

Risk factors for unplanned hospital admission in a specialist homeless general practice population:

case-control study to investigate the relationship with tri-morbidity

Abstract

Background

'Tri-morbidity' describes the complex comorbidity of chronic physical illness, mental illness, and alcohol and/or drug misuse within the homeless population. Poor health outcomes of homeless people are reflected by the higher rate of unplanned hospital admissions compared with the non-homeless population.

Aim

To identify whether tri-morbidity is a risk factor for unplanned hospital admissions in the homeless population.

Design and setting

A case-control study of patients who were registered with a specialist homeless GP surgery in Brighton (72 cases and 72 controls).

Method

Cases were defined as those who had ≥ 1 overnight hospital admission within a 12-month period. Controls were matched for demographics but with no hospital admission. The primary care record was analysed, and tri-morbidity entered into binomial logistic regression with admission as the dichotomous dependent variable.

Results

The logistic regression analysis demonstrated that other enduring mental health disorders and/or personality disorder [odds ratio (OR) 3.84, 95% confidence interval (CI) = 1.56 to 9.44], alcohol use [OR 2.92, 95% CI = 1.42 to 5.98], and gastrointestinal disorder [OR 2.90, 95% CI = 1.06 to 7.98] were independent risk factors for admission. Tri-morbidity increased odds of admission by more than four-fold [OR 4.19, 95% CI = 1.90 to 9.27].

Conclusion

This study shows that tri-morbidity is an important risk factor for unplanned hospital admissions among the homeless population, and provides an interesting starting point for the development of a risk stratification tool to identify those at risk of unplanned admission in this population.

Keywords

emergency service; hospital; general practice; homeless persons; risk factors; tri-morbidity; unplanned admissions.

INTRODUCTION

The health of the homeless population in the UK is a multifaceted interplay between long-term comorbidities, mental ill health, and substance misuse.^{1,2} The term 'tri-morbidity' was coined by Hewett and Halligan in 2010 to describe the complexity of presentation in chronically homeless people.³ One point of particular interest has been the relationship between tri-morbidity and its consequences in terms of higher levels of unplanned hospital admissions.

In this study, the term 'homelessness' is used to refer to single homeless people who do not meet the statutory duty of care to be housed by their local authority.⁴ Homelessness in this context refers to the street homeless, sofa surfers, hostel dwellers, squatters, and those in temporary accommodation because of a high level of need.

Social factors such as social isolation, inability to access suitable healthcare services, difficulty in maintaining benefits with no fixed abode, poor nutrition, being a victim of violence or hate crimes, incarceration for drug crimes, and unstable living conditions all have an impact on the health of homeless people.⁵⁻⁷

Homeless people have on average 1.18 hospital admissions per year, compared with 0.28 per year in the general population, hence the rate of admissions is over fourfold higher in the homeless population,¹ at a cost of £85 million per year.²

The average cost of no-elective episode has been estimated at £1603.⁸ By comparison, the average cost of a GP consultation is £30.⁹

The purpose of this research was to investigate the interaction between morbidity (including tri-morbidity) and unplanned use of secondary healthcare services among the homeless population. This was achieved by examining the Electronic Health Record (EHR), a SystmOne database, for diagnoses that could be categorised as chronic physical illness, mental illness, or alcohol and/or drug misuse from a cohort of homeless people in Brighton, England.

These diagnoses were statistically analysed with regard to admissions data, to identify which of them act as predictive risk factors for unplanned hospital admissions. The results were compared with a recent study of predictive factors for accident and emergency (A&E) admissions in a cohort of homeless people in Birmingham,¹⁰ with the aim of building up a body of evidence that reflects the current health needs of the homeless population in the UK.

METHOD

This is a case-control study of patients with full General Medical Services registration with a specialist homeless GP surgery (HGPs) in Brighton, UK. The HGPs is an NHS provider of primary care that only registers patients who are homeless or

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Submitted: 17 March 2019; **Editor's response:** 24 May 2019; **final acceptance:** 2 October 2019.

©British Journal of General Practice

This is the full-length article (published online 19 May 2020) of an abridged version published in print. Cite this version as: **Br J Gen Pract 2020; DOI: <https://doi.org/10.3399/bjgp20X710141>**

How this fits in

The risk factors for unplanned overnight hospital admissions among the homeless population have not been studied in the UK. This study looked at the 'tri-morbidity' of homelessness, namely the complex comorbidity of chronic physical illness, mental illness, and alcohol and/or drug misuse in the homeless population, to identify whether it acts as a risk factor for ill health. The study findings may enable clinicians to provide proactive care for homeless patients, who are at higher risk of being admitted to hospital than the general population.

living in temporary accommodation. The clinical and administrative staff within the service are trained to deliver holistic care that meets the needs of this population, while ensuring that the model of care reduces barriers to accessing services. The practice had a list size of 1650 patients at the start of the study.

The primary care system in Brighton interacts largely with a single hospital trust, the Brighton and Sussex University Hospital Trust (BSUHT). The hospital trust provided data identifying patients with

≥1 unplanned overnight admission (that is, they were in hospital bed at midnight) within the 12-month timeframe (1 June 2015 and 31 May 2016) to secondary care and registered with the HGPS at the time of admission. Overnight admissions demonstrate ill health, in comparison with A&E attendances that do not result in an admission and may not be due to medical ill health.

Cases were identified as having ≥1 unplanned overnight admission within the 12-month period. Controls had no admission in the same timeframe, but were matched to cases for year of birth, sex, type of homelessness, and length of time registered with HGPS. Although type of homelessness is a transient state, evidence suggests that those who are street homeless do have much poorer health outcomes.¹ Cases were matched for the length of registration, as patients at this specialised practice tend to stabilise medically over time. Patients who are newly registered tend to have lots of tests, and hence diagnoses, and so matching was necessary. The practice population is mainly white British, and hence ethnicity information would have enabled identification of individual patients.

The specialist HGPS healthcare team cross-checked admissions data and reviewed clinical information from the EHR. Clinical data relevant to the chronic disease, mental health, and substance misuse categories of tri-morbidity were extracted and recorded, if they had been entered prior to the date of unplanned admission. Data were recorded from clinical coded entries, free-text information, and correspondence. Unplanned admission data were extracted from EHR through discharge summaries. Any information shared with the researcher was fully anonymised and stored on an encrypted memory stick.

Prevalence data were compressed into groups, and clinical judgement plus ensuring adequate size of group was applied to determine which variables should be added to logistic regression, with unplanned admission (yes/no) as the dichotomous dependent variable. Chronic respiratory, gastrointestinal, neurology, heroin, other drug use, alcohol, depression and/or anxiety, other enduring mental health and personality disorder, and suicide and/or self-harm were added as independent variables into the backwards step model.

Each participant was given a tri-morbidity (yes/no) score if they had a diagnosis in each of the chronic disease, mental health, and substance misuse categories. The tri-morbidity score was entered as the variable

Table 1. Prevalence of chronic disease, substance misuse, and mental health diagnosis of cases (with admission) and controls (no admission)^a

	Cases, N= 72	Controls, N= 72
Mean age, years ± SD	41.15 ± 11.46	41.8 ± 11.82
Sex, %		
Male	77.8	75.0
Female	22.2	25.0
Chronic disease		
Respiratory	27.7	19.4
Gastrointestinal	23.6	9.7
Neurology	11.1	2.8
Other	26.4	9.7
Substance misuse		
Heroin/opiate	36.1	22.2
Other drug	44.4	38.9
Alcohol	58.3	36.1
Mental health		
Depression	54.2	58.3
Other enduring mental health issue and/or personality disorder	33.3	12.5
Self-harm and/or suicidality	25.0	18.1
Behavioural disorder	1.4	5.6

^aCases and controls were matched for age, sex, type of homelessness, and length of time of registration with HGPS and so these demographic variables were not added to the model. There was a matching error with the sex of the cases and controls. Individuals with at least one condition were included in the prevalence data; individuals with more than one condition in each variable were counted only once. HGPS = homeless GP surgery. SD = standard deviation.

Table 2. Binomial logistic regression to identify independent predictors of unplanned hospital admission^a

Independent variable	P-value	OR	95% CI
Gastrointestinal	0.04	2.90	1.06 to 7.98
Alcohol	0.00	2.92	1.42 to 5.98
Other enduring mental health disorders and personality disorder	0.00	3.84	1.56 to 9.44

^aVariables added to the original regression model: chronic respiratory, gastrointestinal, neurological, heroin and/or opiate use, other drug use, alcohol, depression and/or anxiety, other enduring mental health and personality disorder and suicide and/or self-harm. CI = confidence interval. OR = odds ratio.

in a binomial logistic regression, with unplanned admission as the dependent variable. The analysis was carried out in SPSS version 25.

RESULTS

There were 146 patients with an unplanned overnight admission in hospital during the study period. Of the 146 potentially eligible cases that were identified, only 72 were included because of participants moving to a new GP practice ($n=45$), participants who had died since their admission ($n=10$), patients who were aged <18 years ($n=2$), those unsuitable because of other reasons ($n=1$), and those who did not have adequate information in their discharge summary for inclusion ($n=16$) (Supplementary Figure S1).

Of the cases ($n=72$), 22.2% were female and 77.8% were male. The average age for a case with an overnight unplanned admission was 41 years (SD = ± 11.46) (Table 1). There was a small error in the matching process in that males and females were incorrectly matched, in that there were 75.0% males and 25.0% females in the controls.

The prevalence data for each of the cases and controls are described in Table 1. The data were categorised into the three elements of tri-morbidity: chronic disease, substance misuse, and mental health. Originally there were 41 clinical codes recorded: 15 within chronic disease, 14 within substance misuse, and 12 within

mental health (Supplementary Box S1). The clinical codes were placed into broader categories to increase the size of each variable for the logistic regression.

The most prevalent chronic disease for cases with an unplanned admission was chronic respiratory disease at 27.7%, with the second being gastrointestinal disease at 23.6% (Table 1).

Substance misuse was consolidated into three variables, of which alcohol had the largest prevalence (58.3%) within the unplanned admissions group, followed by all other street drug use (44.4%), and heroin and/or opiate use (36.1%) (Table 1).

Within the mental health category, 54.2% of cases had a diagnosis of depression and/or anxiety, 33.3% had an enduring mental health condition and/or personality disorder, and 25.0% had experienced self-harm and/or suicidality (although accidental drug overdose was removed from this variable because of confounding) (Table 1).

Logistic regression analysis of the clinically relevant diagnoses demonstrated that other enduring mental health disorders and/or personality disorder (OR 3.84, 95% CI = 1.56 to 9.44), alcohol (OR 2.92, 95% CI = 1.42 to 5.98), and gastrointestinal (OR 2.90, 95% CI = 1.06 to 7.98) all acted as independent risk factors for unplanned admissions (Table 2). The greatest risk factor was other enduring mental health disorders and/or personality disorder, which increases the likelihood of admission by almost fourfold.

Analysis was carried out to see whether tri-morbidity predicts unplanned hospital admission. The results show that the odds of unplanned hospital admission are over four times higher in those having tri-morbidity compared with those who did not have tri-morbidity (OR 4.19, 95% CI = 1.90 to 9.27) (Table 3).

DISCUSSION

Summary

This study identified three independent risk factors that increased risk of unplanned hospital admissions spanning the tri-morbidity categories of chronic disease, substance misuse, and mental health. Enduring mental health conditions (including personality disorder) was the biggest predictor, increasing the odds of an overnight admission by almost fourfold, demonstrating that severe mental health issues impact on the likelihood of poor physical health outcomes, potentially because of lack of engagement or late presentation to services. Similarly, individuals in this study with a previous

Table 3. Binomial logistic regression analysis to determine whether tri-morbidity acts as a predictive risk for unplanned hospital admissions^a

	P-value	OR	95% CI
Tri-morbidity	0.00	4.19	1.90 to 9.27

^aCases and controls were matched for age, sex, type of homelessness, and duration of registration with HGPS and so these variables were not added to the model. There was a matching error with the sex of the cases and controls. CI = confidence interval. HGPS = homeless GP surgery. OR = odds ratio.

diagnosis of alcohol use disorder or gastrointestinal disease, are almost three times more likely to be admitted overnight. The extent of the incessant issue of alcohol dependence, and the effect this has on the systems within the body have been well described.^{10,11} It is not an unexpected finding that history of alcohol dependence was a predictor of ill health in this homeless population. Gastrointestinal issues are a significant issue in the homeless community, as these include liver damage from hepatitis C, alcohol misuse, and drug misuse.

The study demonstrates that the presence of tri-morbidity in a homeless person, as described by Hewett and Halligan,³ increases the odds of unplanned admissions in this homeless population by four times more than those without tri-morbidity (OR 4.19, 95% CI = 1.90 to 9.27). This is an interesting result as it begins to quantify tri-morbidity and associated outcomes.

Comparison with existing literature

This is the first study, to the authors' knowledge, to look specifically into factors influencing unplanned hospital admissions within a UK-based homeless population. Bowen *et al* retrospectively analysed the primary care data of patients registered with an HGPS in Birmingham and compared the relationship with A&E attendance.¹⁰ Both studies have comparatively similar inner-city homeless populations who are registered with an HGPS. The Birmingham methodology compared the homeless population with the general population rather than the Brighton case-controlled method. However, both analysed a 12-month timeframe. Bowen *et al* used Read codes and Quality and Outcomes Framework (QOF) codes for 21 key health conditions, whereas this study reviewed the entire medical record for codes and free text that were associated with tri-morbidity (41 conditions). The Birmingham research had a large sample size of 928, compared with 144 in Brighton.

The larger sample size in Birmingham allowed regression analysis of specific conditions, for example, epilepsy (OR 4.776, $P=0.013$) and leg ulcers (OR 2.191, $P=0.004$), to predict A&E attendance, allowing for greater clinical relevance in practice. As previously discussed, A&E attendance and unplanned overnight admission are different outcomes; however, hepatitis C (OR 2.735, $P<0.001$) was a risk factor in Birmingham, and gastrointestinal disorders (which included hepatitis C virus [HCV] and cirrhosis) (OR 2.90, 95% CI = 1.06

to 7.98) were a significant risk factor in Brighton. This also reflects the findings of a Boston-based study that also found HCV infection to be a predictor of emergency department use.¹²

In Brighton, enduring mental health disorders and/or personality disorder (OR 3.84, 95% CI = 1.56 to 9.44) were found to be the largest predictor of unplanned admission, whereas in Birmingham enduring mental health disorders did not predict A&E attendances, perhaps reflecting how patients living with enduring mental health issues interact with health services. Alcohol dependence predicted both A&E attendance (OR 3.95, $P<0.001$) in Birmingham and unplanned admissions in Brighton (OR 2.92, 95% CI = 1.42 to 5.98). These two studies begin to build a picture of the burden of alcohol dependence faced by homeless people living in English cities today, and the impact that this has both on individual health and on the services that they access.

Russolillo *et al* examined whether different mental disorders were predictors of acute hospital admissions (both medical and psychiatric).¹³ The adjusted rate ratio (ARR) values for personality disorder (ARR 1.6, 95% CI = 1.8 to 2.6) and for alcohol dependence (ARR 1.5, 95% CI = 1.2 to 2.0) were both lower than in this study. The strongest risk factor was schizophrenia (ARR 4.7, 95% CI = 3.9 to 5.6), followed by bipolar disorder (ARR 2.2, 95% CI = 1.8 to 2.6); all the reported results from this Canadian study were significant.

Strengths and limitations

The strengths of this research are that it utilises admissions data from the hospital alongside the rich data recorded in the EHR. The disadvantages of using EHR include poor record keeping, and the potential for medical issues to have resolved and not be recorded as such.

The advantage of this study is that it seems to represent a closed system, for example, there is only one HGPS from which patients will only access one health trust.

Furthermore, this is the first study in the UK to quantify the medical risk of the 'tri-morbidity' of homelessness as a predictor for unplanned hospital admissions.

In this case-control study there is researcher bias on selection of the controls, as this could not be blinded. There was an error in the matching process in that males and females were incorrectly matched, with cases having 77.8% males and 22.2% females, and controls had 75.0% males

and 25.0% females. This has created an inherent inaccuracy within the study design and statistical model.

This is a retrospective study, and attrition from the sample was large, reducing the sample size and power of the study. This is due to the transient nature of the sample group and the high death rate within the group. The reduced size of the prevalence variables prevented the use of logistic regression on more specific disease diagnoses. An improved methodology would be a prospective cohort study, although this would require rigorous ethical governance and explicit consent from participants.

Unfortunately, not every individual had an adequate discharge summary for each admission, hence the admissions that had no, or inadequate, recording had to be excluded from the study, thus altering the true picture. All of the unplanned admissions were included in an original dataset from the health trust. However, if this dataset was inaccurate, because of poor coding, then it is possible that controls could have actually been cases, but without accurate coding/discharge summary.

Of course, the focus on GP-registered homeless people does raise questions about how far the results can be generalised across wider populations of

homeless people. Specialist medical centres for homeless people are rare, and it simply has to be acknowledged that the research may not be directly applicable to all those other situations where homeless people have no such access to specialised homeless medical services. It is for this reason that claims about the wider possible application of the research findings are only very cautiously made.

Implications for research and practice

The long-term aim of this study is to create a risk stratification system that can quantify medical vulnerability in homeless people. There may be scope to combine tri-morbidity and weighting other risk factors to create a scoring system to predict ill health and so focus resources on those most in need, in line with NHS England's *Long Term Plan*.¹⁴ This has a broad value in reducing health inequalities in a population, creating equity in the delivery of health services, and enabling potential financial savings for the healthcare system.

This was a small-scale study, based on a specific cohort, which has offered an interesting starting point for potential future studies that can feed into the discourse on health among homeless people in the UK.

Funding

None.

Ethical approval

Not applicable The student researcher was provided with secondary data that were fully anonymised.

Provenance

Freely submitted; externally peer reviewed.

Competing interests

Catherine Himsworth and Priyamvada Paudyal have declared no competing interests. Christopher Sargeant is director of ARCH Healthcare.

Acknowledgements

This piece of work was only made possible by the willingness of ARCH Health CIC Homeless Healthcare and the Brighton and Sussex University Hospital Trust to provide anonymised patient data.

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