# Health service use and predictors of high health service use among adults experiencing homelessness: a retrospective cohort study

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Homelessness is a significant public health issue in Australia and many other countries.[1-6] On the night of the 2016 Census in Australia, an estimated 116,000 people were classified as homeless,[7] and in February 2020, just prior to the COVID-19 pandemic, 334 people were found to be sleeping in the open in inner-city Sydney, with another 505 in crisis accommodation, including homeless hostels.[8] The causes of homelessness include a combination of individual (e.g. economic deprivation, mental illness, family conflict, substance use) and structural (e.g. limited availability of low-cost housing, employment opportunities, and welfare support) factors.[6,9-11]

Individuals experiencing unstable housing or homelessness are known to have social and economic deprivation, poor health literacy and unsatisfactory living conditions.[1,4,12] People experiencing homelessness can struggle to meet the basic human needs of food and shelter, let alone adherence to medication for acute and chronic conditions and attendance at appointments to address physical and mental health conditions.[1,4,12,13] People experiencing homelessness, particularly the young, are vulnerable to interpersonal violence and injury.[1,6]

Earlier research conducted in the UK,[2,5] the US[4,14] and Finland[15] found that those who are homeless have rates of mortality, hospital admission and emergency department (ED) attendance 2–6 times higher than the general population, generating high health costs.[16] The prevalence of severe mental illness and substance use disorder, as well as comorbid health conditions, are higher among individuals experiencing homelessness.[4,6,17,18] The lack of readily available preventive healthcare means that over time people experiencing homelessness are more likely to be readmitted to hospital,[2,3,6,19] which may reflect incomplete treatment or suboptimal arrangements for post-discharge care.[3,12,20]

Understanding the patterns of health service use by people who are homeless, especially the characteristics and circumstances of high health service users, is important to inform service providers and direct resources to minimise potentially unnecessary ED

## Abstract

**Objective**: To describe the characteristics and cost of health service use of a cohort of 2,140 people attending homeless hostel clinics, and identify predictors of high health service use and time to readmission.

**Method**: A retrospective cohort study of 2,140 adults who attended a homeless hostel clinic and were hospitalised in New South Wales (NSW) using linked clinic, health and mortality data from 1 July 2008 to 30 June 2021. Multivariable logistic regression examined predictors of high health service users.

**Results**: There were 27,466 hospital admissions, with a median cost of A$81,481 per person, and a total cost of A$548.2 million. Twenty per cent of the cohort were readmitted within 28 days and 27.4% were classified as high users of health services. Factors associated with high use were age ≥45 years, female (AOR: 1.52; 95%CI 1.05-2.22), the presence of a mental disorder, substance use disorder (AOR: 1.36; 95%CI: 1.03-1.82), or if the person had been homeless for >1 year (AOR: 1.31; 95%CI: 1.06-1.62).

**Conclusions and implications for public health**: The high health costs generated by homeless adults confirm the need to develop models of supported housing with a focus on integrated care, improved referral pathways and better coordination with community-based support agencies.

**Key words**: homeless, healthcare, readmission, cost, mortality

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representations and hospital readmission.[4,19] This study aims to describe the characteristics and cost of health service use of a cohort of 2,140 people attending homeless hostel clinics and identify predictors of high health service use and time to readmission.

## Method

This is a retrospective cohort study of 2,155 people who attended mental health clinics conducted in homeless hostels and were hospitalised in New South Wales (NSW), Australia using linked clinic, health, and mortality data from 1 July 2008 to 30 June 2021. Ethical approval and a waiver of consent were obtained from the NSW Population Health Services Research Ethics Committee (2018HRE0301).

### Data sources and record linkage

Homeless clinic clients attended clinics performed at the three main homeless hostels in inner-city Sydney, the Matthew Talbot Hostel run by St Vincent De Paul, the Edward Eager Lodge run by the Wesley Mission, and Foster House run by the Salvation Army from 17 February 2008 to 19 May 2020. In total, 2,477 individual patients attended the clinics and 2,173 (87.7%) were admitted to hospital during the study timeframe. Of the 2,173 clients admitted to hospital, 18 were aged <18 years at their index admission and were therefore excluded from further analysis (Supplementary Figure 1).

Health service use information was obtained from ED presentations and hospital admission data collections in NSW from the NSW Ministry of Health. ED presentations to public hospitals included data on arrival and departure times and visit types. Hospitalisations included admissions to both public and private hospitals, and information available included principal and additional diagnoses, clinical procedures, and separation type (e.g. hospital transfer, death). Diagnoses were classified using the International Classification of Diseases, 10th Revision Australian-modification (ICD-10-AM).

Information on the number of ambulatory specialist mental health services at public hospitals was obtained from a database of ambulatory mental health client contacts from the NSW Ministry of Health. The database recorded client attendance at mental health day programs, public

psychiatric outpatient and outreach services. Mortality data were obtained from the NSW Registry of Births, Deaths and Marriages and included date of death.

Record linkage of the data collections was conducted by the Centre for Health Record Linkage (CHeReL) using probabilistic record linkage. Upper and lower probability cut-offs for a link were 0.75 and 0.25, respectively, and record groups with probabilities between the cut-offs were clerically reviewed.

### Identification of comorbidities and other related conditions

The Charlson Comorbidity Index was used to identify comorbidities using up to 50 diagnosis classifications in hospital records.[21] Charlson comorbidities were categorised as nil, 1–2 and ≥3 comorbidities. Comorbid conditions related to mental and behavioural conditions (ICD-10-AM: F00-F99; see Supplementary Table 1) were also identified using hospital records. Clinic records were used to identify health issues (i.e. the presence of a history of substance use and current substance use disorder), social issues (i.e. problem gambling, experience of trauma as a child or adult), homelessness status (i.e. being homeless for >1 year, a history of sleeping in the open), and receipt of social assistance (i.e. receiving a disability pension, being under a financial management order).

### Hospital admissions, ED presentations, and ambulatory mental health client contacts

The first hospital admission during the study period was identified as the index admission. The number of hospital admissions, ED presentations, and ambulatory mental health contacts during the study period was identified. The count of ED presentations included visits to the ED that were followed by hospital admission, as these visits incurred service use in the ED, and the proportion of ED presentations that resulted in hospital admission was identified. High users of health services were defined as adults who had ≥4 ED presentations in the 12 months following their index hospital admission.[1] Adults who had ≥4 hospital separations in the 12 months following their index hospital admission were also identified.

### Hospital treatment costs

The Australian Refined-Diagnosis Related Groups (AR-DRGs) and episode of care length

of stay (LOS) were used to estimate hospital treatment costs. Estimates of public hospital costs were obtained from the *National Hospital Costing Data Collection, Round 23 (2018-19)*.[22] The average cost per AR-DRG included an estimate of the cost of medical and nursing clinical services, non-clinical salaries, pathology, imaging, allied health, hospital pharmaceuticals, intensive and coronary care, operating rooms, EDs, supplies and ward overheads, specialist procedure suites, prostheses, staff on-costs (e.g. superannuation, termination, long-service leave, workers' compensation, recruitment costs), cleaning, linen and food services, and fixed asset depreciation. The average daily cost per AR-DRG was multiplied by the episode of care LOS for each hospitalisation. All costs are in 2018-19 Australian dollars.

### Data management and analysis

Data analysis was conducted using SAS 9.4 (SAS Institute, Cary NC). All hospital episodes of care related to the same event were linked to form a period of care. Hospital readmissions included readmissions for all causes and emergency (i.e. unplanned) hospital readmissions were identified using the status of 'emergency'. The calculation of hospital length of stay (LOS) was cumulative and included transfers between hospitals. Descriptive statistics were used to describe the cohort, cumulative hospital LOS and total cost. Thirty-day mortality was calculated from the index admission date.

Person time at-risk of readmission was calculated as the sum of the total days in the study period for each adult post-discharge from the index admission, excluding days spent in hospital, and was censored at date of death or study end (i.e. 30 June 2021). The total days at-risk for the cohort (i.e. 9,391,733) was converted into years (i.e. 25,713), and the rate of hospital readmission was estimated per 1,000 person-years and 95% confidence intervals (CIs) were calculated in Excel™.[23]

Multivariable logistic regression was used to examine predictors of high health service users (i.e. ≥4 ED presentations in the 12 months post index admission). Variables included in the model were those previously identified as associated with hospital readmission,[1–3] available in the linked data, and were significant in univariate analysis: age group at index admission, sex, mental illness diagnosis, principal diagnosis at index admission, use of alcohol or other drugs, >1 year homeless, discharged from psychiatric

hospital, and discharged at own risk. A backwards stepwise regression was used to sequentially eliminate factors from the model that did not significantly contribute to the risk of readmission at a significance level of ≤0.25.[24] Odds ratios (OR), adjusted odds ratios (AOR) and 95% CIs were calculated. Model fit was assessed as good using the Hosmer-Lemeshow test for logistic regression (*p*<0.28).[24] A Kaplan-Meier survival plot was used to calculate time to readmission within 12 months of discharge of the index admission.[25] The model was right censored at 365 days or days from discharge until date of death, if death occurred before 365 days.

## Results

Of the 2,155 admitted to hospital, most were male (92.7%) and just over half (58.4%) were aged 25–44 years. Males had a mean age of 39.9 (SD 11.0) and females had a mean age of 39.2 (*SD* 11.9) years. Just over 12% of adults had either 1 or 2 Charlson comorbidities. The majority had a mental disorder (88.0%) and a substance use disorder (81.9%). The most common mental illnesses were schizophrenia (48.5%) and anxiety disorders (39.2%). Almost two-thirds (60.9%) had been homeless for >1 year and 37.5% slept in the open. One in five had a history of experiencing trauma as a child or adult (Table 1).

The two most common principal diagnoses at the index admission were mental and behavioural disorders (47.5%) and injuries (17.0%). Of the 367 index injury admissions, 87 (23.7%) were following assault, 73 (19.9%) after self-harm, and the remaining injury admissions were unintentional (56.4%). One in five adults spent a single day in hospital during their index admission, 15.2% were discharged to a mental health, alcohol and other drugs non-inpatient facility, and 7.1% were discharged at their own risk (i.e. against medical advice).

Throughout the study period, there were 27,466 hospital admissions (mean 12.7 per individual, median 7 and SD 24.9), with a cumulative hospital LOS of 295,542 days (median 41 days) at a total cost of A$548,254,886 (median A$81,481). The hospitalisation incidence rate was 1,068.2 per 1,000 person-years (95%CI: 1,055.5-1,080.8). There were 1,917 (89.0%) with a further hospital admission after their index admission during the study timeframe. Of these, 425 (19.7%) were readmitted within 28 days of the index admission, of which 318 (74.8%) were

| Table 1: Characteristics of homeless hostel clinic attendees at index admission. | | |
|---|---|---|
| **Characteristic** | **n** | **%** |
| Age at index admission mean (SD) | 39.9 | (11.1) |
| **Age group** | | |
| 18–24 | 182 | 8.5 |
| 25–34 | 548 | 25.4 |
| 35–44 | 711 | 33.0 |
| 45–54 | 495 | 23.0 |
| ≥55 | 219 | 10.2 |
| **Sex** | | |
| Male | 1,997 | 92.7 |
| Female | 158 | 7.3 |
| **Number of Charlson comorbidities** | | |
| 0 | 1,882 | 87.3 |
| 1–2 | 258 | 12.0 |
| ≥3 | 15 | 0.7 |
| **Mental disorder diagnoses identified using any admission record** | 1,897 | 88.0 |
| Schizophrenia | 1,044 | 48.5 |
| Anxiety disorder | 844 | 39.2 |
| Depression | 599 | 27.8 |
| Personality disorder | 683 | 31.7 |
| Intellectual disability | 95 | 4.4 |
| **Alcohol or other drugs identified at clinic** | 1,765 | 81.9 |
| **Other conditions identified at clinic** | | |
| Acquired brain injury | 317 | 14.7 |
| Problem gambling | 247 | 11.5 |
| Non-adherent to psychotropic medication | 1,086 | 50.4 |
| History of experiencing trauma as a child/adult | 941 | 43.7 |
| Ever employed for more than one year (Yes) | 1,265 | 58.7 |
| Public trustee financial management order | 183 | 8.5 |
| Greater than one year homeless | 1,312 | 60.9 |
| Sleeps in the open | 807 | 37.5 |
| Discharge from psychiatric hospital | 491 | 22.8 |

classified as emergency readmissions. Mental and behavioural disorders (54.1%), injuries (18.2%) and other conditions (27.7%) were the most common principal diagnoses for emergency readmissions. The median time to readmission within the first 12 months after an index admission was 10 days and a Kaplan-Meier curve of the probability of readmission within the first 12 months post index admission is shown in Supplementary Figure 2.

There were 66,888 ED presentations (mean 31.0, median 15 and SD 51.8) and 354,23 non-admitted ambulatory mental health clinician-patient contacts (mean 164.3, median 28 and SD 368.2) during the study period. The ED presentation rate was 2,601.3 per 1,000 person-years (95%CI:2,581.6-2,621.0) and 27.4% were high health services users. The ambulatory mental health client contact rate was 13,772.1 per 1,000 person-years (95%CI:13,726.7-13,817.4). There were 323 (15.1%) people experiencing homelessness who had been admitted to hospital and who died during the study period (Table 2).

Compared to infrequent health service users, older adults (≥45 years) had a 1.7 times higher likelihood of being a high health service user compared to adults aged 18–24 years, and female clinic attenders had a higher risk of readmission compared to males (AOR: 1.52; 95%CI 1.05-2.22). High health service users were twice as likely to have an intellectual disability (AOR: 2.94; 95%CI: 1.85-4.67). Clinic attendees with a diagnosis of personality disorder (AOR: 1.91; 95%CI: 1.51-2.40), anxiety disorder (AOR: 1.93; 95%CI: 1.56-2.41), schizophrenia (AOR: 1.38; 95%CI: 1.10-1.72), a substance use disorder (AOR: 1.36; 95%CI: 1.03-1.82) or who had been homeless for >1 year (AOR: 1.31; 95%CI: 1.06-1.62) were more likely to be high health service users (Table 3).

## Discussion

This study confirmed the high use of hospital services and the high costs generated by a cohort of mostly men attending mental health clinics in the homeless sector. The study identified 27,466 hospital admissions

among 2,155 homeless hostel clinic attendees during a 13-year period, with a median cost per person of A$81,481. The study also found that 27.4% of the homeless sample were high health services users, defined by repeated ED presentations and frequent re-admissions, and that 20% were readmitted within 28 days, with a median time to readmission of 10 days. High health service users were aged ≥45 years, more likely to be female, had a mental illness or substance use disorder, and were more likely to have been homeless for >1 year.

Possible reasons for the high service use include the effect of mental disorders on adherence to treatment, including treatment for comorbid physical conditions, and the generally poor physical health of people with severe forms of mental illness. Severe mental illness is disproportionately common amongst people experiencing homelessness,[17] and in the UK, the most common reason for admission to hospital among people experiencing homelessness was also to treat mental illness.[2] Mental illness and substance abuse were prominent

among homeless populations In the US and Canada,[3,4,19,20] which in Canada contributed to very high health service use and costs.[16]

Despite 82% of the cohort having a history of some form of substance use, only 15.2% of those in the current study were reported to have been referred to mental health, alcohol and other drug facilities on hospital discharge from their index admission, either because the disorder developed later, because of therapeutic nihilism towards homeless patients[13] or because of the requirement by NSW Health for a fixed address to enable referral to community mental health services and the voluntary nature of drug and alcohol treatment. Whether substance abuse was a cause or consequence of homelessness (i.e. used as a coping mechanism[5]) is unclear in the current study, but interviews with homeless youth have identified that substance abuse is a common factor in their life,[9] suggesting that in many cases substance use was a cause of their being homeless. In turn, housing people who have been homeless in Canada has been shown to reduce substance use,[26] although this is not a consistent finding internationally.[27,28] Hospital presentation and admission could be a missed opportunity to arrange outpatient services for substance use disorder for people experiencing homelessness and reveals a need for clinical staff to routinely consider referral pathways[19] to either outpatient or other community-based services.

In the current study, 47.5% of index admissions and 54.1% of emergency re-admissions were for mental and behavioural disorders, which is not entirely surprising, as the cohort was drawn from attendees at psychiatric clinics and about half were diagnosed with a psychotic illness.[29] People experiencing homelessness who have a mental illness are frequent users of hospital services[30] and often require emergency admissions, largely due to crisis management of their illness.[2] Issues with medication adherence to treat mental illness are likely to play a role in frequent hospital use, including prescription filling and medication storage,[4,20] which may not be possible with the unstable living conditions experienced by people who are homeless.

Homeless adults in the current study had high rates per 1,000 person-years of hospital admissions (1,068.2), ED presentations (2,601.3), and ambulatory mental health client contacts (13,772.1), consistent with the findings of other studies showing high health

**Table 2: Health services use of homeless hostel clinic attendees, 2008−09 to 2020−21.**

| Characteristic | n | % |
|---|---|---|
| **Principal diagnosis at index admission** | | |
| Mental and behavioural disorders | 1,023 | 47.5 |
| Injury | 367 | 17.0 |
| Digestive diseases | 127 | 5.9 |
| Skin and subcutaneous tissue diseases | 75 | 3.5 |
| Musculoskeletal system and connective tissue disorders | 64 | 3.0 |
| Respiratory diseases | 58 | 2.7 |
| Circulatory diseases | 50 | 2.3 |
| Other[a] | 391 | 18.2 |
| **Hospital LOS at index admission (days)** | | |
| 1 | 900 | 41.7 |
| 2−3 | 314 | 14.6 |
| 4−5 | 193 | 9.0 |
| 6−7 | 126 | 5.9 |
| 8−14 | 209 | 9.7 |
| ≥15 | 413 | 19.2 |
| **Discharge at own risk from index admission** | 153 | 7.1 |
| **Discharge to mental health/alcohol and other drugs non-inpatient facility from index admission** | 328 | 15.2 |
| **Hospital admissions** | | |
| High admissions (i.e. ≥4 separations within 12 months of index admission) | 273 | 12.7 |
| Number of admissions (rate per 1,000 person-years and 95%CI) | 27,466 | (1,068.2; 95%CI: 1,055.5−1,080.8) |
| Cumulative hospital length of stay (bed days) (median) | 295,542 | (41) |
| Hospital admission treatment cost (median) | $548,254,886 | ($81,418) |
| **Readmissions within 28 days** | | |
| Readmission within 28 days of index admission | 425 | 19.7 |
| Emergency readmission within 28 days of index admission | 318 | 14.8 |
| **ED presentations** | | |
| High health service users (i.e. ≥4 ED presentations within 12 months of index admission) | 591 | 27.4 |
| ED presentations resulting in hospital admission | 19,183 | 28.7 |
| Number of ED presentations (rate per 1,000 person-years and 95%CI) | 66,888 | (2,601.3; 95%CI: 2,581.6−2,621.0) |
| **Ambulatory mental health client contact visit** | | |
| Number of client contacts (rate per 10,000 person-years and 95%CI) | 354,123 | (13,772.1: 95%CI: 13,726.7−13,817.4) |
| **Mortality** | | |
| 30-day mortality post index admission | 10 | 0.5 |
| Mortality during study period | 323 | 15.0 |

*Note:*

*a: Other includes: genitourinary diseases, endocrine, nutritional and metabolic diseases, nervous system diseases, neoplasms, infectious an parasitic diseases, eye and adnexa diseases; ear and mastoid process diseases; blood and blood-forming organs and certain disorders involving the immune mechanism; congenital malformations, deformations and chromosomal abnormalities; pregnancy, childbirth and the puerperium; factors influencing health status and contact with health services; and symptoms, signs and abnormal clinical and laboratory findings.*

service use rates among people experiencing homelessness.[2,6] Living on the street can make it difficult to treat other chronic health conditions, such as infections, or contributes to injuries[20] that necessitate hospital-based treatment. The finding that 15% of the cohort died in the follow-up period confirms the high mortality of people with severe mental illness and substance use disorder,[31-33] with life expectancy for people experiencing homelessness reduced by around 20 years compared to the general population.[34]

This study found that 27.4% of homeless adults were high health service users, again consistent with studies conducted elsewhere.[1,19,20] Repeated hospital presentations could be related to care quality, including premature discharge, inadequate discharge planning and referrals to appropriate community services.[4] However, one US study[20] found that people experiencing homelessness attending hospitals that frequently treated people experiencing homelessness had lower rates of readmission than hospitals that less often treated people experiencing homeless, which could be due to greater experience in discharge planning and in linking people experiencing homelessness into community-based services. People experiencing homelessness often report feeling stigmatised because of mental illness or substance use[9] and a lack of understanding among health and social care professionals.[13] People experiencing homelessness have also reported barriers to receiving primary care due to limited access,[20] a lack of flexibility in health service provision and exclusion from decision-making regarding their healthcare.[13]

Reducing unnecessary or inappropriate health service use among people experiencing homelessness requires addressing both individual and structural risk factors. Improved living conditions, stable housing, and financial and social support[4,6,35] are key structural factors. Programs in the US, such as Housing First, that provide access to housing, integrated treatment and rehabilitation with the community are proven means of improving the duration of tenancy for otherwise people experiencing homelessness.[16,35] In the US, Housing First programs have been shown to reduce the number of ED visits and hospital admissions and increase the number of routine outpatient visits for homeless living with a mental illness;[30] all steps towards preventive mental healthcare. However, while programs

such as Housing First have provided access to stable housing, these programs have not been as successful in addressing symptoms of mental illness, rates of substance abuse or measures of social inclusion such as employment among people experiencing homelessness.[11,35]

In the UK, the Homeless Hospital Discharge Fund has established partnerships with the National Health Services and non-profit organisations to provide short-term supported housing for people experiencing homelessness and supported discharge planning where the focus is on recovery from mental illness episodes and substance use.[2] However, improved discharge planning does little to overcome the structural causes of the poor physical and mental health of the homeless, in particular, the availability of long-term supported housing for people with disabling forms of mental illness.

Australia has trialled a number of models aimed at addressing unstable housing and mental illness, including 'assertive outreach'

| Table 3: Multivariable logistic regression of characteristics associated with homeless hostel clinic attendees who were high health service users versus infrequent users, 2008-09 to 2020-21. | | | | |
|---|---|---|---|---|
| **Characteristics** | **Univariate** (n=2,155) | | **Multivariable** (n=2,155) | |
| | **OR** | **95%CI** | **AOR** | **95%CI** |
| **Age group** | | | | |
| 18-24 | 1 | | 1 | |
| 25-34 | 1.40 | 0.96-2.04 | 1.54*** | 1.02-2.31 |
| 35-44 | 0.96 | 0.66-1.39 | 1.40 | 0.93-2.10 |
| 45-54 | 1.02 | 0.69-1.49 | 1.78** | 1.16-2.72 |
| ≥55 | 0.74 | 0.47-1.18 | 1.79*** | 1.07-2.98 |
| **Sex** | | | | |
| Male | 1 | | 1 | |
| Female | 1.69** | 1.21–2.37 | 1.52*** | 1.05–2.22 |
| **Mental disorder diagnosis identified in any admission record[a,b]** | 7.06* | 4.15–12.00 | – | |
| Schizophrenia[a] | 1.87* | 1.55–2.27 | 1.38** | 1.10–1.72 |
| Anxiety disorder[a] | 2.66* | 2.19–3.23 | 1.93* | 1.56–2.41 |
| Depression[a] | 2.09* | 1.70–2.55 | – | |
| Personality disorder[a] | 3.08* | 2.53–3.76 | 1.91* | 1.51–2.40 |
| Intellectual disability[a] | 4.94* | 3.22–7.58 | 2.94* | 1.85–4.67 |
| **Principal diagnosis at index admission** | | | | |
| Mental disorder | 1.55* | 1.25–1.93 | 1.05 | 0.82–1.35 |
| Injury | 1.37*** | 1.03–1.82 | 1.29 | 0.96–1.76 |
| Other diagnosis[c] | 1 | | 1 | |
| **Acquired brain injury[a]** | 1.29 | 0.99–1.67 | – | |
| **Alcohol or other drugs[a]** | 1.39* | 1.07–1.81 | 1.36*** | 1.03–1.82 |
| **Hospital LOS at index admission (days)** | | | | |
| 1 | 1 | | – | |
| 2-3 | 1.13 | 0.85–1.49 | | |
| 4-5 | 1.08 | 0.77–1.52 | | |
| 6-7 | 0.82 | 0.53–1.26 | | |
| 8-14 | 0.81 | 0.57–1.15 | | |
| ≥15 | 0.78 | 0.60–1.02 | | |
| **Greater than 1 year homeless[a]** | 1.35** | 1.11–1.65 | 1.31*** | 1.06–1.62 |
| **Discharged from psychiatric hospital[a]** | 1.81* | 1.46–2.24 | 1.32*** | 1.04–1.68 |
| **Discharged at own risk from index admission[a]** | 1.54*** | 1.09–2.17 | 1.57*** | 1.10–2.31 |
| **Discharged to mental health, alcohol and other drugs non-inpatient facility from index admission[a]** | 1.30 | 1.01–1.68 | – | |

Notes:
* p<0.0001;**p<0.005; ***p<0.05.
a: No is the reference group.
b: Not included in multivariable analysis.
c: Other includes: digestive diseases, skin and subcutaneous tissue diseases, musculoskeletal system and connective tissue disorders, respiratory diseases, circulatory diseases, genitourinary diseases, endocrine, nutritional and metabolic diseases, nervous system diseases, neoplasms, infectious an parasitic diseases, eye and adnexa diseases; ear and mastoid process diseases; blood and blood-forming organs and certain disorders involving the immune mechanism; congenital malformations, deformations and chromosomal abnormalities; pregnancy, childbirth and the puerperium; factors influencing health status and contact with health services; and symptoms, signs and abnormal clinical and laboratory findings.

where mental health service teams spend time at locations frequented by people experiencing homeless, and build therapeutic relationships, with eventual transition to outpatient services.[36] An evaluation of Common Ground (a similar model to Housing First) in Victoria had mixed results, as the program reduced psychiatric readmissions in one hospital, but increased the number and duration of admissions at another hospital,[37] although the increase in admissions was thought to be due to the provision of mental health services to clients who had previously lacked any healthcare support.[37] Many of the models developed to reduce high health service use, including those provided by non-government organisations, have faced challenges of cost and sustainability[11] and in some cases may have further stigmatised the disadvantage by 'marking' where they reside.[38]

The strengths of this study include that it provided a comprehensive examination of the use of health services by a large cohort of people who are homeless or at risk of becoming homeless in a range of living arrangements, and was not limited to people experiencing homelessness attending a single hospital. However, the study has a number of limitations. The homeless cohort may not fully capture the wide range of people who experience homelessness as it included attendees at three clinics in Sydney, Australia, and it is not known whether the health service use characteristics of the cohort was generalisable to that of other homeless populations in other jurisdictions. For example, one in five people in the current cohort indicated they slept in the open, yet homelessness takes many forms, and can include people with unstable or unpredictable housing. Women were under-represented, as two of the three clinics were in hostels for men only. A matched comparison cohort was not included in the study design, and therefore no attempt was made to compare the study cohort to the general population.

Information on ambulance service and primary care health service use was not accessed, and despite approaches to Housing NSW, the authors were not able to obtain information on whether individuals became public housing tenants at any stage during the study period. The preventability of ED presentations and hospital admissions could not be assessed, nor was the severity of the health condition able to be identified. Only

health conditions that were relevant to the current hospital episode of care are reported in each hospital record. However, by using an 'if in any of the 50 diagnoses codes during the study period' identification strategy, better estimates of the prevalence of mental illnesses were likely to be obtained. Studies that use record linkage are likely to be subject to some degree of error in the data linkage process. However, for the current study, the CHeReL estimates the false positive rate for this linkage (i.e. the proportion of false matches) to be 0.5%.

## Conclusion

This research highlights the need to address society-wide structural issues to combat homelessness, along with individual issues, to combat the high use of health services among people experiencing homelessness. There is a need to assess the effect of various models of supported housing for the homeless, along with a focus on integrated care (i.e. coordinated acute and non-acute healthcare services), appropriate use of referral pathways, and coordination with community-based support agencies.

## Acknowledgements

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## Supporting Information

Additional supporting information may be found in the online version of this article:

**Supplementary Figure 1**: Cohort selection flowchart.

**Supplementary Figure 2**: Time to readmission within the first 12 months for homeless hostel clinic attendees, 2008-09 to 2020-21.

**Supplementary Table 1**: Identification of mental disorders.