcer or varices	702	25.9	GI ulcer or varices	3.6	Liver disease	2.4	Pneumonia	1.4
Acute Kidney Injury (AKI)	1342	25.6	AKI	2.8	Pneumonia	2.2	Sepsis	1.7
Dementia delirium (D/D)	1291	25.6	D/D	4	Pneumonia	2.9	UTI	2.4
Fracture	1838	21.9	Pneumonia	2.7	Fracture	2.3	Sepsis	1.3
Coronary artery disease (CAD)	2553	21.8	CAD	6.8	Pneumonia	1.1	Arrhythmia	0.5
Other	45114	21.5	Other	12.7	Pneumonia	1.8	Sepsis	0.7
Arrhythmia and conduction	1904	20.5	Arrhythmia	6	Pneumonia	1.9	HF	1.7
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Stroke and Non-Traumatic Intracerebral Events	440	10.7	Pneumonia	1.1	D/D	0.9	Sepsis / UTI	0.9
Whole population	89897	24.2	Pneumonia	2.9	Sepsis	1.2	UTI	1

heart failure, are less frequently seen in readmissions compared to first admission.

When evaluating co-morbidities as risk factors for readmission, the most quantitatively impactful co-morbidity for 30 day readmission was again liver disease (17.1% readmission in people with liver disease versus 12.1% in those without). At 90 days, the most impactful co-morbidity was heart failure. Here, 34.4% of patients with heart failure were readmitted compared to 22.8% of those without, a difference of 11.6% of all patients. Other co-morbidities associated with more than a 5% greater proportion of the overall population being readmitted were chronic kidney disease (32.0 versus 23.3%), coronary artery disease (29.0 versus 23.1%), obstructive airways disease (30.2 versus 22.1%), delirium or dementia (29.0 versus 23.4%), atrial fibrillation (29.7 versus 23.3%), malignancy (30.1 versus 23.7%) and liver disease (34.7 versus 23.8%).

Co-morbid factors not associated with an overall >5% difference in readmission were hypertension and diabetes. For these co-morbidities there were however individual first presentation groups where risk was elevated. For example, patients with diabetes who first presented with gastrointestinal disorders had a 19.4% 30 day readmission rate compared to 12.4% in those without diabetes. In hypertension, 26.7% patients presenting with malignancy were readmitted ay 30 days compared to 14.2% of those without hypertension.

There was a similarly broad difference in the most impactful co-morbidity for readmission between first presentation disease groups. At 30 days, respiratory admissions in people with co-morbid heart failure had an 18.9% readmission rate. For cardiovascular presentations, CKD patients had the highest readmission rate (17.1%) as was the case in haematology presentations (17.6%). In renal

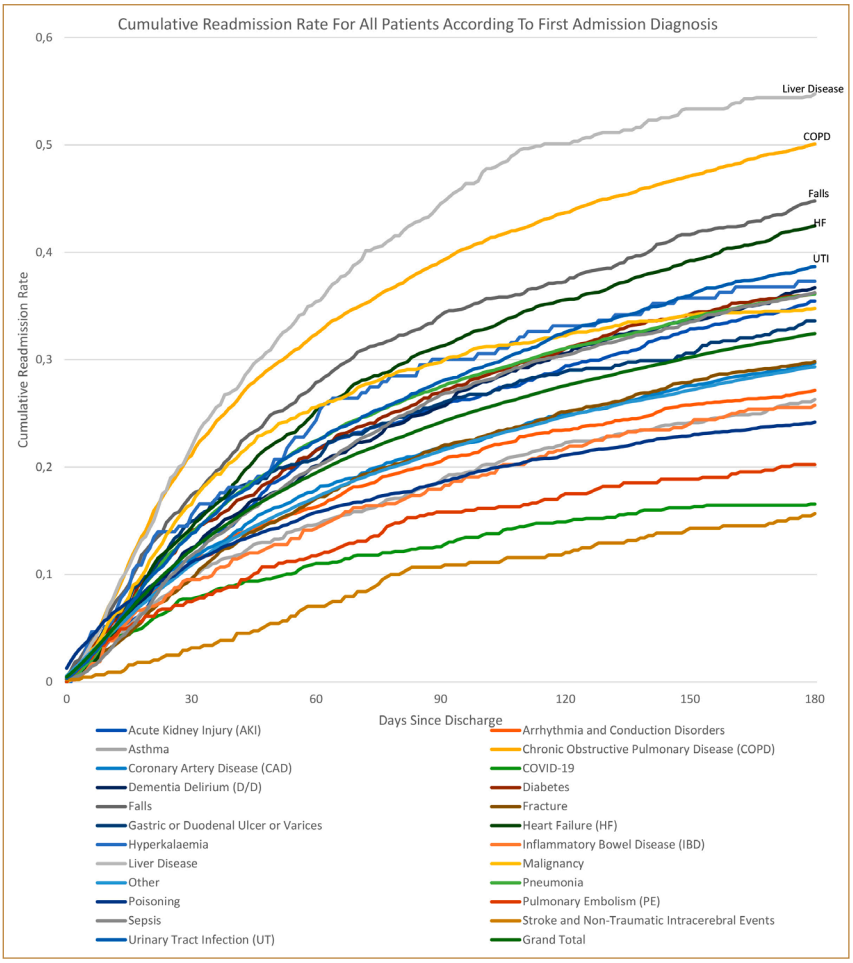

Figure 1. Cumulative readmission rate onto the acute medical unit for all patients according to first admission diagnosis.

presentations, people with atrial fibrillation had the highest 30 day readmission rate at 16.8%. This data and broader results for all disease groups and co-morbidities are found in Table 3.

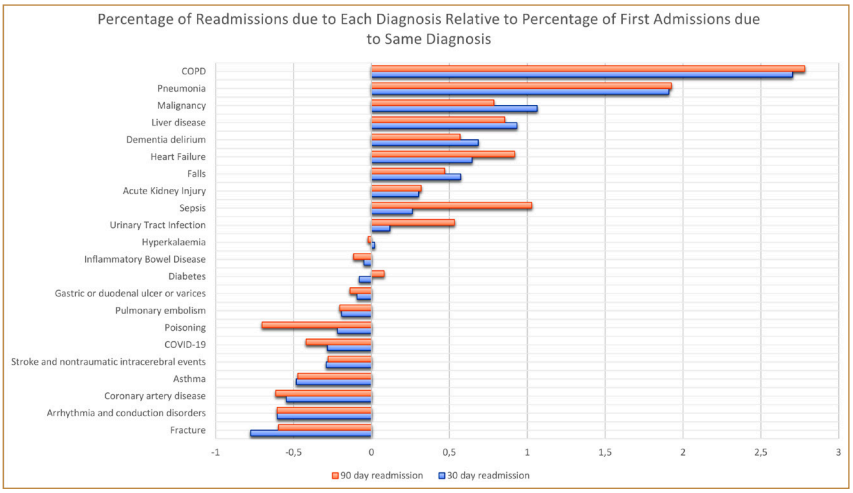

Figure 2. Percentage of readmissions due to each diagnosis relative to percentage of first admissions due to same diagnosis.

Equivalent data for 90 day readmissions is found in Table 4. Here, CKD was again the most impactful co-morbidity for readmission in cardiovascular disease presentations (34.9%). Respiratory presentations in people with heart failure had a 40.4% likelihood of readmission. The overall highest risk group for 90 day readmission was in patients presenting with malignancy with co-morbid heart failure. Here, nearly half of all patients were readmitted within this timeframe at 47.7%.

The overall number of these selected co-morbidities was also strongly associated with readmission likelihood. For patients with 1 co-morbidity, 30 and 90 day readmission rates were 8.0 and 15.4%. By contrast, for patients with 6 of these co-morbidities, readmission rates were 19.5 and 38.2%. Number of co-morbidities was more strongly associated with readmission than either age or clinical frailty score. The oldest age group evaluated (80+ years) had 30 and 90 day readmission rates of 13.7 and 28.1%. For people with clinical frailty score of 9 the figures were 18.5 and 36.9% (table 5).

Finally, we quantified readmission rates in patients who experienced significant inpatient complications or interventions (Table 6). Here, patients who had in-patient AKI and delirium during first admission had the highest readmission rate at 30 days (both 13.7%). Hospital acquired pneumonia, ICU or HDU admission, hospital acquired COVID-19, falls on wards and hyperkalaemia did not lead to a greater risk of readmission. In respect of interventions, patients requiring non-invasive ventilation (NIV) or blood transfusion had higher rates of readmission, while the use of a urinary catheter did not. Patients who received intravenous (IV) therapy had comparable readmission rates to the cohort overall.

Discussion

This study provides more granularity and understanding of the reasons for readmission and associated comorbidities.

Pneumonia was the most common diagnosis overall and after recurrence of primary diagnosis it was also the most common reason for readmission at both 30 day and 90 days. Pneumonia contributed to readmission in all 22 of the common acute medical diagnostic categories. This finding is perhaps unsurprising. There is proportionate increase in pneumonia with advancing age due to the susceptibility of older patients with a respiratory infection requiring hospital care.[19] This phenomenon of 'pyjama paralysis' is well recognized and measures to reduce its occurrence save hospital bed days.[20,21] However, in one study only 12.5% of patients had readmissions due to pneumonia that were potentially preventable by 30 days.[20] Diagnosing pneumonia can be difficult and many

Table 3. Percentage of patients readmitted within 30 day, divided by organ system of first admission reason and major co-morbid factors.

Organ System	Diabetes		Heart Failure		Chronic Kidney Disease		Hypertension		Coronary artery disease		COPD / asthma		Dementia / delirium		Atrial Fibrillation		Malignancy		Liver disease	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Malignancy	15.9	24.1	16.1	26.2	16.3	20.0	14.2	26.7	15.6	24.5	15.7	20.4	16.5	15.9	16.5	16.5	-	16.5	16.0	31.4
Haematology	12.3	14.5	12.0	14.9	11.6	17.6	12.3	13.0	12.4	12.7	12.6	11.8	11.9	19.6	12.1	14.4	12.2	14.4	12.1	16.7
Endocrine	13.5	15.9	13.7	16.0	13.8	14.8	14.5	11.9	13.8	14.8	11.7	15.3	13.8	14.5	13.8	14.8	13.3	23.4	13.8	15.9
Neurological	11.4	17.7	11.9	11.6	12.2	9.1	11.8	12.3	11.9	11.9	11.7	13.3	11.7	12.2	11.8	12.9	11.9	13.5	11.9	12.9
Cardiovascular	11.4	14.6	10.3	14.5	10.9	17.1	11.9	11.6	11.4	12.3	11.3	13.7	11.7	12.9	11.3	12.8	11.7	14.3	11.7	16.4
Respiratory	15.4	17.7	14.8	19.5	15.2	18.9	15.5	15.7	14.8	18.6	12.1	17.6	15.3	16.6	15.3	16.9	15.3	18.3	15.5	15.6
Gastrointestinal	12.4	19.4	13.0	14.9	13.0	14.9	12.9	14.4	12.8	15.5	12.8	15.2	13.1	13.3	12.7	17.6	13.0	15.2	11.2	19.8
Dermatology	10.0	13.8	9.7	18.6	9.8	17.2	10.5	10.8	10.0	14.8	10.1	12.6	10.3	12.2	9.8	15.2	10.6	9.3	10.6	9.1
Musculoskeletal	9.6	12.0	9.4	14.7	9.1	16.3	9.9	9.7	9.1	13.5	9.1	13.4	9.3	13.5	9.3	14.3	9.8	9.4	9.7	19.6
Renal	12.5	14.4	12.3	15.6	12.3	13.8	12.8	12.0	12.0	16.6	12.3	14.7	11.9	14.4	12.0	16.8	12.7	12.3	12.7	11.4
Grand Total	11.9	15.7	11.7	16.3	11.9	15.8	12.2	12.3	11.7	14.6	11.1	15.5	12.0	14.0	11.9	14.8	12.0	15.8	12.1	17.1

Table 4. Percentage of patients readmitted within 30 day, divided by organ system of first admission reason and major co-morbid factors

Organ System	Diabetes		Heart Failure		Chronic Kidney Disease		Hypertension		Coronary artery disease		COPD / asthma		Dementia / delirium		Atrial Fibrillation		Malignancy		Liver disease	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Malignancy	29.2	34.8	28.9	47.7	29.3	37.6	27.9	37.9	28.3	42.4	28.3	36.8	29.8	29.0	29.6	31.9	-	29.8	29.3	41.2
Haematology	24.6	28.1	24.4	29.9	23.7	34.7	24.6	27.5	25.4	24.3	25.2	25.2	24.5	34.0	24.4	29.3	24.7	29.5	24.3	38.9
Endocrine	25.6	27.7	26.1	32.0	26.3	28.2	27.9	22.0	26.4	27.9	26.2	28.9	26.2	29.6	26.5	27.7	25.8	38.5	26.4	30.1
Neurological	23.1	27.5	22.9	37.0	23.3	26.9	24.0	21.8	23.4	24.8	23.0	27.0	22.3	25.1	23.3	26.1	23.5	24.7	23.2	29.6
Cardiovascular	22.6	26.3	19.2	30.7	21.3	34.9	24.6	21.2	21.8	25.0	22.2	27.4	22.9	28.5	22.4	25.0	23.0	28.5	23.0	33.1
Respiratory	29.2	32.3	27.9	40.4	29.1	35.6	29.6	30.1	28.2	36.5	23.1	33.8	29.4	32.0	29.0	34.3	29.4	33.5	29.6	37.1
Gastrointestinal	25.1	34.5	26.0	33.6	26.1	31.2	26.6	25.6	25.7	31.1	25.7	30.6	26.1	29.5	25.8	33.0	26.1	30.9	22.3	40.2
Dermatology	21.8	27.2	21.7	35.4	21.5	36.8	22.7	24.3	21.9	31.7	22.4	25.6	22.0	29.8	21.4	33.2	23.1	21.6	22.9	27.3
Musculoskeletal	20.2	24.1	19.7	32.8	19.4	33.1	21.0	20.0	19.6	27.3	19.8	25.5	19.6	29.3	19.6	30.2	20.6	24.1	20.6	34.8
Renal	26.1	27.7	25.2	36.7	25.6	29.5	27.0	24.5	25.5	31.7	25.8	30.3	24.8	30.3	25.4	33.3	26.4	26.8	26.3	29.8
Grand Total	23.4	28.2	22.8	34.4	23.3	32.0	24.3	23.8	23.1	29.0	22.1	30.2	23.4	29.0	23.3	29.7	23.7	30.1	23.8	34.7

patients are admitted to the emergency department instead of treatment as an outpatient; diagnosis of pneumonia in the community remains challenging leading to higher admission.[21] Patients initially treated in the community often require hospitalisation, which is associated with increased mortality and recovery time; hence, predicting which patients need early admission is challenging.[22] Readmission in pneumonia patients is more common in those with chronic comorbid conditions, men and older patients, especially those with dementia or delirium.[23] COPD patients with community acquired pneumonia have higher mortality, longer hospital stay, and increased requirements for mechanical ventilation risk and ICU admission, as seen tables 1 and 2.[24]

COPD patients had the second highest likelihood of readmission. COPD exacerbations are known to be associated readmission and mortality;[25] indeed, after the first readmission COPD patients have an increased risk of further readmissions increased mortality.[26]

Many patients with heart failure readmitted to hospital are found to have more than 3 comorbidities.[31] Readmission in this group is common; Khan et al. found that 18% of patients hospitalised with heart failure between 2010 to 2017 were readmitted within 30 days, 31% within 90 days and approximately 50% at 6 months. There are multiple factors for readmission to hospital in patients with heart failure, including healthcare centered and patient centered reasons. Chronic kidney disease or renal function decline, circulatory support receival or pulmonary disease are all found to be common complications of those patients readmitted.[31,32] While 25% of heart failure readmissions are potentially avoidable,[16] in a study with a declining readmission rate there was a corresponding increase in 30 day and 1 year mortality.[33]

Table 5. Readmission rates by age, frailty, and co-morbidity count.

	% 30 day readmission	% 90 day readmission
Age group		
17 - 29	8.2	13.8
30 - 49	10.0	18.2
50 - 64	10.1	19.7
65 - 79	13.6	26.8
80 +	13.7	28.1
Clinical Frailty score		
1	13.4	22.5
2	12.5	23.7
3	12.1	23.8
4	13.1	28.7
5	13.0	27.2
6	15.8	32.8
7	15.1	33.7
8	15.6	33.8
9	18.5	36.9
Not recorded	11.5	22.0
Comorbidity count		
1.0	8.0	15.4
2.0	11.9	23.5
3.0	14.2	27.6
4.0	15.4	31.0
5.0	16.7	34.2
6.0	19.5	38.2

Table 6. Readmission rates by inpatient complications and interventions.

	% 30 day readmission	% 90 day readmission
Grand Total	12.3	24.2
Inpatient complications		
HAP	13.1	26.1
AKI	13.7	28.4
COVID-19	11.4	21.4
Falls	11.7	24.6
Hyperkalaemia	12.8	24.3
Delirium	13.7	30.2
ICU	7.0	18.3
HDU	11.7	25.4
Interventions		
NIV or CPAP	16.2	34.1
Transfusion	15.6	33.3
IV therapy	12.6	25.6
Urinary catheter	13.0	27.6

Key: HAP = Hospital Acquired Pneumonia, AKI = Acute kidney injury, ICU = Intensive Care Unit, HDU = High Dependency Unit, NIV = Non Invasive Ventilation, CPAP = Continuous Positive Airway Pressure, IV = Intravenous

This highlights the ongoing difficulty with balancing acute care pathways between hospital and community. It is argued that not enough post discharge referrals are made for outpatient rehabilitation programmes.[27] The mostly likely reason for the heavy burden of respiratory readmissions in heart failure patients is due to acute pulmonary oedema, due to volume overload or as a result of inappropriate diuretic administration.[28] 25% of readmissions following an acute kidney injury (AKI) are were associated with acute pulmonary oedema, which makes it a potentially modifiable risk factor if an AKI was diagnosed before, at or during the admission.[12] Medications that heart failure patients are given can induce an AKI, for example overuse of diuretics, drugs acting on the renin-angiotensin-aldosterone system (such as angiotensin-converting enzyme inhibitors) can impair kidney function, so precipitating an AKI.[29]

Strengths and Limitations

A limitation of this study was the reliance on ICD-10 codes for admission and readmission diagnoses; it is known that the coding process is subject to error and that clinical coding does not adequately factor in chronology of events such as whether pneumonia is community or hospital acquired. Also, this study is limited to activity on a single Acute Medical Unit. It is highly likely that some patients will be readmitted onto wards other than AMU or be admitted onto AMU after discharge from another ward. Salford Royal is a regional centre for some medical specialties so there may also be additional readmissions to other hospitals. Overall, this means that the rate of readmissions is likely to be higher than that described here.

Also, we have not undertaken multivariate regression analyses to understand which factors are independently associated with risk of readmission. For some diseases that are more prevalent in older age and greater frailty, these factors may trigger readmission rather than the illness itself.

Implications for practice

Knowing why patients are readmitted may allow targeted discharge planning to prevent readmissions, especially in regard to the primary admission diagnosis and developing pneumonia or a respiratory infection that requires admission to hospital. That is the key message here, that most readmission are due to

either recurrence of the first admission illness or the development of pneumonia.

Work is required to develop strategies to prevent readmission, such as enhanced follow-up in specialty clinics, community-based care and patient education. While there is a role for research in this area, quality improvement is also necessary to establish new services and strengthen links with existing services.

Conflicts of Interest

Nothing to declare

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