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# The impact of co-occurring homelessness and substance misuse on secondary healthcare in Wales

Mae'r ddogfen yma hefyd ar gael yn Gymraeg.

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The impact of co-occurring homelessness and substance misuse on secondary healthcare in Wales

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Views expressed in this report are those of the researcher and not necessarily those of the Welsh Government

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## Summary

The aim of this research was to investigate, amongst people engaged with substance misuse treatment services, the relationship between co-occurring experience of homelessness, substance misuse treatment, and their effects on:

- the frequency of emergency department attendances
- the reasons for emergency hospital admissions
- the frequency of hospital admissions
- the length of hospital admissions

The analysis used linked anonymised administrative data for substance misuse treatment, emergency department attendances and hospital admissions in Wales between 01 January 2014 and 31 December 2019.

We found that co-occurring homelessness and substance misuse was associated with increased usage of secondary healthcare when compared with substance misuse treatment alone. This includes an increase in the number of emergency department attendances, an increase in the number of hospital admissions, an increase in the likelihood of an emergency hospital admission and an increase in the duration of hospital admissions. Consideration is given to the implications and resultant recommendations for health and social care services.

This report is a joint publication between Public Health Wales, Administrative Data Research Wales, the Secure Anonymised Information Linkage (SAIL) Databank and Welsh Government as part of the [Better Outcomes through Linked Data \(BOLD\)](#) programme. BOLD is a HM Treasury funded, cross-governmental programme (2021 to 2025) designed to demonstrate how people with complex needs can be better supported by linking and improving the government data held on them in a safe and secure way.

## Introduction

Homelessness is a growing problem in Wales. In 2023 to 2024, 13,539 households in Wales were assessed as homeless and owed a duty to help secure accommodation under the Housing (Wales) Act 2014<sup>1</sup>. This was an increase of 8% on the previous year and the highest figure since the legislation began. Although traditional interpretations of homelessness only include people living on the streets or in shelters, homelessness is a far wider problem which includes people living in insecure, inadequate or temporary housing<sup>2</sup>. This report examines homelessness as a wider issue.

Homelessness is associated with poor physical and mental health. A study of health outcomes of people with lived experience of homelessness in Wales found that they were more likely to be managing multiple long-term health conditions than the general population, interacted more frequently with health services and relied more on emergency care services during the coronavirus (COVID-19) pandemic<sup>3</sup>.

There is considerable overlap between substance misuse and homelessness. A linked data study found that 23% of individuals assessed by a substance misuse service in Swansea between 2014 and 2016 had also applied to the housing team during the same period<sup>4</sup>. Like homelessness, substance misuse is also associated with poor physical and mental health. A study of individuals in substance misuse treatment in Wales found that substance misuse is associated with elevated mortality risk<sup>5</sup>. The study also found that substance misuse is associated with an increased risk of premature death, both in terms of death from any cause and deaths that are specifically substance misuse related or suicide. Co-occurring homelessness and substance misuse is associated with even greater health inequalities<sup>6</sup>.

The Welsh Government has published several policies addressing substance misuse and homelessness, often discussing mitigation strategies for both issues together due to their close connection. Notably, the Welsh Government's substance misuse delivery plan 2019 to 2022<sup>7</sup> highlighted the importance of addressing the link between substance misuse and homelessness. Although the plan's timeframe has ended, the issues remain relevant. A primary goal of the plan was to foster strong partnerships with housing and homelessness

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<sup>1</sup> Welsh Government, "Homelessness: April 2023 to March 2024," 5 September 2024

<sup>2</sup> FEANSTA, "ETHOS - European Typology on Homelessness and Housing Exclusion," 01 April 2005

<sup>3</sup> J. Song, C. Moreno-Stokoe, C. N. Grey and A. R. Davies, "Health of individuals with lived experience of homelessness in Wales, during the Covid-19 pandemic," Public Health Wales, Cardiff, 2021.

<sup>4</sup> I. Thomas, "Severe and Multiple Disadvantage," ADR Wales, Cardiff, 2021.

<sup>5</sup> Bailey, G. et al., 2024. All-cause and cause-specific mortality amongst individuals with substance misuse: A population-based linked data study in Wales. *International Journal of Population Data Science*, 9(5).

<sup>6</sup> Tweed, E. et al., 2021. Health of people experiencing co-occurring homelessness, imprisonment, substance use, sex work and/or severe mental illness in high-income countries: a systematic review and meta-analysis. *Journal of epidemiology and community health*, 75(10), pp. 1010-1018.

<sup>7</sup> Welsh Government, "Substance misuse delivery plan 2019-2022," 2019

services to enhance the multidisciplinary approach needed to support individuals with substance misuse issues who are homeless or at risk of becoming homeless.

This study aims to contribute to the evidence base in Wales by examining the relationship between homelessness and substance misuse in the context of health inequalities. It specifically addresses how these co-occurring conditions affect the frequency and reasons for Emergency Department (ED) attendance, as well as the frequency and duration of hospital admissions. This research ultimately aligns with Welsh Government priorities on homelessness and substance abuse, addressing health outcomes that are of significant policy and research interest.

## **Methodology**

### **Study design**

A population-scale retrospective electronic cohort (e-cohort) study was conducted to investigate how individuals with experience of homelessness whilst in substance misuse treatment used secondary care in Wales between 01 January 2015 and 31 December 2019. The study used the SAIL Databank, a secure repository of linked, pseudonymised data sets made available to researchers in anonymised form<sup>8</sup>.

### **Study population**

The Substance Misuse Dataset Wales (SMDS) captures data relating to all individuals presenting for substance misuse treatment in Wales<sup>9</sup>. This dataset was used to establish the population of individuals who were engaged with substance misuse treatment in Wales between 01 January 2014 and 31 December 2019.

A set of rules were applied to the data to identify the study population. Figure 1 shows the study inclusion and exclusion criteria and the corresponding counts.

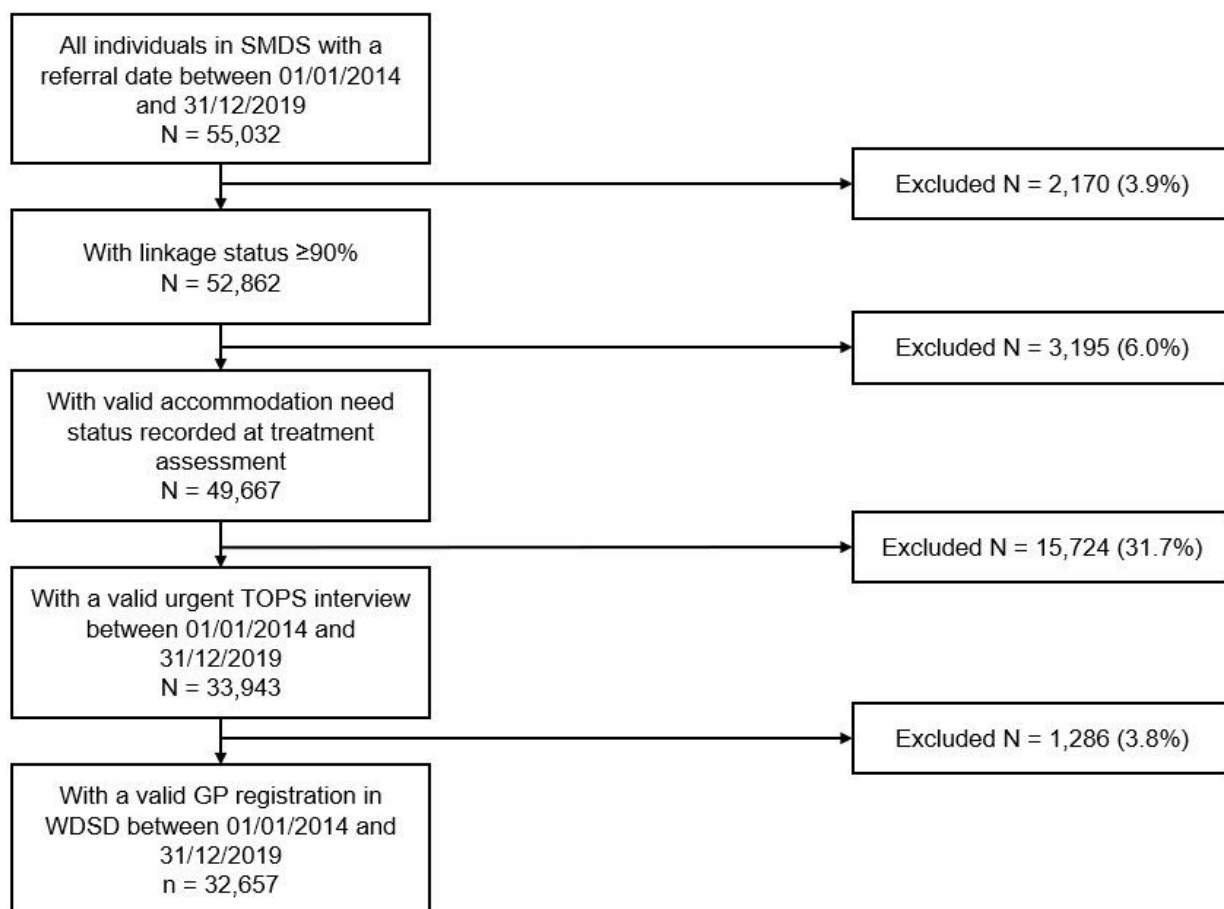
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<sup>8</sup> Lyons, R. et al., 2009. The SAIL databank: linking multiple health and social care datasets. *BMC Medical informatics and decision making*, 16(3).

<sup>9</sup> HDR UK, "Health Data Research Gateway," 2024.



**Figure 1: Flowchart showing the cohort of individuals for this study and the criteria for inclusion**



### Data sources

A number of data sets from SAIL were used in the study, as shown in table 1.

Linkage was made between the SMDS and the WSDS. The Emergency Department Data Set (EDDS) and the Patient Episode Dataset for Wales (PEDW) were also linked to the SMDS. A total of 79,098 emergency department attendances and 44,242 hospital admissions were linked to the cohort of individuals created from the SMDS.

**Table 1: The SAIL Databank data sets used in the study**

<b>Dataset acronym</b>	<b>Dataset description</b>	<b>Purpose in study</b>
SMDS (Substance Misuse Data Set)	Data relating to all individuals presenting for substance misuse treatment in Wales.	Defined study population, experience of homelessness and problem substances
EDDS (Emergency Department Data Set)	Attendance and clinical information for all NHS Wales accident and emergency attendances.	Source of Emergency Department attendances data
PEDW (Patient Episode Dataset for Wales)	All inpatient and day case activity undertaken in NHS Wales, plus data on Welsh residents treated in English trusts.	Source of hospital admissions data
WSDS (Welsh Demographics Service Dataset)	A register of all individuals registered with a GP in Wales	Dates of all GP registrations in Wales

## Variables

To capture the broad spectrum of homelessness experience, which is far wider than those sleeping on the streets<sup>10</sup>, a binary variable was created from housing status: “experience of homelessness”.

Housing status is recorded at assessment and periodically during substance misuse treatment.

Housing status categories at assessment stage:

- no fixed abode: urgent housing problem (like living on the streets, using hostel accommodation nightly, or sleeping in different places each night)
- housing problem: short-term or insecure housing (like staying with friends/family, at a night winter shelter, a short stay hostel, a short-term B&B, or squatting)
- no housing problem: securely housed

Housing status categories during substance misuse treatment:

- urgent housing problem: insecurely housed or homeless
- no urgent housing problem: securely housed

<sup>10</sup> England, E., Thomas, I., Mackie, P. & Browne-Gott, H., 2022. A typology of multiple exclusion homelessness. *Housing Studies*, 39(3), pp. 695-719.

In this study, 'no fixed abode', 'housing problem', and 'urgent housing problem' were combined to create the experience of homelessness variable.

Other variables created:

- problem substance type: binary flags for each problem substance type (opioids, cannabinoids, stimulants, other drugs, alcohol) to indicate that the individual had received treatment with this recorded as a problem substance during the study period; the problem substances recorded at assessment for substance misuse treatment were grouped into problem substance types (appendix 1)
- count of emergency department attendances: calculated from the EDDS data for the individual during the study period
- count of hospital admissions: calculated from the PEDW data for the individual during the study period
- emergency admissions: a binary flag to indicate that a hospital admission was an emergency, taken from the admission method variable in PEDW
- reason for admissions: created by matching the International Classification of Diseases (ICD-10) code recorded as the first primary diagnosis in PEDW to its corresponding ICD-10 chapter<sup>11</sup>
- Person Years at Risk (PYAR): calculated from the dates that the individual was registered with a GP in Wales during the study period.
- death censor: a binary flag to identify those patients who died before discharge from hospital.

## Statistical analysis

Descriptive statistics were used to report the frequency of, reasons for, and duration of their attendance to ED or hospital admissions during the time period. Results are presented by experience of homelessness, problem substance type (opioids, cannabinoids, stimulants, other drugs, alcohol) and demographics.

Negative binomial hurdle models<sup>12</sup> were used to investigate how often people attended emergency department and were admitted to a hospital. The models took into account the PYAR to only consider the time when the individual would be expected to be accessing hospital treatment in Wales. The interaction between experience of homelessness, problem substance type and demographics was also included.

Generalised linear mixed-effects models<sup>13</sup> were used to investigate the reasons for emergency admissions. The models accounted for the non-independence of observations

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<sup>11</sup> WHO, "ICD-10 Version:2019," 2019

<sup>12</sup> Mullahy, J., 1986. Specification and testing of some modified count data models. *Journal of Econometrics*, 33(3), pp. 341-365.

<sup>13</sup> Borja, M. C., 2009. An Introduction to Generalized Linear Models. *Journal of the Royal Statistical Society Series A: Statistics in Society*, 172(3), pp. 695-696.

within individuals. The interaction between experience of homelessness, problem substance type and demographics was also included.

Cox proportional hazards models<sup>14</sup> were used to investigate the time to discharge of hospital admissions. As some hospital admissions ended in death rather than discharge, a censor for death was included in the model. The models accounted for the non-independence of observations within individuals. The interaction between experience of homelessness, problem substance type and demographics was also included.

## **Findings**

### **Cohort description**

A description of the characteristics of the cohort (n = 32,657) is shown in table 2. Notably, individuals within the cohort may have received multiple substance misuse treatments, which may not always have been for the same main problem substance.

A full description of the drugs within each problem substance type can be found in appendix 1.

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<sup>14</sup> Cox, D., 1972. Regression models and Life-Tables. *Journal of the Royal Statistical Society: Series B (Methodological)*, 34(2), pp. 187-202.

**Table 2: A description of the characteristics of the cohort**

<b>Characteristic: Category</b>	<b>Number</b>
Sex: male	21,850
Sex: female	10,807
Age group: 11 to 17	1,423
Age group: 18 to 24	3,443
Age group: 25 to 34	8,672
Age group: 35 to 44	9,042
Age group: 45 to 54	6,415
Age group: 55 to 64	2,720
Age group: 65 and older	941
Ethnicity: white	29,179
Ethnicity: other	550
Ethnicity: unknown	2,885
Experience of homelessness: yes	9,935
Experience of homelessness: no	22,721
Problem substance type: alcohol	18,714
Problem substance type: opioids	8,005
Problem substance type: cannabinoids	4,095
Problem substance type: stimulants	3,815
Problem substance type: other drugs	2,141
Problem substance type: unknown	1,246

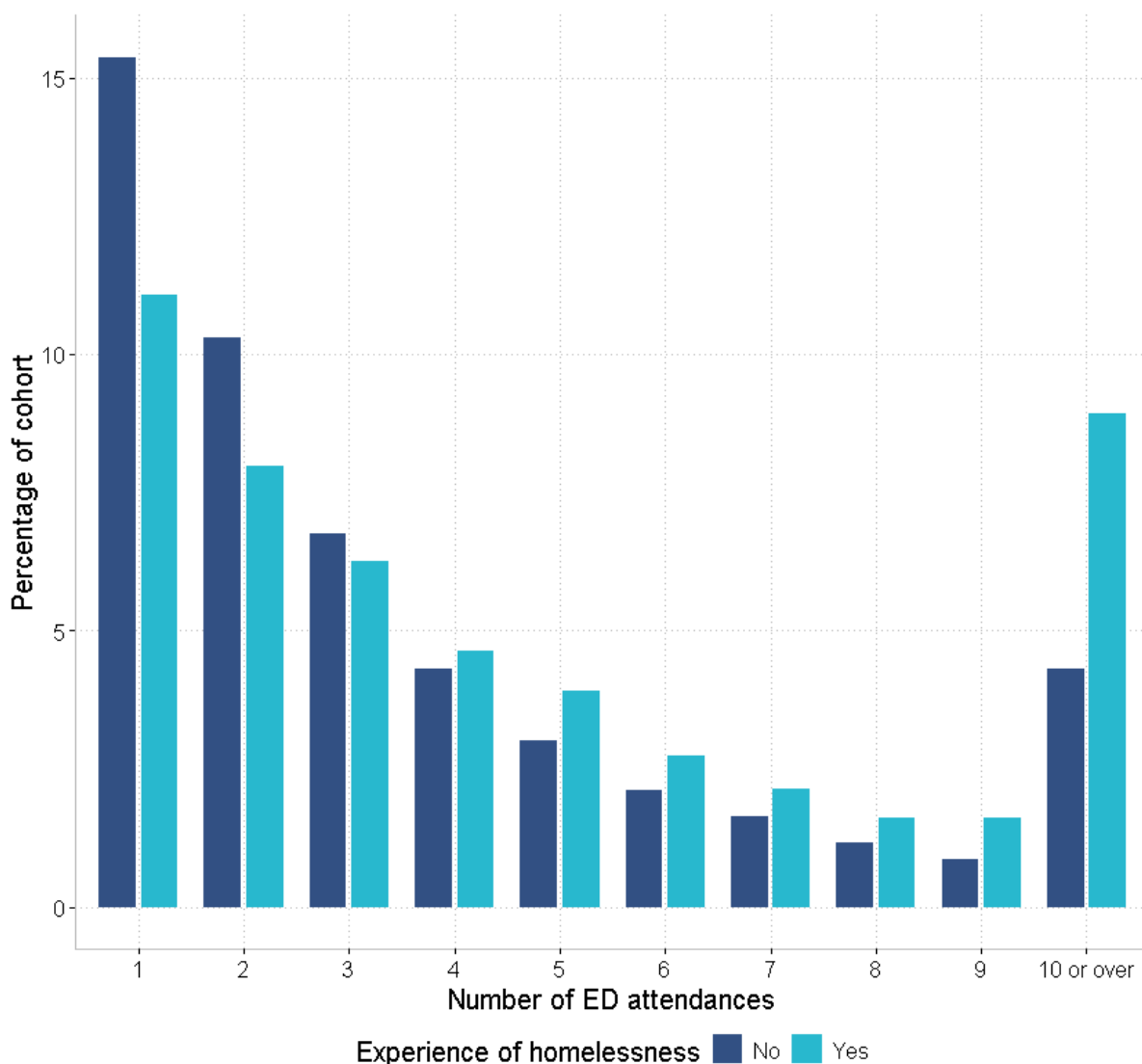
## **Frequency of emergency department attendances**

### **Descriptive statistics**

Amongst the individuals in the cohort, 50% (n = 16,355) attended an ED in Wales at least once. The majority of those (30%, n = 9,869) attended between 1 and 3 times. A small proportion of the overall cohort (6%, n = 1,863) attended ED 10 or more times during the time period.

Amongst people with experience of homelessness 50.8% (n = 4,886) attended an ED in Wales at least once, 0.8% more than the cohort as a whole. The proportion which attended ED 10 or more times was 2.9% higher than the cohort as a whole (8.9%, n = 886) as shown in figure 2.

**Figure 2: Number of ED attendances during the study period, stratified by experience of homelessness**



### Statistical modelling

Model results showed that both opioids as a problem substance and the interaction between experience of homelessness and female sex were associated with an increase in the likelihood of at least one ED attendance. For people with opioids as the problem substance there was a 46% increase. For people who were female and had experience of homelessness there was a 13% increase.

Experience of homelessness, other drugs as a problem substance and alcohol as a problem substance were associated with an increase in the expected number of ED attendances. The interactions between experience of homelessness and alcohol as a problem substance, and experience of homelessness and female sex were also associated with an increase in the expected number of ED attendances (table 3).

**Table 3: Characteristics associated with a statistically significant increase in the expected count of ED attendances**

Characteristic	Increase in expected count of ED attendances (%)
Experience of homelessness: yes	157
Problem substance: other drugs	61
Problem substance: alcohol	37
Experience of homelessness: yes * Problem substance: alcohol	28
Experience of homelessness: yes * sex: female	20

No other characteristic or interaction between characteristics was associated with a statistically significant increase in the likelihood or expected number of ED attendances.

Model summary tables are shown in appendix 2.1.

### Reasons for emergency hospital admissions

#### Descriptive statistics

The most frequent first primary diagnoses amongst patients in the cohort admitted by any method were ‘injury, poisoning and certain other consequences of external causes’, ‘mental and behavioural disorders’ and ‘diseases of the digestive system’. The primary diagnosis is defined as the main condition treated or investigated during an episode of healthcare<sup>15</sup>. The first primary diagnosis is the primary diagnosis which is recorded at the earliest point during an episode of healthcare. The proportion of admissions for ‘injury, poisoning and certain other consequences of external causes’ and ‘mental and behavioural disorders’ were higher for people with experience of homelessness (table 4).

**Table 4: Most frequent first primary diagnoses for patients admitted by any method**

First primary diagnosis chapter	Experience of homelessness	Number of admissions	% of total admissions
Injury, poisoning and certain other consequences of external causes	All	7,064	17.2
Injury, poisoning and certain other consequences of external causes	Yes	2,809	21.4
Injury, poisoning and certain other consequences of external causes	No	4,255	15.3
Mental and behavioural disorders	All	6,251	15.3

<sup>15</sup> Digital Health and Care Wales, “NHS Wales Data Dictionary,” 10 December 2024.

<b>First primary diagnosis chapter</b>	<b>Experience of homelessness</b>	<b>Number of admissions</b>	<b>% of total admissions</b>
Mental and behavioural disorders	Yes	2,463	18.5
Mental and behavioural disorders	No	3,828	13.8
Symptoms, signs and abnormal clinical and laboratory finding, not elsewhere classified	All	5,519	13.5
Symptoms, signs and abnormal clinical and laboratory finding, not elsewhere classified	Yes	1,372	10.4
Symptoms, signs and abnormal clinical and laboratory finding, not elsewhere classified	No	4,147	14.9

Amongst emergency admissions to hospital, the most frequent first primary diagnoses were 'injury, poisoning and certain other consequences of external causes', 'mental and behavioural disorders' and 'symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified'. The proportion of admissions for 'injury, poisoning and certain other consequences of external causes' and 'mental and behavioural disorders' were higher for people with experience of homelessness (table 5).



**Table 5: Most frequent first primary diagnoses for patients admitted as an emergency**

<b>First primary diagnosis chapter</b>	<b>Experience of homelessness</b>	<b>Number of admissions</b>	<b>% of total admissions</b>
Injury, poisoning and certain other consequences of external causes	All	6,683	24.3
Injury, poisoning and certain other consequences of external causes	Yes	2,659	27.0
Injury, poisoning and certain other consequences of external causes	No	4,024	22.8
Mental and behavioural disorders	All	5,963	21.7
Mental and behavioural disorders	Yes	2,316	23.5
Mental and behavioural disorders	No	3,647	20.7
Symptoms, signs and abnormal clinical and laboratory finding, not elsewhere classified	All	3,989	14.5
Symptoms, signs and abnormal clinical and laboratory finding, not elsewhere classified	Yes	1,255	12.7
Symptoms, signs and abnormal clinical and laboratory finding, not elsewhere classified	No	2,734	15.5

### Statistical modelling

Within the cohort, several demographic characteristics were significantly associated with an increase in the odds ratio of an emergency admission in comparison with a non-emergency admission (table 6). There were no statistically significant effects for the interaction between experience of homelessness and problem substance type.

**Table 6: Cohort characteristics associated with an increase in the odds ratio of an emergency admission**

<b>Characteristic</b>	<b>Increase in the odds ratio of an emergency admission (%)</b>
Experience of homelessness: yes	117
Problem substance: opioids	136
Problem substance: other drugs	77
Problem substance: stimulants	72
Problem substance: alcohol	42
Experience of homelessness: yes * sex: male	59

Experience of homelessness was significantly associated with an increase in the odds ratio of an emergency admission with certain first primary diagnoses (table 7). These include the two most frequent first primary diagnoses for emergency admissions: injury, poisoning and certain other consequences of external causes, and mental and behavioural disorders. Experience of homelessness was not associated with a statistically significant increase in the odds ratio of an emergency admission with any other diagnosis chapter as the first primary diagnosis.

**Table 7: Odds ratio of emergency admission by diagnoses associated with experience of homelessness**

<b>First primary diagnosis chapter</b>	<b>Increase in the odds ratio of an emergency admission (%)</b>
Diseases of the skin and subcutaneous tissue	116
Injury, poisoning and certain other consequences of external causes	49
Mental and behavioural disorders	13

Examining more granular data on diagnoses related to drug use, people with experience of homelessness had a 112% increase in the odds ratio of an emergency admission with ‘poisoning by narcotics and psychodysleptics’ as the first primary diagnosis when compared with no experience of homelessness. Experience of homelessness was not associated with an increase in the odds ratio of an emergency admission with ‘Toxic effects of stimulants’ as the first primary diagnosis.

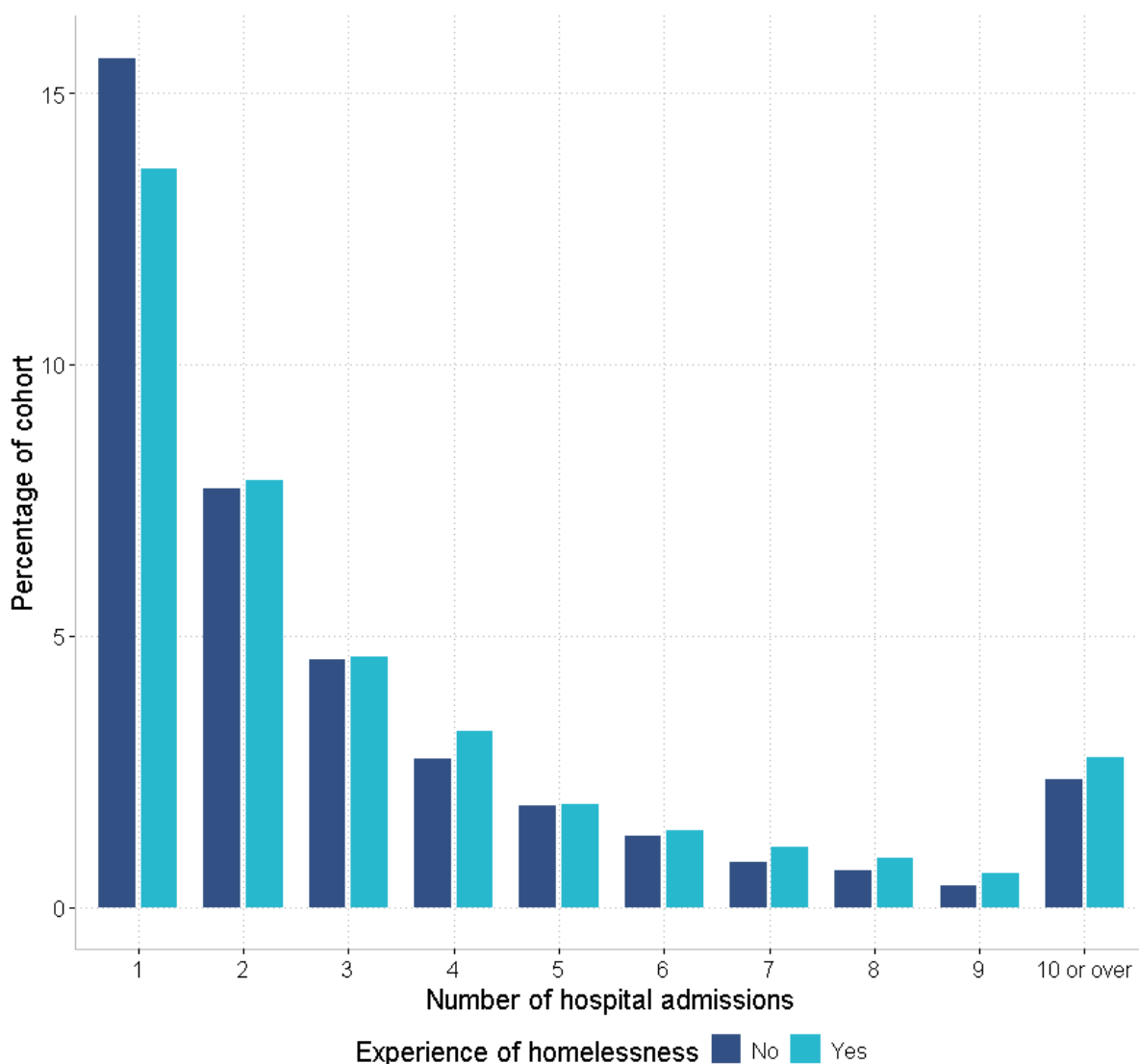
Model summary tables are shown in appendices 2.2 and 2.3.

## Frequency of hospital admissions

### Descriptive statistics

Amongst the individuals in the cohort, 38% (n = 4,886) were admitted to a hospital in Wales at least once. For people with experience of homelessness, although the proportion admitted to hospital was the same as the overall cohort, a higher proportion of individuals were admitted 10 or more times (figure 3).

**Figure 3** Number of hospital admissions per individual during the study period, stratified by experience of homelessness



### Statistical modelling

People with experience of homelessness had a 44% increased expected number of hospital admissions compared with those with no experience of homelessness recorded.

People with experience of homelessness who had cannabinoids recorded as a problem substance had a 35% increased expected number of hospital admissions compared with those who had no experience of homelessness recorded and who did not have cannabinoids recorded as a problem substance.

The interaction between any other substance type and experience of homelessness was not significantly associated with an increased expected number of hospital admissions during the study period. This was also consistent with the interaction between age, sex, or ethnicity with experience of homelessness.

Model summary tables are shown in appendix 2.4.

### **Length of hospital admissions**

#### Descriptive statistics

The majority (58%,  $n = 25,612$ ) of admissions within the cohort during the study period were for 1 day or less. Admission length was slightly longer for those with experience of homelessness.

#### Statistical modelling

Those who were recorded as having had experience of homelessness during substance misuse treatment had a hazard ratio of 0.49 ( $p < 0.001$ ). This indicates that the likelihood of being discharged from hospital at any given time is 51% lower for individuals with experience of homelessness than for individuals without experience of homelessness. This translates to longer hospital stays for individuals with experience of homelessness.

The interaction between problem substance type and experience of homelessness did not have a significant effect on the duration of hospital admissions.

Model summary tables are shown in appendix 2.5.

## **Discussion**

### **Principal findings**

Results showed that co-occurring homelessness and substance misuse was associated with an increase in health inequalities and poorer outcomes in terms of both physical and mental health.

Amongst those in substance misuse treatment, experience of homelessness was associated with a 157% increase in the expected number of ED attendances per individual during the study period.

Investigating the relationship between co-occurring homelessness and substance misuse and hospital admissions, we found that experience of homelessness was associated with a 44% increase in the expected number of hospital admissions of any type.

Experience of homelessness was also associated with a higher rate of emergency admissions, with the likelihood of being admitted to hospital as an emergency 117% higher than for those without experience of homelessness. Considering reasons for those emergency admissions, experience of homelessness was associated with an increase in the likelihood of an initial diagnosis of 'diseases of the skin and subcutaneous tissue' (116%), 'injury, poisoning and certain other consequences of external causes' (49%) or 'mental and behavioural disorders' (13%).

Investigating the relationship between co-occurring homelessness and substance misuse and the length of hospital admissions, experience of homelessness was associated with longer hospital stays. People who experienced homelessness were 51% less likely to be discharged from the hospital at any given time compared to those who hadn't experienced homelessness.

The results from this study are consistent with previous work.

A study in England<sup>16</sup> found that 1 in 10 patients attending the emergency department are frequent attendees and account for over a quarter of attendances. Individuals with co-occurring homelessness and substance misuse had higher expected number of hospital attendances and were more likely to be frequent attendees. The study also found that the likelihood of hospital admission rose steeply with the number of attendances a patient had.

The increased usage of secondary healthcare services from those with co-occurring homelessness and substance misuse may be indicative of an increased prevalence of health conditions, poor management of those health conditions, and difficulties accessing primary healthcare services. Previous studies also confirmed that homeless individuals may have additional challenges in accessing primary healthcare<sup>17</sup> which can lead to increased usage of secondary healthcare, especially emergency departments. Although the cohort in this analysis were not necessarily homeless at the time of the emergency department attendance, ongoing housing insecurity may have contributed to difficulties registering with a GP practice in order to access primary healthcare.

Increased and prolonged usage of secondary healthcare can lead to a number of negative effects on the individual. Frequent emergency department attendances and hospital admissions can lead to increased stress and anxiety for individuals, as they may feel

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<sup>16</sup> Greenfield, G. et al., 2020. Frequent attendances at emergency departments in England. *Emergency Medicine Journal*, Volume 37, pp. 597-599.

<sup>17</sup> Burrige, S., 2017. Three forms of identification and a letter from God. *BMJ*, 359(8127).

uncertain about their health and the care that they will receive<sup>18</sup>. There is also a risk of individuals becoming dependent on emergency services for their healthcare needs, which can prevent them from seeking more appropriate and continuous care<sup>19</sup>. Over time, this can lead to poorer health outcomes and a lower quality of life, as the underlying health issues may not be properly addressed<sup>20</sup>. Studies show that longer lengths of stay in hospitals are related to poorer patient outcomes, including higher risks of complications and infections<sup>21</sup>.

Increased usage of secondary healthcare places a financial burden on health services. The costs associated with emergency department attendances and hospital admissions vary, which makes this financial burden difficult to quantify. However, this analysis shows that co-occurring homelessness and substance misuse is associated with a 157% increase in the expected number of emergency department attendances and a 117% increase in the likelihood of an emergency admission to hospital, which translates to a significant financial cost to health services. Co-occurring homelessness and substance misuse is also associated with longer hospital admissions, leading to a reduction in available beds for other patients.

Taken together these results suggest the importance of early intervention which considers the variety of adverse experiences of the individual. Early interventions might include Housing First programs which provide stable housing without preconditions, integrated care models which combine healthcare, mental health and substance misuse services in one setting, and mobile outreach teams which provide medical care, mental health support and substance misuse treatment to individuals in their communities. This study also provides a better understanding of the relationship between co-occurring homelessness and substance misuse and the frequency and duration of secondary healthcare usage, in addition to reason for attendance that could help health services to improve their support for those individuals.

### **Strengths and limitations**

Data linkage in SAIL enabled the creation of a nationwide e-cohort of 32,657 individuals linked to 79,098 emergency department attendances and 44,242 hospital admissions. The thorough recording of housing problems in the substance misuse treatment data enabled analysis of homelessness when data for homelessness in the general population was

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<sup>18</sup> Zaboli, A. et al., 2024. Emergency Departments in Contemporary Healthcare: Are They Still for Emergencies? An Analysis of over 1 Million Attendances. *Healthcare*, 12(23).

<sup>19</sup> S. Sousa, T. Hilder, C. Burdess and P. Bolton, "2.5 years on: what are the effects of a 'frequent attenders' service in the Emergency Department?," *BJPsych Bulletin*, vol. 43, no. 3, pp. 112-116, 2019.

<sup>20</sup> McHale, P. et al., 2013. Who uses emergency departments inappropriately and when - a national cross-sectional study using a monitoring data system. *BMC Medicine*, 11(258).

<sup>21</sup> Rotter, T. et al., 2010. Clinical pathways: effects on professional practice, patient outcomes, length of stay and hospital costs. *Cochrane Database of Systematic reviews*, Issue 3.

unavailable. The large sample size allowed for data stratification that it is not often possible due to the risk of data disclosure.

This analysis was carried out using data from substance misuse treatment programmes in Wales, rather than the general population. As a result, it can only identify the differences between individuals with substance misuse and individuals with co-occurring homelessness and substance misuse. Substance misuse is associated with poorer health outcomes, therefore comparison of individuals with co-occurring homelessness and substance misuse with the general population is likely to have produced different results.

This analysis identifies associations between co-occurring homelessness and substance misuse and increased usage of secondary healthcare services. The observational nature of the data limits the ability to infer direct causal relationships, therefore it is important to note that these associations do not imply causation.

## **Conclusions**

Homelessness and substance misuse are both individually associated with poor physical and mental health. This study thoroughly investigated the effect on health outcomes of co-occurring experience of homelessness and substance misuse and showed an association with increased usage of secondary healthcare when compared with substance misuse alone. This included an increase in the number of emergency department attendances, an increase in the number of hospital admissions, an increase in the likelihood of an emergency hospital admission and an increase in the duration of hospital admissions. Co-occurring homelessness and substance misuse was also associated with an increase in emergency admissions for skin diseases, injury or poisoning, and mental and behavioural diseases when compared with substance misuse alone.

By addressing the reasons for emergency department attendances and hospital admissions, this study also contributed to further reduce the health disparities experienced by people with co-occurring experience of homelessness and substance misuse. Additionally, these findings could help to mitigate against the financial burden on health services linked to increased usage of secondary healthcare.

This study valuably contributes to address Welsh Government priorities, providing policy with evidence-based results that could be used to support people with co-occurring experience of homelessness and substance misuse and the healthcare settings involved in their care. Increased usage of secondary healthcare may be linked to an increased prevalence of health conditions, poor management of those health conditions, and difficulties accessing primary healthcare services. Future work could further explore the reasons behind this increased use of secondary health care services in this population.

## Reference section

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## Appendices

### Appendix 1: Problem substance types

<b>Problem Substance</b>	<b>Problem Substance Type</b>
Alcohol	Alcohol
Amphetamines	Stimulants
Benzodiazepines	Other Drugs
Cannabis	Cannabinoids
Cocaine	Stimulants
Crack Cocaine	Stimulants
Ecstasy	Stimulants
Hallucinogens	Other Drugs
Heroin	Opioids
Mephedrone	Stimulants
Methadone	Opioids
Other Drugs	Other Drugs
Other Opiates	Opioids
Prescribed Drugs	Other Drugs
Solvents	Other Drugs
Steroids	Other Drugs
Unknown	Unknown Substance
Invalid	Unknown Substance

## Appendix 2: Model summary tables

### 2.1 Emergency department attendance frequency

#### 2.1.1 Count model

Characteristic	Exp (Beta)	95% CI	p-value
Experience of homelessness	2.57	2.38, 2.77	<0.001
Problem substance: opioids	0.93	0.82, 1.04	0.2
Problem substance: stimulants	0.91	0.80, 1.03	0.14
Problem substance: cannabinoids	0.83	0.74, 0.93	0.001
Problem substance: other drugs	1.61	1.30, 1.99	<0.001
Problem substance: alcohol	1.37	1.26, 1.49	<0.001
Experience of homelessness * opioids	1.14	0.95, 1.37	0.2
Experience of homelessness * stimulants	0.81	0.66, 1.01	0.058
Experience of homelessness * cannabinoids	1.23	0.99, 1.53	0.058
Experience of homelessness * other drugs	0.64	0.48, 0.85	0.002
Experience of homelessness * alcohol	1.28	1.10, 1.49	0.002
Age group: 18 to 24	1.24	1.01, 1.51	0.038
Age group: 25 to 34	0.72	0.62, 0.90	0.002
Age group: 35 to 44	0.75	0.60, 0.86	0.001
Age group: 45 to 54	0.77	0.62, 0.90	0.002
Age group: 55 to 64	0.57	0.64, 0.93	0.006
Age group: 65 and older	0.76	0.46, 0.70	<0.001
Experience of homelessness * age group: 18 to 24	0.84	0.58, 1.23	0.4
Experience of homelessness * age group: 25 to 34	1.39	0.98, 1.96	0.062
Experience of homelessness * age group: 35 to 44	1.21	0.85, 1.72	0.3
Experience of homelessness * age group: 45 to 54	0.96	0.66, 1.39	0.8
Experience of homelessness * age group: 55 to 64	1.93	1.20, 3.12	0.007
Experience of homelessness * age group: 65 and older	1.00	0.46, 2.17	>0.9
Sex: male	1.30	1.20, 1.41	<0.001
Experience of homelessness * sex: male	1.20	1.01, 1.42	0.035
Ethnicity: other	0.96	0.70, 1.32	0.8
Ethnicity: unknown	0.78	0.69, 0.89	<0.001
Experience of homelessness * ethnicity: other	0.98	0.59, 1.64	>0.9
Experience of homelessness * ethnicity: unknown	1.11	0.86, 1.43	0.4

### 2.1.2 Zero model

<b>Characteristic</b>	<b>Exp (Beta)</b>	<b>95% CI</b>	<b>p-value</b>
Experience of homelessness	1.04	0.99, 1.09	0.10
Problem substance: opioids	0.54	0.50, 0.58	<0.001
Problem substance: stimulants	1.26	1.15, 1.37	<0.001
Problem substance: cannabinoids	1.30	1.21, 1.41	<0.001
Problem substance: other drugs	0.96	0.84, 1.09	0.5
Problem substance: alcohol	1.27	1.20, 1.34	<0.001
Experience of homelessness * opioids	1.06	0.95, 1.19	0.3
Experience of homelessness * stimulants	0.93	0.80, 1.06	0.3
Experience of homelessness * cannabinoids	1.21	1.05, 1.40	0.010
Experience of homelessness * other drugs	1.18	0.99, 1.41	0.066
Experience of homelessness * alcohol	1.09	0.99, 1.20	0.080
Age group: 18 to 24	1.01	0.86, 1.18	>0.9
Age group: 25 to 34	0.61	0.53, 0.70	<0.001
Age group: 35 to 44	0.45	0.39, 0.52	<0.001
Age group: 45 to 54	0.46	0.40, 0.53	<0.001
Age group: 55 to 64	0.52	0.44, 0.60	<0.001
Age group: 65 and older	0.74	0.62, 0.90	0.002
Experience of homelessness * age group: 18 to 24	0.68	0.50, 0.91	0.009
Experience of homelessness * age group: 25 to 34	0.71	0.54, 0.92	0.011
Experience of homelessness * age group: 35 to 44	0.66	0.51, 0.86	0.002
Experience of homelessness * age group: 45 to 54	0.62	0.47, 0.81	<0.001
Experience of homelessness * age group: 55 to 64	0.59	0.43, 0.83	0.002
Experience of homelessness * age group: 65 and older	0.57	0.33, 0.98	0.041
Sex: male	1.14	1.08, 1.20	<0.001
Experience of homelessness * sex: male	0.87	0.79, 0.97	0.009
Ethnicity: other	1.10	0.88, 1.37	0.4
Ethnicity: unknown	1.17	1.07, 1.28	<0.001
Experience of homelessness * ethnicity: other	1.31	1.93, 1.85	0.13
Experience of homelessness * ethnicity: unknown	1.62	1.35, 1.95	<0.001

## 2.2 Emergency admissions

<b>Characteristic</b>	<b>OR</b>	<b>95% CI</b>	<b>p-value</b>
Experience of homelessness	2.17	1.95, 2.42	<0.001
Problem substance: opioids	1.44	1.19, 1.74	<0.001
Problem substance: stimulants	1.39	1.13, 1.72	0.002
Problem substance: cannabinoids	0.80	0.66, 0.97	0.023
Problem substance: other drugs	1.42	1.03, 1.96	0.033
Problem substance: alcohol	0.96	0.83, 1.09	0.5
Experience of homelessness * opioids	1.30	0.99, 1.70	0.060
Experience of homelessness * stimulants	0.91	0.65, 1.27	0.6
Experience of homelessness * cannabinoids	0.92	0.66, 1.29	0.6
Experience of homelessness * other drugs	1.44	0.93, 2.23	1.10
Experience of homelessness * alcohol	0.81	0.65, 1.02	0.075
Age group: 18 to 24	1.12	0.79, 1.59	0.5
Age group: 25 to 34	0.95	0.69, 1.31	0.8
Age group: 35 to 44	1.21	0.88, 1.66	0.2
Age group: 45 to 54	0.86	0.63, 1.19	0.4
Age group: 55 to 64	0.59	0.42, 0.82	0.002
Age group: 65 and older	0.83	0.58, 1.21	0.3
Experience of homelessness * age group: 18 to 24	0.94	0.53, 1.68	0.8
Experience of homelessness * age group: 25 to 34	1.47	0.87, 2.49	0.15
Experience of homelessness * age group: 35 to 44	1.13	0.67, 1.92	0.6
Experience of homelessness * age group: 45 to 54	1.00	0.58, 1.73	>0.9
Experience of homelessness * age group: 55 to 64	1.88	0.98, 3.58	0.057
Experience of homelessness * age group: 65 and older	1.00	0.40, 2.49	>0.9
Sex: male	1.86	1.65, 2.09	<0.001
Experience of homelessness * sex: male	1.59	1.27, 1.98	<0.001
Ethnicity: other	1.05	0.64, 1.73	0.8
Ethnicity: unknown	0.70	0.58, 0.84	<0.001
Experience of homelessness * ethnicity: other	1.43	0.64, 3.16	0.4
Experience of homelessness * ethnicity: unknown	0.76	0.53, 1.08	0.13

### 2.3 Reasons for emergency admissions

<b>First primary diagnosis (ICD-10 chapter)</b>	<b>OR</b>	<b>95% CI</b>	<b>p-value</b>
Diseases of the skin and subcutaneous tissue	2.17	1.33, 3.52	0.002
Factors influencing health status and contact with health services	1.64	0.70, 3.86	0.3
Injury poisoning and certain other consequences of external causes	1.49	1.34, 1.65	< 0.001
Diseases of the eye and adnexa	1.28	0.14, 12.1	0.8
Mental and behavioural disorders	1.13	1.13, 1.13	< 0.001
Pregnancy childbirth and the puerperium	1.05	0.36, 3.05	> 0.9
Diseases of the musculoskeletal system and connective tissue	0.96	0.56, 1.63	0.9
Diseases of the respiratory system	0.84	0.56, 1.25	0.4
Diseases of the circulatory system	0.82	0.51, 1.31	0.4
Certain infectious and parasitic diseases	0.82	0.48, 1.42	0.5
Diseases of the nervous system	0.76	0.38, 1.53	0.4
Symptoms signs and abnormal clinical and laboratory findings not elsewhere classified	0.73	0.66, 0.81	< 0.001
Endocrine nutritional and metabolic diseases	0.64	0.31, 1.35	0.2
Diseases of the genitourinary system	0.63	0.36, 1.09	0.1
Diseases of the blood and blood forming organs and certain disorders involving the immune mechanism	0.55	0.13, 2.3	0.4
Diseases of the digestive system	0.54	0.40, 0.71	< 0.001
Diseases of the ear and mastoid process	0.50	0.02, 13.9	0.7
Neoplasms	0.43	0.07, 2.54	0.4

## 2.4 Hospital admissions frequency

### 2.4.1 Count model

<b>Characteristic</b>	<b>Exp (Beta)</b>	<b>95% CI</b>	<b>p-value</b>
Experience of homelessness	1.45	1.34, 1.58	<0.001
Problem substance: opioids	0.82	0.72, 0.94	0.005
Problem substance: stimulants	0.69	0.59, 0.81	<0.001
Problem substance: cannabinoids	0.72	0.63, 0.83	<0.001
Problem substance: other drugs	1.10	0.87, 1.41	0.4
Problem substance: alcohol	1.48	1.34, 1.64	<0.001
Experience of homelessness * opioids	1.20	0.98, 1.47	0.071
Experience of homelessness * stimulants	0.97	0.76, 1.24	0.8
Experience of homelessness * cannabinoids	1.35	1.04, 1.75	0.022
Experience of homelessness * other drugs	0.68	0.49, 0.94	0.021
Experience of homelessness * alcohol	0.91	0.76, 1.08	0.3
Age group: 18 to 24	1.13	0.87, 1.46	0.4
Age group: 25 to 34	0.94	0.74, 1.19	0.6
Age group: 35 to 44	1.10	0.87, 1.40	0.4
Age group: 45 to 54	1.30	1.03, 1.65	0.027
Age group: 55 to 64	1.38	1.08, 1.77	0.011
Age group: 65 and older	1.70	1.27, 2.27	<0.001
Experience of homelessness * age group: 18 to 24	1.00	0.64, 1.55	>0.9
Experience of homelessness * age group: 25 to 34	1.01	0.68, 1.51	>0.9
Experience of homelessness * age group: 35 to 44	0.79	0.53, 1.18	0.3
Experience of homelessness * age group: 45 to 54	0.71	0.47, 1.08	0.11
Experience of homelessness * age group: 55 to 64	0.68	0.41, 1.12	0.13
Experience of homelessness * age group: 65 and older	0.58	0.28, 1.20	0.14
Sex: male	0.70	0.64, 0.77	<0.001
Experience of homelessness * sex: male	1.01	0.85, 1.20	>0.9
Ethnicity: other	0.85	0.60, 1.21	0.4
Ethnicity: unknown	0.95	0.82, 1.09	0.5
Experience of homelessness * ethnicity: other	1.13	0.64, 2.02	0.7
Experience of homelessness * ethnicity: unknown	1.24	0.94, 1.64	0.13

#### 2.4.2 Zero model

<b>Characteristic</b>	<b>Exp (Beta)</b>	<b>95% CI</b>	<b>p-value</b>
Experience of homelessness	1.00	0.95, 1.05	0.9
Problem substance: opioids	0.53	0.49, 0.58	<0.001
Problem substance: stimulants	0.83	0.75, 0.91	<0.001
Problem substance: cannabinoids	0.75	0.69, 0.81	<0.001
Problem substance: other drugs	0.87	0.76, 1.00	0.045
Problem substance: alcohol	1.88	1.77, 1.99	<0.001
Experience of homelessness * opioids	1.14	1.01, 1.28	0.028
Experience of homelessness * stimulants	1.21	1.05, 1.40	0.009
Experience of homelessness * cannabinoids	1.35	1.16, 1.57	<0.001
Experience of homelessness * other drugs	1.09	0.91, 1.31	0.4
Experience of homelessness * alcohol	0.90	0.81, 0.99	0.038
Age group: 18 to 24	1.10	0.94, 1.28	0.2
Age group: 25 to 34	0.91	0.79, 1.04	0.2
Age group: 35 to 44	0.86	0.75, 0.99	0.040
Age group: 45 to 54	1.15	1.00, 1.33	0.046
Age group: 55 to 64	1.69	1.45, 1.97	<0.001
Age group: 65 and older	2.57	2.13, 3.10	<0.001
Experience of homelessness * age group: 18 to 24	0.70	0.53, 0.92	0.010
Experience of homelessness * age group: 25 to 34	0.68	0.53, 0.87	0.002
Experience of homelessness * age group: 35 to 44	0.59	0.46, 0.76	<0.001
Experience of homelessness * age group: 45 to 54	0.49	0.38, 0.64	<0.001
Experience of homelessness * age group: 55 to 64	0.52	0.38, 0.71	<0.001
Experience of homelessness * age group: 65 and older	0.78	0.45, 1.36	0.4
Sex: male	0.66	0.62, 0.69	<0.001
Experience of homelessness * sex: male	1.04	0.94, 1.16	0.4
Ethnicity: other	1.12	0.89, 1.40	0.3
Ethnicity: unknown	1.17	1.07, 1.28	<0.001
Experience of homelessness * ethnicity: other	1.04	0.73, 1.48	0.8
Experience of homelessness * ethnicity: unknown	1.44	1.21, 1.72	<0.001



## 2.5 Hospital admissions length

<b>Characteristic</b>	<b>HR</b>	<b>95% CI</b>	<b>p-value</b>
Experience of homelessness	0.48	0.38, 0.61	<0.001
Problem substance: opioids	0.72	0.49, 1.06	0.10
Problem substance: stimulants	1.10	0.99, 1.22	0.081
Problem substance: cannabinoids	0.24	0.11, 0.54	<0.001
Problem substance: other drugs	0.58	0.25, 1.36	0.2
Problem substance: alcohol	2.63	1.81, 3.83	<0.001
Experience of homelessness * opioids	1.16	0.62, 2.16	0.6
Experience of homelessness * stimulants	0.88	0.77, 1.01	0.072
Experience of homelessness * cannabinoids	1.28	0.25, 6.58	0.8
Experience of homelessness * other drugs	1.72	0.54, 5.45	0.4
Experience of homelessness * alcohol	0.76	0.40, 1.42	0.4