



ORIGINAL ARTICLE

Identifying patterns in unplanned hospital admissions during the COVID-19 pandemic: a single-centre retrospective study

Vishal Goel ¹, R. Kimberley Chan,¹ Olivia C. Smibert,^{2,3,4} Natasha E. Holmes ², Nada Marhoon,⁵ Cindy-Anne T. Bach,¹ Jason A. Trubiano^{2,3,4} and Nicholas R. Jones^{1,3}

Departments of ¹General Medicine, ²Infectious Diseases, and ⁵Data Analytics Research and Evaluation (DARE) Centre, Austin Health, ³School of Medicine, University of Melbourne, and ⁴National Centre for Infections in Cancer, Peter MacCallum Cancer Centre Melbourne, Melbourne, Victoria, Australia

Key words

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Correspondence

Nicholas R. Jones, Department of General Medicine, Austin Hospital, Level 7 HSB, 145 Studley Road, Heidelberg, Vic. 3084, Australia.
Email: nicholas.jones@austin.org.au

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Abstract

Background: Countries with a high prevalence of COVID-19 have identified a reduction in crude hospital admission rates for non-COVID-19 conditions during the pandemic. There remains a paucity of such data from lower prevalence countries, including Australia.

Aims: To describe the patterns of unplanned hospital daily admission rates during the COVID-19 pandemic in a major Australian metropolitan hospital, with a focus on acute medical presentations including acute coronary syndrome (ACS), stroke and falls.

Methods: This single-centre retrospective analysis analysed hospital admission episodes between 1 March and 30 April 2020 (COVID-19-era) and compared this to a historical cohort during the same period between 2017 and 2019 (pre-COVID-19). Information collected included total admission rates and patient characteristics for ACS, stroke and falls patients.

Results: A total of 12 278 unplanned admissions was identified across the study period. The daily admission rate was lower in the COVID-19-era compared with pre-COVID-19 (46.59 vs 51.56 days, $P < 0.001$). There was also a reduced average daily admission rate for falls (7.79 vs 9.95 days, $P < 0.001$); however, similar admission rates for ACS (1.52 vs 1.49 days, $P = 0.83$) and stroke (1.56 vs 1.76 days, $P = 0.33$).

Conclusions: Public health interventions have been effective in reducing domestic cases of COVID-19 in Australia. At our tertiary metropolitan hospital, we have observed a significant reduction in unplanned hospital admission rates during the COVID-19-era, particularly for falls. Public health messaging needs to focus on educating the public how to seek medical care safely and promptly in the context of the ongoing COVID-19 crisis.

Introduction

The severe acute respiratory syndrome coronavirus 2 (later renamed COVID-19) virus has now infected over 11 million people worldwide since being declared a global pandemic on 11 March 2020 by the World Health Organization.¹ While the burden of illness related to the direct effects of viral infection is high, there remains a poorly quantified cost to the broader community who are less likely to seek medical care in the context of the pandemic. Multiple countries with high prevalence of

COVID-19 have noted dramatic reductions in the number of hospital admissions for non-COVID-19 conditions.^{2,3} It is speculated this stems from patient avoidance of medical care due to a combination of multiple factors including social distancing and concerns of contracting COVID-19 from healthcare interactions. For example, the UK's emergency departments observed a 25% decline in presentations 1 week into lockdown.⁴ There are significant concerns that reduced or delayed presentations may have negative long-term outcomes for patients for conditions including acute coronary syndrome (ACS),⁵ stroke^{2,6} and falls.⁷ Concerningly, an increase in out-of-hospital cardiac arrest numbers have

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been noted in Italy during the COVID-19 outbreak, all of which are not explained by COVID-19 cases alone.⁸

Aim

The understanding of how the COVID-19 pandemic affects hospital admissions and healthcare utilisation is based on data from high-prevalence countries. There remains a paucity of such data from lower prevalence countries, which includes Australia.

Compared to a historical control period, we sought to compare numbers of daily unplanned hospital admissions during the COVID-19 pandemic, with a specific focus on three pre-specified common medical causes of admissions: ACS, stroke and falls.

Methods

This single-centre, observational study was carried out using deidentified patient information from Austin Health, a large tertiary public teaching hospital in Melbourne, Victoria, Australia. The study period encompassed 60 days between 1 March 2020 and 30 April 2020 (COVID-19-era) and was compared with a historical control group for the same time period between 2017 and 2019 (pre-COVID-19). We compared gross rates of unplanned admissions between the case and control period as well as for three common causes of medical admissions; ACS, stroke and falls.

Data source

Data were extracted via Austin Health's Data Analytics Research and Evaluation Centre. Unplanned admissions were defined as non-elective admissions as determined on Austin Health's electronic medical record. The cause of admission was defined as primary diagnosis coded on discharge as per the International Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10 AM) code. The codes for falls were classified as W00–W19; stroke as I60.0–I60.9, I62.0–I62.1, I62.9, I63.0–I63.6, I63.8–I63.9, I64, and ACS as I21.0–I21.4, I21.9.

Data collected

The daily admission rate for the overall number of unplanned admissions was calculated between the study and control periods, as well as the daily admission rate for ACS, stroke and falls.

Additional data were collected for ACS, stroke and falls admissions including demographics and past medical history. Vital signs on admission, including heart rate,

respiratory rate, systolic blood pressure and oxygen saturation (SpO₂) were collected. Length of stay and discharge disposition were also recorded.

Statistical analysis

Data were analysed using SPSS version 25 (IBM SPSS Statistics for Windows, IBM Corporation, Armonk, NY). Categorical data were summarised using percentage and frequency, and numerical data were summarised using average \pm standard deviation. Admissions per day between study and control periods were compared using the independent samples *t*-test. The comparison of binary variables was carried out using Chi-squared analyses and comparison of nominal variables was carried out using independent samples *t*-tests after checking for normality through the calculation of skewness and kurtosis. *P*-values <0.05 were considered statistically significant.

Ethics approval

Ethics approval was granted through the Austin Hospital Ethics Committee as a low-risk audit (approval number: Audit/20/Austin/49).

Results

We identified 12 278 unplanned hospital admissions for the purpose of this study, of which 2842 were during the COVID-19-era and 9436 from pre-COVID-19. During both periods, there were 365 admissions for ACS, 417 for strokes and 2296 for falls.

Clinical characteristics

Clinical characteristics are summarised in Table 1. A similar proportion of cases between control and study periods were male (48.9 vs 50%, *P* = 0.96). Mean age, risk factor profile and vital signs on admission were comparable across the COVID-19-era and pre-COVID-19 periods.

Admission characteristics

Admission characteristics are summarised in Table 2. During the COVID-19-era, the average number of daily unplanned admissions was significantly lower compared to pre-COVID-19 (46.59 vs 51.56 per day, *P* < 0.001). Analysis of the prespecified conditions demonstrated a significantly reduced daily admission rate for falls during the COVID-19-era (7.79 vs 9.95 per day, *P* < 0.001), but

Table 1 Patient characteristics at admission for pre-specified conditions (acute coronary syndrome, stroke and falls)

	Control period	2020	P-value
Age at admission (\pm SD) (years)	72.24 (\pm 18.33)	72.27 (\pm 17.66)	0.98
Male sex, n (%)	1183 (50.0)	324 (48.9)	0.96
ATSI, n (%)	15 (0.6)	3 (0.5)	0.63
Medicare eligible, n (%)	2369 (98.1)	650 (98.0)	0.93
Medical history, n (%)			
Heart failure	125 (5.2)	29 (4.4)	0.40
Ischaemic heart disease	245 (10.1)	82 (12.4)	0.10
Cerebrovascular disease	335 (13.9)	97 (14.6)	0.62
Type II diabetes mellitus	309 (12.8)	81 (12.2)	0.69
COPD	67 (2.8)	24 (3.6)	0.26
Observations on admission, average (\pm SD)			
Systolic blood pressure (mmHg)	138.12 (\pm 30.58)	138.53 (\pm 32.12)	0.76
Heart rate (b.p.m.)	79.71 (\pm 19.28)	79.96 (\pm 19.87)	0.77
Oxygen saturation (%)	95.23 (\pm 12.16)	94.93 (\pm 13.69)	0.59
Respiratory rate (/min)	17.80 (\pm 4.62)	17.80 (\pm 4.73)	0.99

ATSI, Aboriginal and Torres Strait Islander; b.p.m., beats per minute; COPD, chronic obstructive pulmonary disease; SD, standard deviation.

Table 2 Admission episode characteristics

	Control period (n = 9436)	2020 (n = 2842)	P-value
Total admissions per day (n = 12 278), average (\pm SD)	51.56 (\pm 7.71)	46.59 (\pm 7.87)	<0.001
Prespecified conditions admission rates, number/day (\pm SD)			
ACS (n = 365)	1.49 (\pm 1.17)	1.52 (\pm 1.29)	0.83
Stroke (n = 417)	1.76 (\pm 1.41)	1.56 (\pm 1.35)	0.33
Fall (n = 2296)	9.95 (\pm 3.22)	7.79 (\pm 3.20)	<0.001
Discharge disposition/day, average % of daily admissions (\pm SD)			
Home	80.05 (\pm 5.50)	79.75 (\pm 7.21)	0.73
Death	3.69 (\pm 2.68)	2.77 (\pm 2.40)	0.18
Other hospital	3.06 (\pm 2.56)	3.06 (\pm 2.19)	0.98
Subacute campus	9.04 (\pm 4.34)	9.88 (\pm 5.27)	0.22
RACF	2.98 (\pm 2.48)	2.73 (\pm 2.24)	0.48

ACS, acute coronary syndrome; RACF, residential aged care facility; SD, standard deviation.

similar admission rates for ACS (1.52 vs 1.49 per day, $P = 0.83$) and stroke (1.56 vs 1.76 per day, $P = 0.33$).

Median weighted inlier equivalent separation, a measure of hospital funding based on services provided as an inpatient, was \$4862 during the pre-COVID-19-era and \$5232 during the COVID-19-era (Mann-Whitney $U = 12\,796\,594$, $P < 0.001$).

Discussion

To our knowledge, this is the first study investigating patterns in unplanned hospital admissions during the COVID-19-era in Australia, a country with a lower prevalence of COVID-19. We observed a significant reduction in total unplanned daily admissions during the COVID-19-era, including a reduction in daily unplanned admissions for falls.

In the absence of directed antivirals, effective therapies or a vaccine, public health measures that interrupt the

forward transmission of disease, such as social distancing, form the cornerstone of the public health response. These measures were also critical to stop the spread of the SARS pandemic in the early 2000s.⁹ In Australia, our local departments of health have responded with measures including suspension of non-urgent elective surgery, stage three restrictions, limits to social gatherings and mandatory 14-day quarantine for all travellers returning to Australia.¹⁰

Falls

The present study has identified a significant reduction in admissions for falls during the COVID-19 pandemic. This pattern was also observed in a Level 1 trauma centre in New Zealand,¹¹ a nation with a similarly low prevalence of COVID-19. Falls are a common cause of morbidity, causing injuries such as fractures, with one study reporting one-third of community-dwelling adults

over the age of 75 years falling at least once in a year and a quarter of those sustaining serious injuries.^{12–14} Concerningly, Mi *et al.* noted a worse prognosis of individuals with COVID-19 who sustain a fall with fracture.⁷

This decreased admission rate during stay-at-home orders raises concerns that individuals may not be seeking medical assistance when falling due to patient avoidance of medical care due to fears of contracting COVID-19. While the reduction in falls may reflect decreased mobility outdoors, Cox *et al.* found that falls commonly occur at private residences,¹⁵ where the majority of time is spent during stay-at-home orders. Although further studies are required to investigate this decreased admission rate, it is imperative that public health measures focus on ensuring those in at-risk populations, such as the elderly, are empowered to seek medical attention to prevent complications of falls.

Acute coronary syndrome

The present study shows a comparable number of admissions per day for ACS during the COVID-19-era compared to the same time periods in the preceding 3 years. This is in contrast with reports from Austria that demonstrated a significant decline in the number of patients admitted to hospital due to ACS during the COVID-19 pandemic.³ It is unclear whether this may be explained by a flatter epidemic curve and lower rates of community transmission and deaths in Australia.

Despite the comparable rates of admissions, Toner *et al.* found a fourfold increase in symptom to door time in patients with ACS requiring percutaneous coronary intervention during the COVID-19 pandemic in Australia which is concerning due to the risk posed by infarct-related morbidity and mortality.⁵ Continual efforts need to be made to educate the community on warning signs of a heart attack and the need for timely medical intervention, especially during the COVID-19 era.

Stroke

Like ACS, the present study shows a comparable number of presentations with stroke during the COVID-19 era

compared to pre-COVID-19. This is in contrast to the World Stroke Organization (WSO) survey across multiple countries demonstrating a sharp reduction in the number of acute stroke admissions globally during the COVID-19 pandemic.² It is postulated by the WSO that this might be due to a reduction in admissions of patients with milder stroke, perhaps due to fears of infection if they are referred to hospital during times of pandemic surges.² It is reassuring that the acuity of stroke is well recognised by Australian individuals, and continual efforts are needed to ensure the public continues to seek urgent medical care when experiencing symptoms consistent with stroke.

Limitations

We acknowledge limitations when interpreting these findings. The present study was a retrospective analysis of crude hospital admission data and may not represent subtleties in admission rates, including type of ACS or stroke on presentation. Coding is subject to local and regional variation and can be influenced by clinician interpretation and reimbursement models and incentives.

Conclusion

The present study has identified a significant reduction in daily rates of unplanned hospital admissions during the COVID-19-era at a major metropolitan tertiary hospital in Melbourne, Australia, especially a reduction in admissions for falls. There were similar daily numbers of presentations for acute medical conditions including ACS and stroke. The decreased daily admission rate for falls may be explained by several factors, including public avoidance of medical attention due to fear of contracting COVID-19 or decreased movement during stay-at-home orders. Irrespectively, public health campaigns during the COVID-19 pandemic should aim to continue motivating patients to comply with stay-at-home orders, while empowering them to seek prompt treatment of non-COVID-19 conditions as required.

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