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Health and Homelessness in Scotland

PEOPLE, COMMUNITIES AND PLACES

social research

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Executive Summary

Whilst health inequalities across Scotland are well evidenced, this study links homelessness and health datasets for the first time at a national level, to explore the relationship between homelessness and health in Scotland.

Study design

This study considered 435,853 people who had been in households assessed as homeless or threatened with homelessness between June 2001 and November 2016. These households had been assessed by Scottish Local Authorities under section 28 of the Housing (Scotland) Act 1987. These people formed the Ever Homeless Cohort (EHC).

Each person in the EHC was matched on age and sex to a non-homeless individual from the 20% least deprived areas of Scotland, and a non-homeless individual from the 20% most deprived areas of Scotland. This formed two control cohorts - the Least Deprived Cohort (LDC) and the Most Deprived Cohort (MDC). Each cohort had the same number of people and the same age–sex distribution. In total, the study contained over 1.3 million people.

Key findings

- At least 8% of the Scottish population (as at 30 June 2015) had experienced homelessness at some point in their lives.
- Of those who had experienced homelessness at some point:
    - over half (51%) had no evidence of health conditions relating to drugs, alcohol or mental health. This was much lower than in the control groups (MDC 74%, LDC 86%).
    - Around 30% had evidence of a mental health problem at some point during the study period (with no evidence of drug or alcohol-related conditions at any point). This was higher than in the control groups (MDC 21%, LDC 13%).
    - There was evidence of drug and/or alcohol-related interactions for the remaining fifth of people (19%), higher than in the control groups (MDC 5.1%, LDC 1.2%). Of these, the vast majority (94%) also had evidence of mental health issues.
    - In particular, around 6% of people experiencing homelessness had evidence of all three of the following conditions – a mental health condition, a drug-related condition and an alcohol-related condition – although not necessarily at the same time. This was much higher than in the control groups (MDC 1%, LDC 0.2%). The figure was markedly higher for those experiencing repeat homelessness (11.4%).
- Increased interactions with health services preceded people becoming homeless.
- A peak in interactions with health services was seen around the time of the first homelessness assessment.

The study contained six health datasets from NHS National Service Scotland covering Accident and Emergency attendances (A&E2), Inpatient admissions (SMR01), Outpatient appointments (SMR00), Prescriptions (PIS), the Scottish Drugs Misuse Database (SDMD) and Mental Health admissions (SMR04), together with information about deaths from National Records of Scotland.

There was a particular focus on mental-health, drug-related health conditions and alcohol-related health conditions. Comparisons of interactions with health services (hereafter referred to as "health activity") between these cohorts were made by looking at the number of times people appeared in these various datasets.

Findings

Homelessness affects a sizable minority of people in Scotland (at least 8% of the population as at 30 June 2015 had experienced homelessness at some point in their lives). This is an under-estimate as the homeless assessments in the study only covered around three quarters of all Scottish homelessness assessments for the study period.

Of the EHC people, 29% of males and 26% of females had been in households assessed as homeless **on multiple occasions** during the study period. Following their first homelessness assessment, people included in the EHC cumulatively spent 9.7% of their time for males (9.2% for females) in open homelessness cases, before local authorities had discharged their duties under the homelessness legislation.

The EHC people tended to be younger than the Scottish population. The proportion of people in the EHC at around 20–30 years was higher for females than for males.

Health Service Activity

- The Ever Homeless Cohort (EHC) accounted for 1.16 million (or 55%) of **Accident and Emergency Attendances**, out of a study total of 2.12 million. The EHC rate of attendances was almost twice (i.e. 1.9) as high as the Most Deprived Cohort (MDC) and three and a half (i.e. 3.5) times higher than the Least Deprived Cohort (LDC).
- Similarly, the EHC accounted for 1.19 million (or 52%) of **Acute Hospital Admissions**, out of a study total of 2.27 million. The EHC rate was 1.7 times greater than the MDC and 3.1 greater than the LDC.
- There were 9.01 million **Outpatient Appointments** over the study period with 4.40 million (or 49%) by people in the EHC. The rate was 1.6 and 2.3 times higher than the MDC and LDC cohorts respectively.
- The EHC accounted for 6.23 million (or 66%) of the 9.49 million **Dispensed Prescriptions**, with a rate 2.5 times higher than the MDC and 8.2 higher than the LDC. The differences in rates was much more pronounced for Alcohol related (3.9 and 23.5 times higher respectively) and Opioid related (6.4 and 169 times higher respectively) prescriptions.
- There were around 100,000 **Admissions to Mental Health Specialities** over the study period, with 80,000 (80%) by people in the EHC. The rate was 4.9 times greater than the MDC and 20.5 times greater than the LDC.

- The EHC accounted for 80,761 (90%) of **Initial Assessments at Drug Treatment Services** over the study period, which was 10 times higher than the MDC and 132 times higher than the LDC.

Interactions with Health Services Over Time

The study showed increased interactions with health services preceded people becoming homeless and that a peak in interactions was seen around the time of the first homelessness assessment. Some health service interactions remained at a higher level following the first homelessness assessment, whereas others returned to previous levels. The four charts in this summary (repeated from the charts in Chapter 11) illustrate these findings where health service activity for the Ever Homeless Cohort (EHC) is shown relative to the health service activity of the Least Deprived Cohort (LDC).

- **Figure 11.1a** for males (with a higher scale) shows some activity remains higher after the first homelessness assessment date, particularly for drug-related and alcohol-related acute admissions, and for repeat homeless people - mental health admissions (SMR04) and mental health prescriptions.
- **Figure 11.1b** for males (with a lower scale) shows some activity remains higher after the first homelessness assessment date, particularly for mental health acute admissions (SMR01), mental health prescriptions and A&E attendances by repeat homeless persons.
- **Figure 11.2a** for females (with a higher scale) shows some activity remains higher after the first homelessness assessment date, particularly for drug-related and alcohol-related acute admissions, and for repeat homeless people - mental health admissions (SMR04) and mental health prescriptions.
- **Figure 11.2b** for females (with a lower scale) shows some activity remains higher after this date, particularly for mental health acute admissions (SMR01), mental health prescriptions and A&E attendances by repeat homeless persons.

From these charts, the following observations can be made:

Increased interactions with health services preceded people becoming homeless

It was found that health activity increases in the years prior to the homelessness assessment date for people in the EHC, indicating a relationship. The relationship is most clearly seen for health activity that relates to mental health, drugs and alcohol. These issues are likely to be risk factors for homelessness.

A peak in interactions with health services was seen around the time of the first homelessness assessment.

This suggests a relationship between becoming homeless and health activity. This is particularly (although not exclusively) associated with activity related to drugs, alcohol and mental health. Preventing homelessness could reduce health activity, and improve health outcomes.

Higher levels of interactions with health services followed the first homelessness assessment for people experiencing repeat homelessness.

For those who had been homeless on only one occasion health activity eventually returned to the (albeit higher) pre-homelessness levels. However, for people who were homeless on multiple occasions, levels of health activity remained high. It is not possible to say that health activity following homelessness is the direct consequence of homelessness itself. It could be due to a further crises or health problems such as drug or alcohol related conditions, or a mental health condition.

For males in the EHC, mortality was around a third higher during periods of homelessness than during periods when they were not in open homelessness cases. This difference may be driven by the higher number of drug-related deaths amongst males that had been homeless on multiple occasions.

Health, homelessness, and area-based deprivation

Homeless people are more likely to come from deprived areas, based on their last settled address. The distribution of homeless people across the area-based deprivation spectrum (as measured by the Scottish Index of Multiple Deprivation) closely follows the distribution of income and employment deprived people.

The health activity of people in the EHC was consistently higher than for the non-homeless controls in the 20% most deprived areas (MDC). In turn, this was consistently higher than the non-homeless controls in the 20% least deprived areas (LDC).

Health inequalities are known to exist across Scotland and they are monitored using area-based measures of deprivation. Using health activity as an imperfect proxy for poor health, the study provides evidence that health inequalities are likely to exist between people that have experienced homelessness and those who have not.

Deaths

- Of the 23,718 **Deaths** recorded over the study period, 14,186 (60%) were in the EHC, with a death rate 2.1 times higher than the MDC and 5.3 times higher than in the LDC.

Differences in mortality between the study cohorts varied by cause of death, although for each cause mortality among the EHC was at least as high as for the controls. The differences were highest for drugs, alcohol, intentional self-harm, and assault. This results in the main causes of death among the EHC being: drugs, heart disease & strokes, and, for males, alcohol and, for females, cancer. Differences in mortality due to drug-related conditions between the EHC and the controls were higher for people who have multiple homelessness assessments during the study period.

Overlap of drugs, alcohol or mental health issues

The **majority** of the EHC had **no** evidence of mental-health, drugs or alcohol related issues during the study (51%). This is lower than for both control cohorts (MDC 74%, LDC 86%).

Just under a third of the EHC (30%) had evidence of a mental health issue which excluded drug- or alcohol-related issues. This was higher than in the control groups (MDC 21%, LDC 13%).

There was evidence of drug and/or alcohol-related interactions for the remaining fifth of people (19%) in the EHC. Of these, the vast majority (94%) also had evidence of mental health issues. The proportion of people with all three conditions – mental-health, drugs or alcohol related issues - was higher among the EHC (5.9%) than in the MDC (1.0%) or the LDC (0.2%). This proportion was also much higher among people with multiple homelessness assessments (11.4% compared with 3.8% for once-only homeless). This difference cannot be explained by the younger age profile amongst the repeat homeless cohort, suggesting a relationship between repeat homelessness and drug, alcohol and mental health issues.

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Figure 11.1a: An increase in health activity precedes the first homelessness assessment for **males.** Some activity remains higher after this date, particularly for drug-related and alcohol-related acute admissions, and for repeat homeless people - mental health admissions (SMR04) and mental health prescriptions.

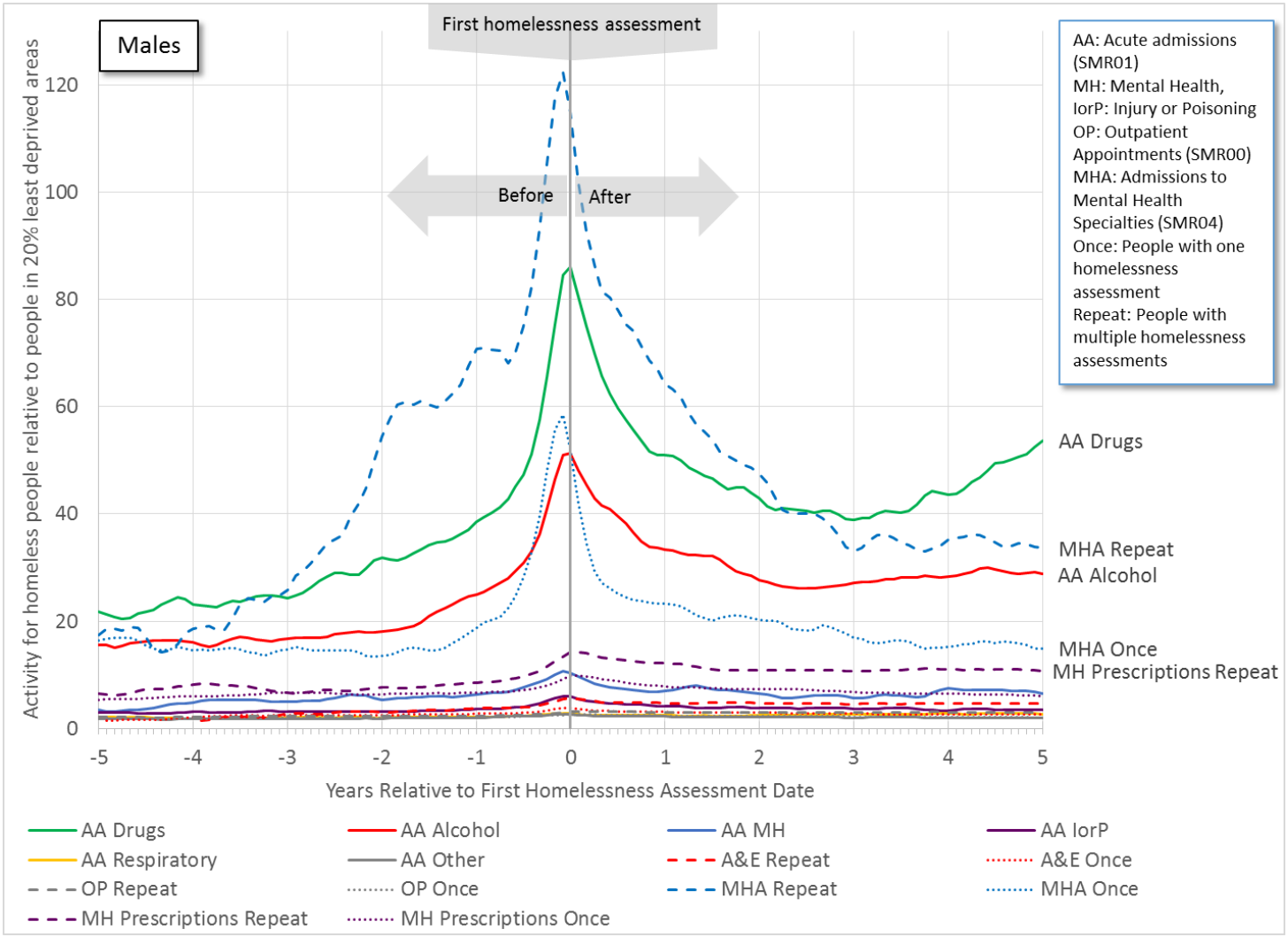


Figure 11.1b: An increase in health activity precedes the first homelessness assessment for **males.** Some activity remains higher after this date, particularly for mental health acute admissions (SMR01), mental health prescriptions and A&E attendances by repeat homeless persons.

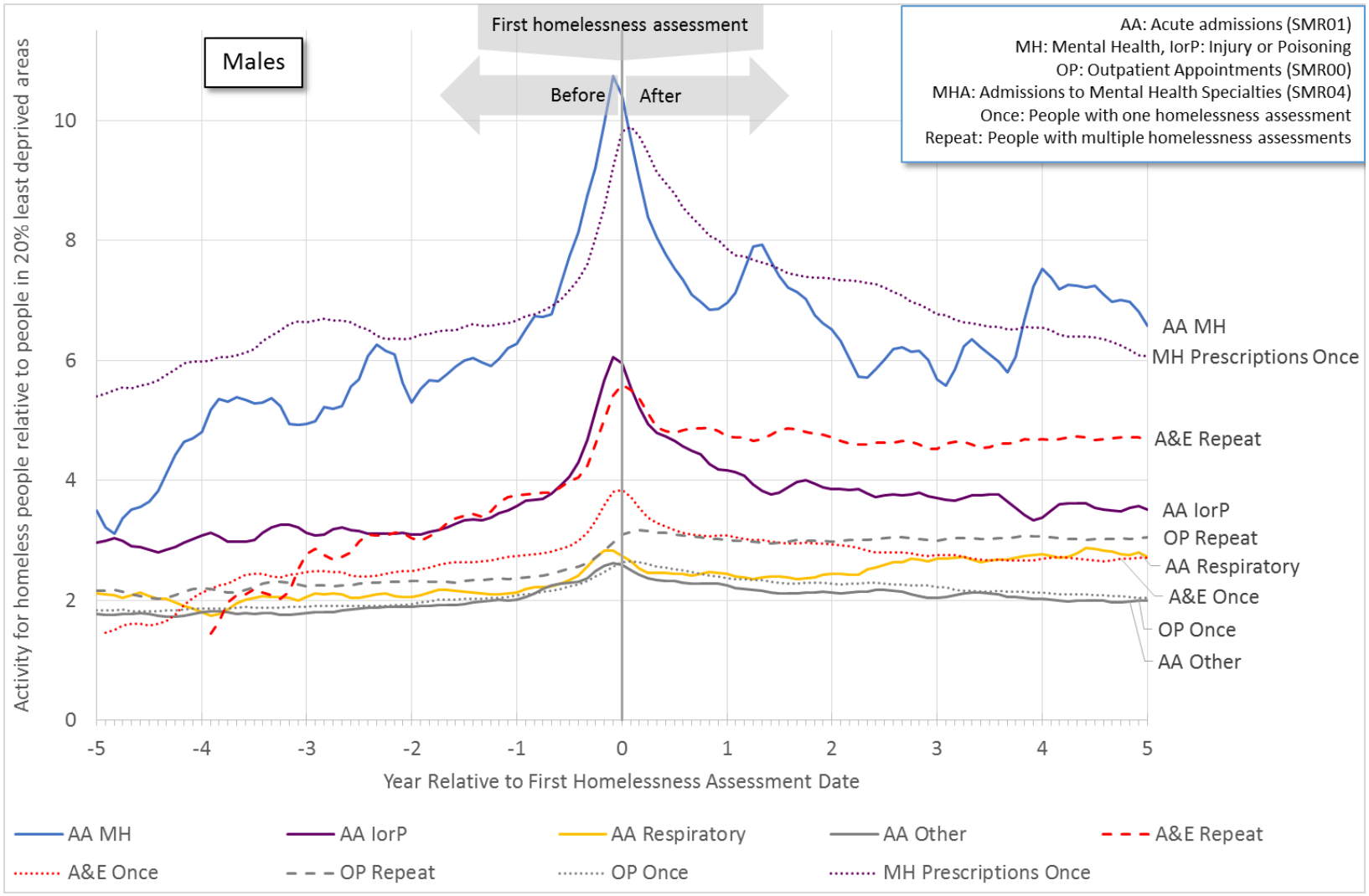


Figure 11.2a: An increase in health activity precedes the first homelessness assessment for **females.** Some activity remains higher after this date, particularly for drug-related and alcohol-related acute admissions, and for repeat homeless people - mental health admissions (SMR04) and mental health prescriptions.

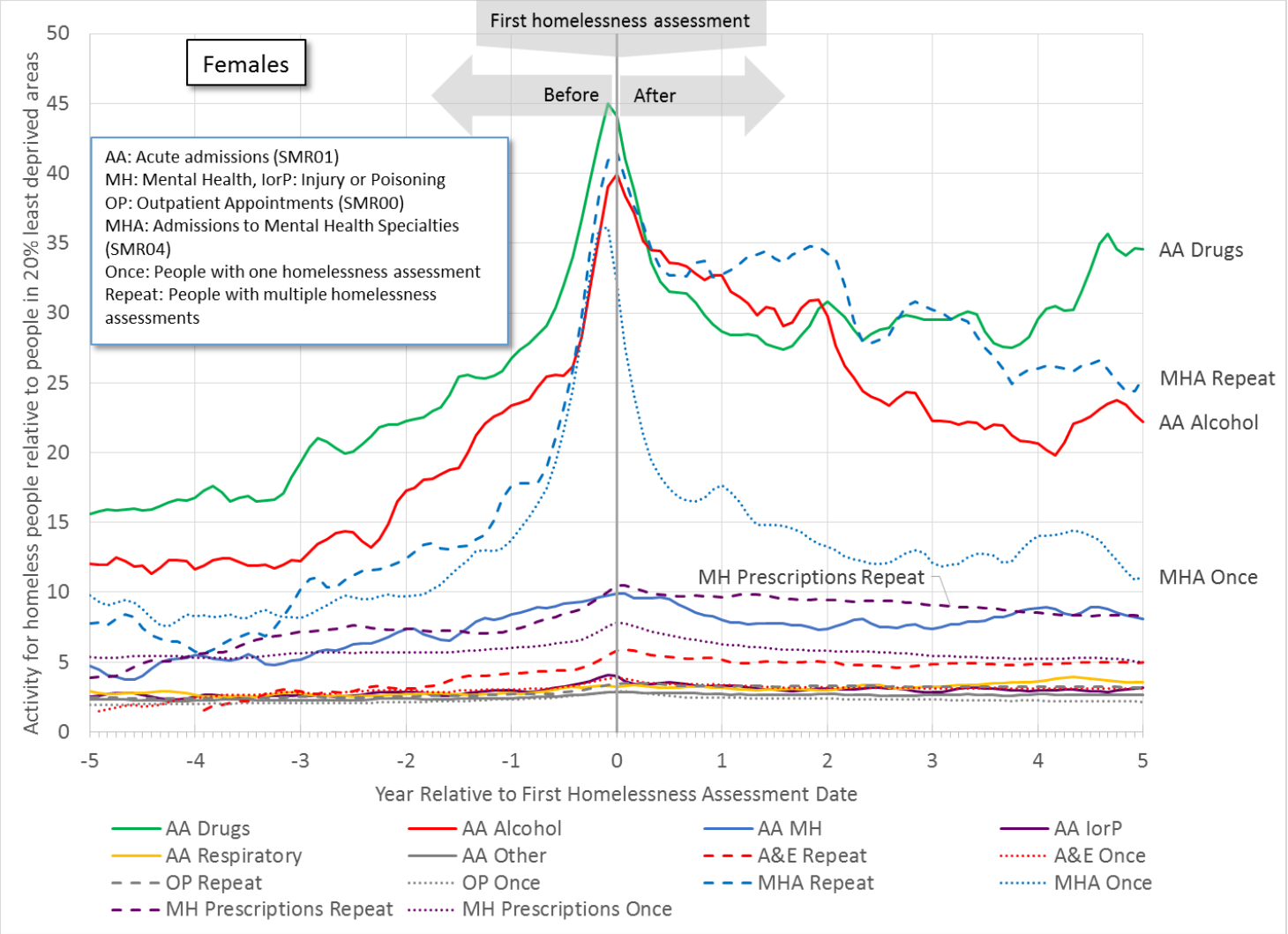
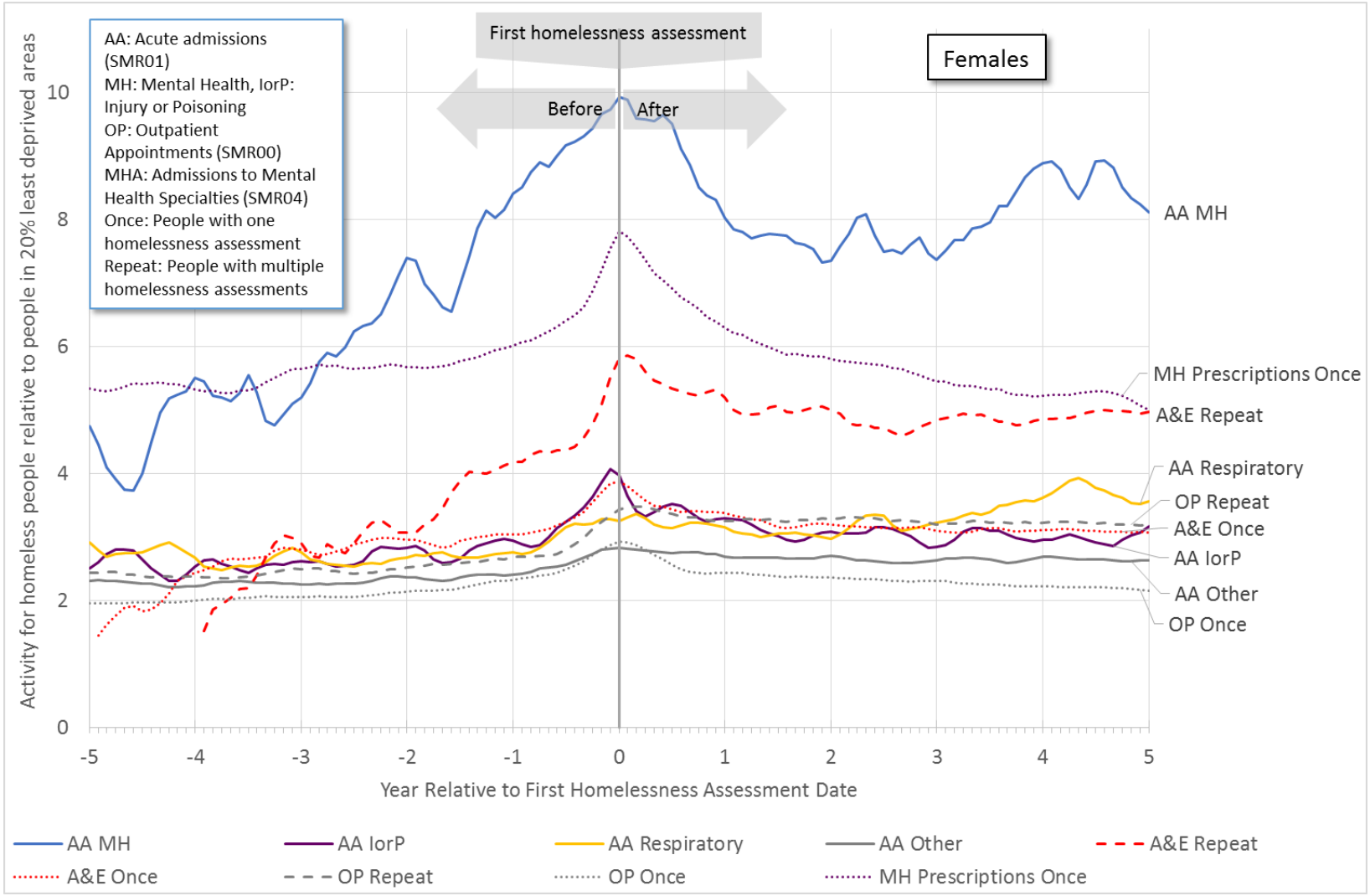


Figure 11.2b: An increase in health activity precedes the first homelessness assessment for **females.** Some activity remains higher after this date, particularly for mental health acute admissions (SMR01), mental health prescriptions and A&E attendances by repeat homeless persons.



Contents

Chapter 1: Introduction

Building upon analysis undertaken in the United States of America[1] and by Fife Council and NHS Fife in 2015[2], this reports links health and homelessness data for the first time at a national level in Scotland. This research combines Scottish Government homelessness data (HL1) with six health datasets from NHS National Service Scotland covering Accident and Emergency attendances (A&E2), Inpatient admissions (SMR01), Outpatient appointments (SMR00), Prescriptions (PIS), the Scottish Drugs Misuse Database (SDMD) and Mental Health admissions (SMR04), together with information about deaths from National Records of Scotland.

1.1 Background

Health inequalities across Scotland are well known. Many sources provide evidence that individuals in more deprived areas have worse health outcomes compared with those from less deprived areas:

- The Long-term Monitoring of Health Inequalities[3] show that people born in the 10% most deprived areas in Scotland have considerably shorter healthy life expectancies than those born in the least deprived areas (26.0 years lower for males, 22.2 lower for females). This difference has been stable for several years. Furthermore, premature mortality rates were 3.7 times higher for people in the most deprived areas.
- Individuals living in the most deprived areas account for twice as many attendances to Emergency Departments (A&E) as those in the least deprived areas. The likelihood of being admitted following an Emergency Department attendance also increases as deprivation increases. The difference in attendances could be for a number of reasons including poorer health, more complex social needs and service provision in areas of higher deprivation[4].
- Another study suggests that patients in the most deprived areas had an overall prescription rate for antibiotics that is 36.5% higher than those in the least deprived areas[5].

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[1] Culhane, D.P., Metraux, S. & Hadley, TR. (2002) Public service reductions associated with the placement of homeless people with severe mental illness in supportive housing. Housing Policy Debate 13(1) pp107-163.

[2] See Fife Council's PowerPoint presentation available at: http://www.gov.scot/Resource/0047/00476237.pptx

[3] The most recent publication was released in December, 2017. In 2007, a Ministerial Task Force on Health Inequalities, led by the Minister for Public Health, was established to identify and prioritise practical actions to reduce the most significant and widening health inequalities in Scotland. The Task Force recognised the need to monitor progress in tackling health inequalities in the longer term as well as managing short and medium term progress: http://www.gov.scot/Publications/2017/12/4517/0

[4] Understanding Emergency Care in NHSScotland. NHS National Services Scotland. September 2015. Available at: https://www.isdscotland.org/Health-Topics/Emergency-Care/Publications/2015-09-29/2015-09-29-EmergencyCare-Report.pdf?597780943

[5] An association between socioeconomic deprivation and primary care antibiotic prescribing in Scotland. / Covvey, Jordan R.; Johnston, Blair F.; Elliott, Victoria; Malcolm, William; Mullen, Alexander B. In: Journal of Antimicrobial Chemotherapy, Vol. 69, No. 3, 03.2014, p. 835-841. Available at:

- Patients from more deprived areas in Scotland were more likely to experience a general acute stay related to drug misuse. The highest rates were observed among those in the most deprived areas[6].

Homelessness in Scotland, is also well documented. Under the Housing (Scotland) Act 1987, people can apply to their Local Authority (LA) for assistance if they are homeless:

- In 2016/17, LAs received just over 34,000 applications for assistance. Of these, LAs made 28,000 assessments where the household was assessed as either homelessness or likely to become homeless within two months (threatened with homelessness)[7].
- The number of assessments where the decision was either homeless or threatened with homeless in Scotland has fallen from a peak of 44,000 assessments in 2009/10 to 28,000 in 2015/16. This reduction is mainly due to the impact of the introduction of Housing Options services in Scottish local authorities which have a focused on homelessness prevention.
- At the end of March 2017, approximately 11,000 homeless households were in temporary accommodation within Scotland.

People assessed as homeless are likely to be among the most deprived in Scotland. As people from more deprived areas are known to have poorer health outcomes, and there are many homelessness applications per year, it is important to understand the impact homelessness and health have on each other.

Health outcomes and homelessness are known to be related. Many studies have been conducted looking at the specific health issues of people experiencing homelessness:

- Homeless people are among the most vulnerable and socially excluded in our society and often find it difficult to access the help they need[8].
- Many homeless people present to health services with multiple morbidity including drug or alcohol dependence, mental health and physical problems such as tuberculosis and breathing difficulties (Department of Health 2010)[9].
- Homeless people have higher rates of premature mortality than the rest of the population, especially from suicide and unintentional injuries, and an increased prevalence of a range of infectious diseases, mental disorders, and substance

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https://pure.strath.ac.uk/portal/en/publications/an-association-between-socioeconomic-deprivation-and-primary-care-antibiotic-prescribing-in-scotland(687e172e-07b5-4a85-b3b9-e844f5190858).html

[6] Drug-Related Hospital Statistics. Scotland 2015/16. NHS National Services Scotland. September 2016. Available at: https://www.isdscotland.org/Health-Topics/Drugs-and-Alcohol-Misuse/Publications/2016-09-27/2016-09-27-DrugHospitalStatistics-Report.pdf

[7] Homelessness in Scotland: 2016-17: http://www.gov.scot/Topics/Statistics/Browse/Housing-Regeneration/RefTables

[8] Equality and Human Rights Commission, England's most disadvantaged groups: Homeless people. March 2016. https://www.equalityhumanrights.com/sites/default/files/ief_homeless_people.pdf

[9] Department of Health. March 2010. Healthcare for Single Homeless People. Available at: https://www.housinglin.org.uk/_assets/Resources/Housing/Support_materials/Other_reports_and_guidance/Healthcare_for_single_homeless_people.pdf

misuse. Although engagement with health services and adherence to treatments is often compromised, homeless people typically attend the emergency department more often than non-homeless people[10].

- Other studies has shown that homeless populations, individuals with substance use disorders, sex workers, and imprisoned individuals experience extreme health inequities across a wide range of health conditions, with the relative effect of exclusion being greater in female individuals than in male individuals.[11]

As deprivation is known to have an adverse impact on health outcomes, poor health outcomes related to homelessness may be the result of the many factors associated with deprivation.

A 2008 study by Dr. David Morrison[12] showed that homelessness *itself* is an independent risk factor for certain health outcomes. The findings include:

- The health of homeless people in Glasgow, measured through hospital care and deaths, was consistently poorer than that of the most deprived non-homeless local populations.
- This could be partly explained by poorer health at the point of becoming homeless but an estimate was also made of the additional hazard of homelessness itself.
- Homelessness is an independent risk factor for deaths from specific causes.

This implies that homelessness influences health outcomes in addition to deprivation.

1.2 Study research questions

This study aims to expand on these findings and examine the relationship between health and homelessness for the first time at a national level in Scotland. The study will adopt a similar methodology to that used by Dr. Morrison, and match people from Local Authority homelessness applications (HL1) to the non-homeless Scottish population across on age and sex. Furthermore, the study will create two controls groups, one from people living in the 20% least deprived areas, and one from people living in the 20% most deprived. In this way, the study can better understand the relationship between health outcomes and homelessness, and their relationships with deprivation.

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[10] Fazel, S; Geddes, J.R; and Kushel, M. The health of homeless people in high-income countries: descriptive epidemiology, health consequences, and clinical and policy recommendations. The Lancet. 2014 October 25; 384(9953): 1529–1540.

[11] Aldridge,W.R.; et al. Morbidity and mortality in homeless individuals, prisoners, sex workers, and individuals with substance use disorders in high-income countries: a systematic review and meta-analysis. Lancet 2018; 391: 241–50

[12] Hospitalisations and deaths for 6,323 homeless adults taken from Glasgow City Council's database covering a single year (2000) . The 12,626 cases for comparison were taken from the Community Health Index (CHI) database for Glasgow. This sample was matched on age and sex and was drawn from the non-homeless population from across Glasgow. Analysis by deprivation levels was also considered.

During the analysis, the following research questions arose to describe the relationship between health and homelessness:

- How does health prior to the first homelessness assessment influence homelessness?
- Does the point at which someone becomes homeless have an impact on one's health? Is a crisis with a health component involved?
- How does homelessness influence health?
- Is there a relationship between health, homelessness and deprivation?

In order to answer these questions, the study tests the following null hypotheses:

- Prior to becoming homeless, all three cohorts (the homeless cohort, the 20% most deprived cohort and the 20% least deprived cohort) use health services the same.
- At the point of homelessness, all three cohorts use health services the same.
- Following being assessed as homeless, all three cohorts use health services the same

These null hypotheses – which we are seeking evidence to reject - assume that use of health services does not change with either homelessness or area-based deprivation.

1.3 Overview of the report

Chapter 2 gives an overview of the study design, an overview of the datasets used in this study and their limitations. The methods used in the analysis are explained.

Taking each health dataset at a time, chapters 3 to 8 quantify usage of the above health services by these three groups. The differentials in usage are highlighted. Chapter 9 analyses the deaths dataset.

Chapter 10 focuses on individuals rather than the particular datasets. It quantifies the proportion of people in the cohort who have multiple conditions - issues with drug or alcohol dependence, mental health conditions, or a combination of these.

Chapter 11 concludes the report and brings together the findings from the previous chapters.

1.4 Study history

In total, this report is the culmination of over three years of work involving Communities Analysis Division of the Scottish Government, all 32 Local Authorities in Scotland, National Records of Scotland (NRS) and NHS National Services Scotland (NSS).

The study has made use of the Scottish Informatics and Linkage Collaboration[13] – the national infrastructure for data linkage in Scotland. This has involved use of eData Research and Innovation Service (eDRIS) research co-ordinators, the

[13] http://www.datalinkagescotland.co.uk/

indexing team at NRS and the national Safe Haven (the environment in which this analysis was conducted).

In order for this work to commence, a number of key Information Governance documents needed to be completed. These are available on the Scottish Government website[14]. This included an application to the Public Benefit and Privacy Panel (PBPP) for Health and Social Care , covering the privacy, security and ethical aspects of the project. The timescales for the project were as follows:

- November 2014: Fife Council presents their analysis at Scottish Government and CoSLA Homelessness Prevention and Strategy Group. Question asked whether this can be taken forward for Scotland.
- April 2015: Initial application submitted to SG Analytical Leadership Group including Privacy Impact Assessment
- December 2015: Public Benefit and Privacy Panel Application submitted. Approval with conditions granted Feb 2016. Enabled access to health datasets and access to de-identified data in the National Safe Haven.
- November 2016: Data Processing Agreements with all 32 LAs in Scotland and NRS signed, enabled indexing of personal identifiable data on homelessness.
- November 2016: Data Sharing Agreement signed between SG and NSS ISD for Homelessness Data
- December 2016: NRS: Indexing Completed
- February 2017: Final Conditions met for PBPP
- April 2017: Health and Homelessness datasets prepared by NSS ISD
- May 2017: Analysis commenced in NSS National Safe Haven
- June 2018: Results published

1.5 Acknowledgements

The authors would like to acknowledge the support of Fiona Campbell and Dionysis Vragkos at eDRIS, the staff of the 32 LAs for providing data for this project and the team at Information Services Division for the provision of the health data. Thanks also goes to the Scottish Government Analytical Leadership Group for providing funding for this work and the Scottish Government Communities Analysis Division for the supply of the homelessness data. Thanks go to Dave Clark and Ken Humphreys at the NRS Indexing Team for their role in de-identifying the personal data and for the construction of the cohorts.

The authors would also like to thank Esta Clark (Head of Design for Scotland's Census 2021) and Amy Wilson (Head of Scotland's Census 2021 and Director of Statistical and Registration Services at NRS), for generously allowing us time to work on the project.

[14] http://www.gov.scot/Topics/Statistics/Browse/Housing-Regeneration/RefTables/HealthHomelessnessDataLinkage

In addition the authors would like to thank Professor Glen Bramley and Dr Emily Tweed for their input from an academic perspective. Particular thanks also go to Adam Krawczyk and Joe Jobling from Scottish Government Communities Analysis Division and Marion Gibbs from the Scottish Government Homelessness Team for their invaluable input on the draft report.

1.6 Re-use of the data

Applications to re-use the data in this study should be made to Communities Analysis Division[15] and the Public Benefit and Privacy Panel for Health and Social Care[16].

[15] Homelessness Statistics, Communities Analysis Division, 1F-Dockside, Victoria Quay, EH6 6QQ. Email: homelessness_statistics_inbox@gov.scot,

[16] Contact details available at: http://www.informationgovernance.scot.nhs.uk/pbpphsc/

Chapter 2: Study Methodology

This chapter explains how the study was prepared and conducted. This includes introducing the study's research questions, the homelessness and health activity datasets, the creation of the analysis cohorts, limitations and implications on findings, and the study's approach to answering the research questions.

2.1 Study design

2.1.1 The study's health and homelessness framework

This study aims to better understand the relationship between health and homelessness. During the analysis, the following research questions arose to describe the relationship between health and homelessness:

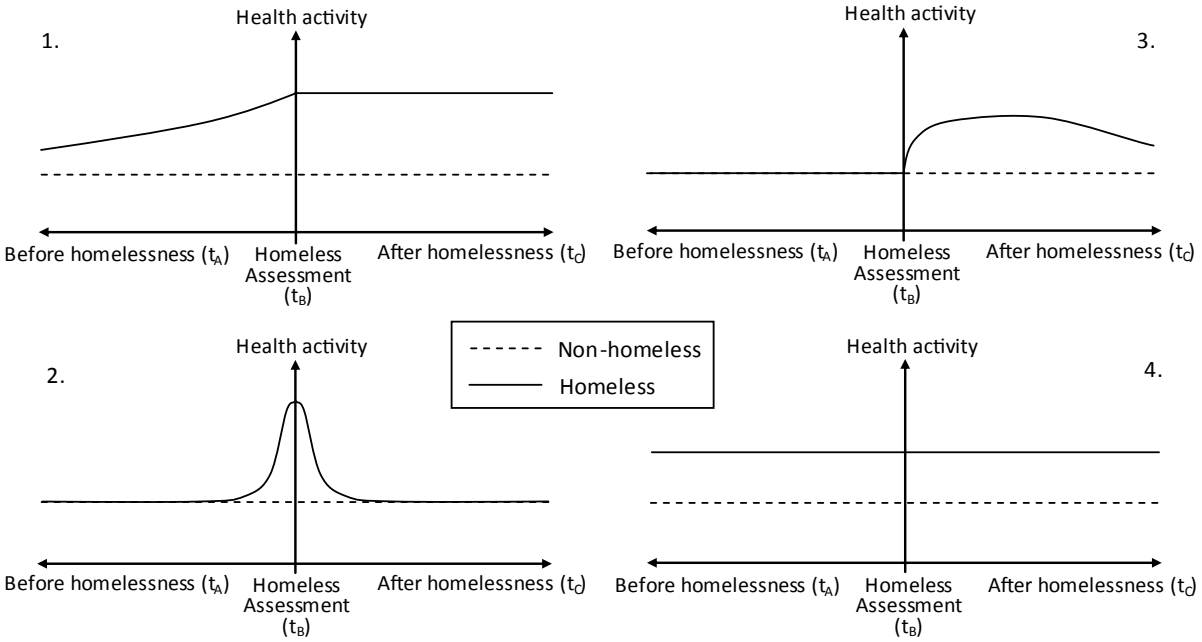
1. How does health prior to the first homelessness assessment influence homelessness?
2. Does the point at which someone becomes homeless have an impact on one's health? Is a crisis with a health component involved?
3. How does homelessness influence health?
4. Is there a relationship between health, homelessness, and area-based deprivation?

These correspond to the following statements:

1. Health-related issues may cause situations leading to homelessness.
2. Some short-term crises could be linked to both health activity and homeless episodes.
3. Homelessness may cause health problems.
4. Some other factors (e.g. income) affect both health and the likelihood of becoming homeless.

The relationship between health and homelessness can be illustrated by comparing health activity in relation to the date of homelessness. There are three distinct time periods: the time period before the homelessness assessment (t_A) (when an individual applies to a Local Authority and is assessed as statutory homeless), the time period at and around the homelessness assessment (t_B), and the time period after the homelessness assessment (t_C). During each time period, individuals have an underlying state of health and create measureable health related activity. Each of the four statements above will result in different health activity profiles across the three time periods (Figure 2.1).

Figure 2.1: Profiles of health activity for homeless and non-homeless people. Each numbered plot shows the activity profile relating to the corresponding research questions and statements above.



In (1) it may be that underlying health problems (which would clearly impact on health activity) could impact on, for example, employment and relationships. In turn, these could impact on the likelihood of becoming homeless. This would be observed as an increase in health activity over time prior to homelessness assessment among the people that become homeless.

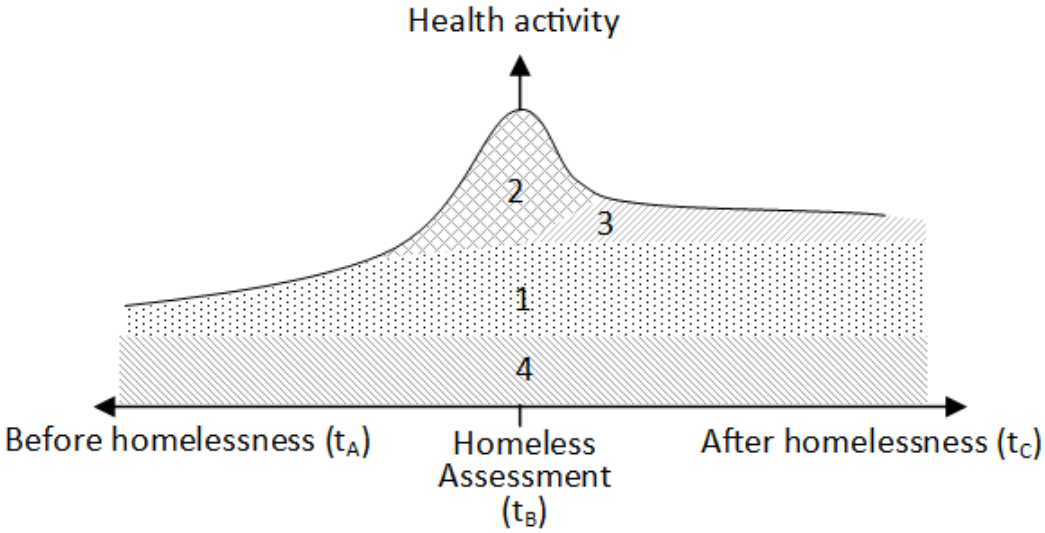
In (2) it may be that one experiences a short-term health-related crisis that results in homelessness. There may be temporary health related problems that could lead people finding themselves homelessness. When we consider that some of the health activity explored in the study is related to drugs or alcohol this seems plausible.

In (3) we might imagine that the stress of homelessness could cause health problems, which would then result in increased health activity after homelessness assessment. The length of time before health activity returns to the level it was prior to assessment would indicate how long the health impacts typically last.

In (4) it may be that there is a wider range of underlying factors that affect both health and homelessness. In this case we would expect to see a higher health activity level for homeless people in all three time periods.

It is likely that all these effects would be present to some degree (Figure 2.2). However the overall shape of the trend would indicate which effects are of the greatest influence.

Figure 2.2: Cumulative health activity, by effect of statements 1–4 corresponding to each research question



2.1.2 Study design options

A number of study designs exist to examine relationships. These include:

Randomised Controlled Trials (RCT)

A RCT involves selecting a group of participants and randomly allocating them to receive some sort of intervention in the experiment ('treatment group').Those that were not assigned to the treatment group are included in the 'control group'. RCTs aim to measure and compare the outcomes of the participants who receive the intervention, and those that do not.

Cohort Studies

Cohort studies begin with a group of people. An example of this might be an investigation into the relationship between smoking and its' impact on health. The people in the cohort are grouped by whether or not they smoke. The whole cohort is followed over time to see how their health is affected. The health differences between smokers and non-smokers are compared. This provides evidence as to how smoking affects health.

Case Control studies

A case-control study begins with the selection of cases (people with an outcome) and controls (people without the outcome). An example of this might be people with a particular kind of cancer (the cases). The controls would be a sample of people who had not developed the particular cancer. Factors which are a potential cause of the cancer would then be determined for both cases and controls, e.g. diet, level of physical activity, where they live. How these factors differ between the cases and their controls is then calculated.

A RCT study design, thought of as one the best designs to analyse the relationship between exposure and outcome, is not possible for this study as one cannot intervene and, at random, create homeless or differing health individuals.

2.1.3 Chosen study designs

To answer the research questions, the study adopts both a Cohort and Case Control design.

A *Case Control design* is used to understand whether health, as measured by health activity, influences homelessness. The case cohort is constructed using available homelessness data in Scotland. The case cohort is defined by including only those people being assessed as homeless. That is, all people in the case cohort exhibit the outcome of homelessness. A control data of equal size is constructed from the population of Scotland, linked by age and sex. It consists of people who have not been assessed as homeless. The study then analyses whether health activity is a potential cause of homelessness by measuring health activity differences between the cohorts.

A *Cohort design* is used to understand whether homelessness influences health, as measured by health activity. Compared with the Case Control design, homelessness is no longer the outcome, rather, it is the causal variable. Instead, health, as measured by health activity, is the outcome. Similarly, both case and control cohorts are constructed based on whether or not people have been assessed as homeless. The study analyses whether homelessness is a potential cause of further health activity.

To address the final research question relating to area-based deprivation, the study creates two control cohorts for each design. One control cohort is constructed with people from areas with high area-based deprivation, while the other is based on people from areas with low area-based deprivation. In this way the study can make inferences on deprivation at the individual level (using homelessness as a proxy) versus area-based measures of deprivation.

2.2 Homelessness data

This section introduces the source of homelessness data used in the study, what alternatives were available, and how representative the data is of homelessness in Scotland. It is from this data that the people are chosen to form the case cohort used in both the Case Control and Cohort designs. This homelessness data is used as the outcome variable in the Case Control design, and as the explanatory variable in the Cohort design.

2.1.1 HL1 returns

When someone is homeless in Scotland, they may apply to their Local Authority for assistance under section 28 of the Housing (Scotland) Act 1987. When this happens, an HL1 return is completed and submitted to the Scottish Government Housing Statistics branch. As such, the Scottish Government HL1 datasets is the main record level source of administrative data on homelessness in Scotland. This system has been in place nationally since December 2001, although some Local Authorities began recording earlier in 2001. There are three distinct stages to each case recorded on the HL1: the application stage, the assessment stage, and the outcome stage. Returns to the Scottish Government cover complete stages. However,

information from earlier stages may be updated as an application progresses[17]. For more information, see the Scottish Homelessness Statistics webpage.

Between 4 June 2001 and 7 November 2016, there were 562,255 applications assessed as homelessness, or threatened with homelessness, by Local Authorities in Scotland. Threatened with homelessness assessments - that is where the household was likely to become homeless within two months - accounted for 13% of all those assessed as homeless in 2002/3, reducing to 6% in 2014/15[18].

Alternative measures of homelessness in Scotland exist and were considered (Annex A).

2.1.2 Definition of homelessness and repeat homelessness used in this study

For the purpose of this study, homeliness is defined by section 24 of the Housing (Scotland) Act 1987 (as amended)[19]. Broadly this defines someone as homeless if they are:

- sleeping on the streets
- staying with friends or family
- staying in a hostel or bed and breakfast hotel
- living in overcrowded conditions
- at risk of violence in the home
- living in poor conditions that affects their health.
- living in a house that is not suitable for them because they are sick or disabled.

Under the European Typology of Homelessness and housing exclusion (ETHOS)[20], the definition of homelessness used in the research covers people classed as roofless, houseless, in insecure accommodation and in inadequate accommodation.

Repeat Homelessness

For the purpose of this project, a **person** is defined as experiencing repeat homelessness if they appear in two or more homeless applications, where these applications have been assessed as homeless or threatened with homelessness during the period of the study.

This is different from the definition of repeat homelessness which is used in Scottish Government Homelessness statistics[21]. This considers whether a homelessness

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[17] HL1 Guidance Notes – Updated December 2010

[18] Homelessness in Scotland: Annual Publication 2016-17. National and Local Authority analyses. See Table 11. Proportion assessed as threatened with homelessness in 2002/3 = 5,002/ (5002+34,645)=13%

[19] Housing (Scotland) Act 1987 (as amended). Available at: https://www.legislation.gov.uk/ukpga/1987/26/section/24

[20] http://www.feantsa.org/download/en-16822651433655843804.pdf

[21] Homelessness in Scotland: 2016-17. Scottish Government. Available at: http://www.gov.scot/Resource/0052/00521186.pdf

assessment is a repeat assessment. To be classed as a repeat homelessness assessment the applicant household must:

1. be assessed as homeless or threatened with homelessness in both applications;
2. the previous case must have been closed within 12 months of the current assessment and;
3. the adults and family circumstances also need to be the same in both applications.

2.1.3 Representativeness of homelessness data in the Study

The HL1 data collection records all people who apply to Scottish Local Authorities for assistance under the Homelessness Legislation. As such it does not record people who may be homeless but who do not apply to their Local Authority for assistance.

The number of homeless applications in Scotland has been influenced by policy changes. The increase in homelessness between 2000/1 and 2006/7 was, in part, a consequence of Scottish homelessness legislation which extended councils' duties to non-priority homeless households. Applications peaked at just over 60,000 applications during 2005/6. The priority need test was abolished on 31st December 2012, giving all unintentionally homelessness households the right to settled accommodation, and not just those assessed as also having a priority need. Meanwhile, the number of homelessness applications decreased in recent years – from 2011/12 onwards - mainly due to the impact of the introduction of Housing Options services in Scottish local authorities with a focus on prevention[22].

The focus on prevention has led to an increasing proportion of homeless people with more complex needs. The following support needs are identified at the time of homelessness assessment (as recorded on the HL1 return). These support needs cover:

- Mental health problems
- Learning disability
- Physical disability
- Medical conditions
- Drug or alcohol dependency
- Basic housing management / independent living skills

If a person has support needs, any combination of the above can be selected. Between 2007/08 and 2013/14, the proportion of households assessed as homeless (or threatened with homelessness) with one or more support needs remained stable at around 32% to 35%. However since 2014/15, this proportion has increased from 29% to 44% in 2016/17[23]. This may be due to better completion of this question by LAs or in an increase in complex needs amongst homeless people.

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[22] Homelessness in Scotland: 2016-17. Scottish Government. June 2017 .http://www.gov.scot/Publications/2017/06/8907/5

[23] Homelessness in Scotland: 2016-17. Scottish Government. June 2017 Available at: http://www.gov.scot/Resource/0052/00523009.xls

In the study we have included records for all those assessed as homeless or threatened with homelessness – that is those likely to become homeless within two months. The proportion assessed as threatened with homelessness is relatively small (as mentioned previously 13% of those assessed as homeless in 2002/3, reducing to 6% in 2014/15). However, some of those assessed as threatened with homelessness may not have gone on to become homeless – their homelessness may have been prevented. As such, there may be a minority of people in our study who did not go on to become homeless.

Nonetheless, the HL1 dataset represents the most comprehensive dataset available covering homelessness in Scotland, at an individual record level.

A complete description of the homelessness data used in this study is contained in Annex B.

2.3 Health data

This section introduces the NHS health activity data used in the study. Firstly, this section addresses some limitations of using activity data, next a summary of the activity datasets is presented, followed by an in-depth look at each.

2.3.1 Health data limitations

Health Activity Data as a proxy for health need

Use of health services – as measured through health activity - is recognised as being an imperfect proxy of health need. The Inverse Care Law[24] is the principle that the availability of good medical or social care tends to vary inversely with the need of the population served. On this basis, the availability of services, and ease of access to these services, has an impact on whether a person appears in these datasets.

According to Audit Scotland[25], findings from the Deep End project indicate that GPs working in the most deprived areas of Scotland face significant challenges in tackling health inequalities. For example, GPs in these practices reported that:

- they treat patients with higher levels of multiple health problems than GPs working in less deprived areas
- public sector budget reductions and changes to the benefits system were increasing patients' visits to GPs and having detrimental effects on patients' mental and physical health
- they are constrained by a shortage of consultation time with patients which limits the opportunity to provide appropriate treatment, advice and referral to suitable services.

These findings suggest that the Inverse Care Law is potentially in effect in Scotland. However, the extent to which the Inverse Care Law applies to Scotland is not investigated in this study, but should be kept in mind.

[24] Julian Tudor Hart, The Inverse Care Law. The Lancet. Volume 297, No. 7696, p405–412, 27 February 1971

[25] Health inequalities in Scotland . Audit Scotland. December 2012. Available at: http://www.audit-scotland.gov.uk/docs/health/2012/nr_121213_health_inequalities.pdf

Under-coverage of health data: Private health care

The health activity data considered in the study is only sourced from the NHS. Health activity in the private sector[26] is not covered by the data used in the study. By having a potential under-coverage present in the health activity data, a bias could be introduced.

If under-coverage is present, then it is most likely to affect the health activity of those people that are more inclined to access private health care – i.e. those in the least deprived areas. One would presume that homeless individuals are unlikely to use private health care. Therefore, this limitation would increase health activity among homeless individuals **relative** to their non-homeless controls.

However, the use of private health care accounts for a very small proportion of health activity in Scotland. It is therefore assumed that the effect of this on the results is negligible.

2.3.2 Health activity data sources in the study

The study requested and was approved to use the following health activity datasets. They were all provided by NHS National Services Scotland, Information Services Division[27], apart from the Deaths dataset, which was provided by the National Records of Scotland.

- Accident and Emergency data (A&E2)
- Inpatients and Day Cases (SMR01)
- Outpatient data (SMR00)
- Prescribing Information System (PIS)
- Mental Health Inpatient and Day Case (SMR04)
- Scottish Drug Misuse Database (SDMD) (SMR24 and SMR25a)
- National Records of Scotland – Deaths

Further details on each of these datasets in contained in Annex C.

Table 2.1 presents a summary of the health activity datasets, their data reference periods, and the number of records that are attributed to the study's analysis population.

The proportion of population health activity that these records correspond to is discussed in detail in section 2.6.2.

[26] If the NHS sends a patient to a private health care provider, this will still be included in the NHS data. This limitation refers to private patients.

[27] http://www.ndc.scot.nhs.uk/National-Datasets/index.asp?ID=1&Topic=Hospital%20Activity%20Statistics

Table 2.1: Summary table of Health Activity Data included in the study

Study data set name	Data period	Records*
Accident and Emergency data (A&E2)	1 January 2011 to 31 December 2016	2,118,143
Inpatients and Day Cases (SMR01)	1 April 2002 to 31 March 2015	2,266,144
Outpatient data (SMR00)	1 April 2002 to 31 March 2015	9,014,864
Prescribing Information System (PIS)	14 January 2009 to 31 March 2015	9,488,022
Mental Health Inpatient and Day Case (SMR04)	1 April 2002 to 31 March 2015	100,055
Scottish Drug Misuse Database (SDMD) (SMR24/ SMR25a)	1 April 2002 to 31 March 2015	89,281
National Records of Scotland – Deaths	1 April 2002 to 31 March 2015	23,718

*Note: the number of records correspond to those that are attributed to the study's analysis population. This is defined in section: 2.5.4 – The Analysis Cohorts.

2.4 Data linkage

In order to conduct the study across Scotland, it was first necessary to obtain personal identifiable information – first name, last name, date of birth, gender and postcode - for people who had made homelessness applications (HL1). This information is not submitted to the Scottish Government as it is not required for monitoring of homelessness legislation at the national level. This information was collected from local authorities via the H2H return and submitted directly to the NRS Indexing Service.

Each person in the H2H dataset was matched to the Research Indexing Spine (RIS). In total 564,501 unique individuals were identified.

The Indexing Service created two control groups for the study by linking the H2H dataset (564,501 unique individuals) to individuals on the RIS on age (assumed age at 31st March 2015[28]) and sex. The first control group was defined by only containing individuals living in the 20% most deprived areas of Scotland (SIMD1), and the second control group as only containing individuals living in the 20% least deprived areas of Scotland (SIMD5). Area deprivation was calculated using the Scottish Index of Multiple Deprivation (SIMD) 2012, based on the postcodes on the Research Indexing Spine at June 2016.

As a result, just under 1.7 million people were selected from the Scottish population to be used in the study (Table 2.2, 'Age-sex Matched Controls'). They can be classified in one of the following three groups:

- 564,501 unique individuals sourced from H2H
- 563,207 unique individuals from the 20% most deprived SIMD1 areas, with the same age and sex distribution as the H2H group. However, the size of the H2H group was so large that there were not enough people on the RIS in SIMD1 areas, with the same age and sex breakdown, to create a complete control group.

[28] An assumed age was used as some people in the cohort may have died before reaching the end of the study period.

- 564,501 unique individuals from the 20% least deprived SIMD5 areas, with the same age and sex distribution as the H2H group.

Further information on the H2H dataset, the matching process and creating the controls is contained in Annex D.

2.5 Defining the three cohorts to be used for analysis

Not all of the 1.7 million people selected from the Scottish population for the study were appropriate to be used for analysis. Firstly, the control groups were created using assumed age at 31st March 2015. It is possible for a control to have died prior to their linked homeless counterpart being assessed as homeless. These needed to be removed. Secondly, not all groups were the same size, and needed to be rebalanced. Lastly, as the H2H data itself does not contain HL1 payload information, it is not possible to determine which of the 564,501 unique H2H individuals were assessed as statutory homeless. This study is only interested in those assessed as statutory homeless. Therefore those people not assessed as homelessness needed to be removed.

2.5.1 Removing deaths

In some cases, one of the controls from either the 20% most or 20% least deprived quintile died before the first assessment date of the homeless person to whom they were linked. By design, people associated with homelessness applications survive until the date of homeless assessment. If a homeless individual had died before their first assessment, they would never have had an assessment in the first place, and so could not have been included in the HL1 data. There was a concern that this could introduce bias when comparing health activity data between the cohorts.

To avoid bias, it was therefore important to ensure that everyone in the matched controls survived until the data of first homelessness assessment, too. All individuals that died prior to the date of first homelessness assessment of their matched homeless person were removed from the study. In total, just under 6,000 individuals were removed from the study due to early deaths (Table 2.3). In this way the probability of death prior to the first assessment date is zero for the homeless person and their controls. Therefore for the early years of the study, most of the people cannot have died by definition. The number of people who could have died will increase over time. This will result in a large increase in the death rate over the time of the study.

Table 2.2: Cases selected for the study

	Homelessness	SIMDQ1	SIMDQ5	Total
Number of unique persons (CHI numbers) amongst matched homeless records	564,501	563,207	564,501	1,692,209
Deaths prior to assessment date	88[29]	4,402	1,453	5,943
Removed unbalanced Controls	6,931	1,323	5,566	13,820
Removed people not assessed as homeless	121,629	121,629	121,629	364,887
Total cases removed	128,648	127,354	128,648	384,650
Total number of unique persons in study	435,853	435,853	435,853	1,307,559

2.5.2 Further balancing

As mentioned earlier, the size of the H2H group was so large that there were not enough people on the Research Indexing Spine in SIMD1 areas with the same age and sex breakdown to create a full SIMD1 control group. In practical terms, this means that there were just over 1,000 H2H individuals successfully linked to a SIMD5 person, yet unable to link to a SIMD1 person. These can be referred to as 'unbalanced' matched-pairs.

In addition, the previous Section 2.5.1 removed almost 6,000 individuals from the study that had died before the first assessment date of the homeless person to whom they are linked. Doing so created another source of unbalanced matched-pairs.

Complete matched-pairs are necessary for analysis purposes. Almost 14,000 individuals were removed from the study (Table 2.3) to remove all occasions where an unbalanced matched-pair exists.

2.5.3 Removing those not assessed as homeless

After removing those who died prior to the first assessment and after further balancing, not all of the remaining unique individuals in the H2H dataset had been assessed as statutory homeless, or threatened with homelessness.

It was decided that this study will focus only on individuals who were assessed as statutory homeless. An entire further study could be designed around the differences between those that were assessed as homeless, and those that were not. Using health activity to investigate this difference would align well with this study's research question. However, this has been noted for future, and not included in the study.

By combining the HL1 homelessness data with the H2H data using the HL1 Application Reference Number, it is possible to determine each person's homelessness assessment decision, or decisions if they appeared in multiple HL1 applications. In total, 121,629 people in the H2H dataset had never been assessed as either homeless or threatened with homelessness by a Local Authority (Table

[29] 88 people were removed from the H2H controls – these applications contained multiple people - one of whom had died between the initial application being made but before the homeless assessment took place. The surviving people within the homeless application are retained as part of the study.

2.4). These individuals were removed from the study, along with an identical number from each of the other 20% most and 20% least deprived groups.

In total, 384,650 individuals were removed from the study due:

- to people dying before the first assessment date (5,943),
- unbalanced matched-pairs (13,820), and
- not being assessed as homeless or threatened with homelessness (364,887).

2.5.4 The analysis cohorts

After removing individuals as in Table 2.2, the study included just over 1.3 million people. These people are included in one of three specific cohorts that are defined here, and will be used throughout the study for analysis:

The Ever Homeless Cohort (EHC):

This contains 435,853 individuals included on one or more homelessness applications, where the HL1 application was assessed as either homeless, or threatened with homelessness, with an assessment date between 4 June 2001 and 7 November 2016.

The Non-homeless Most Deprived Cohort (MDC):

This contains 435,853 individuals residing in the 20% most deprived SIMD areas (recorded on the Researching Indexing Spine as residing on the date the RIS was extracted at a postcode that is included in the 20% most deprived datazones according to the Scottish Index of Multiple Deprivation 2012). They were matched to the EHC on age and sex. The MDC individual was still alive at the date of first homelessness assessment of the matched individual in the EHC. As these individuals do not appear in the HL1 data provided for this study, they are assumed not to have been assessed as homeless or threatened with homelessness in the study period.

The Non-homeless Least Deprived Cohort (LDC):

The 435,853 individuals residing in the 20% least deprived SIMD areas (recorded on the Researching Indexing Spine as residing at a postcode that is included in the 20% least deprived datazones according to the Scottish Index of Multiple Deprivation 2012). They were matched to the EHC on age and sex. The LDC individual was still alive at the date of first homelessness assessment of the matched individual in the EHC. As these individuals do not appear in the HL1 data provided for this study, they are assumed not to have been assessed as homeless or threatened with homelessness in the study period.

From here on, when we refer to people in the **study**, we explicitly mean people in all three cohorts.

2.6 Data coverage

2.6.1 Homelessness data coverage

Coverage of HL1 homelessness applications in the cohorts

In order to remove those individuals that were not assessed as statutory homeless, the H2H individuals were linked back to the HL1 payload data by the HL1 application reference number. This payload data can then be used to determine the number of HL1 assessments used in the study compared with the total number of assessments over the study period, i.e., is there under-coverage?

The 435,853 individuals in the EHC were associated with 429,078 HL1 homelessness assessments made by Local Authorities between 4 June 2001 and 7 November 2016. The numbers slightly differ as multiple individuals can be associated with a single assessment, and people can be associated with more than one assessment.

As stated, Local Authorities were invited to submit personal identifiable information for those who had made HL1 homelessness applications, via the H2H return. Table 2.4 displays the **total** number of HL1 homelessness assessments, made by Local Authorities between 4 June 2001 and 7 November 2016, where the people associated with the application were assessed as being homeless, or likely to become homeless within two months (threatened with homelessness). This is compared with the number of HL1 assessments in the study associated with the EHC.

Table 2.4: Total HL1 homelessness assessments made where the people associated with the application were assessed as being homeless, or likely to become homeless within two months (threatened with homelessness), by Local Authorities between 4 June 2001 and 7 November 2016, compared with the EHC.

Local Authority	EHC HL1 assessments in the study	All HL1 Assessed as homeless*	Proportion of total HL1 Assessments assessed as homeless in the study
Aberdeen City	16,305	18,852	86%
Aberdeenshire	9,267	15,314	61%
Angus	6,384	11,924	54%
Argyll & Bute	573	7,918	7%
Clackmannanshire	6,385	7,156	89%
Dumfries & Galloway	12,113	13,100	92%
Dundee City	10,542	16,488	64%
East Ayrshire	4,171	9,430	44%
East Dunbartonshire	5,980	6,302	95%
East Lothian	8,688	10,089	86%
East Renfrewshire	2,106	3,783	56%
Edinburgh	61,688	66,403	93%
Eilean Siar	1,865	2,161	86%
Falkirk	17,605	19,147	92%
Fife	28,038	37,435	75%
Glasgow City	100,653	114,875	88%
Highland	18,368	20,570	89%
Inverclyde	4,958	5,496	90%
Midlothian	6,811	8,188	83%
Moray	6,351	7,169	89%
North Ayrshire	11,505	13,561	85%
North Lanarkshire	28,304	31,146	91%

Orkney	45	1,404	3%
Perth & Kinross	1,854	11,819	16%
Renfrewshire	7,545	11,785	64%
Scottish Borders	7,488	8,617	87%
Shetland	1,611	1,873	86%
South Ayrshire	3,104	9,227	34%
South Lanarkshire	24,719	27,912	89%
Stirling	850	6,991	12%
West Dunbartonshire	11,942	15,795	76%
West Lothian	1,260	20,325	6%
Total (All)	429,078	562,255	76%

*Source: Scottish Government Communities Analysis Division. HL1 Dataset as at 6 July 2017.

There is notable variation in the proportion of homelessness assessments available for use in the study across the 32 Local Authorities. In sum, there were 562,255 homeless assessments made over the period, of which, 429,078 (76%) are available for use in the study. Eighteen Local Authorities have coverage above the Scotland average of 76% or greater. Seven local authorities have coverage of less than 50%.

Looking beneath these numbers, not all Local Authorities submitted data for the entire period between 4 June 2001 and 7 November 2016 (Table 2.5). The Local Authorities with the lowest rates of coverage – Orkney, West Lothian, Argyll & Bute, Stirling, Perth & Kinross , South Ayrshire and East Ayrshire – have only submitted data for part of the period or only a relatively small proportion of their cases.

Furthermore, Local Authorities were only asked to submit data to 31st March 2015 but a number of Local Authorities submitted data beyond this point, for 2015/16 and even into 2016/17. As a consequence, coverage for 2015/16 and 2016/17 is much lower than for other years and results in lowering coverage overall.

Table 2.5: EHC HL1 homelessness assessments provided to the study where the people associated with the application were assessed as being homeless, or likely to become homeless within two months (threatened with homelessness), by Local Authorities between 4 June 2001 and 7 November 2016, by year.

Local Authority	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	Total
Aberdeen City	95%	95%	95%	97%	96%	94%	95%	96%	96%	96%	96%	95%	96%	94%	10%	0%	**86%**
Aberdeenshire	0%	0%	0%	1%	1%	28%	98%	98%	98%	98%	98%	98%	97%	97%	3%	0%	**61%**
Angus	0%	0%	0%	0%	0%	0%	92%	95%	95%	95%	95%	94%	95%	97%	4%	0%	**54%**
Argyll & Bute	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	11%	91%	65%	7%	**7%**
Clackmannanshire	81%	104%	97%	98%	97%	97%	97%	96%	98%	97%	97%	97%	97%	93%	4%	0%	**89%**
Dumfries & Galloway	82%	96%	96%	95%	95%	95%	97%	96%	96%	96%	97%	97%	97%	98%	75%	1%	**92%**
Dundee City	67%	66%	65%	70%	76%	77%	77%	78%	71%	60%	50%	54%	49%	48%	63%	38%	**64%**
East Ayrshire	0%	0%	0%	0%	0%	0%	89%	95%	93%	95%	96%	98%	95%	96%	6%	0%	**44%**
East Dunbartonshire	96%	100%	98%	97%	97%	98%	97%	98%	98%	97%	98%	96%	98%	95%	95%	36%	**95%**
East Lothian	0%	92%	90%	91%	91%	96%	96%	96%	98%	97%	96%	96%	97%	96%	6%	0%	**86%**
East Renfrewshire	3%	2%	4%	4%	1%	20%	95%	98%	96%	97%	98%	97%	95%	97%	8%	0%	**56%**
Edinburgh	97%	96%	96%	96%	97%	96%	96%	97%	97%	96%	96%	96%	95%	94%	90%	1%	**93%**
Eilean Siar	80%	90%	93%	93%	94%	92%	94%	98%	94%	97%	96%	98%	95%	96%	10%	0%	**86%**
Falkirk	85%	96%	97%	96%	88%	95%	100%	108%	103%	96%	83%	67%	64%	87%	95%	32%	**92%**
Fife	71%	80%	78%	79%	80%	81%	81%	82%	81%	83%	85%	86%	82%	90%	2%	0%	**75%**
Glasgow City	90%	91%	94%	93%	93%	93%	94%	95%	94%	94%	95%	93%	93%	92%	4%	0%	**88%**
Highland	98%	98%	96%	97%	96%	97%	95%	96%	96%	96%	96%	95%	95%	96%	4%	0%	**89%**
Inverclyde	83%	93%	93%	94%	98%	96%	96%	96%	98%	97%	94%	92%	96%	95%	11%	0%	**90%**
Midlothian	94%	97%	58%	30%	55%	72%	98%	98%	99%	99%	98%	99%	98%	96%	98%	29%	**83%**
Moray	100%	82%	98%	95%	99%	98%	97%	97%	96%	98%	98%	98%	99%	98%	5%	0%	**89%**
North Ayrshire	0%	93%	96%	96%	95%	95%	97%	97%	97%	97%	21%	0%	86%	96%	97%	62%	**85%**
North Lanarkshire	99%	98%	97%	98%	98%	98%	98%	98%	98%	98%	97%	98%	98%	98%	4%	0%	**91%**
Orkney	0%	0%	0%	0%	1%	3%	6%	4%	6%	5%	7%	8%	1%	8%	0%	0%	**3%**
Perth & Kinross	0%	0%	0%	0%	0%	0%	17%	24%	24%	45%	42%	26%	21%	28%	5%	0%	**16%**
Renfrewshire	0%	0%	0%	0%	0%	89%	97%	98%	97%	96%	97%	96%	96%	93%	6%	0%	**64%**
Scottish Borders	87%	94%	93%	95%	95%	89%	95%	103%	100%	99%	97%	98%	95%	95%	4%	0%	**87%**
Shetland	76%	94%	91%	93%	94%	95%	96%	91%	94%	94%	96%	96%	93%	93%	13%	0%	**86%**
South Ayrshire	24%	27%	29%	28%	31%	36%	43%	39%	42%	40%	42%	35%	32%	31%	31%	11%	**34%**
South Lanarkshire	85%	98%	98%	98%	97%	97%	97%	98%	98%	98%	98%	97%	98%	97%	3%	0%	**89%**
Stirling	0%	0%	0%	0%	0%	0%	0%	0%	1%	17%	70%	53%	43%	26%	21%	0%	**12%**
West Dunbartonshire	100%	100%	98%	96%	96%	97%	96%	96%	96%	96%	97%	97%	8%	0%	0%	0%	**76%**
West Lothian	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	29%	38%	38%	16%	**6%**
Total (All)	73%	76%	77%	74%	76%	79%	86%	88%	86%	86%	84%	83%	82%	83%	29%	6%	76%

Number of people in the assessment

Each HL1 homelessness application *must* contain a main applicant, and may contain one or more other people (hereafter called 'associated applicants'). As previously mentioned, the EHC contains roughly 435,000 individuals that can be attributed to roughly 429,000 HL1 homelessness assessments.

The rebalancing performed during the creation of the analysis cohorts (Table 2.3) resulted in approximately 7,000 H2H individuals being removed from the study group. Of these:

- some will be associated with assessments that were not assessed as being homeless and therefore not relevant in this study,
- some will be associated with the 429,000 EHC assessments included in the study. Those assessments that contained more than one person, i.e. a main plus one or more associated applicants, may have had an individual removed due to either a death of one of their controls, or because the Research Indexing Spine ran out of suitable controls in SIMD1. This results in the number of EHC assessments being unaffected, yet the number of individuals in the EHC decreasing.
- some will be individuals that applied for homelessness as the main applicant in a single person application (i.e., no associated applicants). By removing these individuals, both the number of EHC HL1 assessments and individuals in the EHC will decrease.

Examining the number of individuals associated with each EHC HL1 assessment (Table 2.6), it is clear that not all assessments contain the correct number of individuals. Eight Local Authorities only provided one person (the main applicant), three provided up to two people (the main applicant plus one associated applicant), and the remaining 21 Local Authorities provided all the associated applicants for all of their respective HL1 assessments.

The eleven Local Authorities which have did not provide all associated applicants, only account for roughly 65,000, or 15% of all assessments attributed to the EHC. As the majority of assessments pertain to a single person (70%), the majority of these assessments will also likely be for a single main applicant.

In summary, nearly all of the 429,000 EHC HL1 assessments provided for the study will contain the main applicant. Only those assessments where the main application was removed due to unbalancing will not contain the main applicant. At least 9 out of 10 assessments in the study will contain the correct number of individuals.

As a result, some undercoverage is present. However, the scale of this issue is not considered significant and should have a negligible impact on the results.

Table 2.6: EHC HL1 Assessments by the number of people associated with the assessment, by Local Authority. Shaded cells suggest undercoverage.

	Assessments containing one person only	Assessments containing two people only	Assessments containing three or more people	Assessments in study
Aberdeen City	100%	0%	0%	16,305
Aberdeenshire	50%	24%	26%	9,267
Angus	55%	23%	23%	6,384

Argyll & Bute	77%	23%	0%	573
Clackmannanshire	63%	20%	17%	6,385
Dumfries & Galloway	95%	5%	0%	12,113
Dundee City	57%	24%	19%	10,542
East Ayrshire	74%	14%	12%	4,171
East Dunbartonshire	54%	24%	22%	5,980
East Lothian	72%	16%	12%	8,688
East Renfrewshire	87%	11%	2%	2,106
Edinburgh	70%	18%	13%	61,688
Eilean Siar	92%	8%	0%	1,865
Falkirk	94%	4%	2%	17,605
Fife	70%	17%	13%	28,038
Glasgow City	70%	16%	14%	100,653
Highland	60%	20%	20%	18,368
Inverclyde	82%	10%	8%	4,958
Midlothian	49%	27%	24%	6,811
Moray	51%	25%	23%	6,351
North Ayrshire	97%	2%	2%	11,505
North Lanarkshire	54%	23%	23%	28,304
Orkney	100%	0%	0%	45
Perth & Kinross	47%	28%	25%	1,854
Renfrewshire	82%	10%	8%	7,545
Scottish Borders	78%	12%	11%	7,488
Shetland	100%	0%	0%	1,611
South Ayrshire	39%	29%	32%	3,104
South Lanarkshire	56%	23%	21%	24,719
Stirling	95%	5%	0%	850
West Dunbartonshire	82%	14%	4%	11,942
West Lothian	100%	0%	0%	1,260
Total (ALL)	**70%**	**16%**	**13%**	429,078

Duplicate homelessness records

Table 2.5 displayed the EHC HL1 homelessness assessments provided by year and Local Authority. Three Local Authorities have coverage which exceeds 100% – Clackmannanshire (104% in 2002/03), Falkirk (over 100% in 2007/8 through to 2009/10) and Scottish Borders (103% in 2008/9).

These figures that exceed 100% relate to duplicate records in their submitted data. Overall, there are around 260 duplicate homelessness cases in the study (out of roughly 429,000), so the impact of these on the results will be negligible.

2.6.2 Coverage of Health Activity data in the cohorts

The study contains just over 1.3 million people, split into three cohorts (the EHC, MDC and LDC – section 2.5.4). The number of health activity records that can be attributed to the study population over the time period were summarised (Table 2.7). To understand the coverage of health activity in this study, this section examines how this compares with all of the health activity data in Scotland over a given period.

Table 2.7: Proportion of Scotland's health activity records in the study, by activity datasets in the study, for the period 2014/15 (Deaths for 2014).

Health Activity Dataset	Period	Activity records in study	Activity records in Scotland	% of records in study
Accident and Emergency	2014/15	356,122	569,412	62.5%
Inpatients and Day Cases	2014/15	222,920	1,586,533	14.0%
Outpatient data	2014/15	878,298	4,580,544	19.4%
Prescribing Information System	2014/15	1,843,364	101,147,994	1.8%
Mental Health Inpatient and Day Case	2014/15	7,421	36,542	20.3%
Scottish drug and Misuse	2014/15	6,761	14,542	46.5%
NRS – Deaths	2014	3,171	54,239	5.8%

Given the number of people in the study (just over 1.3 million, approximately one-fifth of the Scottish population), one would expect to see this account for around one-fifth of all activity records in Scotland for each healthy activity type. The exception to this is for the Prescribing Information System data: the study only received PIS activity for a subset of all possible prescriptions[30]. In order for the study population to account for around one-fifth of all health activity, the study population needs to be representative of the Scottish population. However, this is not the case for two main reasons:

- the study contains the vast majority of homeless individuals in Scotland. Homeless individuals are likely to be among the most deprived, and it is known that there is a relationship between deprivation and health activity.
- the study contains a younger age-distribution compared with the entire Scottish population. This will likely result in over representativeness of health activities that are more common among younger people (e.g. A&E and SDMD), and under representativeness of health activities that are more common among older people (e.g. Deaths). The next section examines the age distribution of those in the study.

2.7 Cohorts: What do we know about them

2.7.1 Age and sex distribution

As discussed, each person in the EHC has been linked to a unique person in both the LDC and the MDC, where controls are selected randomly from people who have the same sex and age on the 31st of March. In this way the age and sex distribution of all three cohorts is identical.

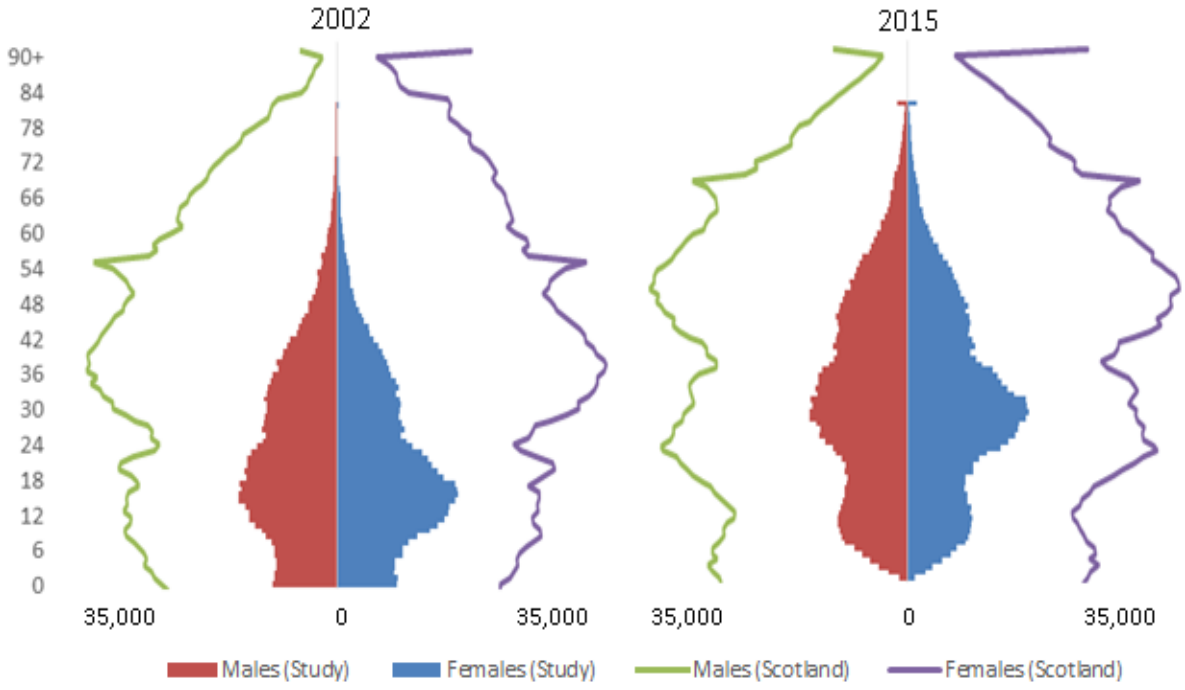
By design, the study covers a period of several years. There is no single age distribution for the cohorts, rather, the distribution will change over time as individuals enter the study group (when someone is born during the study period) and leave the study group (when someone dies during the study period). In 30 June

[30] Prescriptions in the study only relate to mental health conditions, alcohol dependence, opioid dependence and tuberculosis. For more information, see section 2.3.6.

2002 there were around 1,110,000 people alive in the study, and in 30 June 2015, there were around 1,280,000 people alive in the study – a net difference of roughly 175,000 individuals (births minus deaths). The Scotland mid-year estimate for 2002 was 5,070,000 and for 2015 it was 5,370,000[31]. These numbers are used to construct population pyramids (Figure 2.3). The following points are of note about the study distributions:

- The study contains a significant amount of data
- The study appears to contain a relatively larger proportion of young females compared to young males
- The study contains a very small proportion of older persons
- The study population ages between the two time periods, as expected.

Figure 2.3: The age distributions of people in the study in 2002 and 2015 compared with the Scottish population mid-year estimate



To further examine the proportion of people in the study across the different age groups, Figure 2.4 presents the population coverage of people in the study, in both time periods.

At mid-year 2002:

- The study included the majority of females aged 11–19 years in Scotland. This peaked at over 60% for females aged 15 years.
- The peak study coverage for males was for similar age groups, yet for slightly less than 50% of the Scottish population.

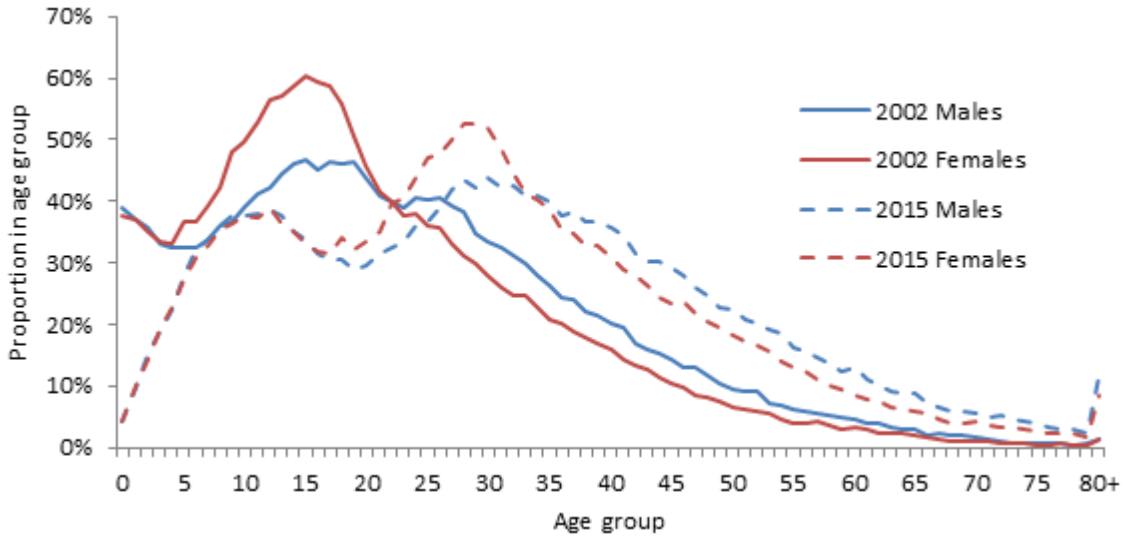
[31] https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/population/population-estimates/mid-year-population-estimates/population-estimates-time-series-data

- For age groups 25+ years, there are more males in the study, as a proportion of males in Scotland, compared with females in the study.
- The study includes a very small proportion of older male and female persons. From the peak coverage rate at roughly 15 years, both coverage rates decrease as age increases.
- People in EHC accounted for 7.3% of the Scottish population

At mid-year 2015:

- The study population in 2015 has higher coverage rates for older people compared with the 2002 distribution. However, it is still considerably skewed towards being more representative of younger people aged 10–40 years.
- There is a very low coverage of children aged 0–5 years. This is due to the study only containing new individuals that were born during the study period, hence the relatively linear slope over these ages.
- People in EHC accounted for 8.0% of the Scottish population

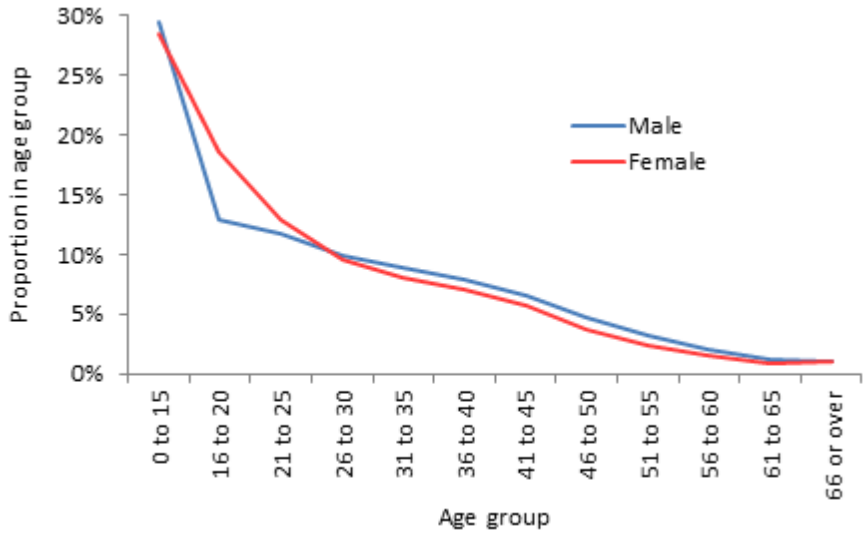
Figure 2.4: The proportion of the population included in the study, by sex and single year age group, at mid-year 2002 and at mid-year 2015



2.7.2 Age and sex distribution at date of first homelessness assessment

In order to be a main applicant on a HL1 homelessness assessment, the main applicant must be aged 16 years or older. Figure 2.5 illustrates the age distribution of those in the EHC at the date of their first homelessness. Almost 30% of males and females in the EHC were under 16 years of age at the date of their first assessment (for many, this would be their first and only assessment). This indicates that a almost a third of the EHC are likely to have been children at the time of their first homelessness assessment.

Figure 2.5: Age distribution of individuals in the EHC at date of first homelessness assessment, by sex

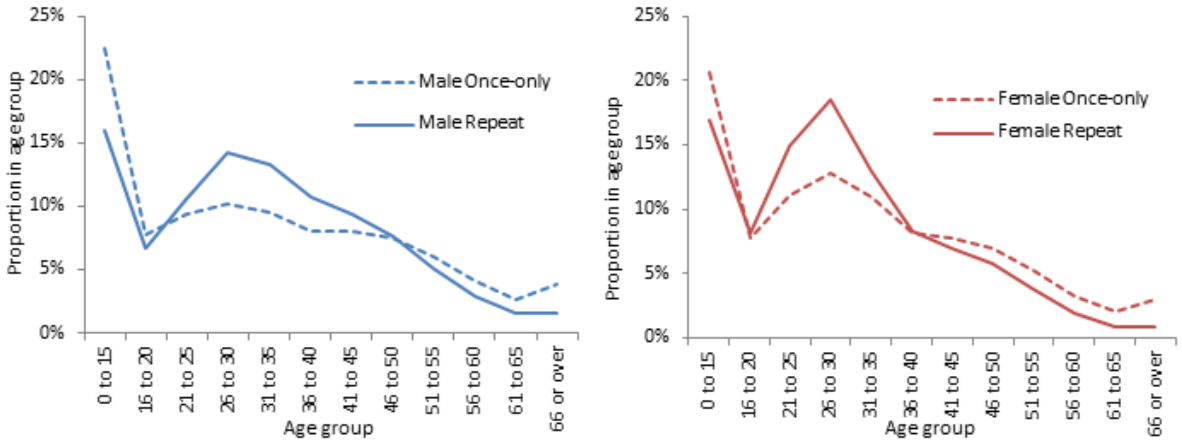


2.7.2 Age and sex distribution of Repeat and Once-only homelessness

Over the study period – 4 June 2001 and 7 November 2016 – individuals in the EHC could potentially be assessed as homeless or threatened with homelessness on multiple occasions. Out of those in the study (435,853), 316,067 individuals were assessed as homeless only once, and 119,786 individuals were assessed as homelessness on two or more occasions.

The study regularly compares health activity of the EHC by Once-only and Repeat homelessness. In order to better understand any observed differences, it is important examine the age-sex distribution of each group (Figure 2.6).

Figure 2.6: Age distribution of Once-only and Repeat homeless individuals, by sex (male blue, female red), at 31 March 2015



The age distributions of Once-only and Repeat homeless individuals in the EHC is fairly similar at 31 March 2015. Individuals associated with Repeat homelessness in the study appear to be disproportionately centred towards young adults, compared with Once-only individuals. These differences are:

- A lower proportion of Repeat males and females are aged 0–15 compared with Once-only individuals.
- A higher proportion of Repeat males are aged 21–45 compared with Once-only males.
- A higher proportion of Repeat females are aged 21–35 compared with Once-only females.
- A lower proportion of Repeat are older persons (males 51+, females 41+) compared with Once-only.

The peak difference between the once-only and repeat homeless populations occurs at age 26 to 30 years for males and females. In this age group there are around 1.4 times more repeat homeless people than once-only people.

These differences could explain a fairly significant proportion of observed differences in health activity between the two groups, depending on the health activity data set in question. However, if observed differences are very large (i.e. greater than 1.4 times), there is likely to be an observed relationship with repeat homelessness.

2.7.3 Age and sex distribution of those removed from the study

In the process of creating the EHC, almost 19,000 individuals were removed the from the final study group due to deaths prior to assessment date and removing unbalanced matched-pairs (Table 2.4), roughly a third of which coming from the group of H2H individuals.

In-scope individuals for the study are those HL1 people assessed as statutory homeless. The study will have removed a few in-scope individuals during removing people who died before the study and from the rebalancing process. However, as the number is small compared to the size of the EHC (436,000), this should have little effect on the study.

2.8 Impact on analysis

2.8.1 Age bands

Throughout this report we analyse levels of particular types of health activity. In each of the analysis chapters we show the number of activity events for each of the EHC, MDC and LDC broken down by sex and age bands. The age bands used in the study are determined by the age on the 31st of March 2015. In some cases the person may not be alive at that date, so their theoretical age on that date is used (i.e. the age they would have been had they been alive then). The bands are 0–15 years and then 5-year bands beyond this up to 61–65, and then 66+. Note that this is slightly different from the bands used by NRS (which use 15–19, 20–24, and so on). However this allows children (those under 16) to be specifically identified.

It should be remembered that as the study is over several years, the age on the 31st of March 2015 will not be the same as the age at the date of the activity in most cases. Despite this, the age breakdown gives a useful indication of the approximate age distribution of those using the particular service, and of particular differences between the cohorts for various age groups.

2.8.2 Main tables and "Standardisation"

Initially, the raw count of activity events is given, however, this will not allow comparison between the age bands. This is because there will be a different number of people in each of the age bands. To make these comparable we continue by dividing the number of activity events by the number of people that these relate to. This "standardization" will then allow direct comparison both between the cohorts, and also between age-sex bands within each cohort. These tables also include totals across all ages for each cohort–sex combination. As each cohort has the same age–sex distribution, these are therefore comparable between the different cohorts (although not directly for the different sexes). In this way these totals have effectively been age standardized.

It should be noted that this standardization is to the age distribution of the homeless cohort. Therefore, while comparisons can be made across the cohorts within this study, comparisons cannot be made to age-standardized figures from other publications, where they will have standardized to the age distribution of a general population. Standardization has not been done to the general population here as this would place focus on parts of the population that are highly underrepresented among the homeless population (in particular older people, see Figure 2.3). Doing so would mean that the results would not be as relevant to the majority of the homeless population. Also, greatly inflating parts of the population for which little data is available risks amplifying noise in the data.

As mentioned these standardized figures within age bands can be compared between the cohorts. To make this comparison clearer we follow up these analyses with ratios of the EHC and MDC to the corresponding values of the LDC.

2.8.3 Deaths

By design, no one in the study will have died prior to the date of first homelessness assessment. Following the first assessment date, the probabilities of death will return to normal, however, it is likely that these will not be the same across the three cohorts. This will mean that there a different number of deaths in each cohort. This in turn will affect the health activity comparisons. For example if one of the cohorts has a higher death rate then at later times this cohort will have fewer people present to potentially make use of the health services. Furthermore, given that deaths will often be preceded by higher than usual hospital activity it could be that some of the increase in activity after assessment is due to the deaths after assessment, which by definition cannot happen before assessment. This effect will apply to the control cohorts as well as the homeless cohort. However we might expect it to be larger for the homeless cohorts that includes more deaths than the control cohorts. This will therefore affect the total amount of health activity of that cohort.

To address this worry some of the analyses were repeated with an adjusted cohort, where each person in the matched-pairs (i.e., from the EHC, MDC and LDC) was removed if any had died at any time during the study. It was found that this

adjustment study population made little difference, and did not qualitatively affect the comparisons. The results presented in the study therefore include the activity of people who die after the first homelessness assessment (and the others in the matched-pairs). Indeed it may be that the health activity of those who do die within the study period is particularly relevant to the findings, as these are the people who are particularly at risk.

2.8.4 Geographic effects

People move between SIMD quintiles

People in the EHC are defined to be people who are included on homelessness application that resulted in an assessment of homelessness or threatened with homelessness in the time period 4 June 2001 and 7 November 2016. The controls in the MDC are defined to be people who are not in the EHC, and are recorded as residing in a one of the 2012 SIMD 20% most deprived datazones as at June 2016. The LDC is defined similarly for the 20 % least deprived datazones. It should be noted that while the people in the LDC and MDC are known to reside in these SIMD quintiles on this date, their location is not known at other times. It is likely that many people in the LDC and MDC will also spend time during the study period residing in other SIMD quintiles. This effect will dilute the difference between the LDC and MDC.

People don't all stay in Scotland all the time

It is also likely that not all the people in these cohorts spend the whole study period in Scotland. Thus the average number of people in each cohort at particular times within the study period is likely to be lower than the total number of people in the cohorts. This should not affect the results unless this effect is substantial and affects the different cohorts differently. It may be that people in the LDC are more likely to move in and out of Scotland if they have more resources to do so, and seek more particular jobs. Conversely, however, the MDC may include people such as refugees who also might move in and out of Scotland. In the absence of data on this we assume that the effects on the results are negligible.

Controls may have been homeless

Note that, while people in the LDC and MDC are not known to have been assessed as homeless it is not guaranteed that none of them were included on homelessness applications. It may be that some had made homelessness applications prior to 4 June 2001 or after 7 November 2016. It is also the case that not all the individuals included on homelessness applications were included in the dataset that is used in the study. Therefore there may be some people in the LDC and MDC who have been assessed as homeless at some time. Indeed, the homeless data for this study only covered around three-quarters of HL1 applications which resulted in an assessment of either homeless or threatened with homelessness (Table 2.4). This means that the ratio of activity in the EHC : MDC or EHC : LDC will be underestimates. Activity will be assigned to the controls rather than to the homeless population. This issue will impact upon the MDC cohort more than the LDC cohort - more people experiencing homelessness had a last settled address in the most-deprived quintile (see section 2.9.1 for more information).

In which Local Authorities are the controls?

Using information taken from the Scottish Government HL1 dataset, the Local Authority of the homeless person's most recent homeless application is used to place people in the EHC in each Local Authority. The study's controls were taken at random from the non-homeless population, and whilst matched on age and sex, were not matched by Local Authority. This was because some Local Authorities do not have datazones classified as 20% most deprived, and the problem the study encountered of running out of controls would have been worse. Instead, the controls are assumed to be drawn at random from the remaining non-homeless populations in SIMD1 (20% most deprived datazones) and SIMD5 (20% most deprived datazones). The estimated distribution of the EHC and controls in each Local Authority is shown in Table 2.8

Table 2.8: Estimated Local Authority for the people in each cohort

	EHC	MDC	LDC
Aberdeen City	2.8%	2.9%	8.4%
Aberdeenshire	3.1%	0.4%	8.2%
Angus	2.1%	0.7%	1.5%
Argyll & Bute	0.1%	0.8%	0.9%
Clackmannanshire	1.6%	1.2%	0.7%
Dumfries & Galloway	2.0%	1.1%	1.0%
Dundee City	3.2%	5.4%	2.4%
East Ayrshire	1.0%	4.0%	1.4%
East Dunbartonshire	1.8%	0.2%	5.2%
East Lothian	2.1%	0.3%	1.6%
East Renfrewshire	0.4%	0.7%	5.0%
Edinburgh, City of	12.9%	4.7%	19.5%
Eilean Siar	0.4%	0.0%	0.0%
Falkirk	3.3%	2.1%	2.8%
Fife	6.8%	6.9%	7.2%
Glasgow City	20.1%	27.5%	4.9%
Highland	5.4%	1.6%	1.7%
Inverclyde	1.1%	3.7%	0.9%
Midlothian	2.2%	0.5%	1.3%
Moray	2.1%	0.1%	1.0%
North Ayrshire	1.9%	5.0%	1.2%
North Lanarkshire	8.2%	9.8%	2.7%
Orkney Islands	0.0%	0.0%	0.1%
Perth & Kinross	0.7%	1.0%	3.1%
Renfrewshire	1.6%	4.9%	3.6%
Scottish Borders	1.8%	0.5%	0.7%
Shetland Islands	0.3%	0.0%	0.1%
South Ayrshire	1.2%	1.7%	2.3%
South Lanarkshire	6.9%	5.4%	4.8%
Stirling	0.2%	1.0%	2.4%
West Dunbartonshire	2.3%	3.1%	0.5%
West Lothian	0.6%	2.9%	2.8%
Scotland	100.0%	100.0%	100.0%
Cohort Size	**435,853**	**435,853**	**435,853**

The Island Authorities of Eilean Siar, Orkney and Shetland have no populations areas assigned as SIMD1 so subsequently none of the MDC controls are taken from these areas. Additionally, Eilean Siar has no population in SIMD5 areas and hence does not appear in the controls for SIMD5.

The Glasgow effect

The Glasgow effect refers to the unexplained poor health of people in Glasgow compared with people in Scotland that cannot be explained, for example, by deprivation[32].

There is a different proportion of people in each cohort that were estimated to be living in Glasgow (20.1% EHC, 27.5% MDC, 4.9% LDC, Table 2.8), therefore the Effect will have a different impact on each cohort. Part of the health activity differences that we observe between the cohorts could be due to this. However, the proportion of total people in each cohort from Glasgow is relatively small, so this shouldn't be a huge effect. The fourth research question on the relationship between health activity, homelessness and deprivation addresses this.

2.9 Interpretation of results

2.9.1 Hypothesis

One of the complexities of this study is that homelessness is an issue which affects individual people. However, the measures of deprivation we are using are area-based. Not all people living in areas ranked within the lowest SIMD deciles will be deprived (however deprived is defined).

From SIMD, counts are available of income deprived individuals and employment deprived individuals. There is no global count of deprived people within each area. The number of income deprived people is equivalent to the count of adults and their dependants in receipt of Income Support, Employment and Support Allowance, Job Seekers Allowance, Guaranteed Pension Credits, and Child and Working Tax Credits[33]. Similarly, the count of Employment Deprived individuals is equal to the number of men aged 16-64 and women aged 16-60 who are on the claimant count, receive Incapacity Benefit, Employment and Support Allowance, or Severe Disablement Allowance[34]. Neither of these counts match the demographic profile of the study population.

Figure 2.7 below shows the distribution of HL1 cases assessed as homeless (or threatened with homelessness) across the SIMD 2012 quintiles, according to their last known postcode of residence. This is done on the 50 per cent of records that have valid postcodes included on the dataset. This is compared to the distribution of the income deprived people and employment deprived people (as indicated in the

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[32] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3209974/

[33] SIMD 2012 Background Data - Part 3 Income Domain. Available at: http://www.gov.scot/Topics/Statistics/SIMD/DataAnalysis/Background-Data-2012/Background3Income2012

[34] SIMD 2012 Background Data - Part 4 Employment Domain. Available at: http://www.gov.scot/Topics/Statistics/SIMD/DataAnalysis/Background-Data-2012/Background4Employment2012

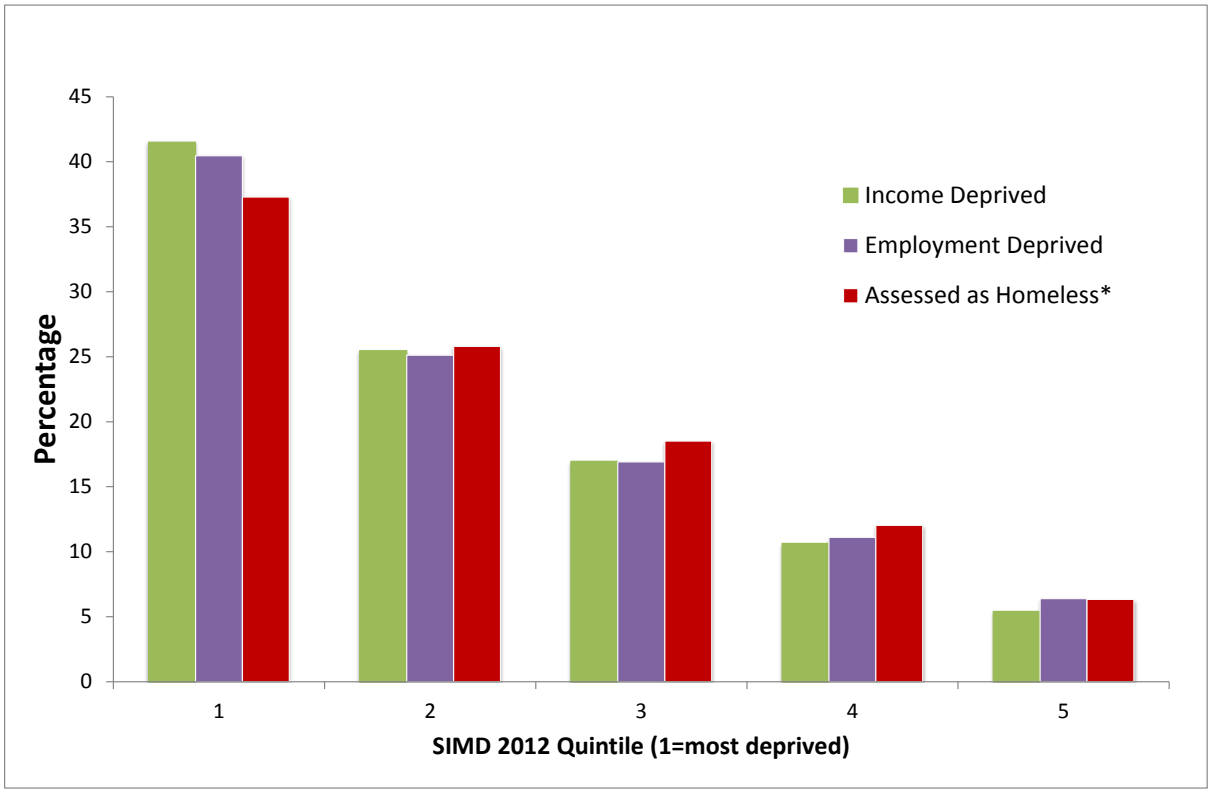
SIMD 2012 dataset). The distribution of cases assessed as homeless across quintiles roughly follows the distribution of both income deprived people and employment deprived people. It is likely that there are overlaps between these groups. However, the extent of overlap is not estimated here.

Our study contains approximately 76% of all HL1 applications which resulted in an assessment of homeless (or threatened with homelessness). As we are missing approximately a quarter of cases, the individuals associated with these cases will be in the wider non-EHC population, from which our two control groups were sampled. Therefore, in-scope homeless individuals that were missed from the study could in fact be contained within our two MDC and LDC control groups. If these missing people are distributed as in Figure 2.7, we would expect these to be based more amongst the MDC controls with a smaller proportion within the LDC controls. Any ratios we construct, comparing activity amongst the EHC with the MDC and LDC, may therefore **under**-estimate any differences observed.

However, there is another force at play. The MDC and LDC cohorts were constructed by randomly selecting individuals from SIMD1 and SIMD5 areas based on the age and sex of H2H individuals. If homeless people are typically deprived, then the EHC contains a large number of people that were residing in SIMD1 and, to a lesser extent SIMD5 areas. As they are in the EHC, these homeless individuals are no longer available for selection for the MDC and LDC cohorts. The remaining individuals in SIMD1 and SIMD5 will therefore not be as deprived, on average, compared with individuals in these SIMD1 and SIMD5 datazones more generally. By having such a large EHC cohort, we have affected the sampling frame for our controls, so that the controls are no longer representative of the true SIMD1 and SIMD5 populations. This effect is likely to have more of an impact on the EHC : MDC ratio than the EHC : LDC ratio. What this means is that the population in our SIMD1 and SIMD5 areas is not comparable with other studies as homeless people have been removed from these areas. In addition, the age-sex profile of the controls also means that LDC and MDC are not representative of the populations living in these areas.

If homelessness was the sole explanation for different rates of health activity, we would expect the ratios EHC : MDC and EHC : LDC to be very similar

Figure 2.7: Distribution of Income Deprived People, Employment Deprived People and HL1 Homeless Applications Assessed as Homeless* across the SIMD 2012 quintiles



Notes: Assessed as homelessness* (or threatened with homelessness) includes 562,447 homelessness assessments where the application was assessed as homeless or threatened with homelessness between 4 June 2001 and 7 November 2016. Of these records, 280,057 had a postcode of their last settled address which could be mapped to a SIMD quintile. This is slightly different to the number of assessments in Table 2.1 (562,255 assessments). The HL1 dataset is a live dataset where some records may have been entered in error and deleted at a later date. This information was sourced from Scottish Government Communities Analysis Division using bespoke analysis of the HL1 dataset as at 22 February 2018.

2.9.2 Null Hypothesis - Are we just measuring "deprivation" or does homelessness have an additional effect?

By comparing the health activity among the three different cohorts we are seeking to show whether this is different or the same. Our null hypothesis is that people in all cohorts are the same. The main difference between the LDC and the MDC is that the MDC has more deprived people than does the LDC. Not all people in the MDC are deprived, but the proportion is higher. There will be other differences (such as more of the MDC than the LDC reside in Glasgow, so it will be more affected by the

Glasgow Effect[35]), but it is expected that the proportion of deprived people is the dominant difference.

If homelessness alone is not the sole explanator for different rates of health activity amongst the cohorts, the ratios of EHC: LDC are expected to be greater than EHC: MDC - purely as a result of aspects of deprivation affecting people in MDC than in LDC.

Whilst area-based indicators of deprivation have been developed, no definitive definition or source of deprived people exists (either at an aggregate or record level). We are therefore unable to quantify this effect on the ratios.

However, by instead looking at the timing of health activity relative to the date when people in the EHC are first assessed as homeless, the impact of health activity before or after this date can be used to determine whether homelessness itself has an additional effect. Under the null hypothesis, if there is no effect, health activity either side of this date will be the same. To measure the relationship between homelessness and health activity, temporal analysis is undertaken.

More information on the temporal analysis method is contained in Annex E.

2.10 Summary

This chapter detailed the study design, the health data and homelessness data used in the study and the construction of the study population. In doing so, three analysis cohorts were created: the EHC (the Ever Homeless Cohort), and its controls the MDC (the Most Deprived Cohort) and the LDC (the Least Deprived Cohort). This enables the study to better compare the health activity of the EHC with people living in the 20% most and least deprived areas in Scotland.

In the following chapters, analysis is conducted that compares the health activity of the EHC to that of the MDC and LDC, for the health activity datasets introduced in this chapter. Comparisons in health activity between the cohorts are presented to introduce the relative differences in health activity. The ratios of health activity between the cohorts themselves (especially the particular values of these) aren't directly comparable with other studies given the aforementioned issues. However, they are still useful in seeing if differences exist in health activity.

These lead on to the temporal analyses - the main focus of each chapter. These addresses the study's research questions, which attempt to understand how homelessness and health activity are related.

[35] Walsh, D. et al. History, politics and vulnerability: explaining excess mortality in Scotland and Glasgow. Public Health. 2017 Oct;151:1-12. doi: 10.1016/j.puhe.2017.05.016. Epub 2017 Jul 8. Available at: https://www.ncbi.nlm.nih.gov/pubmed/28697372

Chapter 3: Accident and Emergency Attendances

There were 2.1 million Accident and Emergency (A&E) attendances over the time period 1 January 2011 to 31 December 2016 inclusive for the 1.3 million people in the study. For more information on the A&E attendances data see Section 2.3.3.

In this chapter we discuss the study cohorts, their A&E attendance activity and how this relates to homelessness. How this relates to deprivation and health needs is discussed in Chapter 11.

3.1 Comparative activity between the EHC and their controls

Accounting for one third of all people in the study, people in the EHC (Ever Homeless Cohort) accounted for 55% of A&E attendances (29% male, 25% female). A&E Attendances amongst the MDC (Non-homeless 20% Most Deprived Cohort) accounted for 30% of attendances during the period (15% male, 14% female). The LDC (Non-homeless 20% Least Deprived Cohort) accounted for 16% of attendances (9% male, 7% female).

Table 3.1: Number of people, number of A&E attendances and the ratio of the number of A&E attendances between EHC and MDC, and between EHC and LDC, by age and sex.

	Male				Female			
Age (at 31 March 2015)	Number of people	A&E Attendances	EHC : MDC	EHC : LDC	Number of people	A&E Attendances	EHC : MDC	EHC : LDC
0 to 15	135,444	252,290	1.2	1.5	127,461	204,874	1.2	1.7
16 to 20	49,263	95,286	1.4	2.3	51,276	95,161	1.7	3.6
21 to 25	64,209	126,352	2.0	3.7	78,690	139,249	2.1	4.9
26 to 30	75,363	128,218	2.2	5.1	93,003	132,336	2.1	5.7
31 to 35	70,407	110,710	2.5	6.1	74,493	100,050	2.3	6.4
36 to 40	58,347	89,185	2.6	6.1	53,259	70,625	2.2	5.9
41 to 45	55,737	88,911	2.5	5.9	48,873	67,155	2.0	5.3
46 to 50	49,818	78,079	2.3	5.1	43,563	62,288	1.9	4.6
51 to 55	37,746	62,720	2.2	4.9	31,578	46,884	1.9	4.0
56 to 60	25,017	40,214	2.1	4.2	19,017	26,585	1.8	3.5
61 to 65	15,765	26,007	2.0	4.2	11,436	15,579	1.5	2.8
66 or over	21,591	35,125	1.7	2.7	16,203	24,260	1.4	2.2
All ages	658,707	1,133,097	1.9	3.4	648,852	985,046	1.8	3.7

In order to see how A&E attendances compare in the different cohorts, ratios of A&E attendances were constructed for each age band and sex (Table 3.1).

The EHC have more A&E activity

In total, the EHC has almost double the number of A&E attendances compared with MDC (1.9 times for males, 1.8 for females) and over three times the number of A&E attendances compared with LDC (3.4 times for males, 3.7 times for females).

For each age and sex breakdown, the EHC have more A&E activity

Compared to the controls in the MDC or LDC, the ratio of attendances is always greater than one (minimum ratio is: 1.2, EHC : MDC at 0–15 years).

EHC people aged 31–40 years have the most A&E activity compared with their controls

The ages at which the peak ratios occur are similar for males and females. For males EHC : LDC peaks at 6.1 at 31–40 years, and EHC : MDC peaks at 2.6 at 36–40 years. For females EHC : LDC peaks at 6.4 at 31–35 years, and EHC : MDC peaks at 2.3 also at 31–35 years.

3.2 Distribution of the number of A&E attendances

The previous section found that, on average, people in the EHC had more A&E attendances than their controls. This section explores whether this is due to a higher proportion of the EHC having attendances, or a higher proportion of the EHC who had attendances having many attendances, or both (Figure 3.1). The following points apply for both sexes:

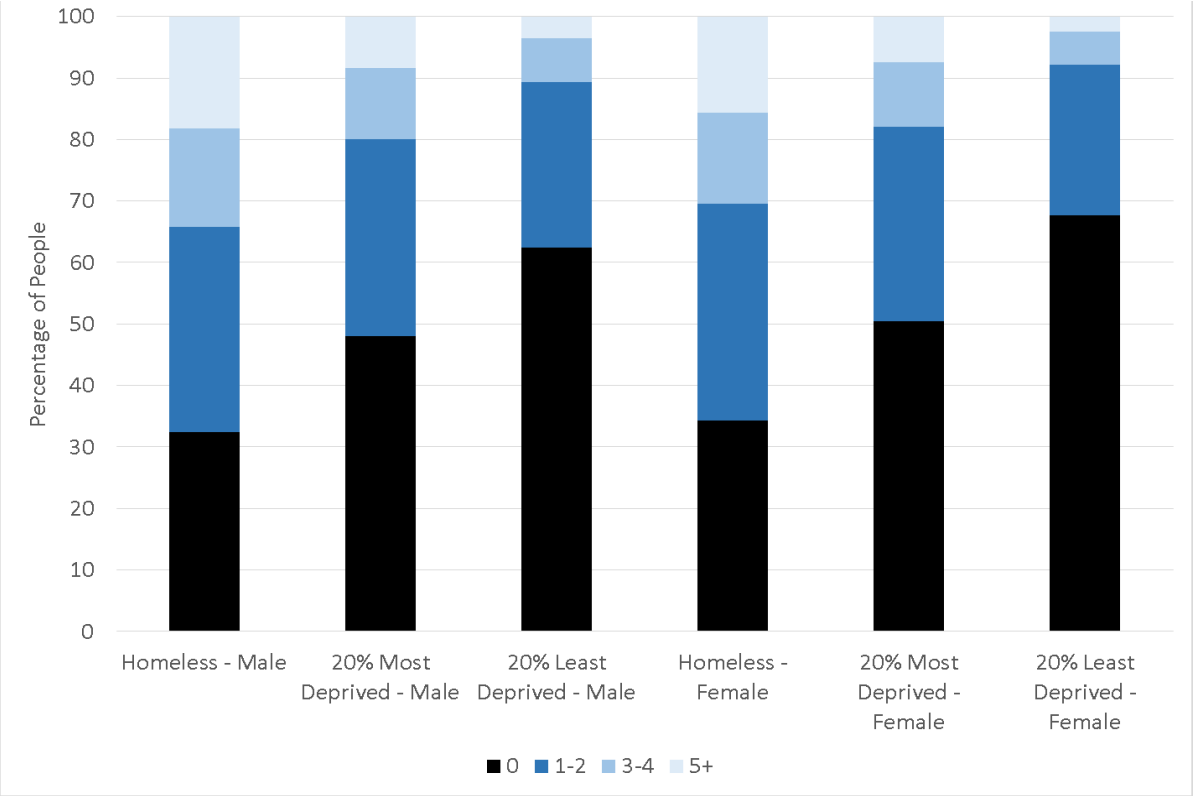
More of the EHC had at least one A&E attendance

A higher proportion of the EHC (68% males, 66% females) had at least one A&E attendance than the MDC (52% males, 50% females) and LDC (38% males, 32% females) over the study period.

More of the EHC had many A&E attendances

A higher proportion of the EHC (18% males, 16% females) had five or more A&E attendances than the MDC (8% males, 7% females) and LDC (4% males, 3% females) over the study period. Even among people who had at least one A&E attendance, a notably higher proportion of the EHC had many attendances than the MDC and LDC.

Figure 3.1: Distribution of the number of A&E attendances for each person by sex and cohort.



3.3 A&E Attendances Relative to the Date of First Homelessness Assessment

In Section 3.1 it was found that the EHC have more A&E attendances than both control cohorts. In order to explore the relationship between homelessness and A&E activity, this section compares the timing of A&E attendances with the date of first homelessness assessment (Figure 3.2). Detail on this method is described in full in Section 2.10.

Figure 3.2: Ratio of A&E Attendances to that of the LDC, by sex, against the time difference between the first assessment and the attendance date.

The shape of the graph for the EHC is markedly different from the MDC. The following points apply for both sexes:

The MDC had consistently more A&E attendances than the LDC

The MDC had approximately double the number of A&E attendances than the LDC. This ratio is roughly constant over time. This makes sense as there would be no particular reason for the activity of people in these cohorts to change with reference to the date of first homelessness assessment. While these people will be aging alongside the EHC person they have been linked to, the date of the EHC person's first assessment will have no particular bearing on them.

Even several years before the date of first assessment, the EHC ratio is higher

Some people who go on to become homeless are more likely to have more A&E attendances, years prior to their first homeless assessment.

EHC A&E attendances increase towards assessment date

From four years prior to, to a few months before, the date of first homelessness assessment, EHC A&E attendances increase relative to LDC A&E attendances (from a ratio of around 2.25 to 3.25). The A&E attendances increasing toward the first homelessness assessment date suggests that, for some people, the homelessness episode is an outcome of a gradually worsening health condition. This underlying condition relates to both A&E attendances and eventual homelessness. In this way,

this excess activity among the EHC is *not* a result of homelessness[36] itself: it pre-dates the first homelessness assessment.

There is a clear peak in EHC A&E attendances around assessment date

In the weeks and months immediately prior to the date of first homelessness assessment, EHC A&E attendances increase sharply (peak value of around 4.4). Notably, the observed peak is *not* after the date of first homelessness assessment. This suggests that becoming homeless is, for some people, part of a crisis, which has a health component.

EHC A&E attendances stabilise after the peak, but at a higher level, with an eventual rise

EHC A&E attendances stabilise one to two years following the date of first homelessness assessment for several years at a level (roughly 3.25), similar to that immediately prior to the sharp increase. Attendances do not decrease to the initial ratio in the long-run, but in fact begin to rise once again. The reason for this is explored in the next section.

If differences in A&E attendances between the cohorts were driven by deprivation alone, then the shape of the EHC line would be similar to that of the MDC. Therefore, it appears that homelessness has a relationship with A&E attendances.

3.4 A&E attendances for Once-Only and Repeat Homelessness

In the last section, EHC A&E attendance were shown to be higher after the date of first homelessness assessment than before. This could be due to more periods of homelessness, but at different times for different people, or it could be a long term effect of the original homelessness assessment. To better understand this, this section explores differences in A&E attendance ratios between those people in that have only been assessed as homeless once (Figure 3.3) (Once-only EHC), and those who have been assessed as homeless on multiple occasions, referred to as repeat homelessness (Repeat EHC) (Figure 3.4). More information on repeat homelessness is available in Section 2.2.

A&E attendance ratios for Repeat EHC are higher than for Once-only EHC. The following points apply for both sexes:

A&E attendance ratio increases up to the peak more rapidly for Repeat EHC

From four years prior to, to a few months before, the date of first homelessness assessment, once-only EHC ratios increase from around 2.25 to around 3 (an increase of around 1 third). This is notably less than the increase from around 2 to around 4.25 for the repeat EHC (which more than doubles). Perhaps the people who go on to have multiple homelessness episodes are more likely to be those who have a worsening underlying condition that is both related to their A&E attendances, and results in their homelessness.

The peak A&E attendance ratio is higher for Repeat EHC

The peak around the date of first homelessness assessment is larger for the repeat EHC than for the once-only EHC. The once-only ratio increases from around 3 to

[36] This refers to statutory homelessness, as defined in Chapter 2.

around 4 (around a third increase), while the repeat ratio increases a greater amount from around 4.25 to around 6 (around a 40% increase). Perhaps the people whose first homelessness episode is associated with a crisis with a health component (i.e. those contributing to the peak) are more likely to go on to have further homelessness episodes than those who do not.

The ratio falls back to pre-homelessness levels for once-only EHC

For the once-only EHC, by around four years following the assessment date the ratio has reduced to around the level it was at two years prior to the assessment date. Perhaps these people eventually recovered from:

- adverse effects of the homelessness episode,
- the health condition that worsened leading to their homelessness, and
- any crisis around the time of homelessness.

This contrasts with the repeat EHC ratio, which remains above the ratio value immediately prior to the peak, for the remainder of the period. This could have one or more of the following causes:

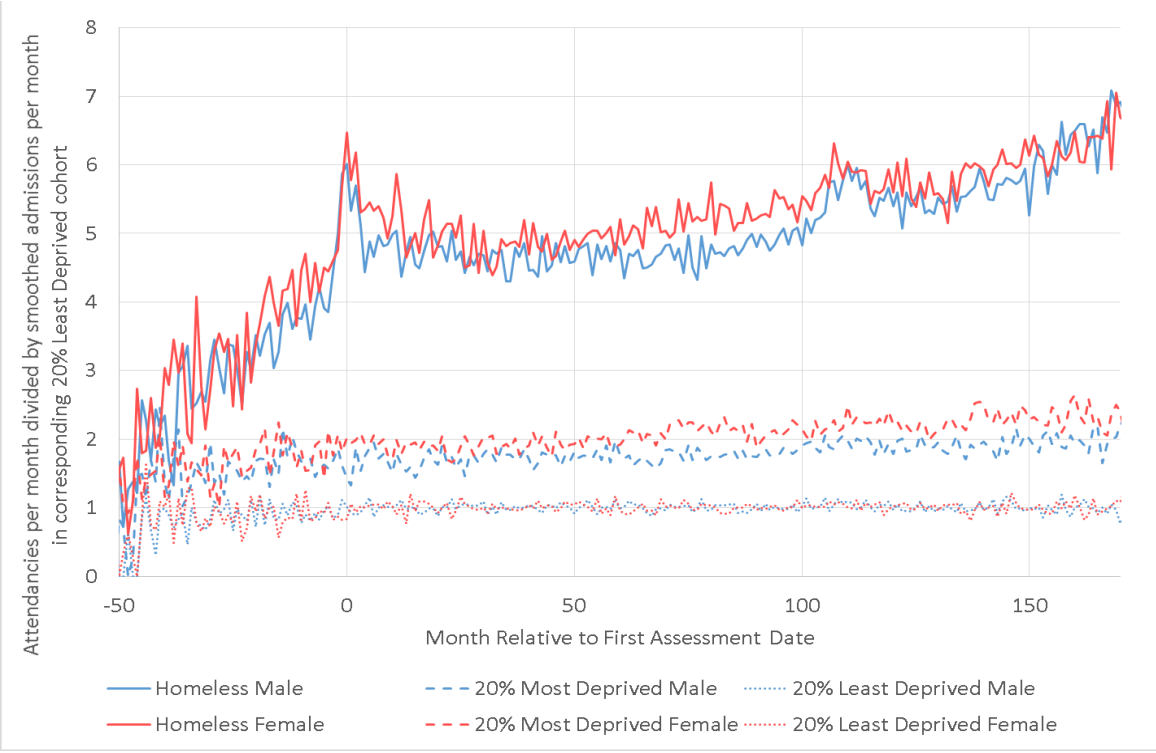
- One is that further homelessness episodes are associated with health-related crises (these will occur at different times for different people leading to a smooth excess on the graph).
- Another is that these people are less likely to recover from the crisis at the first (or subsequent) homelessness episode(s).
- Lastly these people never fully recovered from the underlying health condition that is evident from before the first homelessness episode.

For Repeat EHC the ratio continues to rise above the peak levels, several years later

Around nine years after the first homelessness assessment the ratio increases above that of the peak around the first assessment date. Perhaps this is due to a cumulative health effect of the multiple homelessness episodes.

Figure 3.3: Ratio of A&E attendances for **once-only** homelessness to the controls in the LDC for those homeless people, by sex, against the time difference between the first assessment and the attendance date.

Figure 3.4: Ratio of A&E attendances **repeat** homelessness to the controls in the LDC for those homeless people, by sex, against the time difference between the first assessment and the attendance date.



3.5 Summary

The EHC have more A&E activity than the control cohorts. This is true for each age and sex breakdown, and is greatest among those aged 31–40. This is due to more of the EHC having at least one A&E attendance, and among those who do have attendances, the EHC have more with multiple attendances.

Among the EHC there is a relationship between the timing of A&E attendances and that of the first homelessness episode, suggesting some relationship between these. Most pronounced is a peak in A&E activity around the time of first homelessness assessment, with a gradual rise leading to this, and on average, higher activity afterwards. This is especially the case for those who have multiple homelessness episodes. For people who have only one homelessness assessment, the A&E activity ratio eventually returns to the level it was prior to the homelessness episode.

There is clear evidence to support each of the four research questions:

- A gradually worsening condition prior to the date of first assessment that results in additional A&E activity prior to homelessness.
- Also for some people the (first) homelessness episode is associated with some crisis with a health activity component, as observed by an A&E activity peak around that time.
- Both these effects are greater among those who go on to have multiple homelessness episodes, suggesting that these situations and crises sometimes precede not just homelessness, but repeat homelessness especially.
- The larger ratios after the first assessment date for those who have multiple homelessness episodes could be due to: further crises around the time of those later episodes, long-term effects of the earlier underlying condition, crises or homelessness itself.
- Lastly, people who go on to become homeless appear to have more A&E attendances, even several years prior to their first homeless assessment. This could be a result of the EHC having poorer general health than individuals in other cohorts, or using A&E when accessing GP services may be difficult.

Chapter 4: Acute Hospital Admissions

There were 2.3 million acute hospital admissions (SMR01) for the 1.3 million people in the study over the time period 1 April 2002 to 31 March 2015. For more information on the acute admissions data see Section 2.3.4.

In this chapter we discuss the study cohorts and their acute admission activity and how this relates to homelessness. How this relates to deprivation and health needs is discussed in Chapter 11.

4.1 Comparative activity between the EHC and their controls

Accounting for one third of all people in the study, people in the EHC (Ever Homeless Cohort) accounted for 52% of all acute admissions (27% male, 26% female). Acute admissions amongst the MDC (20% Most Deprived Cohort) accounted for 31% of acute admissions during the period (15% male, 16% female), acute admissions from the LDC (20% Least Deprived Cohort) accounted for 17% (9% male, 8% female).

Table 4.1: Number of people, number of admissions and the ratio of the number of acute hospital admissions between EHC and MDC, and between EHC and LDC, by age and sex.

	Male				Female			
Age (at 31 March 2015)	Number of people	Admissions	EHC : MDC	EHC : LDC	Number of people	Admissions	EHC : MDC	EHC : LDC
0 to 15	135,444	170,531	1.2	1.6	127,461	127,225	1.2	1.6
16 to 20	49,263	51,570	1.2	1.8	51,276	52,115	1.3	2.4
21 to 25	64,209	66,299	1.8	2.7	78,690	98,483	2.0	3.9
26 to 30	75,363	83,063	2.2	3.9	93,003	135,473	2.2	5.0
31 to 35	70,407	86,344	2.6	4.8	74,493	119,083	2.2	4.9
36 to 40	58,347	84,160	2.6	5.3	53,259	95,300	1.9	4.2
41 to 45	55,737	101,775	2.3	5.0	48,873	103,163	1.7	3.6
46 to 50	49,818	107,472	2.1	4.3	43,563	110,521	1.6	3.3
51 to 55	37,746	103,429	2.0	4.1	31,578	93,160	1.5	3.0
56 to 60	25,017	84,758	1.8	3.4	19,017	63,565	1.4	2.8
61 to 65	15,765	66,244	1.6	3.1	11,436	44,695	1.4	2.3
66 or over	21,591	131,506	1.4	2.1	16,203	86,210	1.2	1.9
All ages	658,707	1,137,151	1.8	3.1	648,852	1,128,993	1.7	3.1

In order to see how acute admissions compare in the different cohorts, ratios of acute admissions were constructed for each age band and sex (Table 4.1) and the admission rate is also calculated (Figure 4.1).

The EHC have more acute admissions

In total, the EHC has nearly double the number of acute admissions compared with MDC (1.8 times for males, 1.7 for females) and 3.1 times the number of acute admissions compared with LDC (both for males and for females).

The acute admission rate is highest among older people for each cohort

In each cohort the number of acute admissions per 1,000 people increases with age from 31–35 to 66+.

For each age and sex breakdown, the EHC have more acute admissions

Compared to the controls in the MDC or LDC, the ratio of acute admissions is always greater than one (minimum ratio is: 1.2, EHC : MDC for males at 0–20 years, and for females at 0–15 and 66+).

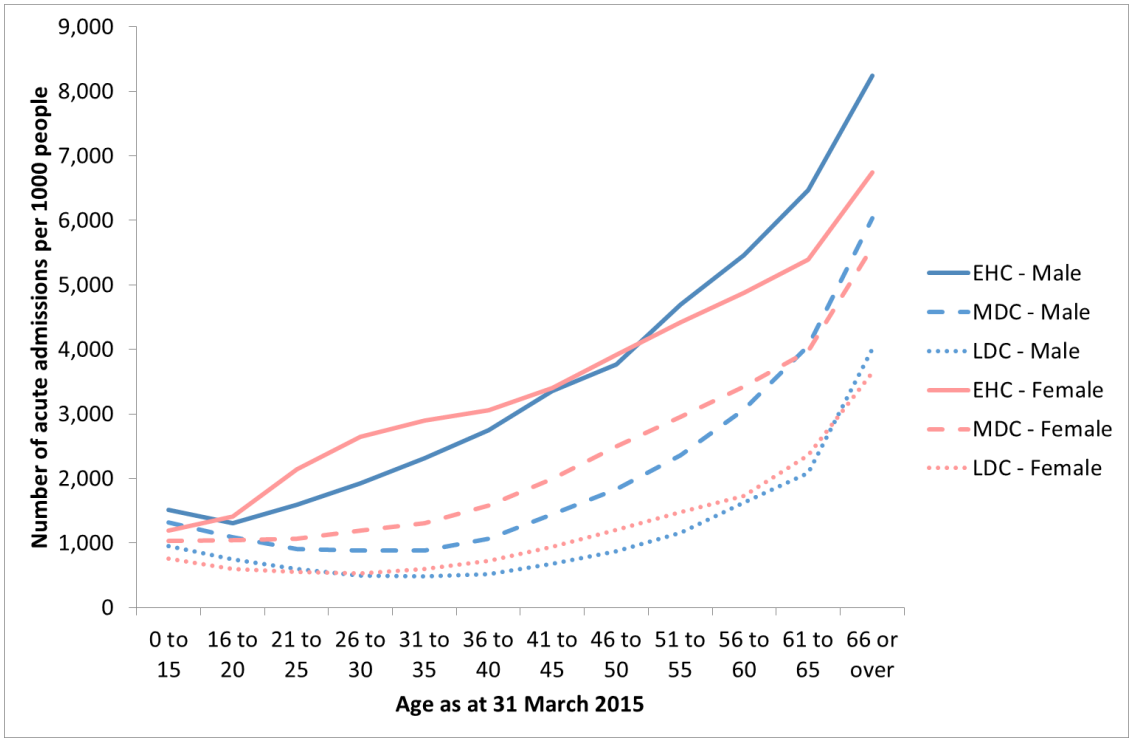
EHC males aged 36–40 years have the most acute admissions compared with their controls

For males EHC : LDC peaks at 5.3 at 36–40 years, and EHC : MDC peaks at 2.6 at 31–40 years. For the controls the acute admission rate decreases with age, reaching a minimum around 30-35 years and then increases again , while for the EHC the admission rate increases from 16 years and onward. This difference in shape is what drives the variation in the ratio with age (Figure 4.1). The peak ratio occurs around when the admission rate among the controls reaches a minimum, and the EHC admission rate is continuing to increase.

EHC females aged 26–30 years have the most acute admissions compared with their controls

For females EHC : LDC peaks at 5.0 at 26–30 years, and EHC : MDC peaks at 2.2 at 26–35 years. This is a similar effect to that seen among males. However among females the admission rate minima among the controls occurs at younger ages, and there is a bulge in the EHC admission rate between 16–20 and 41–45. Both of these differences push the peak ratio between the cohorts to a younger age group.

Figure 4.1: Number of acute admissions per 1,000 people (admission rate) by age, sex and cohort.



Note: this is not a rate per year so is not comparable with admission rates published elsewhere.

4.2 Distribution of the number of acute hospital admissions

The previous section found that, on average, people in the EHC had more acute admissions than their controls. This section explores whether this is due to a higher proportion of the EHC having acute admissions, or a higher proportion of the EHC who had attendances having many acute admissions, or both (Figure 4.2). The following points apply for both sexes:

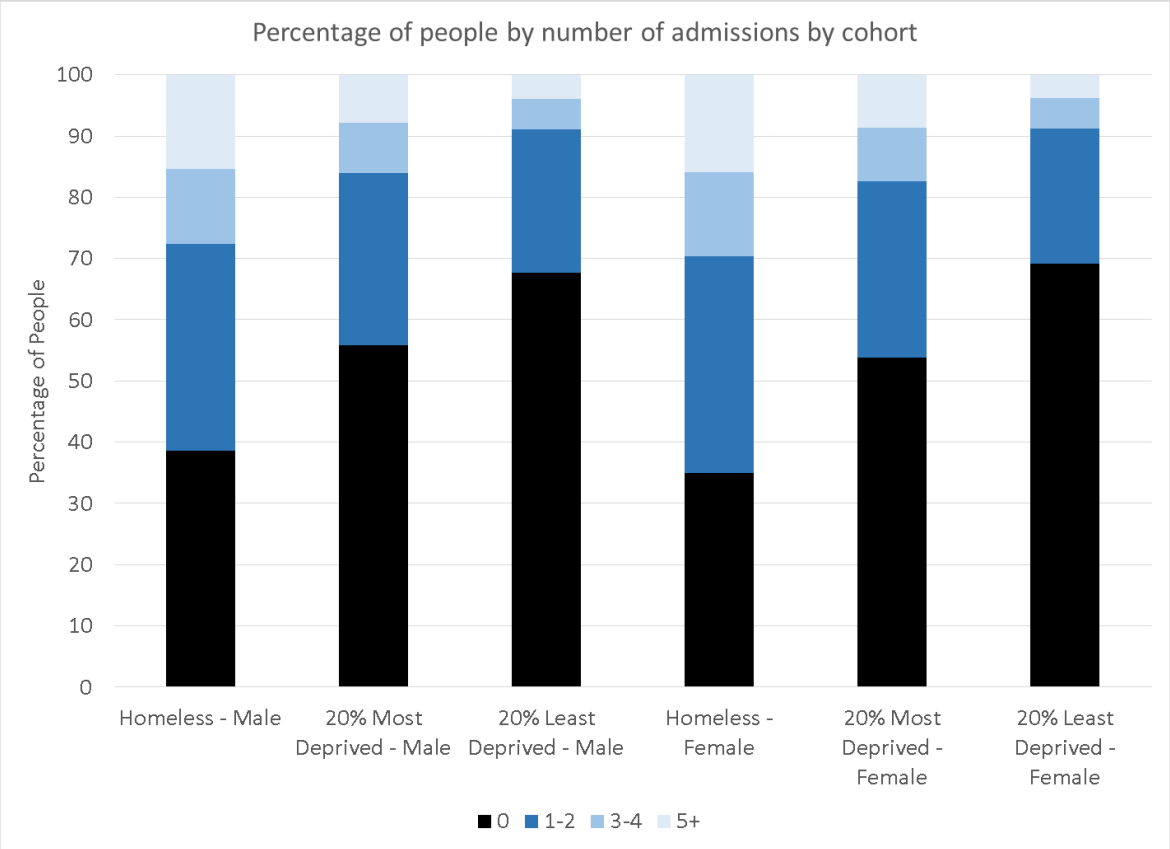
More of the EHC had at least one acute admission

A higher proportion of the EHC (61% males, 65% females) had at least one acute admission than the MDC (44% males, 46% females) and LDC (32% males, 31% females) over the study period.

More of the EHC had many acute admissions

A higher proportion of the EHC (15% males, 16% females) had five or more acute admissions than the MDC (8% males, 9% females) and LDC (4% males, 4% females) over the study period. Even among people who had at least one acute admission, a notably higher proportion of the EHC had many admissions than the MDC and LDC.

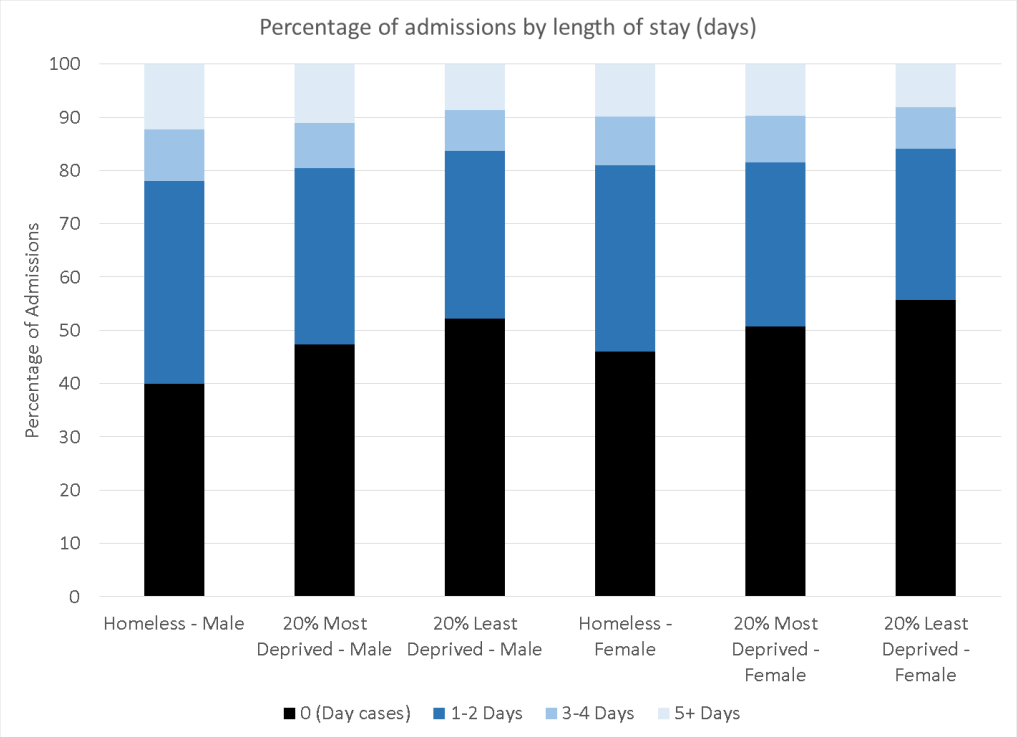
Figure 4.2: Percentage of people by number of acute admissions by cohort and sex.



4.3 Length of stays by age and cohort

Having seen that the EHC have more acute admissions than the control cohorts, this section explores the length of these admissions (Table 4.2 and Figure 4.3). Each admission record contains information on the length of stay in days. This is the difference between the date of admission and the date of discharge[37]. Note that the data used in this study does not distinguish between inpatient admissions with a zero length of stay and day case admissions. For the purposes of the average inpatient length of stay, inpatients include only those admissions with a length of stay of at least one day. This will therefore not be directly comparable with the ISD (Information Services Division, National Services Scotland of the NHS) average length of stay publication, as that includes zero length of stay inpatient admissions[38].

Figure 4.3: Percentage of admissions by length of stay, by cohort and sex.



More of the EHC acute admissions include an overnight stay

A higher proportion of the EHC acute admissions (60% male, 54% female) include an overnight stay than among those in the MDC (53% male, 49% female), and LDC (48% male, 44% female).

[37] Some people – particularly those who require social work services following a hospital stay –may be clinically ready for discharge before their actual discharge date, but they are delayed in hospital whilst they wait for their care packages to be put in place. This may affect the different cohorts differently.

[38] http://www.isdscotland.org/Health-Topics/Hospital-Care/Inpatient-and-Day-Case-Activity/

The distribution of length of stay among acute inpatient admissions is similar between cohorts

The distribution of length of stay among admissions that include an overnight stay is about the same between the different cohorts for males, and also about the same between cohorts for the females (Table 4.2).

Perhaps people in the EHC have more health issues requiring an inpatient admission. However as these inpatient admissions are then discharged within a similar time (and do not require longer stays) to those in the controls, perhaps these health issues have similar severity to those of the controls.

Table 4.2: Percentage of admissions by the number of days the admission was over, for each cohort and sex. Also shown is the average (mean) length of stay of each inpatient admission (admission with a length of stay of 1+ days), calculated from the total length of all admissions and the number of inpatient admissions.

		Male			Female		
		EHC	MDC	LDC	EHC	MDC	LDC
Percentage of admissions that have length of stay (days) of:	0	40	47	52	46	51	56
	1	27	23	22	24	21	20
	2	11	10	9	11	10	9
	3	6	5	5	6	5	5
	4	4	3	3	4	3	3
	5+	12	11	9	10	10	8
	Total	100	100	100	100	100	100
Number of inpatient admissions (where admission had a length of stay of 1+ days)		362,312	177,930	93,749	316,235	174,276	83,661
Total length of stays in days		1,507,223	727,978	343,885	1,128,889	650,280	301,365
Average inpatient length of stay		4.2	4.1	3.7	3.6	3.7	3.6

4.4 Temporal analysis: admissions relative to the date of first homelessness assessment

In Section 4.1 it was found that the EHC have more acute admissions than both control cohorts. In order to explore the relationship between homelessness and acute activity, this section compares the timing of acute admissions with the date of first homelessness assessment (Figure 4.4). Detail on this method is described in full in Section 2.10.

The shape of the graph for the EHC is markedly different from the MDC. The following points apply for both sexes:

The MDC had consistently more acute admissions than the LDC

The MDC had approximately double the number of acute admissions than the LDC. This ratio is roughly constant over time. This makes sense as there would be no particular reason for the activity of people in these cohorts to change with reference to the date of first homelessness assessment.

Even several years before the date of first assessment, the EHC ratio is higher

People who go on to become homeless appear to have more acute admissions, years prior to their first homeless assessment.

EHC acute admissions increase towards assessment date

From around four years prior to, to a few months before, the date of first homelessness assessment, EHC acute admissions increase relative to LDC acute admissions (from a ratio of around 2.5 to 3.25).

There is a clear peak in EHC acute admissions around assessment date, especially for males

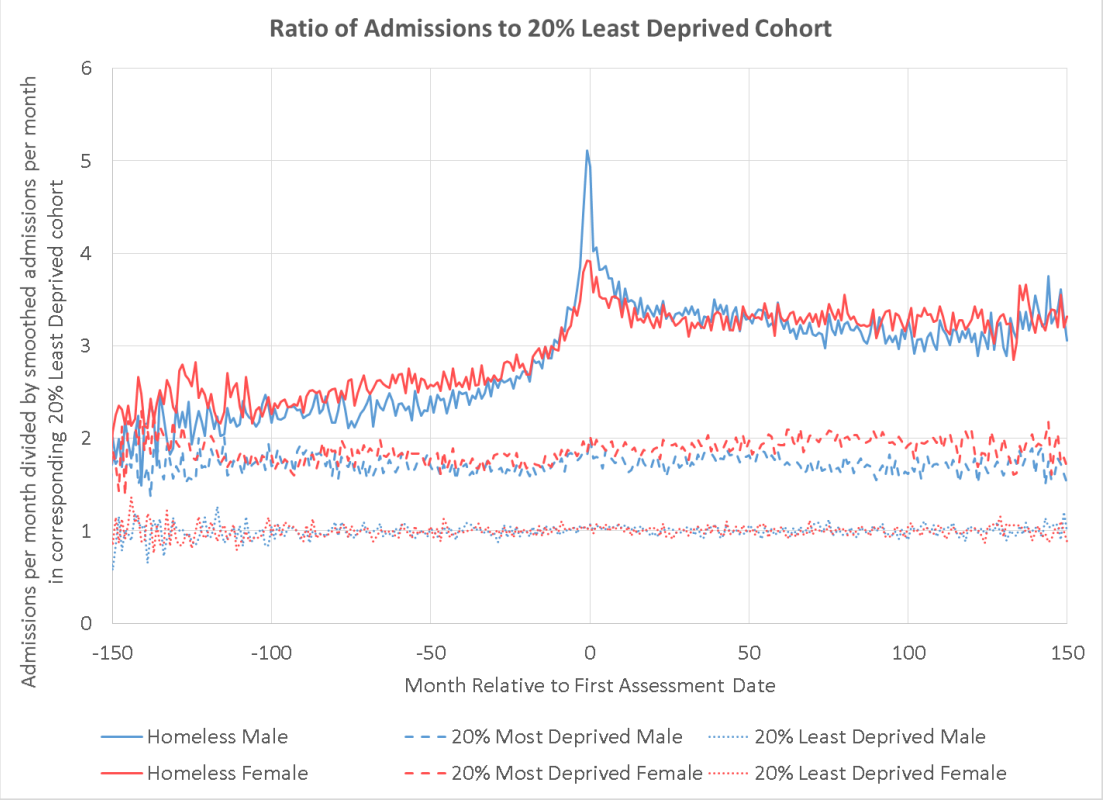
In the weeks and months immediately prior to the date of first homelessness assessment, EHC acute admissions increase sharply (peak value of around 5 for males and 4 for females). Notably, the observed peak is *not* after the date of first homelessness assessment. This suggests that becoming homeless is, for some people, part of a crisis, which has health components.

EHC acute admissions stabilise after the peak, but at a higher level

EHC acute admissions stabilise one to two years following the date of first homelessness assessment for several years at a level (roughly 3.25), similar to that immediately prior to the sharp increase.

If differences in acute admissions between the cohorts were driven by deprivation alone, then the shape of the EHC line would be similar to that of the MDC. Therefore, it appears that homelessness has a relationship with acute admissions.

Figure 4.4: Ratio of acute admissions per month (relative to assessment date) for each cohort to the admissions among the LDC, by sex.



4.5 Acute admissions for Once-Only and Repeat Homelessness

In the previous section, EHC acute admissions were shown to be higher after the date of first homelessness assessment than before. This could be due to more periods of homelessness, but at different times for different people, or it could be a long term effect of the original homelessness assessment. To better understand this, this section explores differences in acute admission ratios between those people in that have only been assessed as homeless once (Figure 4.5) (Once-only EHC), and those who have been assessed as homeless on multiple occasions, referred to as repeat homelessness (repeat EHC) (Figure 4.6). More information on repeat homelessness is available in section 2.1.3.

Acute admission ratios for Repeat EHC are higher than for Once-only EHC. The following points generally apply for both sexes:

Acute admission ratios prior to assessment date are higher for Repeat EHC

For the Repeat EHC the ratio prior to the assessment date is around 3 (for both males and females). This is higher than that for the once-only EHC, which is around 2.5 (for both males and females).

The acute admission peak ratio is sharper for Repeat EHC

The peak around the date of first homelessness assessment increased more sharply for the repeat EHC than for the once-only EHC.

The ratio falls back to pre-homelessness levels only for once-only EHC

For the once-only EHC, by around five years for males (around 10 years for females) following the assessment date the ratio has reduced to around the level it was at two years prior to the assessment date.

This contrasts with the repeat EHC ratio, which remains above the ratio value immediately prior to the peak, for the remainder of the period.

Figure 4.5: Ratio of admissions per month (relative to assessment date) for people with **one** homelessness assessment for each cohort to the admissions among the LDC by sex.

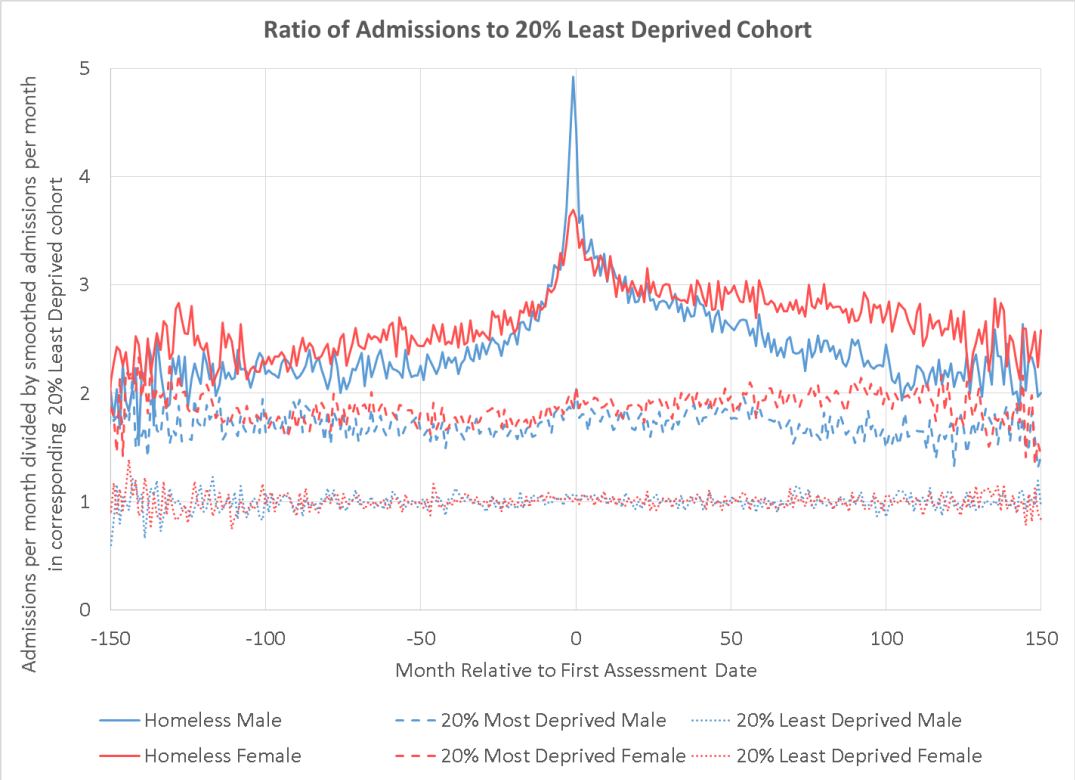
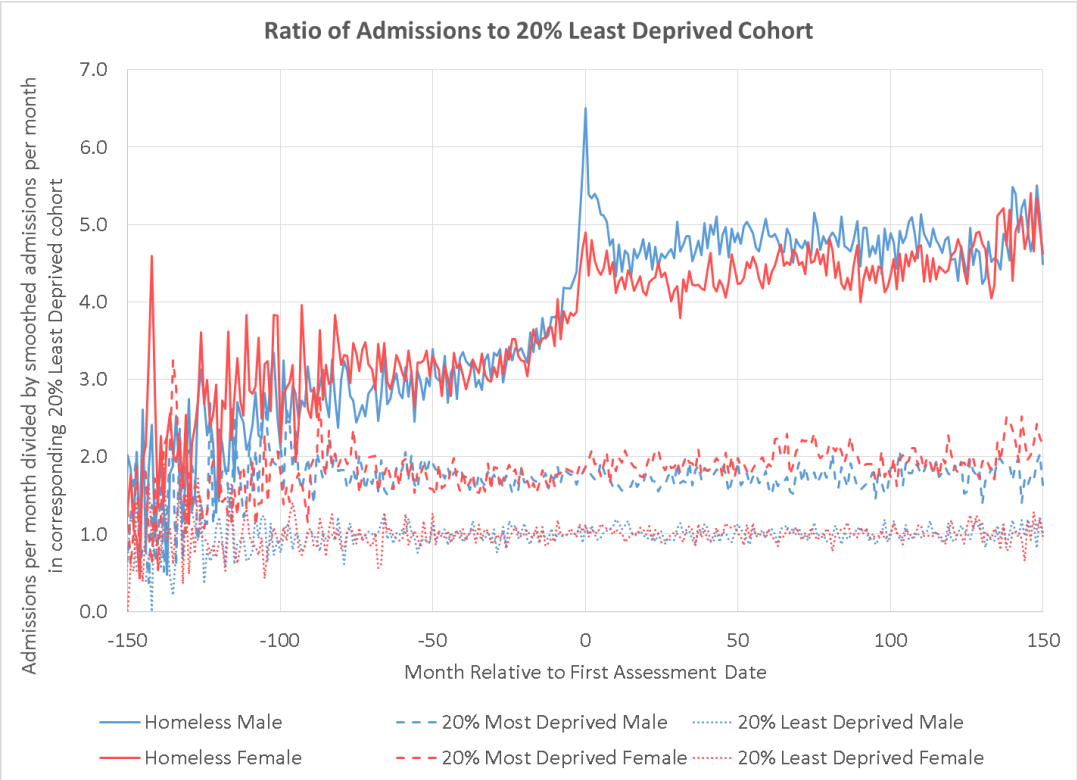


Figure 4.6: Ratio of admissions per month (relative to assessment date) for people with **repeat** homelessness assessments for each cohort to the admissions among the LDC by sex.

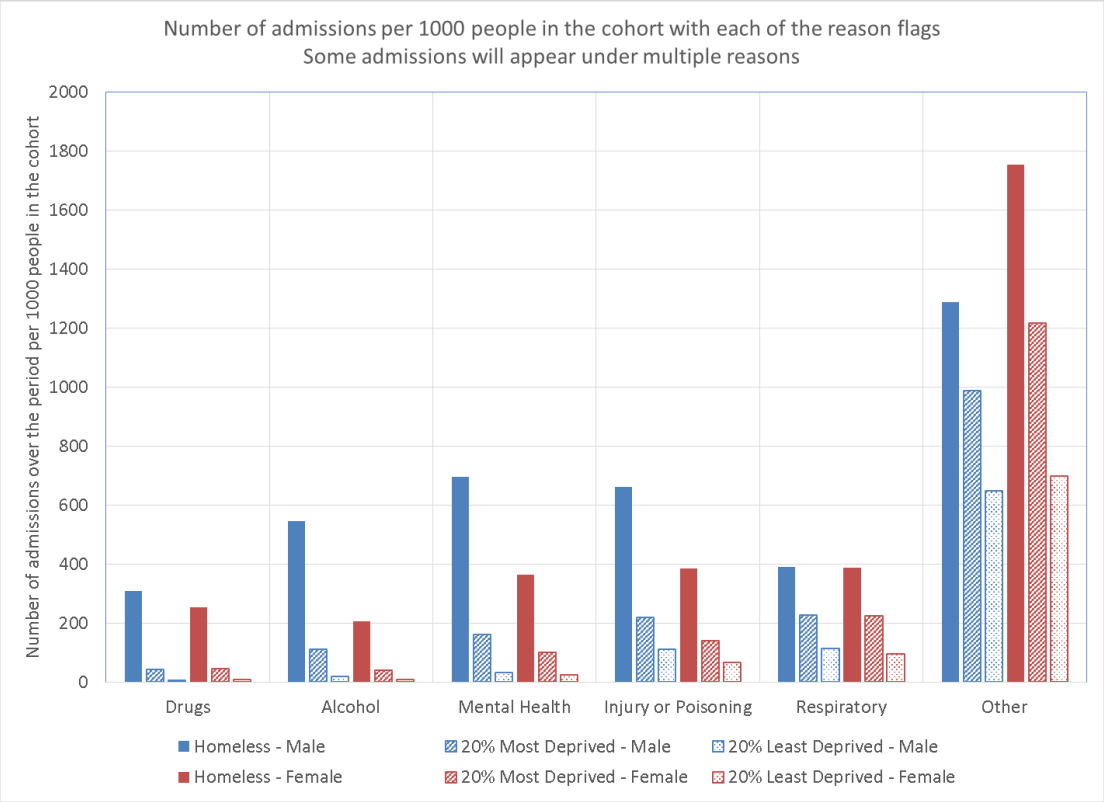


4.6 Reason for admission

For each acute admission record in this study there is an indication of whether it is related to: drugs, alcohol, mental health, injuries or poisonings, or respiratory diseases (as defined in Section 2.3.1). Acute admissions can have one or more of these indicators flagged and so the total of all admission reasons will exceed the total number of admissions. However, if an admission is not related to any of the above conditions, then the admission is labelled as an 'other condition' admission[39].

Figure 4.7 indicates the number of admissions that have each of these flags by sex and cohort per 1,000 people. For each indicator there is a higher admission rate among the EHCs than among the other cohorts. This is particularly pronounced for drugs, alcohol and mental-health related admissions. For all indicators apart from respiratory illness and other there is generally a higher admission rate among males than females.

Figure 4.7: Number of admissions per 1,000 people in the cohort with each of the reason flags by sex.



In order to analyse the ratios between the cohorts, and to look at the temporal analysis broken down by these reasons, we need to identify a set of admissions to include for each reason. This could be done in various ways (Table 4.3).

The problems against options 1 and 2 listed in Table 4.3 are taken as reasons not to use these methods.

[39] In this instance, the 'other condition' admission could still be related to multiple conditions.

Therefore option 3 is used. This requires an ordering of the reason flags to be decided. To decide on an order of the hierarchy the two Option 3 alternatives are explored.

Table 4.3: Options for assigning admissions to reasons for the purpose of analysing ratios and temporal effects driven by these reasons, and problems associated with these.

Option	Set of admissions	Problem
1	All admissions that include that flag	Effects observed (ratios and temporal effects) could be due to the other flags in cases where many admissions include other flags and the other reasons result in larger effects. This could particularly be the case for mental health, where only 17.7 per cent of the admissions with that flag do not include any other flags.
2	Only admissions that include the flag and no others	Can result in very few admissions in the set. For example there are over 145,000 admissions with the drugs flag, but only 75 of them have no other flags. In any case, these admissions could be associated with another condition not included in the five reasons provided for the study. It simply shows that any other reason is not included in the set of reasons captured for the study. So the purpose of this method (to isolate the effect of the specific reason for the admission) cannot be achieved using the study's data.
3	Categorization by hierarchy of reasons	A decision would be required whether to choose an order based on: • the scale of the difference of the activity with that flag between the cohorts, or • ensuring that there are enough admissions in each category.

Firstly, the scale of the difference of the activity with that flag between the cohorts is considered. It would be preferable for the set of admissions considered for a particular reason to exclude admissions that also have a reason that exerts a large difference in activity between the cohorts. This is because they could have an impact on the results. The four ratios (EHC : MDC and EHC : LDC for males and females) for admissions with each reason flag are shown in Table 4.4, ordered in general decreasing order of the size of the ratios.

Table 4.4: Number of admissions with each admission flag and the ratios of these numbers between the EHC and both the MDC and LDC, by sex.

Admission flag	**Male**			**Female**		
	Admissions	EHC : MDC	EHC : LDC	Admissions	EHC : MDC	EHC : LDC
Drugs	236,526	7.2	44.1	200,691	5.5	26.8
Alcohol	444,768	4.9	29.2	166,854	5.0	25.4

Mental Health	586,131	4.3	21.3	316,710	3.6	15.6
Injury or Poisoning	654,231	3.0	5.9	385,380	2.7	5.7
Respiratory	483,462	1.7	3.4	460,188	1.7	4.1
Other	1,927,794	1.3	2.0	2,381,913	1.4	2.5

Secondly, the number of admissions with only the particular flag is considered. This is to ensure that there are a reasonable number of admissions included. For example if drugs was last in the hierarchy then only 75 admissions would be included against this reason. This is because all the other admissions with the drugs flag also have another flag, and so these would then be counted against one of those reasons. Table 4.5 shows the number of admissions that have that flag and no other (the ones that would be counted against that reason if it was last in the hierarchy).

Table 4.5: Number of admissions with only one reason flag by reason.

Reason	Admissions with only this flag	Percentage of all admissions
Drugs	75	0.00
Alcohol	20,538	0.91
Mental Health	53,221	2.35
Injury or Poisoning	189,481	8.36
Respiratory	241,589	10.66
Other	1,436,569	63.39
Total admissions with 1 flag	1,941,473	85.67

Conveniently, these two alternatives result in the same ordering of the reasons. Therefore this hierarchy is adopted in the following analysis. This is summarized as below:

- Drugs: all admissions with the drugs flag
- Alcohol: all admissions with the alcohol flag, apart from those included above
- Mental Health: all admissions with the mental health flag, apart from those included above
- Injury or poisoning: all admissions with the injury or poisoning flag, apart from those included above
- Respiratory: all admissions with the respiratory flag, apart from those included above

Table 4.6: Percentage of admissions by combination of indicators present. Shading indicates the groupings of these combinations used in the remainder of this chapter: red for drugs, blue for alcohol, yellow for mental health, green for injury or poisoning, purple for respiratory and white for other.

		Mental Health							
		No				Yes			
		Injury or Poisoning				Injury or Poisoning			
		No		Yes		No		Yes	
		Respiratory		Respiratory		Respiratory		Respiratory	
Drugs	Alcohol	No	Yes	No	Yes	No	Yes	No	Yes
No	No	63.39	10.66	8.36	0.49	2.35	1.07	0.24	0.04
	Yes	0.91	0.18	0.16	0.01	3.61	0.62	1.37	0.09
Yes	No	0.00	0.00	1.79	0.10	1.14	0.37	0.89	0.09
	Yes	0.00	0.00	0.62	0.03	0.34	0.06	0.93	0.05

Table 4.7: Percentage of all admissions by the category to which they have been assigned.

Categorization	Percentage of admissions
Drugs	6.4
Alcohol	7.0
Mental Health	3.7
Injury or Poisoning	8.9
Respiratory	10.7
Other	63.4
Total	100.0

As discussed above some admissions might be related to more than one factor. Table 4.6 shows the breakdown of admissions by combinations of these indicators, shaded by the categorization indicated in the previous section. Table 4.7 shows the total percentage of admissions in each category.

Having categorized all the admissions to particular reasons, the following analyses explore the differences between the cohorts within each category (Figure 4.8 and Table 4.8).

Figure 4.8 is similar to Figure 4.7 but breaks down the admissions by the category to which they have been assigned, rather than indicating all the admissions with the corresponding indicator. It can be seen that there are now fewer mental-health admissions. This is because many mental-health admissions also include the drug or alcohol flags, and these will be categorized as drug or alcohol admissions. This is particularly the case among males, who tend to have more alcohol admissions, resulting in there now being more female mental health admissions than male ones.

Injury or poisoning, and respiratory have also been affected, but to a lesser extent. The following points apply for both sexes:

The EHC have more acute admissions for each of the admission categories

Compared to the controls in the MDC or LDC, the ratio of admission is always greater than one (minimum ratio is: 1.3, EHC : MDC for males for other admissions, see Table 4.8).

Drugs and alcohol have the highest ratios

The EHC have more drugs and alcohol related admissions than their controls (the minimum EHC : MDC ratio is 4.5 and the minimum EHC : LDC ratio is 23). These differences are larger than the differences for any of the other admission reason categories.

The mental-health EHC : LDC ratios are notably larger than for all categories combined

For males the mental-health EHC : LDC ratio is 6.1 (compared with 3.1 across all admissions). For females the mental-health EHC : LDC ratio is 7.8 (compared with 3.1 across all admissions).

All other ratios are roughly similar to those of all categories combined

The EHC : MDC ratios for remaining categories for males - injury or poisoning, respiratory and other - range from 1.3 to 2.1 (compared with 1.8 across all admissions, for females the range is 1.4 to 2.0 compared with 1.7). The EHC : LDC ratios for remaining categories for males range from 2.0 to 3.5 (compared with 3.1 across all admissions, for females the range is 2.5 to 3.2 compared with 3.1).

Figure 4.8: Number of admissions per 1,000 people in the cohort by admission category by sex.

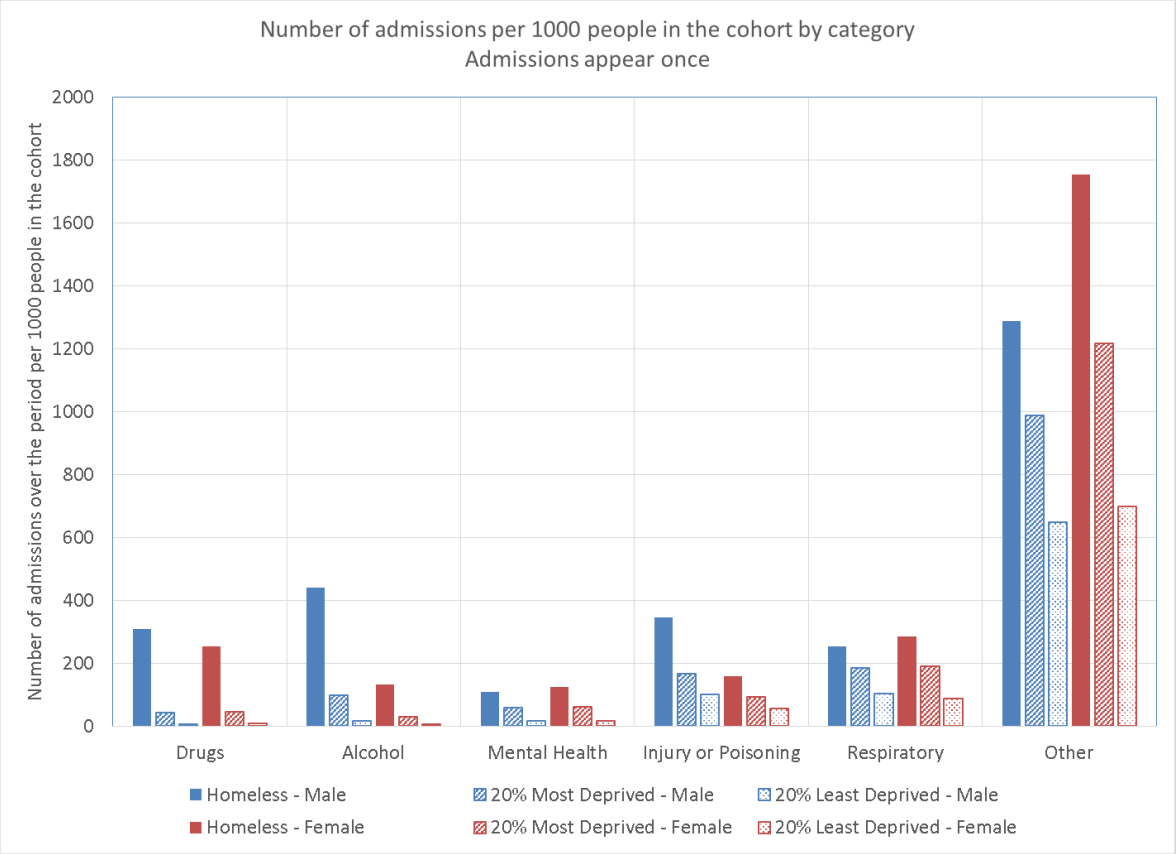


Table 4.8: Number of admissions by category and sex. Also shown are the ratios EHC : MDC and EHC : LDC by category and sex.

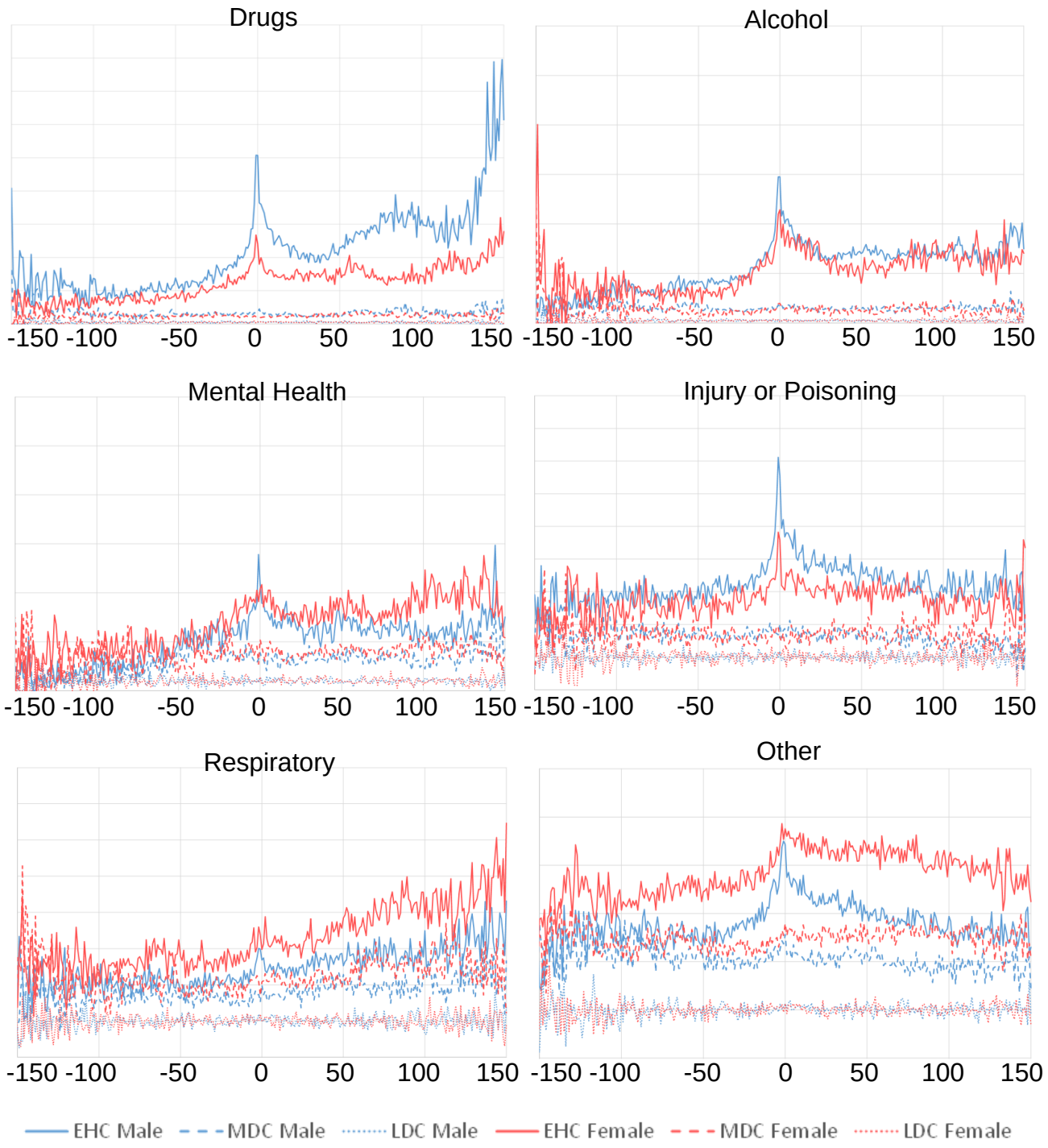
	Male			Female		
Admission category	Admissions	EHC : MDC	EHC : LDC	Admissions	EHC : MDC	EHC : LDC
Drugs	78,842	7.2	44.1	66,897	5.5	26.8
Alcohol	121,728	4.5	26.6	35,997	4.5	23.1
Mental Health	40,433	1.9	6.1	43,509	2.0	7.8
Injury or Poisoning	134,182	2.1	3.5	66,398	1.7	2.9
Respiratory	119,368	1.4	2.4	122,221	1.5	3.2
Other	642,598	1.3	2.0	793,971	1.4	2.5
All	1,137,151	1.8	3.1	1,128,993	1.7	3.1

4.7 Admissions relative to the date of first homelessness assessment by reason

In section 4.4 it was found using temporal analysis that admissions in the EHC relative to their controls peak around the time of first homelessness assessment. In section 4.6 it was found that the ratios vary across categories of admissions (based on the reason flags attached to each admission record). This section explores temporal analysis for each of the admission categories to explore how admissions in

the different categories vary over time relative to the date of first homelessness assessment.

Figure 4.9: Ratio of admissions to that of the 20% least deprived cohort (LDC), by sex, against the time difference(months) between the first assessment and the attendance date. There is one panel for each admission category.



The shape of the graph for the EHC is markedly different from the MDC (Figure 4.9). The following points apply for both sexes:

- The ratios increase in the years prior to first assessment for drugs, alcohol, mental health and to a lesser extent for other
- Peaks at time of first assessment are observed for drugs, alcohol and injury or poisoning, and also for the remaining categories for males
- Injury and poisoning, and male other ratios eventually return to the prior levels
- Respiratory ratios notably increase following the peak

In addition:

- There is an increased peak for drugs ten years after the first assessment, especially for males.
- Alcohol admissions stay constant but high for both males and females after the first homelessness assessment.
- Mental health admissions stay higher for females, more so than for males.
- Other admissions return to pre-first assessment levels, but this takes longer for females.

4.8 Summary

The EHC have more acute admissions than the control cohorts. This is true for each age and sex breakdown. The rate of admissions per 1,000 people increases steadily with age also, and this is true for each cohort. More of the EHC having at least one acute admission, and among those who do have acute admissions, the EHC have more multiple admissions. A higher proportion of acute admissions amongst the EHC included an overnight stay. Of those that stay one or more days, the length of stay for inpatients is similar between cohorts.

Among the EHC there is a relationship between the timing of acute admissions and that of the first homelessness episode, suggesting some relationship between these. There is a clear peak in acute admissions around the time of first homelessness assessment (particularly for males but with a less marked peak for females), with a rise leading to this, yet stabilising at a higher activity level afterwards. This is especially the case for those who have multiple homelessness episodes, with a high ratio and longer lasting peak ratio. For people who have only one homelessness assessment, the acute admissions ratio eventually returns to the level it was prior to the homelessness episode.

This chapter derives a flag to analyse acute admissions by reason for admission. Many of the admission types do not occur in isolation and a hierarchy of types is created. For each admission flag (drugs, alcohol, mental-health, injury or poisoning, respiratory, and other) the EHC has more, with drugs and alcohol having the highest ratios.

It is clear that there is evidence to support each of the four research questions:

- A gradually worsening health condition prior to the date of first assessment (as observed with increasing acute admissions prior) that results in excess acute admissions, occurs prior to homelessness, particularly for drugs, alcohol, mental health and to a lesser extent for other admission types.

- Also for some people the (first) homelessness episode is associated with some crisis with a health activity component, as observed by an acute admission peak around that time. Peaks are observed for drugs, alcohol and injury or poisoning, and also for the remaining categories for males.
- Ratios after the first assessment notably increase following the peak for respiratory admissions, and for people with repeat homeless assessments. Injury and poisoning, and male other ratios eventually return to the prior levels.
- Even several years prior to their first homeless assessment, the EHC ratios are higher. This could be a result of the EHC having an even higher proportion of individuals than the MDC who are affected by factors associated with deprivation.

Chapter 5: Outpatients

There were 9 million outpatient appointments[40] over the time period 1 April 2002 to 31 March 2015 inclusive for the 1.3 million people in the study. For more information on the outpatient appointments (SMR00) data see Section 2.3.5.

In this chapter we discuss the study cohorts, their outpatient activity and how this relates to homelessness. How this relates to deprivation and health needs is discussed in Chapter 11.

5.1 Comparative activity between the EHC and their controls

Accounting for one third of all people in the study, people in the EHC (Ever Homeless Cohort) accounted for 49% of outpatient appointments (21% male, 28% female). Outpatient appointments amongst the MDC (Non-homeless 20% Most Deprived Cohort) accounted for 30% of appointments during the period (13% male, 17% female). The LDC (Non-homeless 20% Least Deprived Cohort) accounted for 21% of appointments (9% male, 12% female).

Table 5.1: Number of people, number of appointments and the ratio of the number of appointments between EHC and MDC, and between EHC and LDC, by age and sex.

	Male				Female			
Age (at 31 March 2015)	Number of people	Appointments	EHC : MDC	EHC : LDC	Number of people	Appointments	EHC : MDC	EHC : LDC
0 to 15	135,444	477,835	1.3	1.4	127,461	389,287	1.2	1.4
16 to 20	49,263	248,966	1.3	1.5	51,276	278,227	1.4	1.9
21 to 25	64,209	309,503	1.5	1.9	78,690	533,021	2.0	3.2
26 to 30	75,363	338,553	1.9	2.7	93,003	753,521	2.0	3.9
31 to 35	70,407	430,872	2.2	3.3	74,493	836,175	1.9	3.0
36 to 40	58,347	280,322	2.1	3.7	53,259	431,756	1.7	2.2
41 to 45	55,737	384,279	1.8	3.5	48,873	504,838	1.5	2.1
46 to 50	49,818	372,236	1.7	2.9	43,563	462,084	1.4	2.2
51 to 55	37,746	313,667	1.6	2.5	31,578	355,088	1.3	2.1
56 to 60	25,017	235,027	1.4	2.1	19,017	230,885	1.3	1.9
61 to 65	15,765	171,961	1.4	2.0	11,436	153,521	1.3	1.6
66 or over	21,591	287,786	1.2	1.3	16,203	235,454	1.2	1.3
All ages	658,707	3,851,007	1.6	2.3	648,852	5,163,857	1.6	2.4

In order to see how outpatient appointments compare in the different cohorts, ratios of outpatient appointments were constructed for each age band and sex (Table 5.1). The following points apply for both sexes:

[40] Episode level data from patients on new and follow up appointments at outpatient clinics in all specialities. This includes appointments not kept.

The EHC have more outpatient activity

In total, the EHC has 60% more outpatient appointments than the MDC (1.6 times for males and females) and over double the number of outpatient appointments compared with LDC (2.3 times for males, 2.4 times for females).

For each age and sex breakdown, the EHC have more outpatient activity

Compared to the controls in the MDC or LDC, the ratio of appointments is always greater than one (minimum ratio is: 1.2, EHC : MDC for males at 66+ years, and for females at 0–15 and 66+).

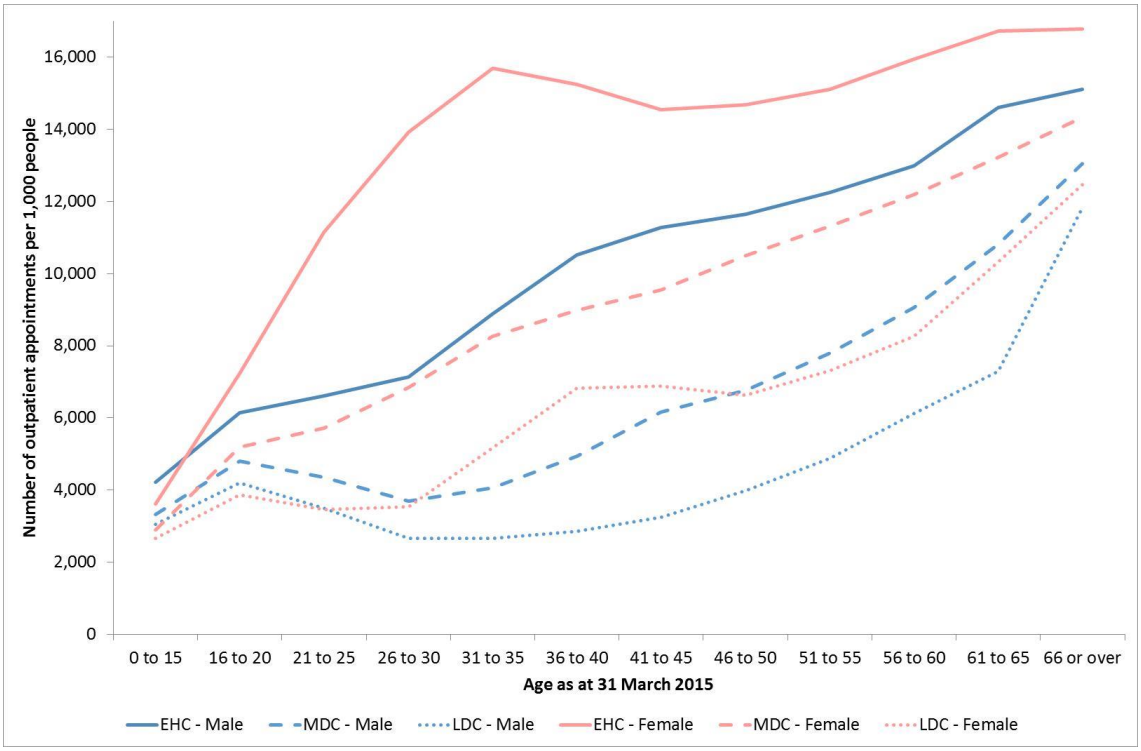
EHC males aged 31–40 years have the most outpatient appointments compared with their controls

For males EHC : LDC peaks at 3.7 at 36–40 years, and EHC : MDC peaks at 2.2 at 31–35 years. The LDC outpatient appointment rate (Figure 5.1) decreases from 16–20 to 26–40 years, while the EHC rate continues to increase with age. Thus the ratio between these increases over this range, to peak at 36–40 years. The MDC shows a trend similar to, but less pronounced than, the LDC. These differences in shape are what drives the variation in the ratios with age.

EHC females aged 26–30 years have the most outpatient appointments compared with their controls

For females EHC : LDC peaks at 3.9 at 26–30 years, and EHC : MDC peaks at 2.0 at 21–30 years. The MDC and LDC appointment rates generally increase with age. In contrast the EHC rate increases steeply to 31–35 years, and then decreases to 41–45 years. This produces a bulge in the appointment rate, similar to that observed in Chapter 4. The peak ratio is therefore at the end of the steep increase of the EHC.

Figure 5.1: Number of outpatient appointments per 1,000 people by age, sex and cohort.



5.2 Distribution of the number of appointments

The previous section found that, on average, people in the EHC had more outpatient appointments than their controls. This section explores whether this is due to a higher proportion of the EHC having outpatient appointments, or a higher proportion of the EHC who had appointments having many outpatient appointments, or both (Figure 5.2). The following points apply for both sexes:

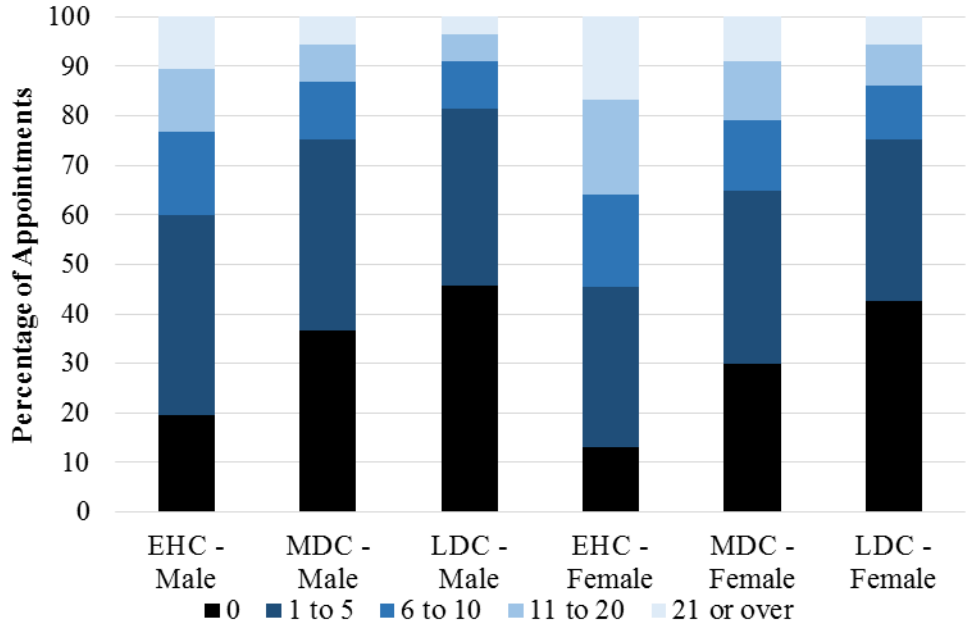
More of the EHC had at least one outpatient appointment

A higher proportion of the EHC (80% males, 87% females) had at least one outpatient appointment than the MDC (63% males, 70% females) and LDC (54% males, 58% females) over the study period.

More of the EHC had many outpatient appointments

A higher proportion of the EHC (10% males, 17% females) had 21 or more outpatient appointments than the MDC (6% males, 9% females) and LDC (4% males, 6% females) over the study period. Even among people who had at least one outpatient appointment, a notably higher proportion of the EHC had many appointments than the MDC and LDC.

Figure 5.2: Proportion of cohort in total number of appointment bands



5.3 Appointments by attendance type

Outpatient appointments are categorised as either: patient was seen, patient attended but was not seen (could not wait, CNW), and patient did not attend and gave no prior warning (did not attend, DNA). The two categories of CNW and DNA both result in the patient not being seen. They can be combined to create a new category – patient was not seen.

Table 5.2: Number of outpatient appointments by clinic attendance by cohort, per 1,000 people in cohort by sex.

	Male			Female		
Clinic attendance per 1,000 people	EHC	MDC	LDC	EHC	MDC	LDC
Patient was seen	6,119	4,284	3,366	9,112	6,146	4,521
Patient was not seen	2,395	975	400	2,580	1,104	412
• Attended but not seen (Could Not Wait)	18	6	2	17	6	2
• Did not attend and no warning	2,376	969	398	2,563	1,098	410
Total	8,514	5,259	3,766	11,692	7,250	4,933
Proportion of total appointments 'not seen'	28%	19%	11%	22%	15%	8%

The proportion appointments that resulted in people not being seen was calculated for each cohort (Table 5.2). The following apply for both sexes:

A greater proportion of appointments for EHC resulted in people not being seen.

The proportion that were not seen was higher for the EHC (28% males, 22% females) than in the MDC (19% males, 15% females), and the LDC (11% males, 8% females).

Could Not Wait was the highest for the EHC

The proportion that CNW was higher for the EHC (0.17%) than the MDC (0.10%) and the LDC (0.05%).

One might suspect that the reason the proportion of patients not being seen was higher for the EHC is that homeless people may not have received or been aware of a reminder for the appointment, or that they were not able to get to the hospital. This would explain the greater proportion of DNA appointments, but not the relatively higher rate of Could Not Wait appointments. In addition, the higher rate of outpatient appointments may also partly be driven by the re-booking of missed appointments.

5.4 Outpatient appointments for Once-Only and Repeat Homelessness

This section explores differences in outpatient appointment ratios between those people in that have only been assessed as homeless once (Figure 5.3) (Once-only EHC), and those who have been assessed as homeless on multiple occasions, referred to as repeat homelessness (repeat EHC) (Figure 5.4). More information on repeat homelessness is available in section 2.1.3.

The shape of the graph for the EHC is markedly different from the MDC. The following points generally apply for both sexes:

Even several years before the date of first assessment, the EHC ratio is higher

People who go on to become homeless (once-only and repeat) appear to have more outpatient appointments, years prior to their first homeless assessment.

EHC outpatient appointments increase towards assessment date

From around four years prior to (for Repeat EHC, two years for Once-only EHC), to a few months before, the date of first homelessness assessment, EHC outpatient appointments increase relative to LDC outpatient appointments.

There is a clear peak for Once-only EHC outpatient appointments around assessment date

In the months immediately prior to the date of first homelessness assessment, Once-only EHC outpatient appointments increase (peak value of around three).

Once-only EHC outpatient appointments gradually decline to the earlier level

By around eight years after the homelessness assessment the Once-only EHC outpatient appointments ratios declines to around the value four years before the date of first assessment.

Repeat EHC ratios increase around assessment date and gradually decrease for females

While there is not a substantial peak among the Repeat EHC, there is a notable level-shift around this time. Among males this higher ratio is maintained for the duration of the study period. Among females this gradually decreases, but still remains above the prior level.

If differences in outpatient appointments between the cohorts were driven by factors associated with deprivation alone, then the shape of the EHC line would be similar to that of the MDC. Therefore, it appears that homelessness has a relationship with outpatient appointments. In general the findings are similar to that for A&E attendances and acute admissions, so the possible mechanisms raised there are also relevant here.

Figure 5.3: Ratio of appointments per month (relative to assessment date) for people with **one** homelessness assessment for each cohort to the appointments among the LDC by sex.

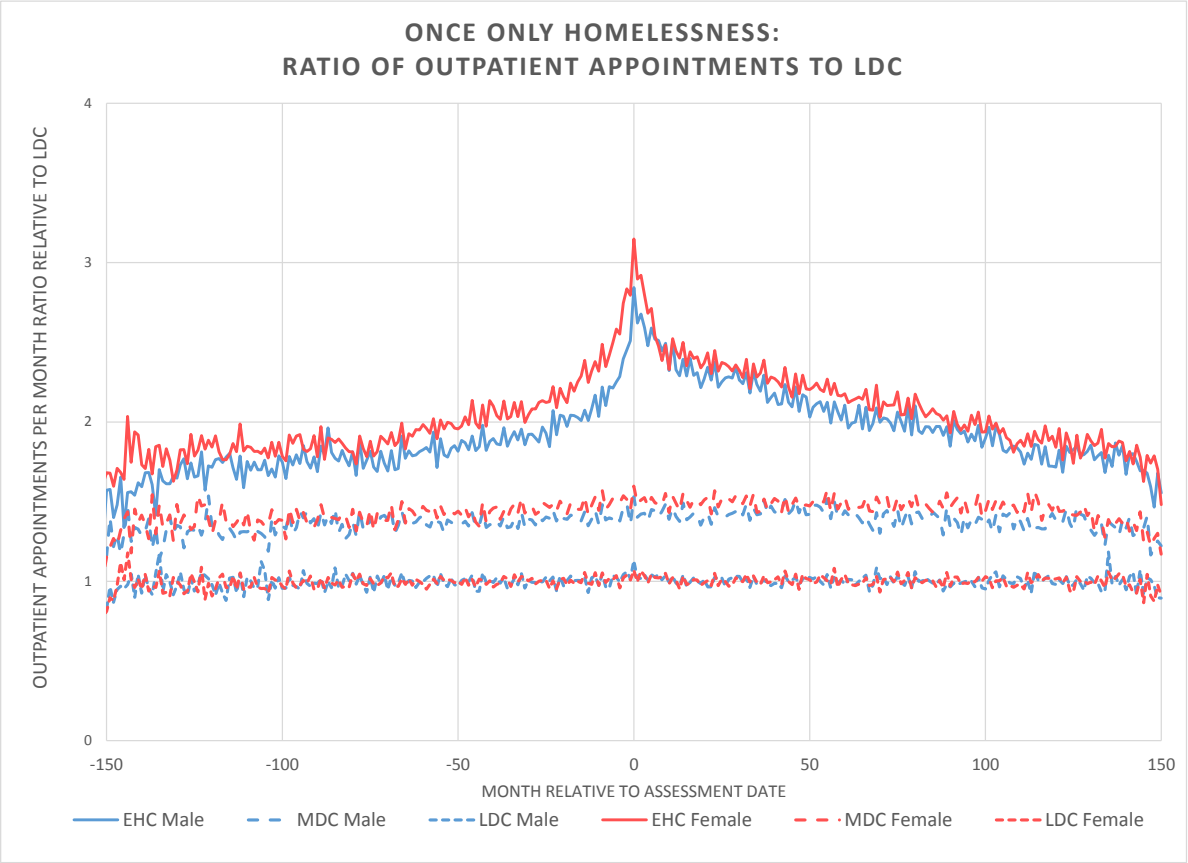
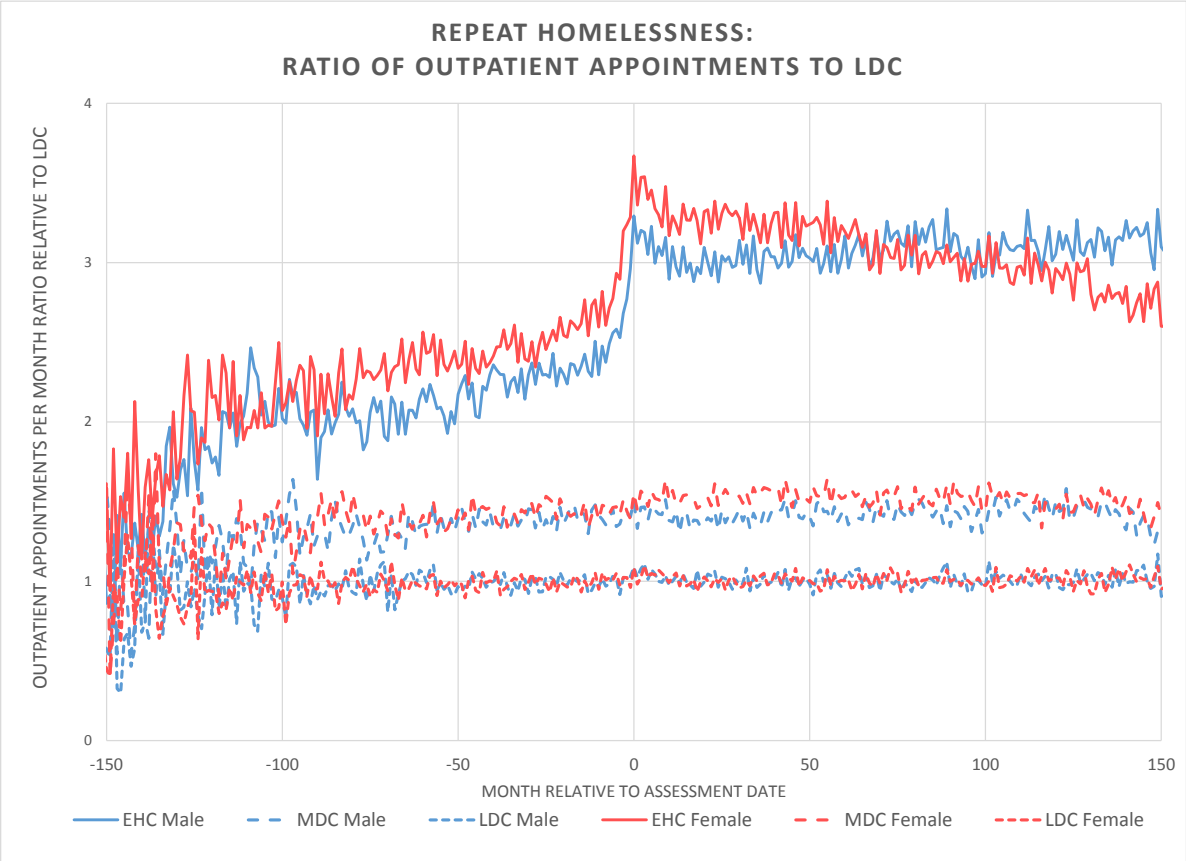


Figure 5.4: Ratio of appointments per month (relative to assessment date) for people with repeat homelessness assessment for each cohort to the appointments among the LDC by sex.



5.5 Summary

The EHC have more outpatient appointments than the control cohorts. This is true for each age and sex breakdown, and is greatest among males aged 31–40 years and females aged 26–30 years. This is due to more of the EHC having at least one outpatient appointment, and among those who do have appointments, more of the EHC have multiple outpatient appointments. A greater proportion of outpatient appointments for people in the EHC resulted in people not being seen, primarily because the person did not attend. The proportion of outpatient appointments classed as could not wait were also much higher for the EHC. Missed appointments only partly explain why the EHC have more outpatient appointments.

It is clear that there is evidence to support each of the four research questions:

- A gradually worsening condition prior to the date of first assessment that results in excess outpatient appointments, before homelessness occurs. EHC outpatient appointments increase towards the first assessment date.
- Also for some people the (first) homelessness episode is associated with some crisis with a health activity component, as observed by an outpatient appointments peak around that time. There is a clear peak for Once-only EHC outpatient appointments around assessment date, and a level-shift for repeat homeless people.

- Ratios after assessment date gradually decline to the earlier level for the Once-only EHC. These ratios gradually decline for repeat females - yet not to earlier levels, and remain high for repeat males.
- Lastly, people who go on to become homeless appear to have more outpatient appointments, even several years prior to their first homeless assessment.

Chapter 6: Prescriptions

In total, there were around 9.5 million prescriptions dispensed over the time period 14 January 2009 to 31 March 2015 to the 1.3 million people in the study. Many homeless people present to health services with multiple morbidity including drug or alcohol dependence, mental health and physical problems such as tuberculosis and breathing difficulties (Department of Health, 2010)[41]. For this reason, the study focuses on the following selection conditions:

- mental health conditions;
- alcohol dependence;
- opioid dependence and;
- the treatment of tuberculosis (TB).

The prescriptions data for this study is a very small subset of all prescriptions (hereafter referred to as study prescriptions). This is typically less than 2% of all prescriptions in any given year. This is because these are a subset of the prescriptions for the people in the study as it does not include other prescriptions (e.g. antibiotics and all other medicines). Also that the people in the study are a subset of all the people in Scotland. For more information on the prescriptions data see Section 2.3.6.

In this chapter we discuss the study cohorts, their dispensed prescriptions and how this relates to homelessness. How this relates to deprivation and health needs is discussed in Chapter 11.

6.1 Overview of prescriptions in the study

Accounting for one third of all people in the study, people in the EHC (Ever Homeless Cohort) accounted for 66% of study prescriptions (30% male, 36% female). Study prescriptions amongst the MDC (Non-homeless 20% Most Deprived Cohort) accounted for 26% of study prescriptions during the period (10% male, 16% female). The LDC (Non-homeless 20% Least Deprived Cohort) accounted for 8% of study prescriptions (3% male, 5% female).

Table 6.1: Number of study prescriptions dispensed by cohort, sex and type of prescription.

	Male			Female		
Type of prescription	EHC	MDC	LDC	EHC	MDC	LDC
Alcohol	40,780	10,360	1,680	23,460	6,040	1,050
Opioid	588,410	95,360	3,910	332,220	47,390	1,530
Mental Health	2,180,000	878,170	271,490	3,065,080	1,457,330	478,300
Tuberculosis	1,590	1,040	540	980	880	460
Total prescriptions	2,810,773	984,933	277,615	3,421,729	1,511,635	481,337

[41] Department of Health. March 2010. Healthcare for Single Homeless People. Available at: https://www.housinglin.org.uk/_assets/Resources/Housing/Support_materials/Other_reports_and_guidance/Healthcare_for_single_homeless_people.pdf

The study prescriptions are dominated by those to treat mental health (Table 6.1). The four different prescription types could have different activity patterns. Therefore in the following sections analysis is done focussing on each type in isolation.

6.2 Comparative prescriptions for alcohol dependence between the EHC and their controls

Accounting for one third of all people in the study, people in the EHC (Ever Homeless Cohort) accounted for 77% of prescriptions for alcohol dependence (49% male, 28% female). Prescriptions for alcohol dependence amongst the MDC (Non-homeless 20% Most Deprived Cohort) accounted for 20% of prescriptions for alcohol dependence during the period (12% male, 7% female). The LDC (Non-homeless 20% Least Deprived Cohort) accounted for 3% of prescriptions for alcohol dependence (2% male, 1% female).

Table 6.2: Number of people, number of prescriptions for alcohol dependence and the ratio of the number of prescriptions for alcohol dependence between EHC and MDC, and between EHC and LDC, by age and sex.

	Male				Female			
Age (at 31 March 2015)	Number of people	Prescriptions	EHC : MDC	EHC : LDC	Number of people	Prescriptions	EHC : MDC	EHC : LDC
0 to 15	135,444	0			127,461	0		
16 to 20	49,263	30			51,276	20		
21 to 25	64,209	660	8.3	58.0	78,690	400	38.0	38.0
26 to 30	75,363	2,520	7.0	72.7	93,003	1,560	3.8	16.9
31 to 35	70,407	5,190	6.3	43.9	74,493	2,900	7.4	41.7
36 to 40	58,347	7,300	4.5	20.5	53,259	4,640	5.8	38.7
41 to 45	55,737	9,950	3.8	25.5	48,873	5,970	3.5	24.9
46 to 50	49,818	10,040	4.4	33.3	43,563	6,470	3.4	20.0
51 to 55	37,746	8,730	2.7	20.6	31,578	4,640	3.0	17.6
56 to 60	25,017	4,520	2.5	20.7	19,017	2,540	3.0	23.0
61 to 65	15,765	2,640	3.4	28.3	11,436	1,030	3.3	9.1
66 or over	21,591	1,240	10.6	4.8	16,203	400	7.8	6.2
All ages	658,707	52,820	3.9	24.3	648,852	30,550	3.9	22.3

In order to see how prescriptions for alcohol dependence compare in the different cohorts, ratios of prescriptions for alcohol dependence were constructed for each age band and sex (Table 6.2).

The EHC have more prescriptions for alcohol-dependence

In total, the EHC has almost four times the number of prescriptions for alcohol-dependence compared with MDC (3.9 times for males and for females) and over 20 times the number of prescriptions for alcohol dependence compared with LDC (24 times for males, 22 times for females).

For each age and sex breakdown, the EHC have more prescriptions for alcohol-dependence

Compared to the controls in the MDC or LDC, the ratio of prescriptions for alcohol dependence is always greater than one (minimum ratio is: 2.5, EHC : MDC at 56–60 years).

EHC aged 21–25 years have the most prescriptions for alcohol dependence compared with their controls

Unlike [many] other ratio variations with age seen in the study, the ratios do not tend to increase with age to a maximum and then decline again. Here we see that the highest ratios are for the youngest ages (the EHC:MDC ratios for those aged 21 to 25 years are 8.3 for males and 38.0 for females. Compared to the LDC, the ratios are even more stark: 58.0 for males and 38.0 for females). This appears to be driven by the LDC and the MDC having very few prescriptions for the younger age groups. The ratios for EHC : MDC increases again above 60 years, although this is not seen in the ratios EHC : LDC.

6.3 Comparative prescriptions for opioid dependence between the EHC and their controls

Accounting for one third of all people in the study, people in the EHC (Ever Homeless Cohort) accounted for 86% of prescriptions for opioid dependence (55% male, 31% female). Prescriptions for opioid dependence amongst the MDC (Non-homeless 20% Most Deprived Cohort) accounted for 13% of prescriptions for opioid dependence during the period (9% male, 4% female). The LDC (Non-homeless 20% Least Deprived Cohort) accounted for 0.5% of prescriptions for opioid dependence (0.4% male, 0.1% female).

Table 6.3: Number of people, number of prescriptions for opioid dependence and the ratio of the number of prescriptions for opioid dependence between EHC and MDC, and between EHC and LDC, by age and sex.

	Male				Female			
Age (at 31 March 2015)	Number of people	Prescriptions	EHC : MDC	EHC : LDC	Number of people	Prescriptions	EHC : MDC	EHC : LDC
0 to 15	135,444				127,461			
16 to 20	49,263	150	14.0		51,276	210		
21 to 25	64,209	4,610	8.2	410.0	78,690	9,490	12.4	
26 to 30	75,363	35,820	14.4	127.9	93,003	47,720	13.4	276.6
31 to 35	70,407	134,990	10.3	214.9	74,493	99,110	9.7	198.7
36 to 40	58,347	189,230	6.1	161.9	53,259	98,470	6.4	257.0
41 to 45	55,737	168,600	5.0	117.1	48,873	68,900	4.9	519.6
46 to 50	49,818	102,980	5.0	225.0	43,563	39,220	5.6	207.1
51 to 55	37,746	37,330	4.3	93.9	31,578	13,050	4.4	58.2
56 to 60	25,017	10,140	5.4	213.0	19,017	3,540	5.7	26.5
61 to 65	15,765	3,140	6.9	20.2	11,436	1,360	3.8	107.0
66 or over	21,591	710	2.5	24.5	16,203			
All ages	658,707	687,680	6.2	150.5	648,852	381,140	7.0	217.1

In order to see how prescriptions for opioid dependence compare in the different cohorts, ratios of prescriptions for opioid dependence were constructed for each age band and sex (Table 6.3).

The EHC have much more prescriptions for opioid dependence

In total, the EHC has over six times the number of prescriptions for opioid dependence compared with MDC (6.2 times for males, 7.0 times for females) and over 150 times the number of prescriptions for opioid dependence compared with LDC (150 times for males, 217 times for females).

For each age and sex breakdown, the EHC have more prescriptions for opioid dependence

Compared to the controls in the MDC or LDC, the ratio of prescriptions for opioid dependence is always greater than two (minimum ratio is: 2.5, EHC : MDC at 66+ years). The EHC:MDC ratios are highest amongst those aged under 35 years and this is true for both males and females.

6.4 Comparative prescriptions for mental-health between the EHC and their controls

Accounting for one third of all people in the study, people in the EHC (Ever Homeless Cohort) accounted for 63% of prescriptions for mental-health (26% male, 37% female). Prescriptions for mental-health amongst the MDC (Non-homeless 20% Most Deprived Cohort) accounted for 28% of prescriptions for mental-health during the period (11% male, 17% female). The LDC (Non-homeless 20% Least Deprived Cohort) accounted for 9% of prescriptions for mental-health (3% male, 6% female).

Table 6.4: Number of people, number of prescriptions for mental-health and the ratio of the number of prescriptions for mental-health between EHC and MDC, and between EHC and LDC, by age and sex.

	Male				Female			
Age (at 31 March 2015)	Number of people	Prescriptions	EHC : MDC	EHC : LDC	Number of people	Prescriptions	EHC : MDC	EHC : LDC
0 to 15	135,444	20,840	1.4	2.4	127,461	8,570	1.4	1.5
16 to 20	49,263	26,340	1.7	2.7	51,276	44,200	2.0	3.2
21 to 25	64,209	119,350	2.6	5.4	78,690	243,130	2.9	5.7
26 to 30	75,363	242,120	3.4	8.7	93,003	483,500	2.9	8.1
31 to 35	70,407	381,420	3.9	12.6	74,493	615,650	2.9	10.1
36 to 40	58,347	465,850	3.4	11.9	53,259	633,170	2.4	9.1
41 to 45	55,737	542,510	2.7	11.4	48,873	737,560	2.1	7.2
46 to 50	49,818	504,660	2.4	9.5	43,563	763,440	1.8	6.2
51 to 55	37,746	399,340	2.0	7.5	31,578	601,520	1.7	5.7
56 to 60	25,017	259,350	1.7	6.1	19,017	375,470	1.6	5.2
61 to 65	15,765	172,210	1.7	5.1	11,436	221,710	1.6	4.5
66 or over	21,591	195,680	1.4	2.7	16,203	272,850	1.4	2.7
All ages	658,707	3,329,660	2.5	8.0	648,852	5,000,710	2.1	6.4

In order to see how prescriptions for mental-health compare in the different cohorts, ratios of prescriptions for mental-health were constructed for each age band and sex (Table 6.4).

The EHC have more prescriptions for mental-health

In total, the EHC has almost over double the number of prescriptions for mental-health compared with the MDC (2.5 times for males, 2.1 for females) and over 6 times the number of prescriptions for mental-health compared with the LDC (8.0 times for males, 6.4 times for females).

For each age and sex breakdown, the EHC have more prescriptions for mental-health

Compared to the controls in the MDC or LDC, the ratio of prescriptions for mental-health is always greater than one (minimum ratio is: 1.4, EHC : MDC at 0–15 and 66+ years).

EHC people aged 31–35 years have the most prescriptions for mental-health compared with their controls

The ages at which the peak ratios occur are similar for males and females. For males EHC : LDC peaks at 3.9 at 31–35 years, and EHC : MDC peaks at 12.6 at 31–35 years. For females EHC : LDC peaks at 2.9 at 21–35 years, and EHC : MDC peaks at 10.1 also at 31–35 years.

6.5 Comparative tuberculosis prescriptions between the EHC and their controls

Accounting for one third of all people in the study, people in the EHC (Ever Homeless Cohort) accounted for 47% of tuberculosis (TB) prescriptions (29% male, 18% female). TB prescriptions amongst the MDC (Non-homeless 20% Most Deprived Cohort) accounted for 35% of TB prescriptions during the period (19% male, 16% female). The LDC (Non-homeless 20% Least Deprived Cohort) accounted for 18% of TB prescriptions (10% male, 8% female).

Table 6.5: Number of people, number of TB prescriptions and the ratio of the number of TB prescriptions between EHC and MDC, and between EHC and LDC, by age and sex.

	Male				Female			
Age (at 31 March 2015)	Number of people	Prescriptions	EHC : MDC	EHC : LDC	Number of people	Prescriptions	EHC : MDC	EHC : LDC
0 to 15	135,444	230	1.8	14.0	127,461	150	0.9	3.0
16 to 20	49,263	50	1.0	2.0	51,276	60	1.0	1.0
21 to 25	64,209	200	1.3	2.3	78,690	150	0.9	3.0
26 to 30	75,363	290	1.2	1.7	93,003	320	1.4	2.5
31 to 35	70,407	340	1.4	1.4	74,493	340	1.4	1.9
36 to 40	58,347	330	1.2	2.0	53,259	230	0.9	2.3
41 to 45	55,737	330	1.1	3.8	48,873	270	0.7	3.3
46 to 50	49,818	350	2.2	7.3	43,563	250	1.0	2.0
51 to 55	37,746	300	1.2	3.5	31,578	200	1.6	5.5
56 to 60	25,017	210	2.6	4.3	19,017	110	1.5	0.5

61 to 65	15,765	210	2.2	6.5	11,436	50	1.0	2.0
66 or over	21,591	350	1.9	1.9	16,203	190	2.0	1.1
All ages	658,707	3,170	1.5	2.9	648,852	2,320	1.1	2.1

In order to see how TB prescriptions compare in the different cohorts, ratios of TB prescriptions were constructed for each age band and sex (Table 6.4).

The EHC have more TB prescriptions

In total, the EHC has more TB prescriptions compared with the MDC (1.5 times for males, 1.1 for females) and over double the number of TB prescriptions compared with the LDC (2.9 times for males, 2.1 times for females).

For each age breakdown for males, the EHC have more TB prescriptions

Compared to the controls in the MDC or LDC, the ratio of TB prescriptions for males is always greater or equal to one (minimum ratio is: 1.0, EHC : MDC at 16–20). However, for four age groups, females had lower ratios of TB prescriptions in the EHC compared to the MDC.

There is no discernible structure relating the TB ratios to age

With there being so few TB prescriptions when breaking down by age, sex and cohort, there is no apparent age trend in the ratios that is clear above the noise.

6.6 Prescriptions for mental health relative to the date of first homelessness assessment: Once-Only and Repeat Homelessness

Mental-health prescriptions account for the large majority of prescriptions in the study prescription data, and will be the focus of this section. In order to explore the relationship between homelessness and prescriptions for mental-health, this section compares the timing of prescriptions with the date of first homelessness assessment (Figures 6.1 and 6.2). Detail on this method is described in full in Section 2.10.

The ratios of prescriptions for mental-health for Repeat EHC are higher than for Once-only EHC. The following points apply for both sexes:

Mental-health prescription ratios increase up to the peak earlier for Repeat EHC

For once-only EHC the ratios begin to increase toward the peak at around 6–12 months before the date of first assessment. For Repeat EHC the increase begins around two years before first assessment.

The peak mental-health prescription ratio is higher for Repeat EHC

The peak around the date of first homelessness assessment is larger for the repeat EHC than for the once-only EHC. For males the once-only ratio increases from around 7 to around 11 (around a 50% increase), while the repeat ratio increases a greater amount from around 8 to around 16 (it doubles). For females the once-only ratio increases from around 5.5 to around 8.5 (around a 50% increase), while the repeat ratio increases a greater amount from around 7 to around 12 (around a 70% increase).

The ratio falls back to pre-homelessness levels only for once-only EHC

For the once-only EHC, by around three years following the assessment date (for males, around two years for females) the ratio has reduced to around the level it was at two years prior to the assessment date.

This contrasts with the repeat EHC ratio, which remains above the ratio value immediately prior to the peak, for the remainder of the period.

Figure 6.1: Ratio of mental health prescriptions for **once-only** homelessness to the controls in the LDC for those homeless people, by sex, against the time difference between the first assessment and the attendance date.

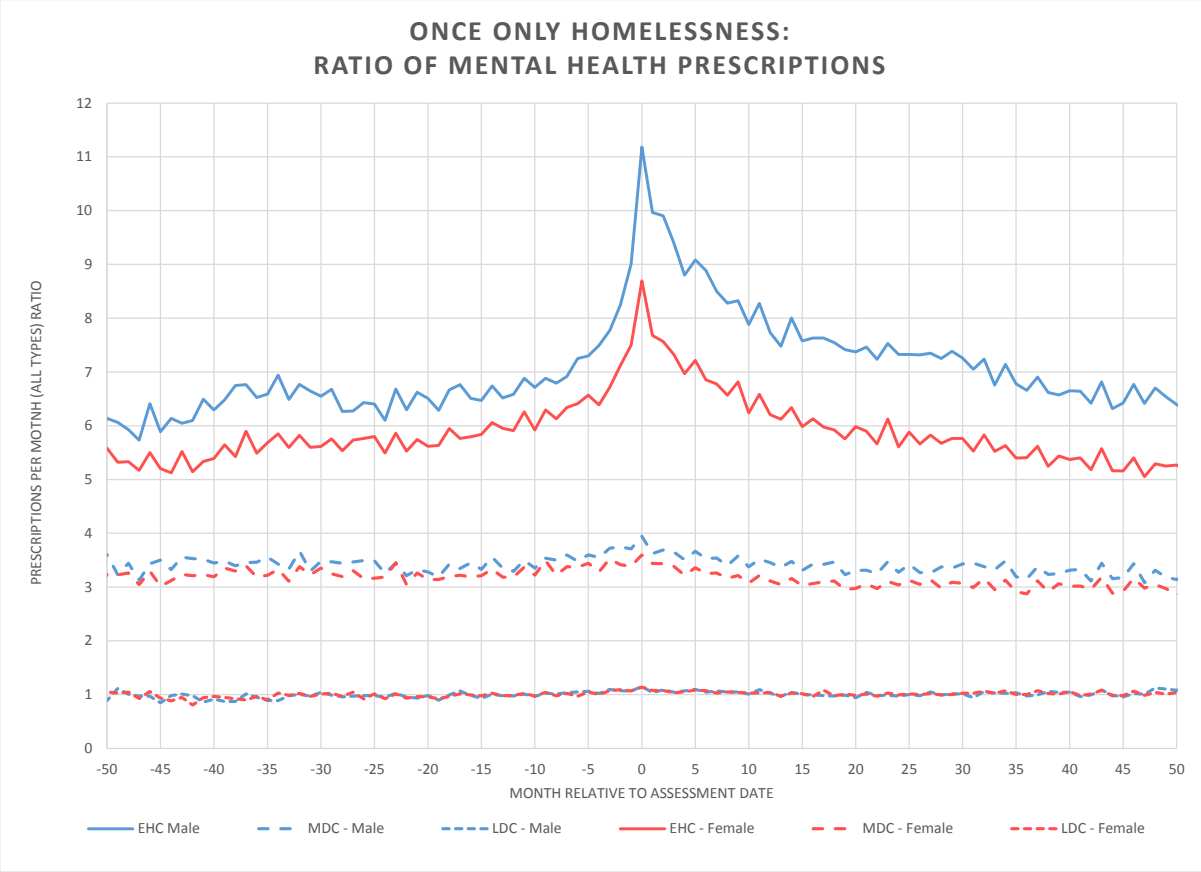
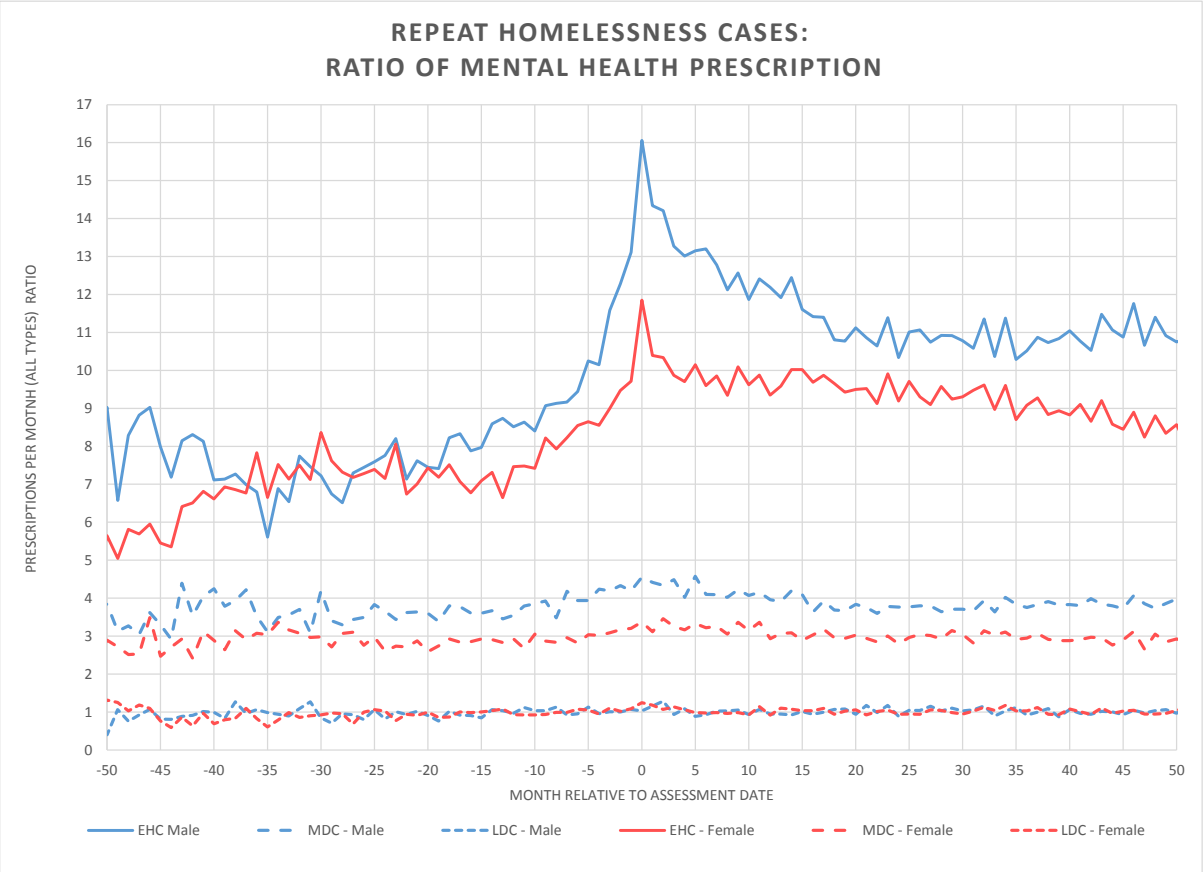


Figure 6.2: Ratio of mental health prescriptions of **repeat** homelessness to the controls in the LDC for those homeless people, by sex, against the time difference between the first assessment and the attendance date.



6.7 Summary

The EHC have more prescriptions than the control cohorts, especially for opioid and alcohol dependence. There are more prescriptions for mental health too. For TB there was little difference between the EHC and the MDC. Besides TB, the EHC have more prescriptions for each age and sex breakdown.

EHC aged 21–25 years have the most prescriptions for alcohol dependence compared with their controls. Furthermore, unlike other ratio variations, the ratios do not tend to increase with age to a maximum and then decline again. Instead, the ratios decline with age, suggesting these issues tend to be more skewed towards younger age groups.

EHC people aged 31–35 years have the most prescriptions for mental-health compared with their controls

It is clear that there is evidence to support each of the four research questions:

- A gradually worsening condition prior to the date of first assessment that results in excess prescriptions, occurs prior to homelessness.
- Also for some people the (first) homelessness episode is associated with some crisis with a health activity component, as observed by a prescription peak around that time. Both these effects are greater among those who go on to have

multiple homelessness episodes, suggesting that these situations and crises sometimes precede not just homelessness, but repeat homelessness especially.

- The larger ratios after the first assessment date for those who have multiple homelessness episodes could be due to: further crises around the time of those later episodes, long-term effects of the earlier underlying condition, crises or homelessness itself.
- Lastly, people who go on to become homeless appear to have more prescriptions, even several years prior to their first homeless assessment. This could be a result of the EHC having an even higher proportion of individuals than the MDC affected by factors associated with deprivation.

Chapter 7: Admissions to Mental Health Specialties

There were around 100,000 admissions to mental health specialties (SMR04), hereafter referred to as mental health admissions) over the time period 1 April 2002 to 31 March 2015 inclusive for the 1.3 million people in the study[42]. Note that this is almost 100 times smaller than the number of mental-health prescriptions discussed in the previous chapter. These mental health admissions represent the most severe mental health issues. For more information on SMR04 mental health inpatient and day case data see Section 2.3.7.

In this chapter we discuss the study cohorts, their mental health admissions activity and how this relates to homelessness. How this relates to deprivation and health needs is discussed in Chapter 11.

7.1 Comparative activity between the EHC and their controls

Accounting for one third of all people in the study, people in the EHC (Ever Homeless Cohort) accounted for 80% of mental health admissions (47% male, 33% female). Mental health admissions amongst the MDC (Non-homeless 20% Most Deprived Cohort) accounted for 16% of admissions during the period (9% male, 7% female). The LDC (Non-homeless 20% Least Deprived Cohort) accounted for 4% of admissions (2% male, 2% female).

Table 7.1: Number of people, number of Mental health admissions and the ratio of the number of Mental health admissions between EHC and MDC, and between EHC and LDC, by age and sex.

	Male				Female			
Age (at 31 March 2015)	Number of people	Admissions	EHC : MDC	EHC : LDC	Number of people	Admissions	EHC : MDC	EHC : LDC
0 to 15	135,444	131	0.1	1.3	127,461	97	3.1	0.5
16 to 20	49,263	554	4.5	4.7	51,276	804	4.0	1.7
21 to 25	64,209	2,353	6.5	14.5	78,690	2,713	3.6	10.4
26 to 30	75,363	5,560	8.6	25.2	93,003	4,505	5.5	19.0
31 to 35	70,407	8,761	6.1	25.4	74,493	6,174	5.5	30.5
36 to 40	58,347	8,669	6.4	31.8	53,259	5,928	4.8	21.8
41 to 45	55,737	9,628	5.4	55.9	48,873	6,287	4.0	21.2
46 to 50	49,818	8,211	4.8	34.7	43,563	6,213	3.4	17.1
51 to 55	37,746	6,558	4.6	23.2	31,578	4,585	4.5	19.9
56 to 60	25,017	3,416	4.7	34.9	19,017	2,277	5.3	19.1
61 to 65	15,765	1,928	4.1	12.8	11,436	1,150	4.0	20.1
66 or over	21,591	2,237	3.8	9.2	16,203	1,316	3.3	6.7
All ages	658,707	58,006	5.4	25.5	648,852	42,049	4.4	16.0

[42] Note that this is distinct from the acute inpatient admissions (SMR01) with the mental health flag considered in Chapter 4.

In order to see how mental health admissions compare in the different cohorts, ratios of mental health admissions were constructed for each age band and sex (Table 3.1).

The EHC have more mental health admissions

In total, the EHC has around five times the number of mental health admissions compared with the MDC (5.4 times for males, 4.4 for females) and around 20 times the number of mental health admissions compared with the LDC (25 times for males, 16 times for females).

For each age and sex breakdown among adults (those aged 16+ years), the EHC have more mental health admissions

Compared to the controls in the MDC or LDC, the ratio of attendances is always greater than one (minimum ratio is: 1.7, EHC : LDC at 16–20 years for females).

For male children, the EHC have fewer mental health admissions than the MDC, but similar to the LDC

The ratio EHC : MDC is 0.1, while EHC : LDC is 1.3. This is the only age-sex breakdown across the entire study where the MDC has the highest activity.

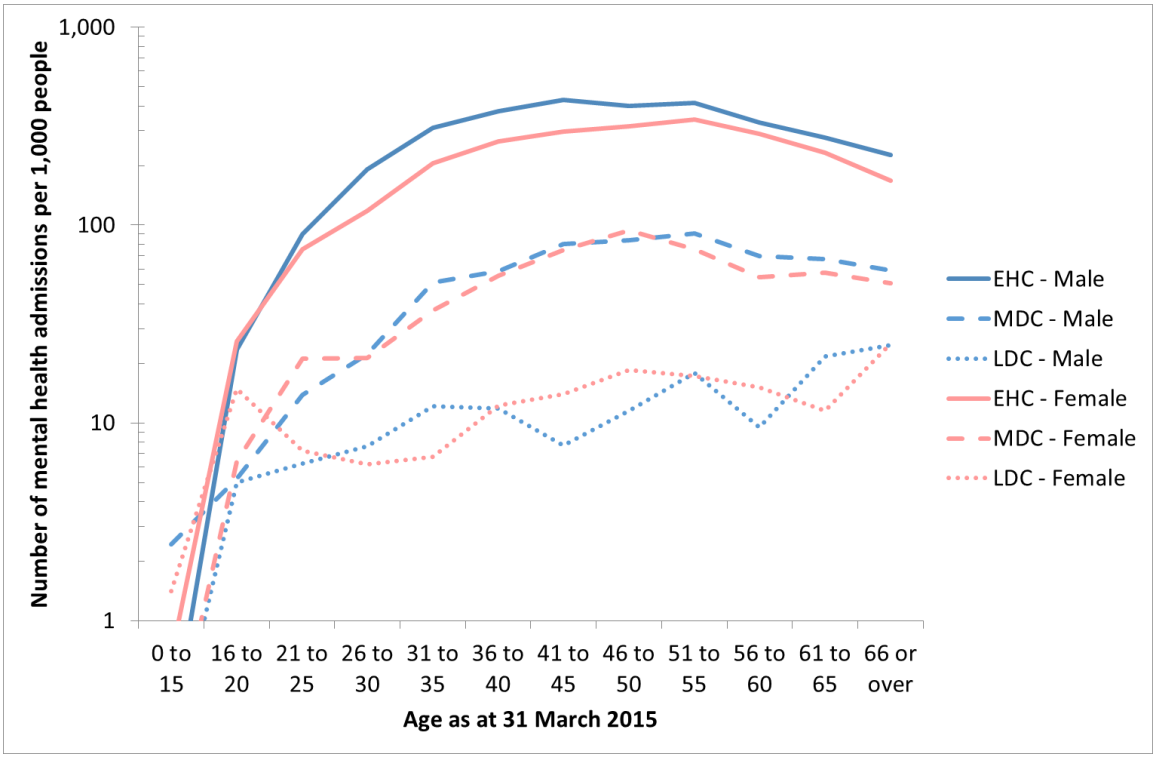
For female children, the EHC have more mental health admissions than the MDC, but fewer than the LDC

The ratio EHC : MDC is 3.1, while EHC : LDC is 0.5. The LDC has significantly higher activity than the EHC or the MDC for females aged 0 to 15 years.

Among adults, the ratios for EHC : LDC vary more with age than those for EHC : MDC

The ratios for EHC : MDC vary with age. For adult males the maximum EHC : MDC ratio is 8.6 (at 26–30 years) and the minimum is 3.8 (at 66+ years). For adult females the highest and lowest are 5.5 (at 26–35 years) and 3.3 (at 66+ years). The age profile of admissions among the EHC is roughly similar to that of the MDC (Figure 7.1). In contrast the highest and lowest of the adult male EHC : LDC ratio are 56 (at 41–45 years) and 4.7 at 16–21 years. For females the highest and lowest are 30 (at 31–35 years) and 1.7 (at 16–20 years). In particular the mental health admission rate increases much less between 16–20 and 36–40 years among the LDC than among the MDC or EHC. Beyond about 50 years the EHC and MDC admission rates start to decline, while the LDC admission rate increases.

Figure 7.1: Number of mental health admissions per 1,000 people (admission rate) by age, sex and cohort. (Note: the y-axis uses a logarithmic scale.)



7.2 Distribution of the number of mental health admissions

The previous section found that, on average, people in the EHC had more mental health admissions than their controls. This section explores whether this is due to a higher proportion of the EHC having admissions, or a higher proportion of the EHC who had admissions having many admissions, or both (Figure 7.2). The following points apply for both sexes:

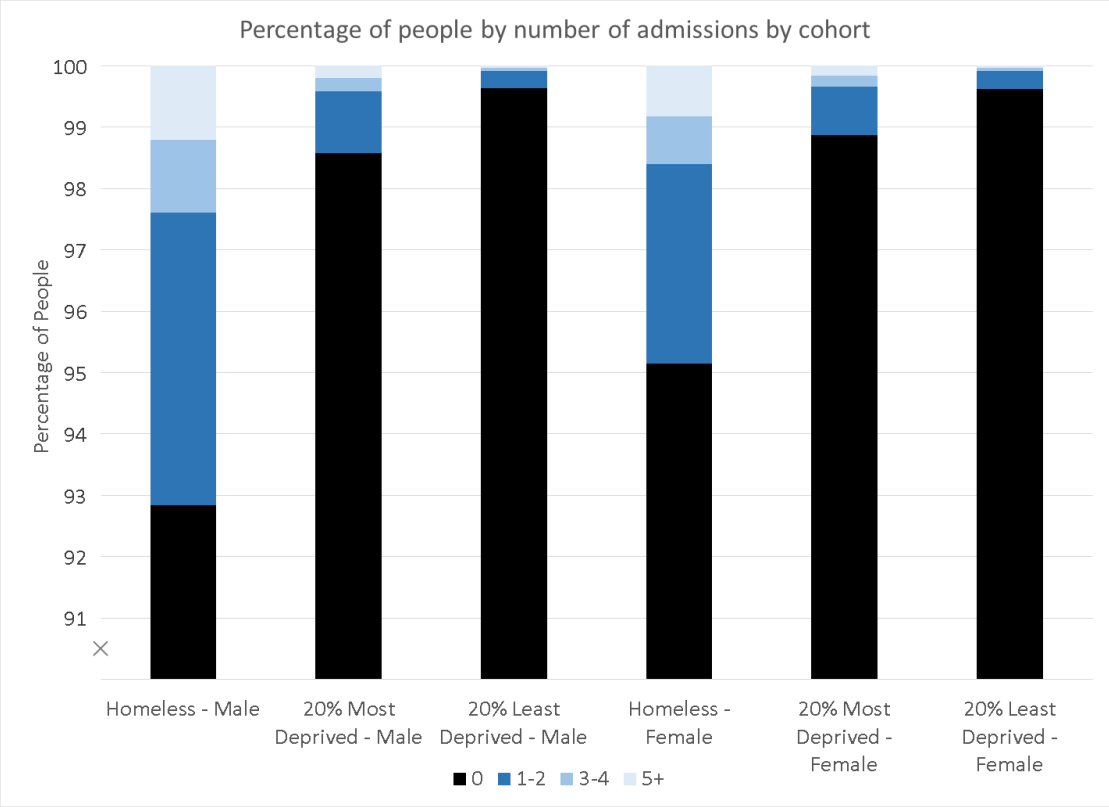
More of the EHC had at least one mental health admission

A higher proportion of the EHC (7.2% males, 4.9% females) had at least one mental health admission, compared to the MDC (1.4% males, 1.1% females) and LDC (0.4% males, 0.4% females) over the study period.

More of the EHC had many mental health admissions

A higher proportion of the EHC (1.2% males, 0.8% females) had five or more mental health admissions than the MDC (0.2% males, 0.2% females) and LDC (0.04% males, 0.04% females) over the study period. Even among people who had at least one mental health admission, a higher proportion of the EHC had multiple admissions compared to the MDC and LDC.

Figure 7.2: Percentage of people by number of mental health admissions, by cohort and sex. (Note: there is a break in the y-axis.)



7.3 Mental health admissions relative to the date of first homelessness assessment

In Section 7.1 it was found that the EHC have more mental health admissions than both control cohorts. In order to explore the relationship between homelessness and mental health activity, this section compares the timing of admissions with the date of first homelessness. Detail on this method is described in full in Section 2.10.

As shown in previous chapters, there appears to be differences in activity for Once-only EHC and Repeat EHC. This could be due to more periods of homelessness, but at different times for different people, or it could be a long term effect of the original homelessness assessment.

This section presents ratios between those people in that have only been assessed as homeless once (Figure 7.3) (Once-only EHC), and those who have been assessed as homeless on multiple occasions, referred to as repeat homelessness (Repeat EHC) (Figure 7.4). More information on repeat homelessness is available in section 2.1.3.

Mental health admission ratios for Repeat EHC are higher than for Once-only EHC. The following points generally apply for both sexes:

Admission ratios begin increasing four years prior to assessment date for Repeat EHC males

For Repeat EHC males the admission ratio increases from around 10, four years prior to the assessment date, to around 80, immediately prior to the peak. This

pattern is not observed among the females to the same extent or for the once-only EHC. This pattern was not observed for prescriptions for mental health, where the mental health issues are likely of lesser severity.

The admission ratio peak is more pronounced for Once-only EHC, especially among males

For Once-only EHC males the peak value is around 80 compared with about 25 surrounding this (around three times larger). For females the peak is around 45, compared with less than 20 either side of the peak (around 2.5 times larger). For the Repeat EHC males the peak value is around 145, compared with around 80 either side (around 80% larger). For female Repeat EHC the ratio increases from about 25 to 45 (around 80% larger), but does not immediately drop substantially.

The ratio falls back to pre-homelessness levels only for Once-only EHC

For the Once-only EHC, by around five years for males (around seven years for females) following the assessment date the ratio has reduced to around the level it was at two years prior to the assessment date. This contrasts with the Repeat EHC ratio. For the males the ratio gradually decreases but remains notably above the value it had before it began to increase about four years before the first assessment. For females the ratio does not substantially decrease at all, but remains almost at the level it had at the time of first homelessness assessment.

Figure 7.3: Ratio of mental health admissions per month in each cohort to that of the LDC, where the homeless person had **one** homelessness assessment during the period, by sex.

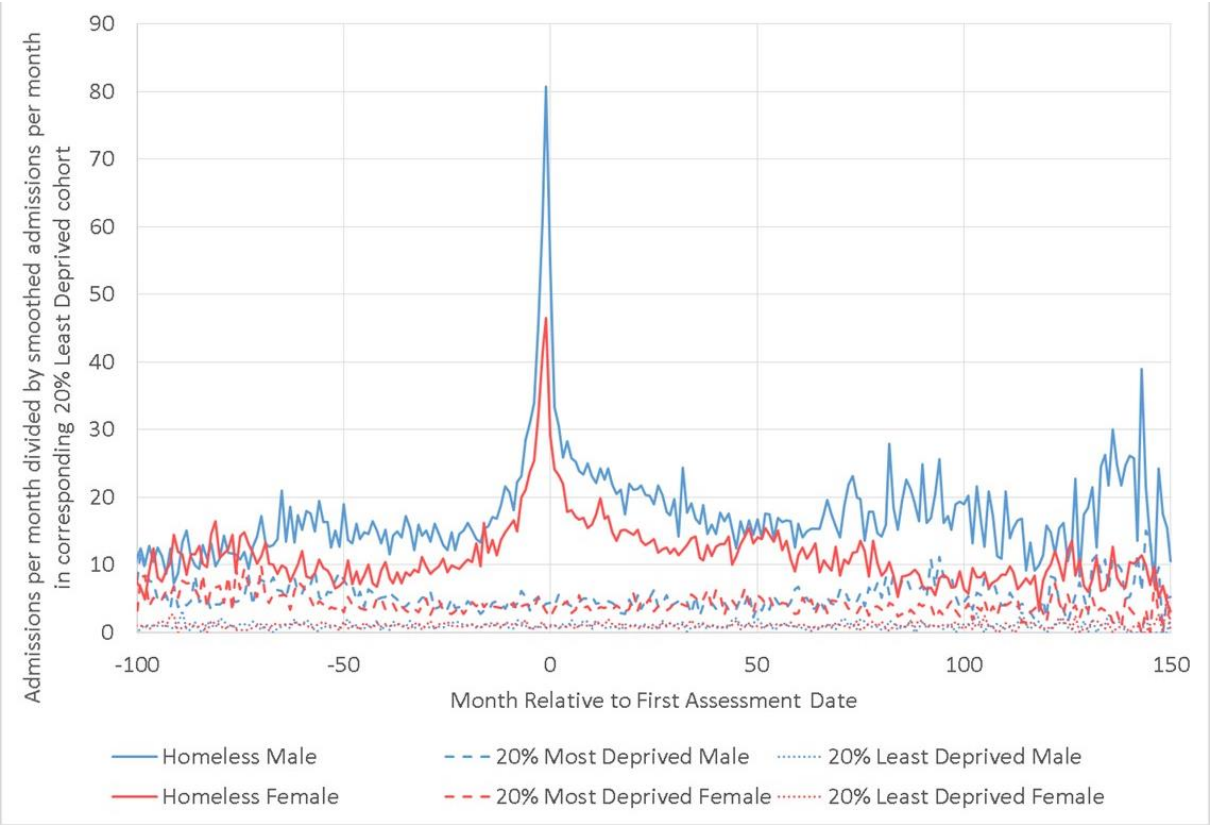
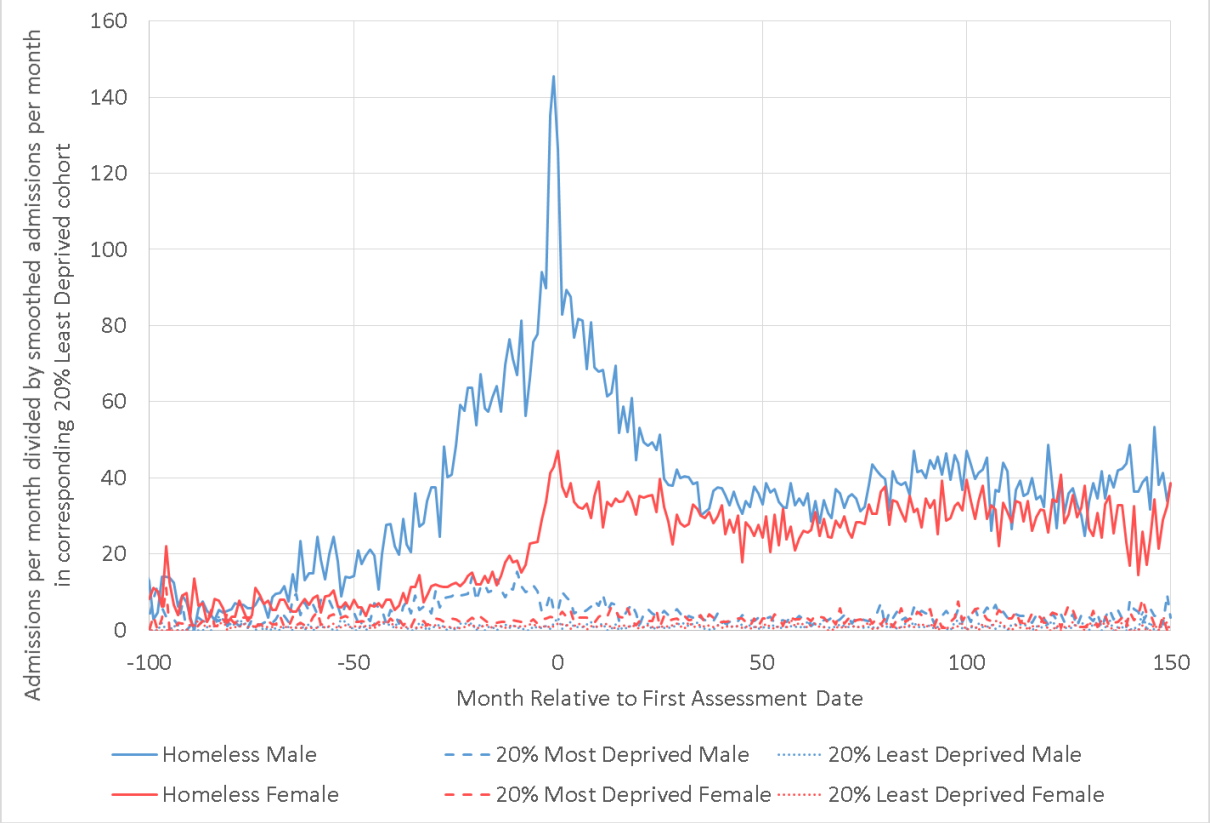


Figure 7.4: Ratio of mental health admissions per month in each cohort to those of the LDC, where the homeless person had **multiple** homelessness assessments during the period (repeat homelessness), by sex.



7.4 Summary

The EHC have more of the most acute mental health admissions (as recorded in the SMR04 dataset). The age profile of admissions among the EHC is roughly similar to that of the MDC, with more admissions in the 26-50 year age range. In contrast, admissions for people in the LDC vary less with age. More of the EHC had at least one mental health admission, and more of these had multiple mental health admissions.

It is clear that there is evidence to support each of the four research questions:

- A gradually worsening condition prior to the date of first assessment that results in excess mental health admissions, occurring prior to homelessness. This is particularly pronounced for Repeat EHC males.
- Also for some people the (first) homelessness episode is associated with some crisis with a health activity component, as observed by a mental health admission peak around that time. Both Once-only and Repeat EHC have very large and well defined peaks around that time, with Once-only being more pronounced.
- The larger ratios after the first assessment date for those who have multiple homelessness episodes could be due to: further crises around the time of those later episodes, or long-term effects of the earlier underlying worsening condition, crises or homelessness itself.

- Lastly, people who go on to become homeless appear to have more of the most acute mental health admissions, even several years prior to their first homeless assessment.

Chapter 8: Scottish Drugs Misuse Database

There were around 89,000 initial assessments at drug treatment services (hereafter referred to as SDMD assessments) over the time period 1 April 2002 to 31 March 2015 inclusive for the 1.3 million people in the study. For more information on SDMD data see Section 2.3.8.

In this chapter we discuss the study cohorts, their SDMD assessments activity and how this relates to homelessness. How this relates to deprivation and health needs is discussed in Chapter 11.

8.1 Comparative activity between the EHC and their controls

Accounting for one third of all people in the study, people in the EHC (Ever Homeless Cohort) accounted for 90% of SDMD assessments (62% male, 29% female). SDMD assessments amongst the MDC (Non-homeless 20% Most Deprived Cohort) accounted for 9% of assessments during the period (6% male, 3% female). The LDC (Non-homeless 20% Least Deprived Cohort) accounted for 1% of assessments (0.5% male, 0.2% female).

Table 8.1: Number of people, number of SDMD assessments and the ratio of the number SDMD assessments between EHC and MDC, and between EHC and LDC, by age and sex.

	Male				Female			
Age (31st March 2015)	Number of people	SDMD assessments	EHC : MDC	EHC : LDC	Number of people	SDMD assessments	EHC : MDC	EHC : LDC
0 to 15	135,444				127,461			
16 to 20	49,263	251	8.4	31.1	51,276	124	6.2	106.0
21 to 25	64,209	2,528	9.6	59.3	78,690	1,656	13.2	153.0
26 to 30	75,363	7,136	14.3	103.3	93,003	4,750	13.1	209.2
31 to 35	82,830	17,717	13.5	145.1	86,046	9,701	12.5	146.3
36 to 40	45,924	11,923	9.2	128.7	41,706	4,883	8.7	189.5
41 to 45	55,737	11,291	8.8	150.5	48,873	4,040	8.0	223.7
46 to 50	49,818	6,486	7.9	136.2	43,563	2,254	6.8	77.7
51 to 55	37,746	2,393	7.3	104.4	31,578	716	5.8	
56 to 60	25,017	805	7.6		19,017	193	7.5	
61 to 65	15,765	243	14.2		11,436	70		
66 or over	21,591	101	8.8		16,203	18		
Total	658,707	60,875	10.3	124.9	648,852	28,406	10.1	154.7

Note: Cells relating to fewer than 10 SDMD cases have been left blank as the uncertainty around these ratios would be high.

In order to see how SDMD assessments compare in the different cohorts, ratios of SDMD assessments were constructed for each age band and sex (Table 8.1).

The EHC have much more SDMD activity

In total, the EHC has ten times more SDMD assessments compared with MDC (10.3 times for males, 10.1 for females) and over 100 times more SDMD assessments compared with LDC (125 times for males, 155 times for females).

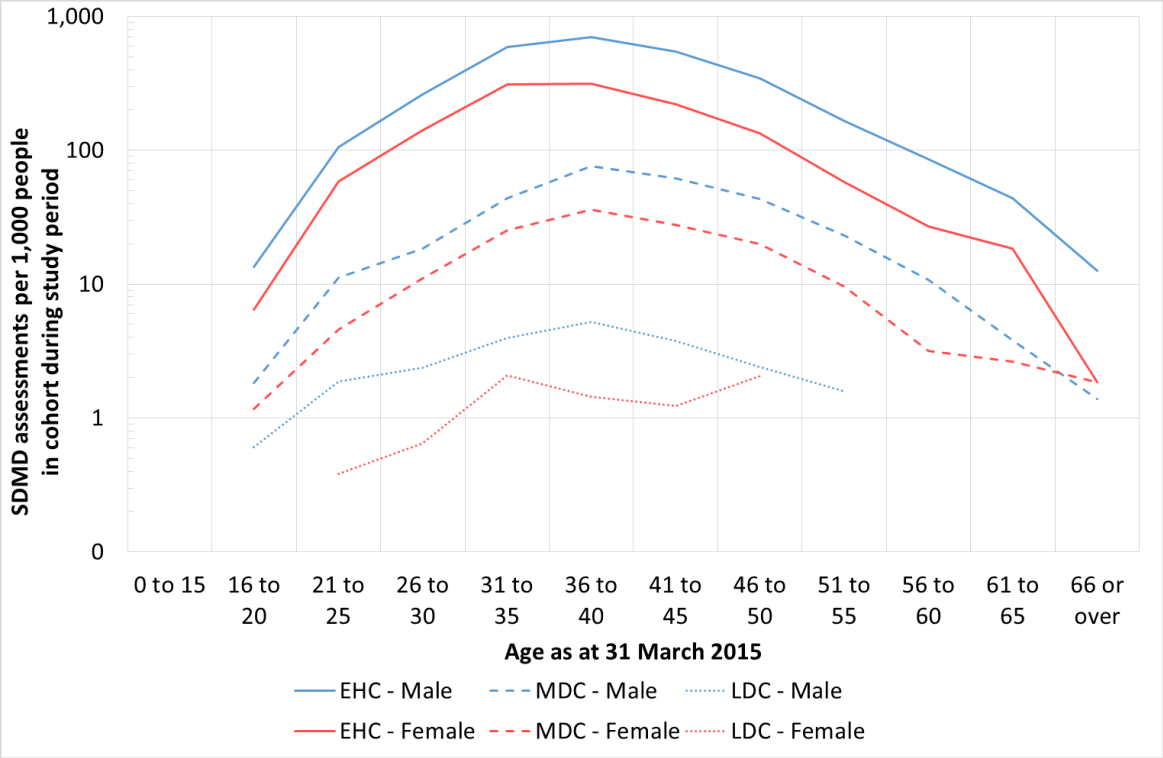
For each age and sex breakdown, the EHC have more SDMD activity

Compared to the controls in the MDC or LDC, the ratio of SDMD assessments is always greater than one (minimum ratio is: 5.8, female EHC : MDC at 51–55 years).

The EHC age profile is roughly similar to those of the MDC and male LDC

The distribution by age is roughly similar for the EHC as for the MDC and for the male LDC. However, the EHC peaks at slightly younger age (Figure 8.1).

Figure 8.1: Total number of SDMD assessments by age, sex and cohort, standardized per 1,000 people. (Note the y-axis has a logarithmic scale).



8.2 Number of SDMD assessments per person

The previous section found that, on average, people in the EHC had more SDMD assessments than their controls. This section explores whether this is due to a higher proportion of the EHC having SDMD assessments, or a higher proportion of the EHC who had SDMD assessments having multiple SDMD assessments, or both (Figures 8.2 and 8.3). The following points apply for both sexes:

More of the EHC had at least one SDMD assessments

A higher proportion of the EHC (8.8% males, 4.0% females) had at least one SDMD assessment than the MDC (1.2% males, 0.5% females) and LDC (0.11% males, 0.04% females) over the study period.

More of the EHC had many SDMD assessments

A higher proportion of the EHC people who had at least one SDMD assessment had seven or more SDMD assessments (7.5% males, 8.4% females) than the MDC (3.2% males, 4.0% females) and LDC (2.0% males, 1.1% females) over the study period.

Figure 8.2: Proportion of people in the study who have at least one SDMD assessment during the study period by cohort and sex.

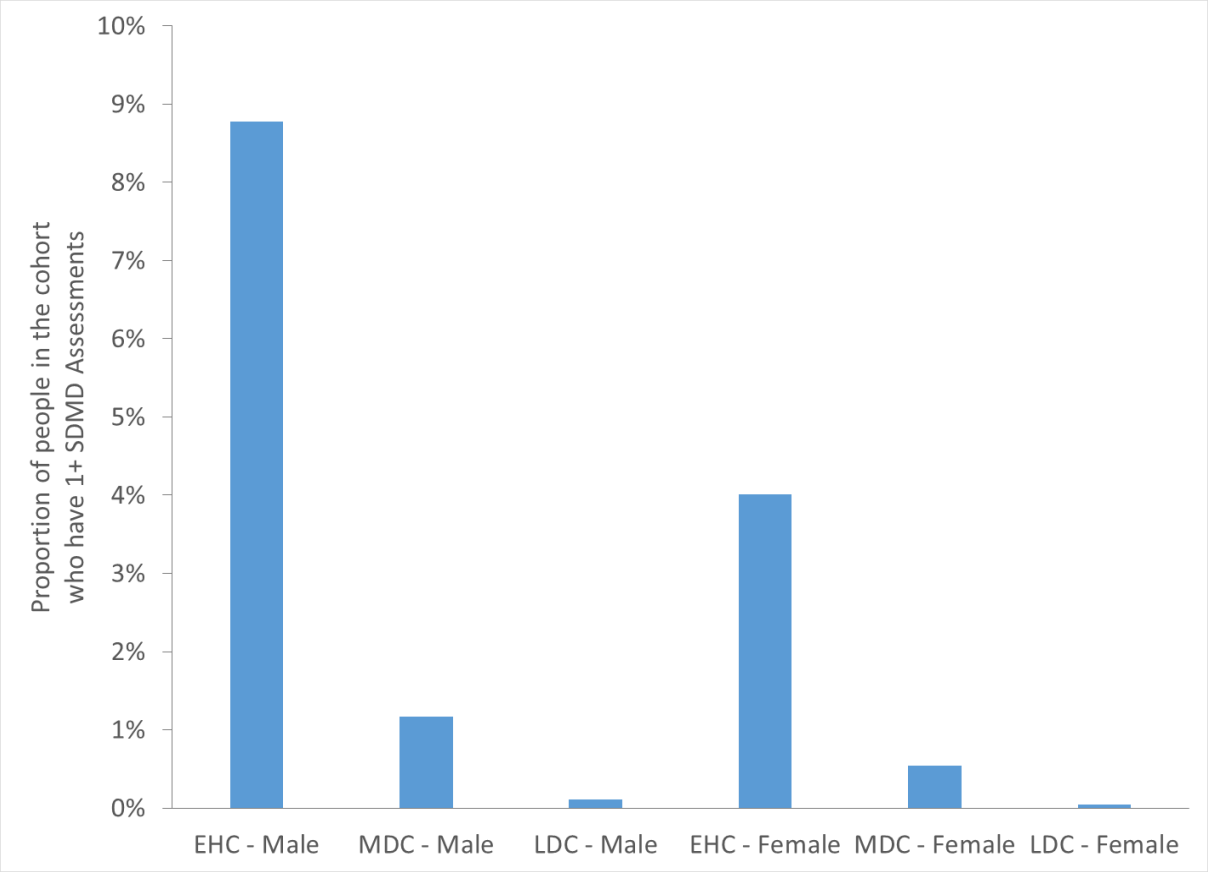
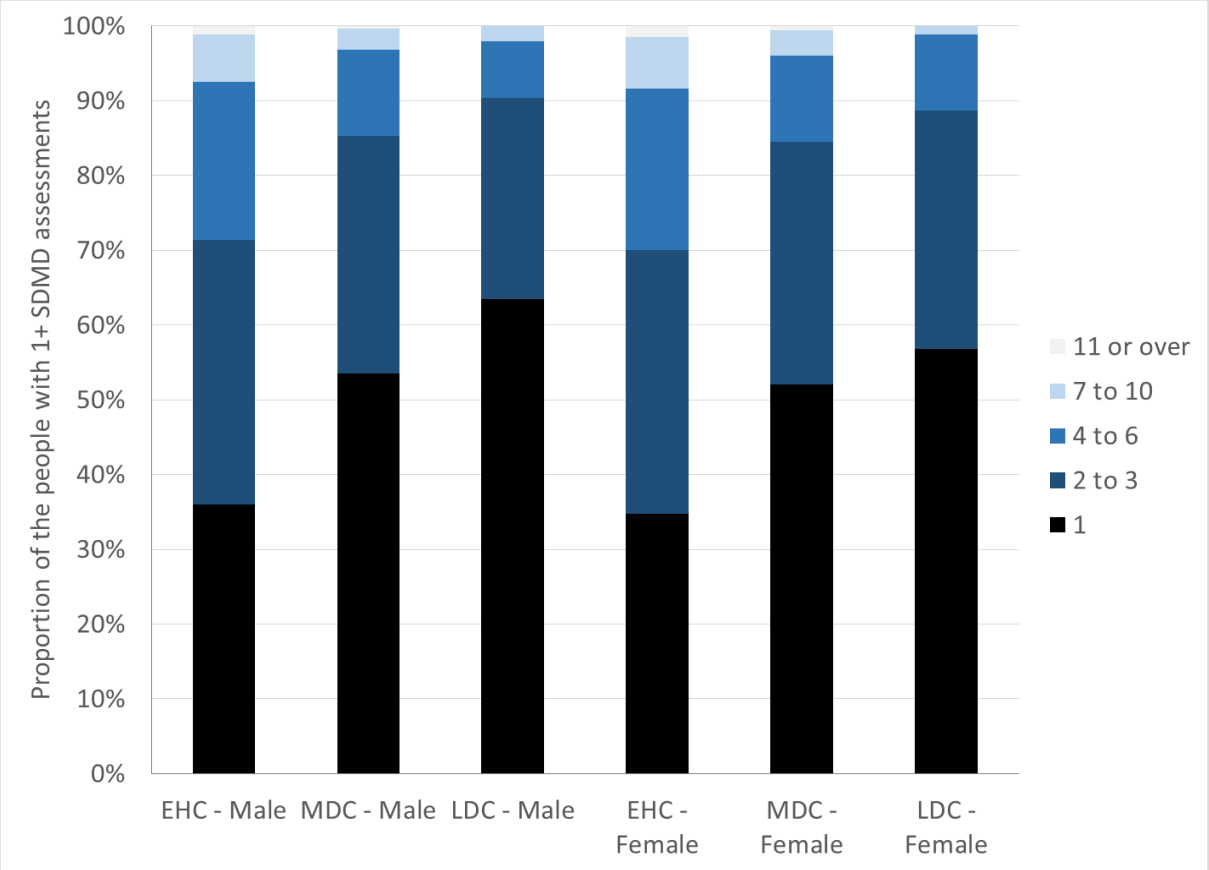


Figure 8.3: Proportion of people who have at least 1 SDMD assessment during the study period by cohort, sex and how many SDMD assessments they had.



8.3 Illicit Drugs

The SDMD records up to eight illicit drugs for each assessment. This section considers the ten most commonly recorded main illicit drugs (Table 8.10). The following apply for both sexes:

The majority of SDMD cases among the cohorts had heroin as the main illicit drug.

The ratios of the EHC to the controls for crack cocaine, methadone , diazepam, and cannabis are also particularly high.

Table 8.10: Count of the ten most commonly recorded main illicit drugs in SDMD assessment (number) and the ratios of these across the cohorts.

	Male			Female		
Age (31st March 2015)	SDMD assessments	EHC : MDC	EHC : LDC	SDMD assessments	EHC : MDC	EHC : LDC
Heroin	31,092	12.3	154.5	14,586	12.8	168.2
Missing	13,009	10.7	155.7	6,532	9.4	139.6
Cannabis unspecified	5,916	8.1	70.3	1,991	6.7	85.8
Diazepam	3,795	9.7	214.1	1,743	9.7	
Cocaine unspecified	1,596	4.8	33.1	440	6.0	

Methadone unspecified	882	8.3		605	9.4	
Dihydrocodeine	861	6.5		579	5.5	
Alcohol unspecified	689	6.3		247	7.3	
Amphetamines unspecified	425	4.0		320	5.9	
Crack cocaine	289	17.9		178	16.8	
Benzodiazepines unspecified	242	10.0		100	8.1	
Total - top 10 only	58,796	10.4	128.4	27,321	10.3	154.8
All SDMD Assessments	60,875	10.3	124.9	28,406	10.1	154.7

8.4 SDMD Assessments Relative to the Date of First Homelessness Assessment by Once and Repeat

In Section 8.1 it was shown that the EHC had more SDMD assessments than both control cohorts. In order to explore the relationship between homelessness and SDMD activity, this section compares the timing of SDMD assessments with the date of first homelessness assessment. As in previous chapters this is done separately for Once-only EHC (Figure 8.4) and Repeat EHC (Figure 8.5). Detail on this method is described in full in Section 2.10.

However in this chapter there were very few cases among the LDC. Therefore using the numbers from the LDC as a denominator for the temporal plots would be problematic. Instead, the number of people present in the dataset at each day (relative to the homelessness assessment date) during the period that the SDMD dataset covered was calculated. This was then used as the denominator. The numerators were unchanged from the previous method. This could be thought of as comparing the actual activity, to hypothetical activity if all people in the study had one unit of activity each day. In this way the y-axis now shows the number of SDMD assessments per person per day. Hereafter these are referred to as rates.

SDMD assessment rates for Repeat EHC are higher than for Once-only EHC. The following points apply for both sexes:

SDMD assessment rate increases up to the peak earlier for Repeat EHC

From three years for males (1.5 years for females) prior to, to a few months before, the date of first homelessness assessment, Once-only EHC rates increase. This is a notably shorter time than the increase for the repeat EHC. The increase among the Repeat EHC starts eight years prior to first homelessness assessment for males (four years for females). Perhaps the people who go on to have multiple homelessness episodes are more likely to be those who have an underlying drug-related condition.

There is a peak for Once-only EHC and for male Repeat EHC

For males there is a peak around the date of homelessness assessment. For both the Once-only and Repeat EHC this increases by around 2.3 times from the previous values. For females there is a smaller peak for the Once-only EHC, with an increase of around 50%. For the female Repeat EHC the rate undergoes a level-shift increase around this time, but does not drop back again immediately following this.

The ratio falls back to pre-homelessness levels only for once-only EHC

For the once-only EHC, by around two years following the assessment date the ratio has reduced to around the level it was at two years prior to the assessment date.

This contrasts with the repeat EHC ratio, which remains above the ratio value immediately prior to the peak, for the remainder of the period.

Figure 8.4: Number of SDMD assessments per month (relative to assessment date) for people with **one** homelessness assessment divided by the number of those people present in the study at that time for each cohort by sex.

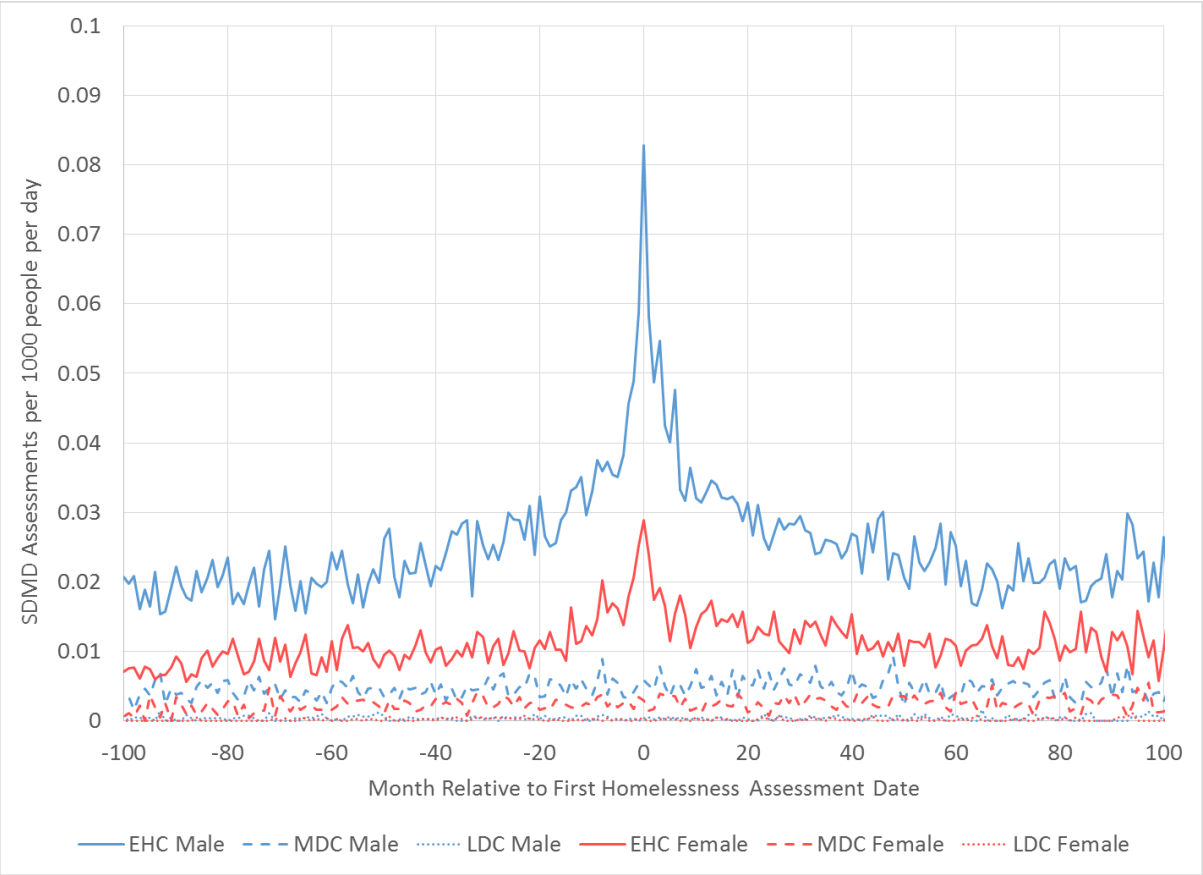
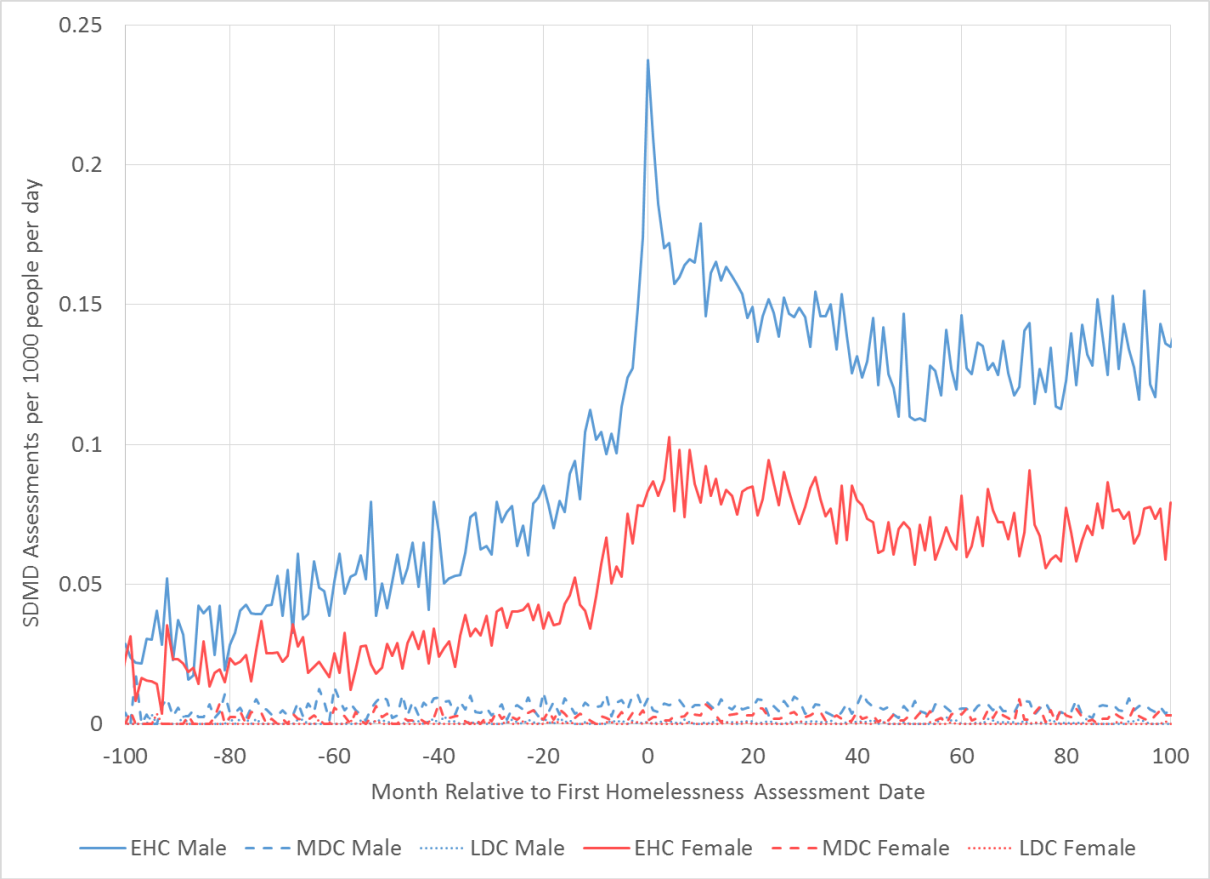


Figure 8.5: Number of SDMD assessments per month (relative to assessment date) for people with **repeat** homelessness assessments divided by the number of those people present in the study at that time for each cohort by sex.



8.5 Summary

The EHC have many more SDMD assessments than the control cohorts (10 times more than MDC, 100 times more than LDC). This is true for each age and sex breakdown. The age profile of number of SDMD assessments by age is similar between the EHC, MDC, and LDC. More of the EHC have at least one SDMD assessment, and among those who do have assessments, the EHC have a greater number of multiple SDMD assessments.

The majority of SDMD cases among the cohorts had heroin as the main illicit drug. The ratios of the EHC to the controls for crack cocaine, methadone , diazepam, and cannabis are also particularly high.

It is clear that there is evidence to support each of the four research questions:

- A gradually worsening condition prior to the date of first assessment that results in excess SDMD assessments, prior to homelessness occurring. The SDMD assessment rate increases up to the peak for both Once-only and Repeat EHC, yet occurs earlier for Repeat EHC.
- For some people the (first) homelessness episode is associated with some crisis with a health activity component, as observed by an SDMD assessment peak around that time for both Once-only and Repeat EHC.

- The larger ratios after the first assessment date for those who have multiple homelessness episodes could be due to: further crises around the time of those later episodes, or long-term effects of the earlier underlying worsening situation, crises or homelessness itself.
- Lastly, people who go on to become homeless appear to have more SDMD assessments, even several years prior to their first homeless assessment.

Chapter 9: Deaths

There were around 23,700 deaths over the time period 1 April 2002 to 31 March 2015 inclusive for the 1.3 million people in the study. For more information on NRS Vital Events – Deaths data see Section 2.3.9.

In this chapter we discuss the study cohorts, how many died and their causes, and how this relates to homelessness. How this relates to deprivation and health needs is discussed in Chapter 11.

9.1 Comparative mortality between the EHC and their controls

Accounting for one third of all people in the study, people in the EHC (Ever Homeless Cohort) accounted for 60% of deaths (42% male, 17% female). Deaths amongst the MDC (Non-homeless 20% Most Deprived Cohort) accounted for 29% of deaths during the period (18% male, 11% female). The LDC (Non-homeless 20% Least Deprived Cohort) accounted for 11% of deaths (7% male, 4% female).

Table 9.1: Number of people, number of deaths and the ratio of the number of deaths between EHC and MDC, and between EHC and LDC, by age and sex.

	Male				Female			
Age (at 31 March 2015)	Number of people	Deaths	EHC : MDC	EHC : LDC	Number of people	Deaths	EHC : MDC	EHC : LDC
0 to 15	135,444	104	1.0	2.6	127,461	105	0.7	1.9
16 to 20	49,263	79	1.1	2.9	51,276	32		
21 to 25	64,209	285	2.9	7.1	78,690	159	2.9	4.0
26 to 30	75,363	631	4.8	10.3	93,003	295	2.8	12.1
31 to 35	70,407	964	5.0	18.3	74,493	378	3.9	15.0
36 to 40	58,347	1136	4.4	21.8	53,259	464	3.7	13.8
41 to 45	55,737	1479	3.3	13.0	48,873	628	2.9	9.6
46 to 50	49,818	1710	3.3	13.1	43,563	779	2.3	6.8
51 to 55	37,746	1666	2.6	9.5	31,578	787	1.7	5.1
56 to 60	25,017	1615	2.1	7.4	19,017	757	1.5	4.6
61 to 65	15,765	1553	1.9	6.0	11,436	670	1.4	3.5
66 or over	21,591	4834	1.4	2.6	16,203	2608	1.0	2.0
Total (ALL)	658,707	16056	2.3	6.1	648,852	7662	1.7	4.0

In order to see how mortality compare in the different cohorts, ratios of deaths were constructed for each age band and sex (Table 9.1).

Among all cohorts the number of deaths per 1,000 people increases with age (Figure 9.1)

The EHC have more deaths

In total, the EHC has around twice the number of deaths compared with the MDC (2.3 times for males, 1.7 for females) and around five times the number of deaths compared with the LDC (6.1 times for males, 4.0 times for females).

For each age and sex breakdown among adults (those aged 16+ years), the EHC have at least as many deaths

Compared to the controls in the MDC or LDC, the ratio of deaths is always at least one (minimum ratio is: 1.0, EHC : MDC for females aged 66+ years).

If EHC people die, they tend to die at a younger age than their controls

The ratios for those age 26–50 years are larger than the ratios for those aged over 50 years. However, the data in the study provides no evidence to suggest that the overall life expectancy of EHC is different from their controls. Given that less than 2% of the cohorts died during the study period, the cohorts would need to be followed over a longer much period of time in order to compare their overall life expectancies.

EHC people aged 31–40 years have the most deaths compared with their controls

The ages at which the peak ratios occur are similar for males and females (Figure 9.2). For males EHC : LDC peaks at 21.8 at 36–40 years, and EHC : MDC peaks at 5.0 at 31–35 years. For females EHC : LDC peaks at 15.0 at 31–35 years, and EHC : MDC peaks at 3.9 also at 31–35 years.

Figure 9.1: Deaths per 1,000 people during study period by age at 31 March 2015, cohort and sex.

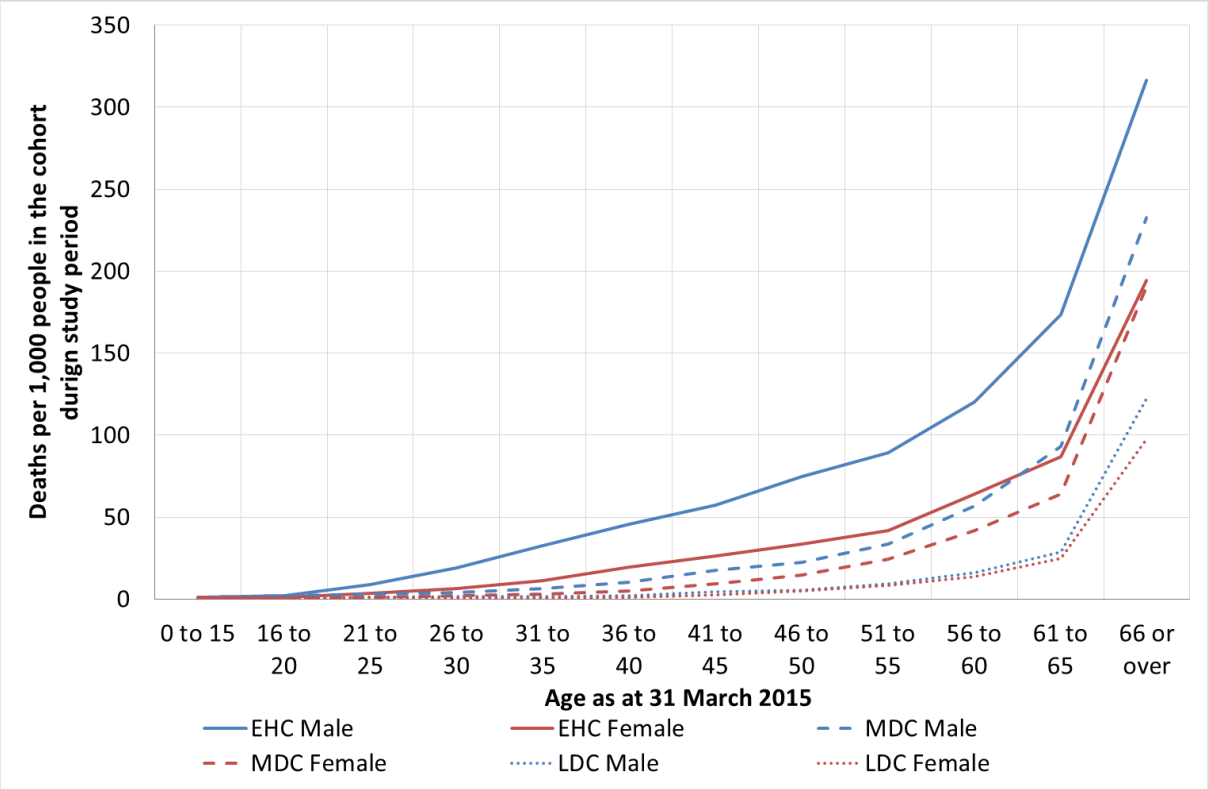
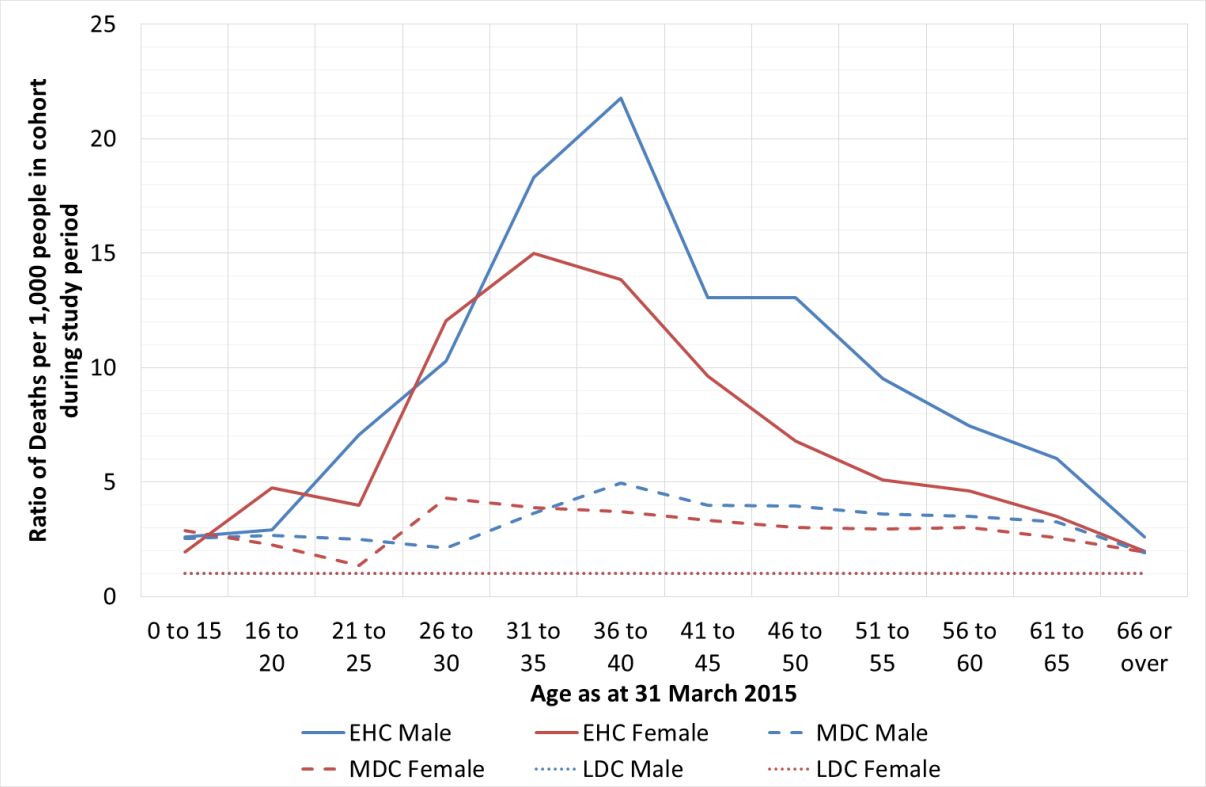


Figure 9.2: Ratio of deaths per 1,000 people in each cohort to those in the LDC by age at 31 March 2015 and sex.



9.2 Cause of death

The previous section found that, on average, more people in the EHC had died than in the control cohorts. This section explores how these ratios vary by cause of death (Table 9.2). Also explored is whether the distribution of the causes of death differs between the cohorts (Figure 9.3). The following points apply for both sexes:

Table 9.2: Number of people, number of deaths and the ratio of the number of deaths between EHC and MDC, and between EHC and LDC, by cause of death and sex.

	Male			Female		
ICD-10 Cause of death	Deaths	EHC : MDC	EHC : LDC	Deaths	EHC : MDC	EHC : LDC
Other causes	2221	2.2	4.7	1115	1.4	3.2
Alcohol Related Conditions	1850	3.7	33.9	676	3.6	18.8
Drug Related Conditions	2620	7.7	73.9	856	7.6	67.9
Mental and Behavioural Disorders	124	1.5	2.1	114	1.7	1.7
Diseases of the Respiratory System	1122	1.5	5.7	731	1.2	5.6
Malignant Neoplasm (Cancer)	2999	1.2	2.2	2205	1.1	1.9
Heart Disease & strokes	3327	1.6	4.2	1324	1.2	3.2
Intentional Self-Harm	927	3.5	8.2	262	4.0	7.9
Assault	274	6.1		64	4.6	

Diseases of the digestive system	592	2.1	6.6	315	1.4	4.9
All Causes	16056	2.3	6.1	7662	1.7	4.0

Note: See section 2.3.9 for details of how the ICD-10 codes were mapped to these groupings.

In order to see how mortality compare in the different cohorts, ratios of deaths were constructed for each age band and sex (Table 9.1).

All the ratios for drugs, alcohol, intentional self-harm, and assault are higher than the all-cause ratio

For each of drug-related deaths, alcohol-related deaths, intentional self-harm and assault the ratios of each of EHC : MDC and EHC : LDC for both males and females are higher than the respective ratios for the all-cause total (2.3 and 6.1 for males, 1.7 and 4.0 for females).

All the ratios for cancer are notably lower than the all-cause ratio

The EHC : MDC ratio for cancer was 1.2 for males (1.1 for females), and the EHC : LDC ratio for cancer was 2.2 for males (1.9 for females).

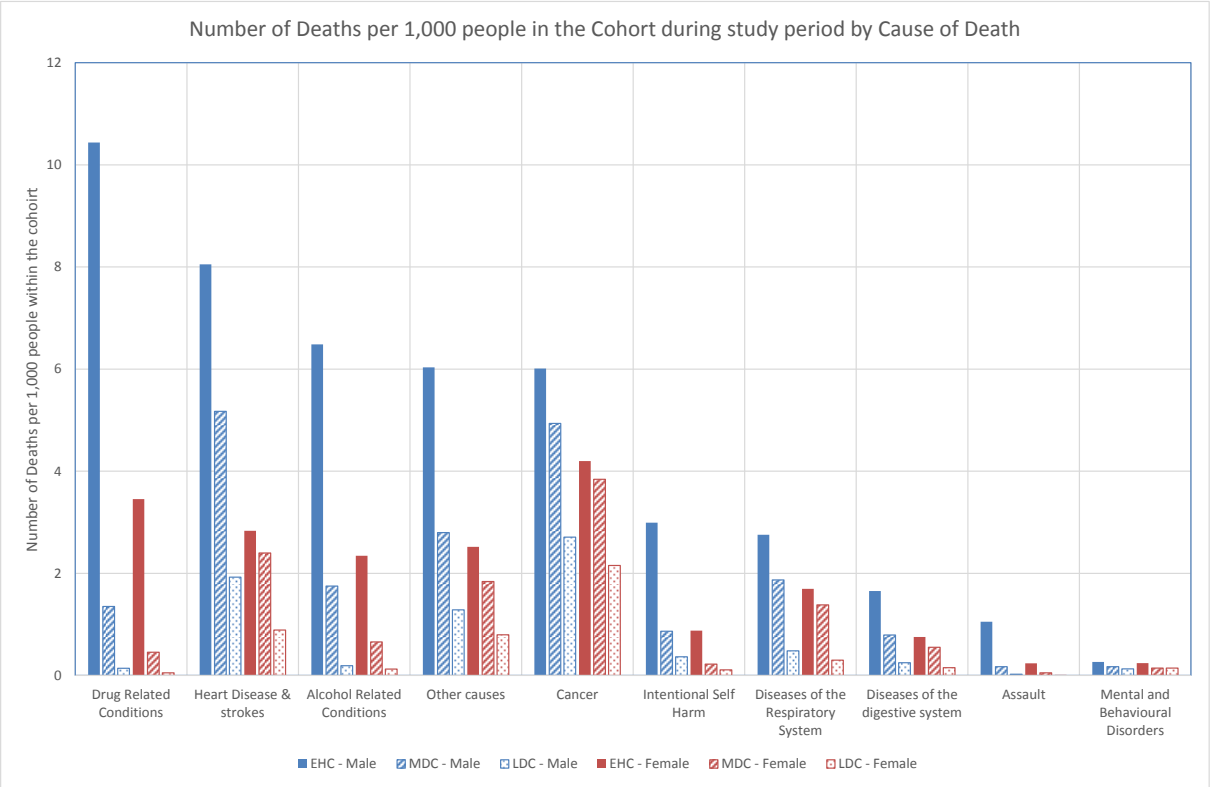
The three causes with the most deaths among the male EHC are drugs, heart disease & strokes, and alcohol

22.8% of deaths among the male EHC were due to drug-related conditions, 17.6% were due to heart disease and strokes, and 14.2% were due to alcohol-related conditions (Figure 9.3). By contrast the three main causes of death among the male MDC and LDC are cancer, heart disease & strokes, and other causes.

The three largest causes of death among the female EHC are cancer, drugs, and heart disease & strokes

21.9% of deaths among the female EHC were due to cancer, 18.0% were due to drug-related conditions, and 14.8% were due to heart disease and strokes. By contrast the three main causes of death among the female MDC and LDC are cancer, heart disease & strokes, and other causes.

Figure 9.3: Number of deaths per 1,000 people by cause of death, cohort and sex.



9.3 Cause of death by age and sex

It was found in Section 9.2 that deaths caused by drug-related conditions, alcohol-related conditions and intentional self-harm showed the largest differences between the EHC and the control cohorts. This section explores the deaths per 1,000 people in the study period from these causes by age at 31 March 2015 (Figure 9.4: drugs, Figure 9.5: alcohol and Figure 9.6: intentional self-harm). This will show whether the EHC people who die from these causes tend to be old or young. The following points apply for both sexes:

Mortality from alcohol is higher for older people, peaking at 61–65 years

The deaths per 1,000 people from alcohol-related conditions are highest among people aged 61–65 years across each of the cohorts (apart from male LDC where the peak occurs in 66+ years) and this is much higher than among younger people. The shape of the distribution is similar in the EHC to those in the controls (Figure 9.4). Thus EHC people of particular ages are not especially affected by alcohol. It appears that the differences between cohorts are similar across ages. Because most alcohol deaths generally are among older people this is translated across to most alcohol deaths among the EHC being for older people.

Mortality from drugs is higher for people, particularly males, around 31–50 years

The deaths per 1,000 people from drug-related conditions are highest among people, particularly males, aged around 31–50 years (Figure 9.5).

Mortality from intentional self-harm is higher for people, particularly males, around 31–50 years

The standardized deaths from intentional self-harm are highest among people, particularly males, aged around 31–50 years (Figure 9.6).

Figure 9.4: Alcohol related deaths per 1,000 people by cohort, age at 31 March 2015 and sex. Note: A logarithmic scale has been used here to highlight that the cohort distributions are similar (the lines are approximately parallel).

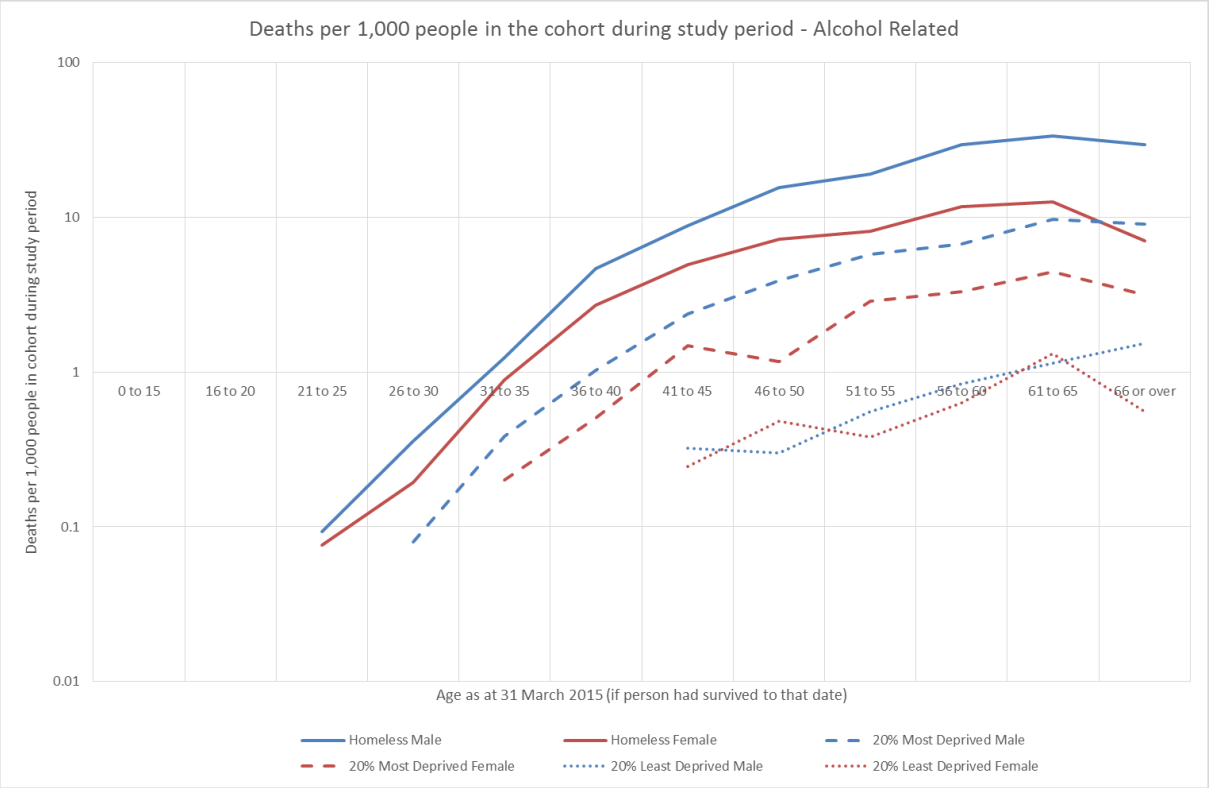


Figure 9.5: Drug related deaths per 1,000 people by cohort, age at 31 March 2015 and sex.

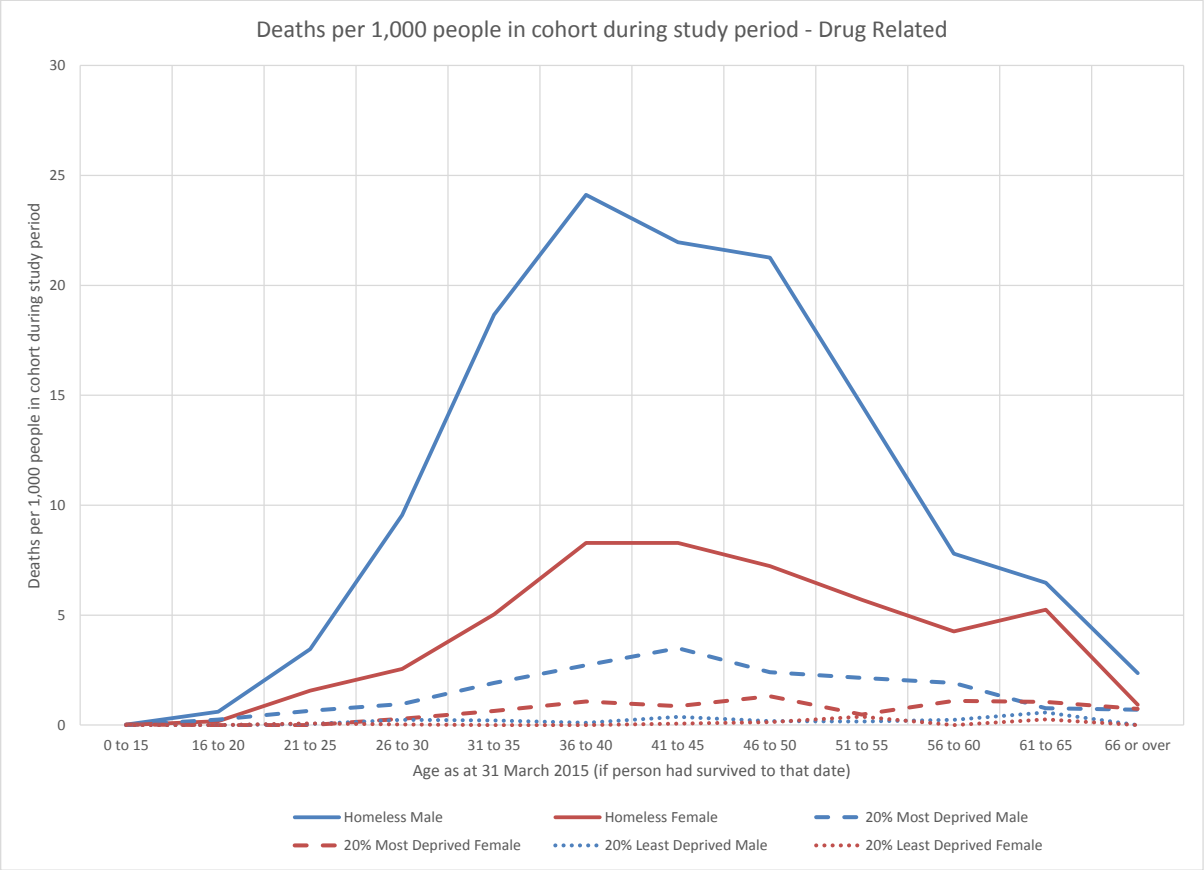
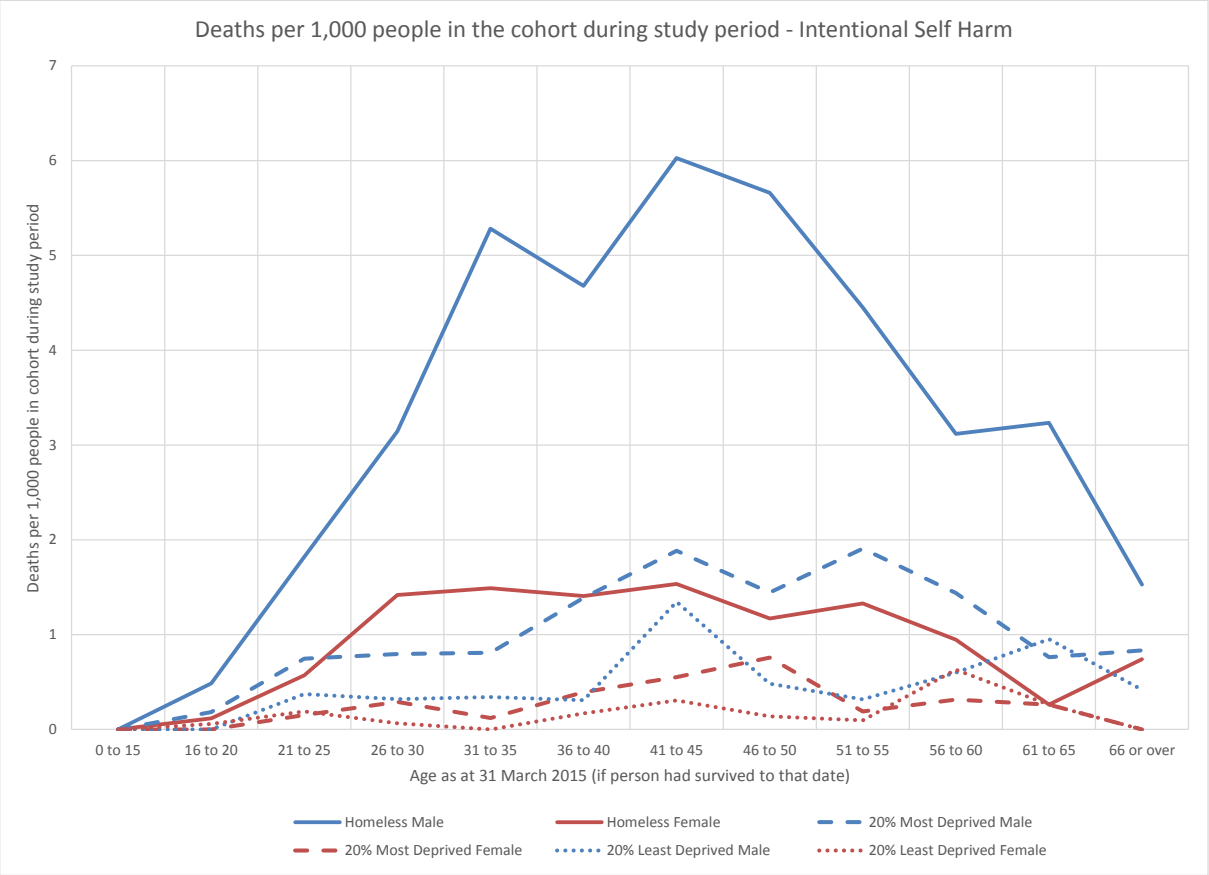


Figure 9.6: Intentional self-harm deaths per 1,000 people by cohort, age at 31 March 2015 and sex.



9.4 Cause of death for Once-Only and Repeat Homelessness

In order to see how mortality compares in for the Repeat and Once-only EHC the distribution of deaths by cause are analysed separately for these (figures 9.7 and 9.8). Also the ratios of deaths were constructed for each cause and sex (tables 9.3 and 9.4), for Repeat and Once-only EHC.

The three causes with the most deaths among the Repeat EHC are drugs, alcohol and other causes

37% of deaths among the male EHC (33% female) were due to drug-related conditions, 14% (male and female) were due to alcohol-related conditions, and 13% (male and female) were due to other causes (Figure 9.8).

The three causes with the most deaths among the Once-only EHC are heart disease & strokes, cancer, and drugs (males) or other causes (females)

For male Once-only EHC the three main causes of death (Figure 9.7) are heart disease & strokes (20%), cancer (17%), and drugs (15%). For female Once-only EHC the three main causes of death are cancer (25%), heart disease & strokes (17%) and other causes (13%).

The Repeat EHC have larger differences in mortality between the EHC and controls than do the Once-only EHC

The reason that there are more drug-related deaths among the Repeat EHC than among the Once-only EHC will partly be that the Repeat EHC has a younger age distribution (the deaths per 1,000 people is higher among younger people (Figure 9.5). However it is also seen that the ratios EHC : LDC and EHC : MDC for drug-related conditions (which control for age) are higher for the Repeat cohorts than for the Once-only cohorts (11.6 compared with 5.6 for males, and 12.3 compared with 5.4 for males – see Tables 9.3 and 9.4). If differences in age alone were the driver, we would not expect these ratios to differ by more than a factor of 1.4 times – see section 2.3.2). Previous chapters have also shown evidence of higher drug-related health activity for Repeat EHC (see section 8.4: SDMD Assessments). Thus this will also account for the prominence of deaths among the Repeat EHC.

Figure 9.7: Deaths per 1,000 people for **once only** homelessness people by cause of death, cohort and sex.

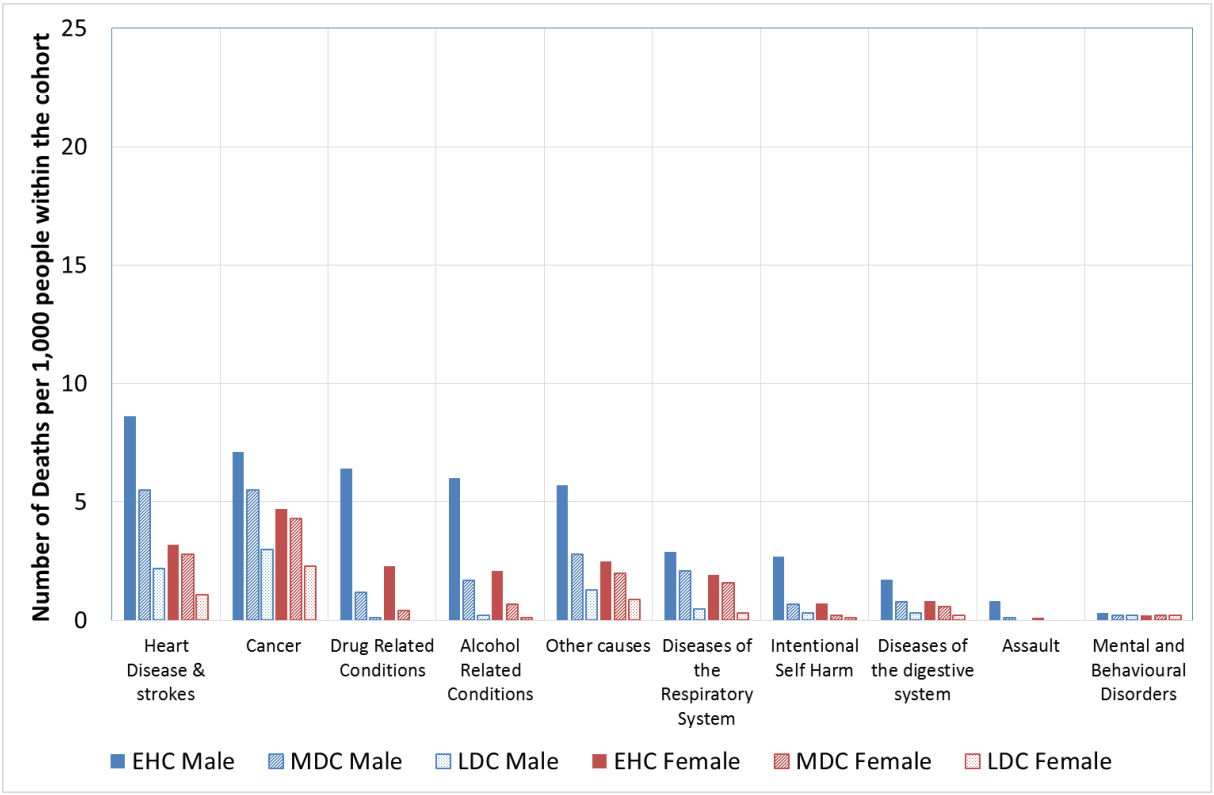


Figure 9.8: Deaths per 1,000 people for people with **repeat** homelessness assessments by cause of death, cohort and sex.

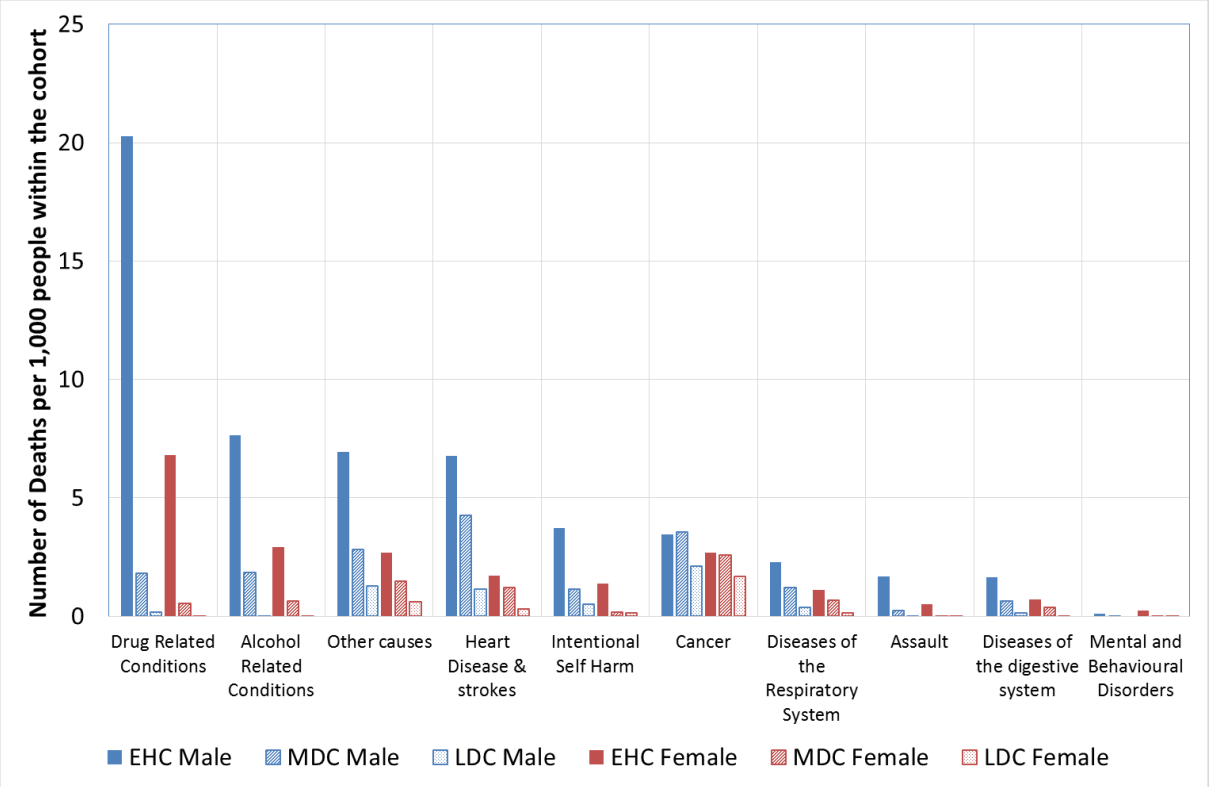


Table 9.3: Deaths per 1,000 people for **males** with homelessness assessments by cause of death, cohort and sex.

	Repeat			Once only		
Age (at 31 March 2015)	Deaths	EHC : MDC	EHC : LDC	Deaths	EHC : MDC	EHC : LDC
Drug Related Conditions	1,417	11.0	117.2	1,203	5.6	50.2
Heart Disease & strokes	778	1.6	5.8	2,549	1.5	3.8
Other causes	702	2.5	5.5	1,519	2.0	4.4
Alcohol Related Conditions	611	4.1		1,239	3.5	26.0
Cancer	582	1.0	1.6	2,417	1.3	2.4
Intentional Self-harm	343	3.2	7.4	584	3.6	8.8
Diseases of the Respiratory System	248	1.9	5.8	874	1.4	5.7
Diseases of the digestive system	155	2.5		437	2.0	5.6
Assault	125	7.1		149	5.4	
Mental and Behavioural Disorders	11			113	1.5	1.8
Total (ALL)	4,972	3.1	9.2	11,084	2.0	5.2

Table 9.4: Deaths per 1,000 people for **females** with homelessness assessment by cause of death cohort and sex.

	Repeat			Once only		
Age (at 31 March 2015)	Deaths	EHC : MDC	EHC : LDC	Deaths	EHC : MDC	EHC : LDC
Drug Related Conditions	418	12.3		438	5.4	
Cancer	391	1.0	1.6	1,814	1.1	2.0
Other causes	268	1.8	4.3	847	1.3	2.9
Alcohol Related Conditions	204	4.6		472	3.2	14.9
Heart Disease & strokes	182	1.4	5.3	1,142	1.1	3.0
Diseases of the Respiratory System	110	1.6		621	1.2	5.4
Intentional Self-harm	97	7.1		165	3.0	7.0
Diseases of the digestive system	64	1.9		251	1.3	4.1
Assault	33			31		
Mental and Behavioural Disorders	18			96	1.3	1.4
Total (ALL)	1,785	2.6	6.4	5,877	1.4	3.5

9.5 Time of death relative to homelessness

In previous chapters in order to explore how homelessness itself is related to the health measure, temporal plots of health activity relative to the date of first homelessness assessment were produced. These showed how health activity following the date of first homelessness assessment compared with that before this date. However such analysis will not be possible for deaths. This is partly because there are comparatively few deaths, but also because there are no deaths prior to the first assessment date (by construction of the datasets).

Therefore, in order so explore the link between homelessness and deaths, the number of deaths that occurred while people in the EHC were homeless is compared with the number of death for these people while they were not homeless (Table 9.5). Here people are considered to be homeless from the date of homelessness assessment until the date that the local authority has discharged its duties under the homelessness legislation and closed the HL1 case. Note that this method is not as robust as the previous temporal analysis as it does not control for the effects of aging and other potential issues, such as different recording practices by local authorities. However it should give an indication of whether there is a difference.

Table 9.5: Number of days people in the EHC spent during open homelessness cases from the date of their first homelessness assessment until the end of the study period (31 March 2015), or their date of death (whichever is earlier). People are considered to be in open homelessness cases from the date of homelessness assessment until the date the HL1 case was closed. Also shown is the number of days these people were not in open homelessness cases. For each of these periods the number of deaths that occurred among these people are shown. Finally a death rate is calculated for each of these periods. This has been calculated by dividing the number of deaths in these periods by the total time (converted to years) and then multiplied by 1,000.

		EHC Male	
	Homeless	Not homeless	Total
Days while:	51,878,616	484,140,960	536,019,576
Percentage of total time while:	9.7%	90.3%	100.0%
Deaths while:	1,247	8,796	10,043
Deaths per year per 1,000 people while:	8.8	6.6	6.8
		EHC Female	
	Homeless	Not homeless	Total
Days while:	49,987,286	491,842,621	541,829,907
Percentage of total time while:	9.2%	90.8%	100.0%
Deaths while:	378	3,765	4,143
Deaths per year per 1,000 people while:	2.8	2.8	2.8

For EHC females the death rate while homeless is the same as that while not homeless

For females in the EHC there is no observed difference in the death rate while they are homeless from the death rate while they are not homeless.

For EHC males the death rate while homeless is higher than that while not homeless

For males in the EHC the death rate during periods of homelessness is a third higher than during periods when they were not homeless. This may be symptomatic of the higher number of drug-related deaths amongst the Repeat EHC males.

9.6 Summary

Across all age bands there are at least as many deaths among the EHC than among the MDC or LDC. However the differences between cohorts are most pronounced for younger people, (those aged 26–50 years compared with those aged 51+ years). This suggests that people in the EHC will in general die younger than people in the LDC or MDC. (Note however that this study has not been set up to show this so this cannot be confirmed nor quantified. No inferences are made about the life expectancies of the study population). This provides evidences towards research question 4 – is there a relationship between health, homelessness and area-based deprivation?

Deaths among the EHC for most cause of death groupings were higher than among the MDC and LDC. These differences were most pronounced for drugs, alcohol, intentional self-harm, and assault. This results in the main causes of death among the EHC being drugs, heart disease & strokes, and, for males, alcohol and, for females, cancer. Note that the duration of the study period is limited so deaths for only a minority of the EHC are recorded. As the EHC age further the distribution of causes of death will likely vary and so these cases may not ultimately be the main causes of death across the whole EHC.

Alcohol-related deaths occurred when people were older (over 60 years) and this was true for all cohorts. Drug-related deaths and deaths resulting from intentional self-harm peaked earlier than this (around 31-50 years) and were highest amongst males.

There were more drug-related deaths in the Repeat EHC than in the Once-only EHC. Whilst this can partly be explained by the younger age profile of the Repeat EHC, the differences are too large to be due to the different age profiles alone. This suggest a relationship between repeat homelessness and deaths from drug-related conditions.

In order to more closely relate these differences to homelessness itself (rather than just differences in deprivation levels between the EHC and controls) the mortality during periods of homelessness were compared with the mortality during periods when people in the EHC were not in open homelessness cases (research question 3 – homelessness leads to health activity). It was found that for females there was no difference in mortality between these periods. However for males it was found that mortality was a third higher during periods of homelessness. This difference may be driven by the higher number of drug-related deaths amongst the repeat homeless males.

Chapter 10: Individual Person-level Analysis of Drug-related, Alcohol-related and Mental Health Issues

Previous chapters have considered the use of various parts of the health service in isolation – A&E, inpatients, outpatients, prescriptions, mental health services and the Scottish Drugs Misuse services. In these chapters the study found that drugs, alcohol and mental health were recurring themes in the differences observed between cohorts.

In this chapter, we consider the 1.3 million people in the study and look to see who amongst them have any evidence of drug related, alcohol related or mental-health related interactions (hereafter in this chapter simply referred to as drugs, alcohol and mental health) at any point during the period of the study. The following datasets contain information about these issues: prescriptions (PIS), mental health (SMR04), Scottish Drugs Misuse Database (SDMD) and acute admissions to hospital (SMR01).

For example, someone may have had a prescription for a mental health issue (in the PIS dataset) and also have had an acute admission to hospital in relation to a drug issue (in the SMR01 dataset). When looking at these in isolation, the information available on the PIS record did not indicate that there was also a drug-related admission in the study for that person. In this chapter, no comment is made about whether these health conditions occurred prior or after any episodes of homelessness, or whether the person had these health conditions concurrently.

The crucial difference between this chapter and chapters 3 to 8 is that the analysis is conducted for individual people, rather than looking at each the health activity datasets in isolation.

10.1 Drug, Alcohol and Mental Health related issues amongst the cohorts

In the previous chapters the focus was on the amount of activity in the different cohorts (i.e. the number of interactions). It was not always clear whether the number of people using each service differed between the cohorts. It was also not discussed whether the people using a particular service are the same people as those who use services analysed in different chapters.

This section explores the proportions of people who have *any* mental health interactions (prescriptions, acute admissions, or mental-health admissions). The same is then explored for drug-related interactions and alcohol-related interactions. In order to see how these vary between cohorts, the proportions of these are presented (Table 10.1).

Table 10.1: Study individuals with evidence of drug-related, alcohol-related and/or mental health related interactions, by cohort.

	EHC	MDC	LDC
Number of people in each cohort	435,853	435,853	435,853
Proportion with:			
Any mental health	47.9%	25.7%	13.6%
Any drugs	14.4%	3.1%	0.7%

Any alcohol	10.6%	3.0%	0.8%

Almost half of the EHC had mental health interactions, more than the MDC or LDC

48% of the EHC had mental health interactions. This is notably higher than for the MDC (26%) and the LDC (14%). However it shows that for a majority of the people in the EHC there is no evidence of mental-health interactions.

A significant minority of the EHC had drug-related interactions, more than the MDC or LDC

14% of the EHC had drug-related interactions. This is notably higher than for the MDC (3%) and the LDC (0.7%). However it shows that for most of the people in the EHC there is no evidence of drug-related issues.

A significant minority of the EHC had alcohol-related interactions, more than the MDC or LDC

11% of the EHC had alcohol-related interactions. This is notably higher than for the MDC (3%) and the LDC (0.8%). However it shows that for most of the people in the EHC there is no evidence of alcohol-related issues.

More people in the EHC had drug-related interactions than alcohol-related interactions

Around a third[43] more people in the EHC had drug-related interactions than alcohol-related interactions. This differs from the MDC and LDC, where the proportions are more comparable.

10.2 Overlap of drug-, alcohol-related and mental health issues amongst the cohorts

In the previous section it was seen that a majority of EHC people had no evidence of mental health issues, and the same was true for drug-related and alcohol-related conditions. In this section the overlap between these groups is explored. That is, are the people who have evidence of one of these issues the same people as have evidence of the others. For example it may be the case that the EHC people with evidence of alcohol-related issues are a subset of those who have evidence of drug-related issues, who in turn are a subset of those who have evidence of mental-health issues. This would suggest that a majority of the EHC have no evidence of any of these issues. Conversely it could be the case that these sets are all distinct (no people have evidence of more than one of these). This would suggest that 73% of the EHC would have evidence of (exactly) one of these issues.

In order to see how the people with evidence of these issues overlap, we first examine the proportion of people in each cohort and how drug-related and alcohol-related issues coincide (Table 10.2).

[43] 14.4% of the EHC have drug-related interactions compared with 10.6% for alcohol-related interactions. Whilst this is a 3.8% difference in percentage points, the number of people with drug-related interactions is 36% more than those with alcohol-related interactions.

10.2.1 Overlap between people with drug-related and those with alcohol-related conditions

Here only drugs and alcohol are considered and how they overlap.

Most of the EHC do not have evidence of any of drug or alcohol issues

81% of the EHC do not have evidence of any of drugs or alcohol issues. Thus while it is certainly the case that this proportion is smaller than for the MDC (95%) and for the LDC (99%), it can be seen that most EHC people do not have any evidence of drug-related issues or alcohol-related issues.

More people have both drugs and alcohol than expected were these independent

Given the proportion of the EHC who have evidence of drug-related conditions (14%) and the proportion with evidence of alcohol-related conditions (11%), it would be expected that 1.5% would have evidence of both (if these attributes were independent). However it is observed that 6.1% have both drug and alcohol-related conditions. This shows that these attributes are not independent: people are more likely to have drug-related issues if they have alcohol-related issues, and vice versa.

More of the people who have drugs and/or alcohol have both in the EHC than in the controls

Given that drugs and alcohol are not independent, the group of people who have **any** drug or alcohol- related conditions is considered (19% of the EHC, 5.1% of the MDC and 1.2% of the LDC). This group is largest among the EHC, as would be expected given the findings in Section 10.1. However it can also be seen that the composition of these groups are also different. Around a third (32%) of these people with either drug- or alcohol-related conditions within the EHC have both conditions, compared with 21% of the MDC and 16% of the LDC.

Table 10.2: Study individuals with drug-, alcohol- or mental health related interactions, by cohort.

Additional Needs	EHC	MDC	LDC
No Interactions with any dataset	51.0%	73.8%	86.2%
Mental health only	30.1%	21.2%	12.6%
Drugs only	0.7%	0.4%	0.2%
Drugs and mental health	7.6%	1.7%	0.3%
Alcohol only	0.2%	0.1%	0.1%
Alcohol and mental health	4.4%	1.8%	0.5%
Alcohol and drugs	0.1%	0.1%	0.0%
Alcohol and drugs and mental Health	5.9%	1.0%	0.2%
Total	**100.0%**	**100.0%**	**100.0%**
No alcohol or drugs (no interactions or mental health only)	81.0%	94.9%	98.8%
Drugs and/or alcohol (with or without mental health)	19.0%	5.1%	1.2%

Drugs and alcohol (with or without mental health)	6.1%	1.1%	0.2%
Drugs and alcohol as proportion of drugs and/or alcohol	31.9%	21.4%	16.4%
Any of drugs, alcohol or mental health	49.0%	26.2%	13.8%
Mental health, and drugs and/or alcohol	17.9%	4.5%	1.0%
Mental health, and drugs and/or alcohol as proportion of any of drugs, alcohol or mental health	36.5%	17.1%	7.0%
Proportion of drugs/alcohol who also have mental health	94.3%	88.7%	79.8%

10.2.2 Overlap between people with mental health and those with drugs and/or alcohol

Having considered drugs and alcohol above, this subsection looks at how this overlaps with mental health issues.

A majority of the EHC do not have any of mental health, drug or alcohol issues

51% of the EHC do not have any of mental health, drug- or alcohol-related issues. Thus while it is certainly the case that this proportion is smaller than for the MDC (74%) and for the LDC (86%), it can be seen that a majority of EHC people do not have any evidence of drug-related issues, alcohol-related issues or mental health issues.

Just under a third of the EHC have had a mental health issue which excludes drug- or alcohol-related issues

30% of the EHC have experienced a mental health issue which excludes drug- or alcohol-related issues. This proportion is higher than for the MDC (21%) and for the LDC (13%).

Most of the people with drug- or alcohol-related conditions also have mental health issues

Given the proportion of the EHC who have evidence of any drug- or alcohol-related issues (19% of all EHC), the vast majority also have evidence of mental health issues. In particular most of the people who have evidence of drug- or alcohol-related issues also have evidence of mental health issues, especially in the EHC (94%, compared with 89% in the MDC and 80% in the LDC).

5.9% of the EHC have drug-, alcohol-related and mental health issues

The proportion of people with all three conditions is higher among the EHC (5.9%) than in the MDC (1.0%) or the LDC (0.2%).

In the remainder of this chapter we use a simpler categorization as follows:

- people with no evidence of mental health, drug or alcohol issues (referred to as “None”);
- people with all three issues (drugs, alcohol and mental health);
- all other people (these have one or more of drugs, alcohol or mental health issues, but not all three).

10.3 Drugs, alcohol and mental health by age and sex

10.3.1 All three issues - drugs, alcohol and mental health

Figure 10.1 shows the age and sex of people in the cohort who have evidence of all three issues – drugs, alcohol and mental health – at some point during the study period. The age used in this and subsequent figures is the age each person would have attained at 31 March 2015.

In the EHC more of the males than females have all three issues

The proportion of the EHC that has evidence of drugs, alcohol and mental health issues is 7.2% for males and 4.6% for females. This differences is larger than the difference between sexes among the MDC (1.1% males, 0.9% females). The proportion for the LDC are too small to comment upon (<0.2% for both males and females).

In the EHC a higher proportion of males than females have all three issues for ages 26+years

In the EHC a slightly higher proportion of females than males have all three issues for 0–20 years. At 21–25 years the proportions are similar. In each age above this the proportion is higher for the males than for the females (Figure 10.1).

The proportion of the EHC that have all three issues is lowest for young and old people

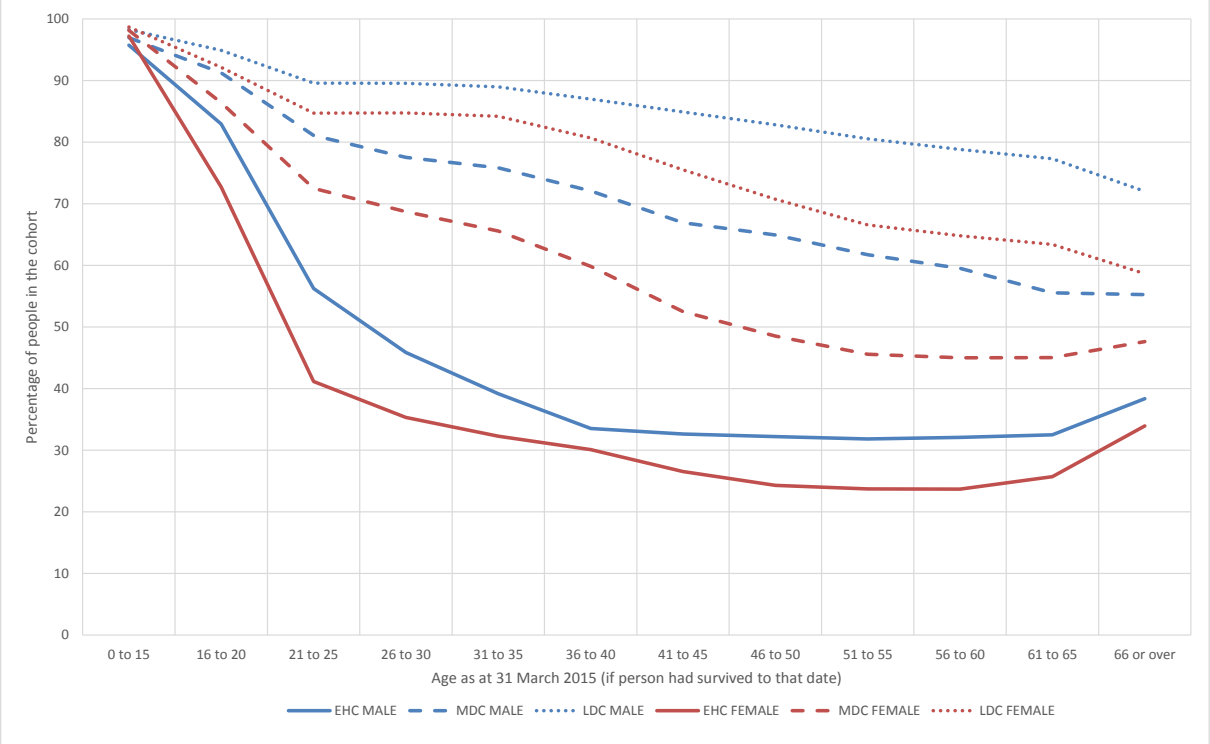
At ages 26–60 years (for males, 21–60 for females) the proportion of the EHC that have all three issues is higher than the average across all ages. Above and below this age range the proportion is below the average.

Figure 10.1: Percentage of people in the study with a drug, alcohol and mental health issue at some point during the study period, by age, sex and cohort.

10.3.2 People with no evidence of drug, alcohol or mental health issues

Figure 10.2 shows the proportion in each cohort with **none** of the above issues at any point during the study period. For the EHC cohort, the proportion of people with none of these issues falls sharply with age. Females fall more sharply than males. By age 36 to 40 years, only around a third of the EHC cohort have none of these issues, and this is much lower than for the MDC and LDC.

Figure 10.2: Percentage of people in the study with **no evidence** of drug, alcohol or mental health issues during the study period, by age, sex and cohort.



10.4 Repeat and Once-Only Homelessness

Table 10.3 shows the relationship between those experiencing repeat homelessness (Repeat EHC), Once-only homelessness (Once-only EHC) together with evidence of mental health, drug- or alcohol-related issues. This is compared to their respective controls in the MDC and LDC, matched on age and sex.

The Repeat EHC has fewer people with no of drug-, alcohol-related or mental health issues

39% of the Repeat EHC have no evidence of drug-, alcohol-related or mental health issues, compared with 74% for MDC and 87% for the LDC. This is lower than the 55% of the Once-only EHC who have none (compared with 74% for the MDC and 86% for the LDC). The proportions for the controls being similar between the once-only and repeat, suggests that the difference between once-only and repeat is not due to the difference in the age distribution.

The Repeat EHC has more people with all of drugs, alcohol or mental health

Over a tenth (11.4%) of people in Repeat EHC have evidence of all three of mental health, drug- and alcohol-related conditions, compared with 1.0% for MDC and 0.2%

for the LDC. This is higher than the 3.8% of the Once-only EHC who have all three (compared with 1.0% for the MDC and 0.2% for the LDC). Even though the proportions among the controls are similar between the once-only and repeat groups, the proportion for the Repeat EHC is around three times larger than the proportion for the Once-only EHC. Although the Repeat EHC and Once-only EHC have different age structures, the difference here is too large to be explained by age differences alone (see Section 2.3.2). There is a relationship between repeat homelessness and drug-, alcohol-related and mental-health issues.

Table 10.3: Proportion of people with drug-, alcohol-related or mental health issues, by cohort and repeat or once-only homelessness.

	Once Only			Repeat		
	EHC	MDC	LDC	EHC	MDC	LDC
Number of People in the Cohort	316,067	316,067	316,067	119,786	119,786	119,786
Proportion with:						
Any mental health	43.6%	25.8%	13.7%	59.4%	25.3%	13.2%
Any drugs	9.8%	3.1%	0.6%	26.4%	3.3%	0.7%
Any alcohol	8.1%	3.0%	0.7%	17.2%	3.0%	0.8%
None	55.4%	73.6%	86.0%	39.3%	74.1%	86.5%
Alcohol, drugs and mental health	3.8%	1.0%	0.2%	11.4%	1.0%	0.2%

10.5 Drug, alcohol and mental health Issues amongst different groups

This section considers how those in particular groups are affected by mental health, drugs and alcohol issues. The groups focussed on here are:

- those who were previously a member of the armed forces,
- whether someone has slept rough in the three months preceding their homelessness application
- whether someone has previously been looked after as a child by a local authority
- whether someone has become homeless immediately following discharge from prison
- whether someone has experienced domestic abuse or violence.

These groups have been chosen to suggest areas of further analysis, rather than provide definite proportions. For example, splitting the EHC into those that have been discharged from prison may result in forming groups which have different age-sex balances. The differences between these and the people in the EHC seen may therefore not just be due to whether the person has been discharged from prison, but also in differences in the age-sex structure of each group.

The Scottish Government HL1 datasets does not identify which individual in the homelessness application has these attributes. Thus if one person in the application is in one of these groups, then all household members are assumed to be in group. As most homelessness applications contain only one person, this issue is unlikely to have a big impact on the resulting analysis.

For this section of the study, the homeless data was aggregated across all assessments to analyse the above groups. For example, for the analysis of prison leavers, the dataset was analysed to see whether a person had been recorded as homeless directly from prison across all the HL1 data provided for the study – it was not just based on the most recent homeless case.

Table 10.4: Additional analysis by groups of interest

	People with any evidence of:			Observed count				
Groups of interests*	Alcohol	Drugs	Mental health	People with none	People with all three	All people in this group	% none	% all three
Previously a member of the armed forces	1,285	1,396	5,018	5,360	655	10,495	51%	6%
Someone who has experienced domestic abuse or violence	7,553	11,189	36,890	35,929	4,892	73,572	49%	7%
Someone who has previously been looked after as a child by a local authority (looked after)	2,301	3,797	7,320	4,982	1,687	12,533	40%	13%
Evidence of rough sleeping	9,208	13,392	24,694	11,620	6,018	36,824	32%	16%
Evidence of rough sleeping and having been looked after.	659	1,107	1,598	480	536	2,116	23%	25%
Someone has become homeless immediately following discharge from prison	5,097	9,266	11,892	2,521	3,976	14,697	17%	27%
All EHC	**46,274**	**62,752**	**208,959**	**222,285**	**25,715**	**435,853**	**51%**	**6%**

*Note: People may be in more than one group of interest

People who have slept rough, been formerly looked after by a local authority or discharged from prison all appear to have higher proportions of people with all three issues – drug-, alcohol-related and mental health issues.

This is not surprising. Drug use amongst prisoners and formerly looked after people is known. For example, three quarters of prisoners (75%) who were previously in care as children reported using drugs in the 12 months before coming into prison[44]. For the prison population, the percentage testing positive for illegal drugs when entering prison has been relatively stable since 2010/11, ranging between 70% and

[44] Broderick R, McCoard S, Carnie J. Prisoners who have been in care as "looked after children". Scottish Prison Service; 2014. Available online at: https://goo.gl/AoUBbk

77%. In 2016/17, on liberation, 30% tested positive for illegal drugs[45]. Evidence of substance misuse amongst people sleeping rough is also known[46].

Putting aside the differences in age-sex groupings between the different groups, further work may wish to consider the degree to which these factors influence health and homelessness.

10.6 Proportion of people with drug, alcohol and mental health issues by Local Authority

For each person in the EHC cohort, it possible to conduct limited analysis by local authority. Each person in the EHC is assigned to the local authority of their most recent homelessness assessment. The proportion of people within the EHC with all three issues – drug-, alcohol-related and mental health issues - is then calculated for each local authority.

Figure 10.3 is a funnel plot which shows how this proportion varies by local authority. The dotted blue line shows the EHC average for the study (around 6%). If a local authority lies within the red funnel these are not statically different from the EHC average. Points above the upper red line are statistically higher than the EHC average and are very unlikely to have occurred by chance alone. Points below are statistically lower than the EHC average.

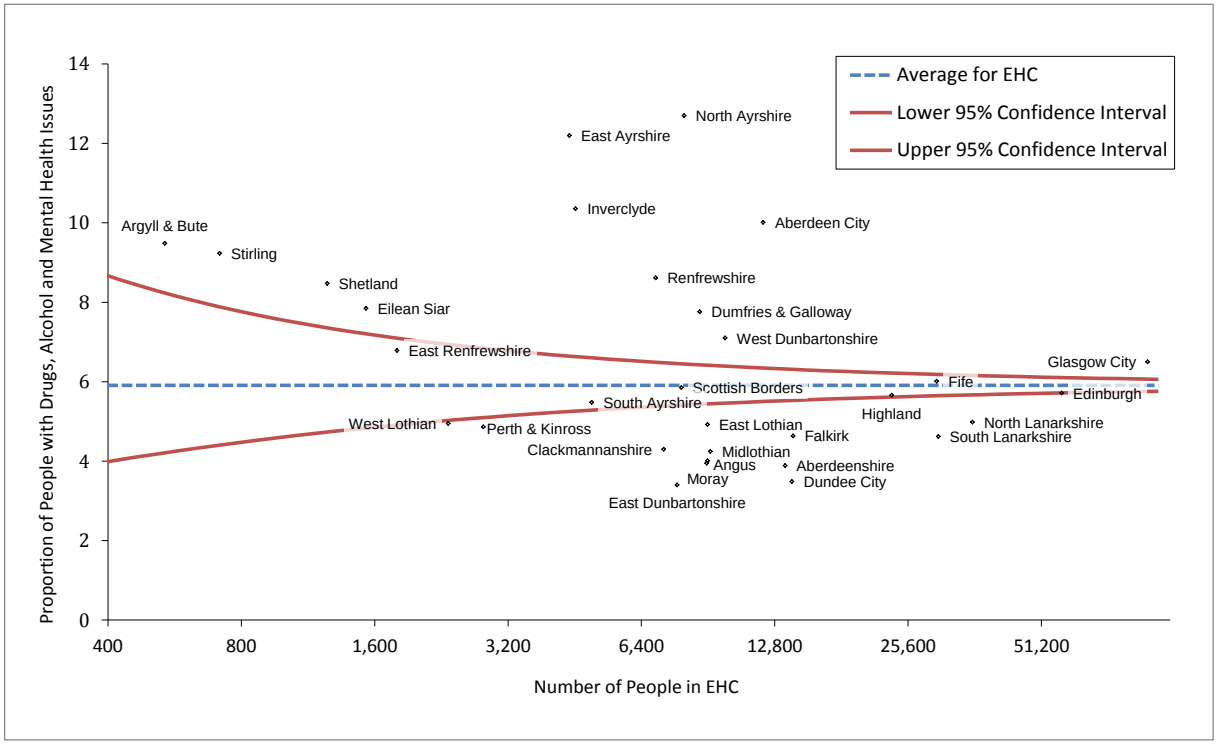
The reasons for the differences between local authorities may be driven by:

- An actual higher proportion of people in each local authority with drug, alcohol and mental health issues
- The age-sex distributions of homeless people between local authorities may be slightly different, driving some differences
- Different recording practices across health boards could drive some of these differences, although a number of different datasets have been used for this section.
- Greater availability of drug, alcohol and mental health services may be greater in some areas, which could cause some of this difference.

[45] Scottish Public Health Observatory. Drug Misuse and Treatment in Scottish Prisons. Accessed 21 March 2018. Available at: http://www.scotpho.org.uk/behaviour/drugs/data/availability-and-prevalence

[46] Joseph Rowntree Foundation. Tackling homelessness and exclusion: Understanding complex lives. September 2011. Available at: https://www.jrf.org.uk/sites/default/files/jrf/migrated/files/homelessness-exclusion-services-summary.pdf

Figure 10.3: Proportion of People in the Cohort with Drug-, Alcohol-Related and Mental Health Issue by Local Authority



All local authorities above the upper red line have higher proportions of EHC people with all three issue than the EHC average. Of these, North Ayrshire and East Ayrshire are the highest. This is consistent with the Drug-Related Hospital Statistics for NHS Ayrshire and Arran. These statistics show that, after taking into account the age structure of the population, this health board has the highest rates in Scotland – typically 1.3 to 1.7 times the Scottish average (depending on the measure used)[47].

Inverclyde, Aberdeen City, Argyll & Bute and Stirling are also amongst the highest. The same comparison with their health board areas is more complicated[48].

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[47] Drug-Related Hospital Statistics from 2015/16 produce European Age and Sex Standardised Rates (EASR) to allow comparisons across populations by controlling for differences in the age structure of local populations. 2015/16 EASR stays (NHS Ayrshire and Arran 307.1, Scotland 181), EASR Patients (NHS Ayrshire and Arran 222.8, Scotland 138.1) and EASR New Patients (NHS Ayrshire and Arran 93.8, Scotland 71.8)

The full publication is NSS ISD. Drug-Related Hospital Statistics. Scotland. Financial Year 2016/17. Available at: https://www.isdscotland.org/Health-Topics/Drugs-and-Alcohol-Misuse/Publications/2017-09-26/DRHS_dashboard.swf

[48] The 14 NHS Health Boards relate to the 32 local authorities in Scotland as follows:

NHS Ayrshire and Arran: East Ayrshire, North Ayrshire and South Ayrshire; **NHS Borders**: Scottish Borders; **NHS Dumfries and Galloway**: Dumfries and Galloway; **NHS Fife**: Fife; **NHS Forth Valley**: Clackmannanshire, Falkirk, Stirling; **NHS Grampian**: Aberdeen City, Aberdeenshire, Moray; **NHS Greater Glasgow and Clyde**: East Dunbartonshire, East Renfrewshire, Glasgow City, Inverclyde, Renfrewshire, West Dunbartonshire; **NHS Highland**: Argyll & Bute and Highland; **NHS Lanarkshire**: North Lanarkshire and South Lanarkshire; **NHS Lothian**: City of Edinburgh, East Lothian, Midlothian and West Lothian; **NHS Orkney**: Orkney Islands; **NHS Shetland**: Shetland Islands; **NHS Tayside**: Angus, Dundee City and Perth & Kinross; **NHS Western Isles**: Na h-Eileanan an Siar

For example, Stirling is in NHS Forth Valley along with Clackmannanshire and Falkirk. As Clackmannanshire and Falkirk have much lower proportions than Stirling, the overall effect will be to reduce the figure for NHS Forth Valley. From figure 10.4, if the data was combined for these authorities to get a proportion for the health board, the proportion of people might be somewhere within the red funnel or close to the EHC average. In fact the Drug-Related Hospital Statistics figures for NHS Forth Valley are very close to the Scottish average on all the measures[49].

Of the local authorities below the lower red line, East Dunbartonshire, Dundee City, Aberdeenshire, Angus and Moray are amongst the local authorities with the lowest proportions of EHC people with all three issues.

North and South Lanarkshire are covered by NHS Lanarkshire. This has below average scores on two out of three measures[50].

The island authorities – Eilean Siar and Shetland appear above the upper red line suggesting higher than average rates for all three conditions, compared to the EHC population. However, the Drug-Related Hospital Statistics figures for these NHS boards in these areas are below the Scottish averages on all the measures.

10.7 Summary

A majority of the EHC did not have any evidence of mental-health, drug- or alcohol-related interactions during the study period (51%). This is lower than for both control cohorts (MDC 74%, LDC 86%).

Just under a third of the EHC (30%) have had a mental health issue which excludes drug- or alcohol-related issues. This was higher than in the control groups.

There was evidence of drug and/or alcohol-related interactions for the remaining fifth of people (19%). Of these, the vast majority (94%) also had evidence of mental health issues.

The proportion of people with all three conditions – drug-, alcohol-related and mental health issues is higher among the EHC (5.9%) than in the MDC (1.0%) or the LDC (0.2%). A higher proportion of males have all three issues than females for the EHC. The difference between males and females was generally among those aged 26+. In general the proportions of the EHC that had evidence of all three issues was higher among the age range 26–60 years. Furthermore, the proportion of people with all three issues is much higher among those that have had multiple homelessness assessments (11.4% compared with 3.8% for once-only homeless). This difference cannot be explained by the younger age profile amongst the repeat homeless cohort, suggesting a relationship between repeat homelessness and drug-, alcohol-related and mental health issues.

People who have slept rough, been formerly looked after by a local authority or discharged from prison all appear to have higher proportions of people with all three issues. This is consistent with other research.

[49] 2015/16 EASR stays (NHS Forth Valley 175.9, Scotland 181), for EASR Patients (NHS Forth Valley 132.4, Scotland 138.1) and EASR New Patients (NHS Forth Valley 74.3, Scotland 71.8)

[50] 2015/16 EASR stays (NHS Lanarkshire 157.6, Scotland 181), for EASR Patients (NHS Lanarkshire 124.2, Scotland 138.1) and EASR New Patients (NHS Lanarkshire 79.3, Scotland 71.8)

Analysis suggests there is variation across local authorities and this variation appears to be broadly consistent with Drug-Related Hospital Statistics.

Chapter 11: Discussion

Having analysed all the health and homelessness study data, this chapter aims to bring the findings together and consider these in relation to the four study research questions. Any other findings of interest relating to homelessness and/or health are also presented.

11.1 Homelessness

11.1.1 Homelessness affects many people in Scotland

Annual homelessness publications report that there were 28,247 HL1 applications assessed as homeless or threatened with homelessness during 2016/17. It is not known whether assessments made in different years are by the same people or different people. If these were all the same people then that would suggest that homelessness affects a relatively small proportion of the Scottish population (5.3 million in 2011, as reported by Scotland's Census). However if these are all different people then a more substantial proportion of the population would be affected.

This study covers 435,853 people who were included in at least one HL1 application that was assessed as homeless or threatened with homelessness between June 2001 and November 2016. Even though not all HL1 applications were included in the study (76% of applications over this time are included), and not all people were included in all the applications provided, this still represents 8% of the Scottish population as at 30 June 2015. Therefore a significant minority of people in Scotland have experienced homelessness at some point.

This indicates that the assessments do not represent a small group of people making many homelessness applications. Specifically we see that 29% of males and 26% of females among the Ever Homeless Cohort (EHC) were classed as repeat homelessness; they were included in more than one HL1 application that was assessed as homeless or threatened with homelessness over the study period.

11.1.2 Time spent as homeless

People included in the EHC spent 9.7% of their time (for males, 9.2% for females) in open homelessness cases. Open cases are those where the Local Authority has not yet discharged its duties under the homelessness legislation – for example, waiting for suitable accommodation to become available. The above time was calculated from the date of their first homelessness assessment until the end of the study period (or the date of their death, whichever is earlier). Further work would be required to determine how sensitive this is to the study period used. (For example were the study period very short then the majority of EHC people would still be in open homelessness cases by the end of the study period and this figure would be much higher.)

11.1.3 Homeless people are younger than the general population

The homeless people included in the study tend to be younger than the population generally. This finding is consistent with published data[51]. It was also observed that

[51] See for example Chart 3 in Operation of the Homeless Persons Legislation In Scotland: 2014-15 available at: http://www.gov.scot/Resource/0048/00480524.pdf

health activity related to drugs was higher among younger people. If drug use is a cause of homelessness then this could also explain why some homeless people tend to be younger. The proportion of people in the EHC at around 20–30 years was higher for females than for males.

While this younger distribution is consistent with published data, it also indicates that comparisons cannot be made directly between the EHC and the general population. Any observed differences could be due to the difference in the age distribution. Therefore for the study comparisons are made with two control cohorts: drawn from people residing the 20% most deprived areas (MDC) and in the 20% least deprived areas (LDC). Each of these cohorts has the same age and sex distribution as the EHC so differences observed will not be due to age or sex.

11.2 Research questions

During the analysis, the following research questions arose to describe the relationship between health and homelessness:

1. How does health prior to the first homelessness assessment influence homelessness?
2. Does the point at which someone becomes homeless have an impact on one's health? Is a crisis with a health component involved?
3. How does homelessness influence health?
4. Is there a relationship between health, homelessness and area-based deprivation?

The EHC is selected from a population identified by an individual measure, while the controls are selected from a population identified by an area-based measure. It is likely that more people in the EHC are affected by factors associated with deprivation than in the LDC or even the MDC. For example, most people in the 20% most deprived areas are neither income or employment deprived. It is therefore possible that differences between the EHC and both the LDC and MDC are due to different levels of these factors associated with deprivation, rather than homelessness itself.

The MDC and LDC may also contain people from the 24% of homelessness assessments that were not submitted for the study. The inclusion of these people in the MDC and LDC cohorts would lead to smaller differences between the cohorts than would otherwise be the case. This issue is likely to affect the MDC cohort more than the LDC cohort.

To better explore the link between health activity and homelessness itself (as distinct from factors associated deprivation), analysis is done that compares the time of the health activity with the date of first homelessness assessment. The following figures in this chapter bring together these analyses from across the analysis chapters (Chapters 3 to 9). The findings from these are discussed in the following sub-sections.

Health activity ratios between the EHC and LDC in relation to the date of first homelessness assessment are shown in Figures 11.1a, 11.1b, 11.2a and 11.2b, as was done in previous chapters. Figures 11.1b and 11.2b are zoomed in versions of 11.1a and 11.2a respectively. The MDC : LDC ratios are not shown for clarity. Also for clarity, the trends have been further smoothed to reduce the noise and make the

overall structure clearer. This also has the effect of making the peaks around the time of first homelessness assessment less pronounced. In most cases these are separated out by Repeat and Once-only EHC. The exception to this is the acute admissions to hospital (SMR01), which are shown for each of the six reason categories discussed in Chapter 4. Figures 11.1a and 11.1b relate to males, while figures 11.2a and 11.2b relate to females.

Figure 11.1a: An increase in health activity precedes the first homelessness assessment for **males.** Some activity remains higher after this date, particularly for drug-related and alcohol-related acute admissions, and for repeat homeless people - mental health admissions (SMR04) and mental health prescriptions.

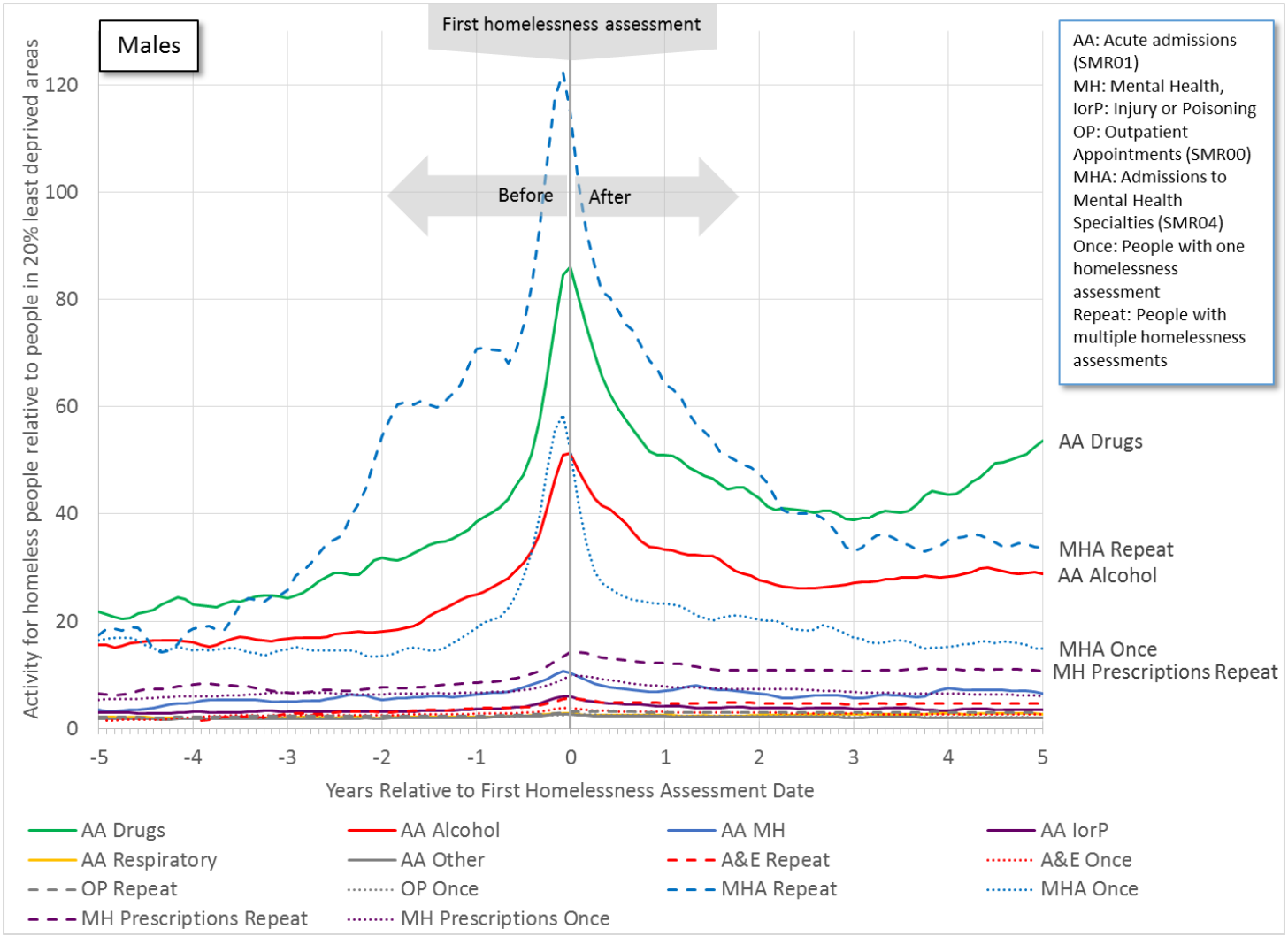


Figure 11.1b: An increase in health activity precedes the first homelessness assessment for **males.** Some activity remains higher after this date, particularly for mental health acute admissions (SMR01), mental health prescriptions and A&E attendances by repeat homeless persons.

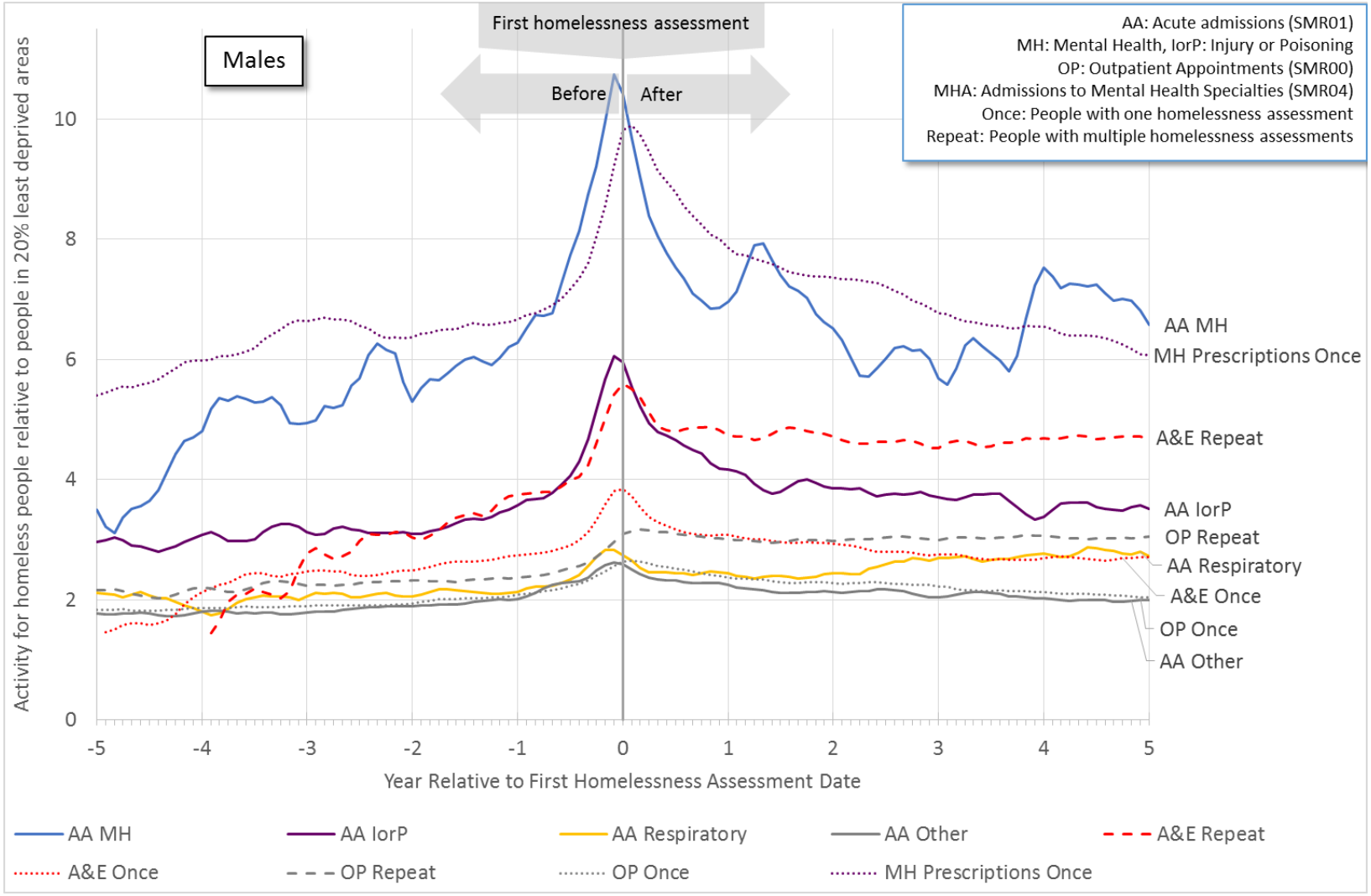


Figure 11.2a: An increase in health activity precedes the first homelessness assessment for **females.** Some activity remains higher after this date, particularly for drug-related and alcohol-related acute admissions, and for repeat homeless people - mental health admissions (SMR04) and mental health prescriptions.

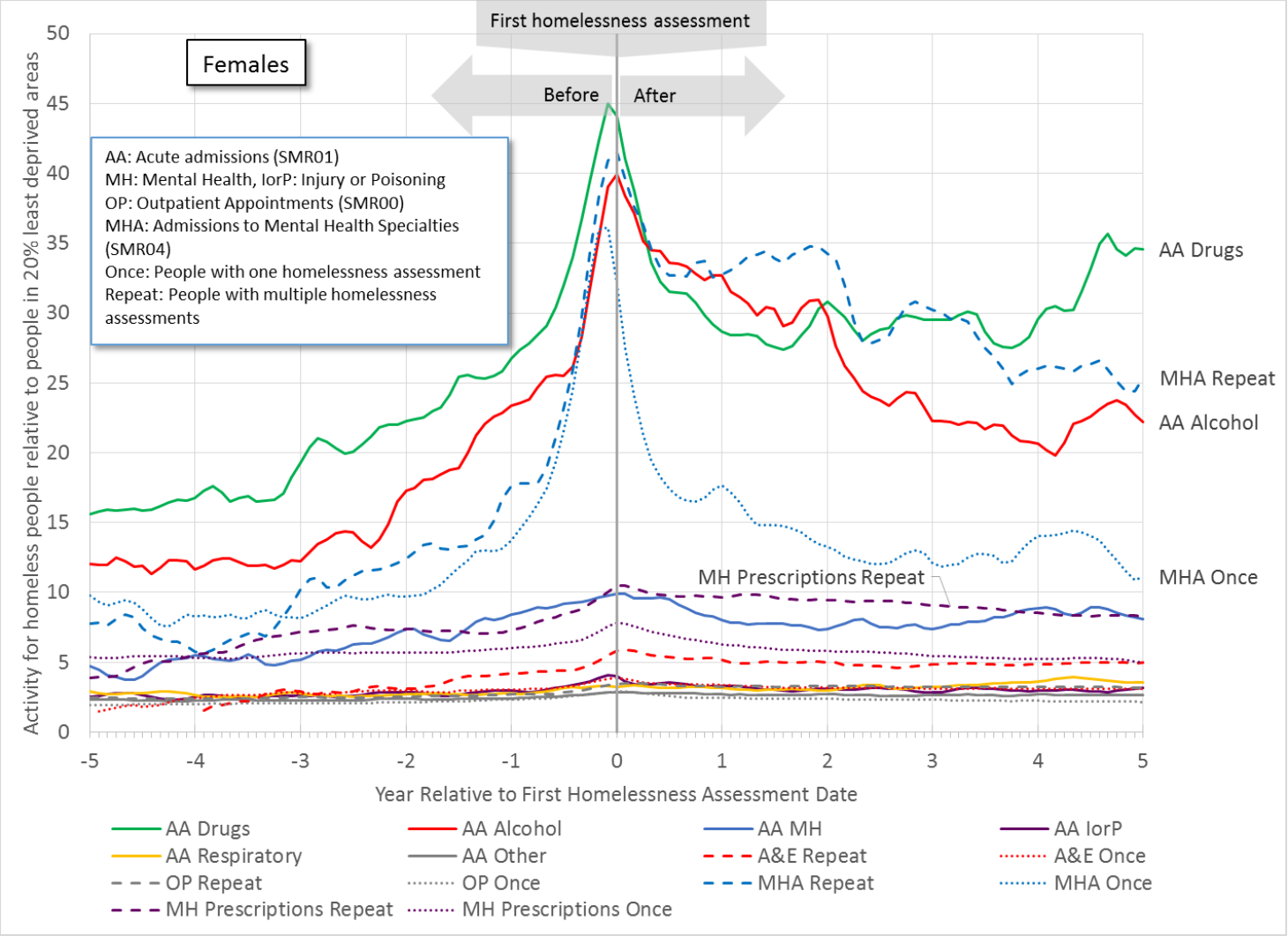
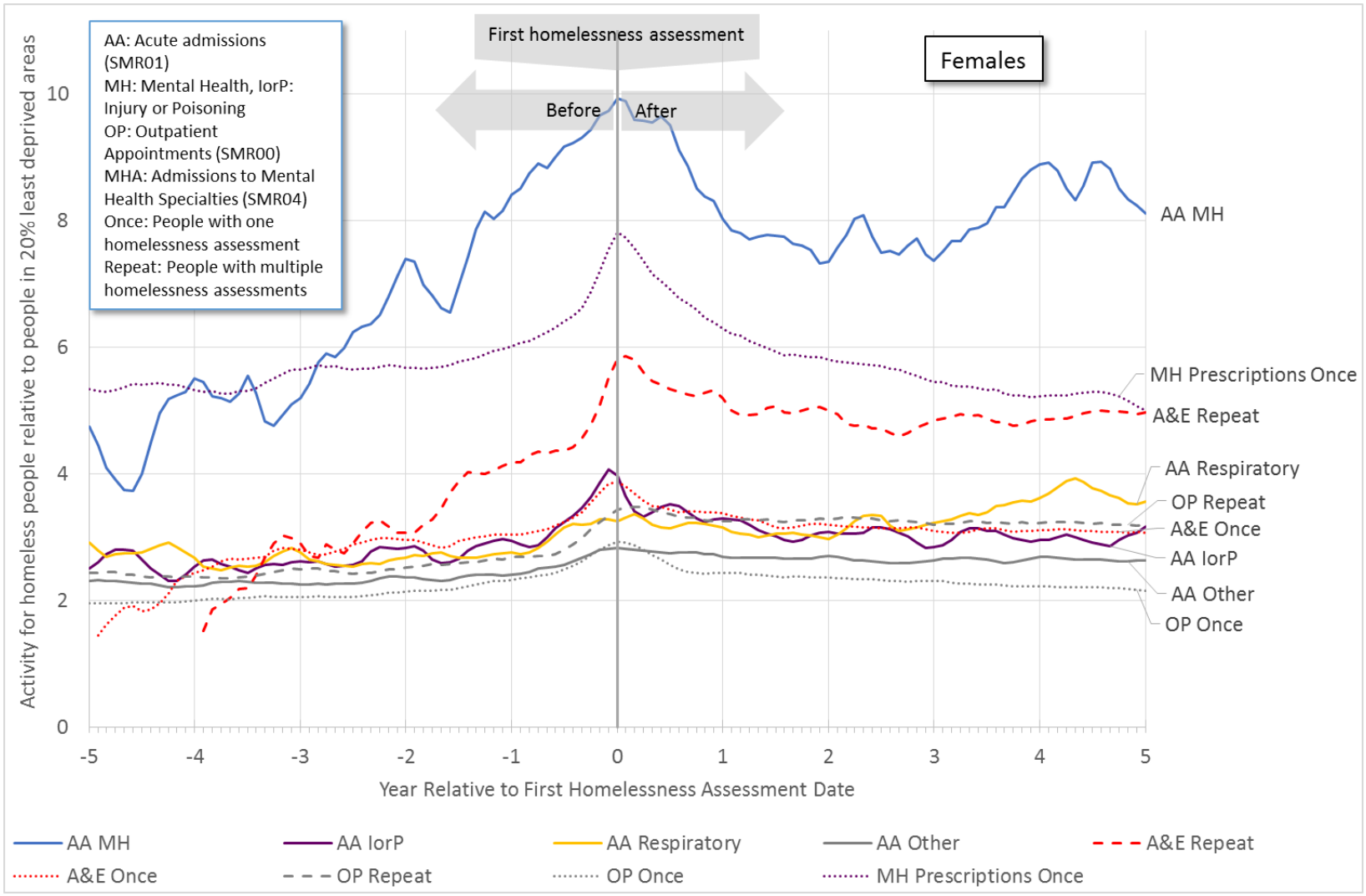


Figure 11.2b: An increase in health activity precedes the first homelessness assessment for **females.** Some activity remains higher after this date, particularly for mental health acute admissions (SMR01) and A&E attendances by repeat homeless persons.



11.2.1 Research question 1: How does health prior to the first homelessness assessment influence homelessness?

Research question 1 concerns whether people with poorer health are more likely than people who are otherwise similar to go on to become homeless. This effect can be explored through examining the temporal plots prior to the date of first homelessness assessment. We are specifically interested here where the temporal ratios increase in the lead up to the date of first homelessness assessment.

An increase in health activity up to the date of the first homelessness assessment **is observed** for:

- drug, alcohol and mental-health acute admissions, and A&E
- outpatients, and mental-health prescriptions (to a lesser extent)
- acute admissions for injury and poisoning and mental-health admissions (SMR04) (for males)
- SDMD assessments (figures 8.4 and 8.5)
- People with experience of repeat homelessness (the repeat EHC) in particular

Such patterns are **not observed** (or if it is observed the effect size is much lower) for:

- acute admissions for respiratory conditions and other acute admissions

It is interesting that these effects are less apparent for respiratory conditions and other acute admissions. The effects are most clearly seen for health activity that relates to issues such as mental health, drugs and alcohol. These issues are likely to be risk factors for homelessness.

11.2.2 Research question 2: Does the point at which someone becomes homeless have an impact on one's health? Is a crisis with a health component involved?

Research question 2 relates to health activity around the time of first homelessness assessment. This explores whether becoming homeless can be associated with an acute crisis that has a health component. Such activity would show on the temporal plots as a peak around the date of homelessness assessment.

A peak in activity around the first homelessness assessment **is observed** for:

- drug, alcohol and injury or poisoning acute admissions, mental health admissions (SMR04), A&E, mental-health prescriptions
- acute admissions for mental health,
- for males acute admissions for respiratory and other conditions
- SDMD assessments (figures 8.4 and 8.5)

Such patterns are **not observed** (or if it is observed the effect size is much lower) for:

- outpatient appointments among the Repeat EHC
- for females, acute admissions for respiratory and other conditions

Peaks in health activity occur around the date of the first homelessness assessment (with larger peaks for males). This suggests a relationship between becoming homeless and health activity. It may be that for some people becoming homeless is associated with a crisis that has a health aspect. This is particularly (although not exclusively) associated with activity related to drugs, alcohol and mental health. The health activity may be symptomatic of acute problems, which in turn could lead to homelessness.

Given that crises around the time of homelessness appears to have some impact on health activity, it would seem likely that preventing homelessness could reduce health activity, and improve health outcomes.

11.2.3 Research question 3: How does homelessness influence health?

Research question 3 concerns whether homelessness episodes have an effect on health. This effect can be explored through examination of the part of the temporal plots following the date of first homelessness assessment. To ensure that the activity is related to the homelessness episode(s) it is necessary to compare these activity levels with activity levels prior to homelessness.

Under research question 2, a peak of activity can occur around the first homelessness assessment. Therefore, for people who have multiple homelessness assessments there is likely to be heightened health activity around the time of these later assessments. This would show up as a similar pattern to that sought by research question 2. To address this the difference between the patterns for the Once-only EHC and that for the Repeat EHC are discussed. Any such pattern that is observed among the Once-only EHC cannot be due to these further peaks, and so would likely be due to the effect of homelessness. Patterns observed among the Repeat EHC may be due to effects of homelessness itself or due to further crises.

A pattern of higher activity following first assessment **is observed** for:

- drug, alcohol, mental health and respiratory acute admissions (although this has not been split by once-only and repeat homelessness)
- all repeat trends (mental-health admissions (SMR04), mental-health prescriptions, outpatient appointments and A&E attendances)
- female once-only A&E
- repeat SDMD assessments (figures 8.4 and 8.5)

Such patterns are **not observed** (or if it is observed the effect size is much lower) for:

- all once-only trends (apart from female once-only A&E)
- acute admissions injury or poisoning
- other acute admissions for males

It is not possible to say that health activity following homelessness is the direct consequence of homelessness itself. It could be due to a further crises or health problems such as drug or alcohol related conditions, or a mental health condition.

For those who had been homeless on only one occasion health activity eventually returned to the (albeit higher) pre-homelessness levels. However, for people who were homeless on multiple occasions, levels of health activity remained high.

There is clear evidence of a relationship between repeat homelessness, drugs, alcohol and mental health. Chapter 9 showed that drug-related deaths were much higher amongst those experiencing repeat homelessness. Chapter 10, showed a much higher proportion of repeat homeless people have drug, alcohol and mental health related health issues. These factors may be driving some of the increase in health activity following the first homelessness assessment.

Temporal analysis was not done for deaths. For males in the EHC, mortality was around a third higher during periods of homelessness than during periods when they were not in open homelessness cases. This difference may be driven by the higher number of drug-related deaths amongst males that had been homeless on multiple occasions.

11.2.4 Research question 4: Is there a relationship between health, homelessness, and area-based deprivation?

Homeless people are more likely to come from deprived areas, based on their last settled address. The distribution of homeless people across the area-based deprivation spectrum (as measured by the Scottish Index of Multiple Deprivation) closely follows the distribution of income and employment deprived people.

The health activity of people in the EHC was consistently higher than for the non-homeless controls in the 20% most deprived areas (MDC). In turn, this was consistently higher than the non-homeless controls in the 20% least deprived areas (LDC).

This **was observed** for:

- all types of health activity (especially for activity related to mental health, and drugs and alcohol)

Health inequalities are known to exist across Scotland and they are monitored using area-based measures of deprivation. Using health activity as an imperfect proxy for poor health, the study provides evidence that health inequalities are likely to exist between people that have experienced homelessness and those who have not.

11.3 Other findings

11.3.1 Cause of death

Differences in mortality between the cohorts varied by cause of death, although for each cause mortality among the EHC was at least as high as for the controls. The differences were highest for drugs, alcohol, intentional self-harm, and assault. This results in the main causes of death among the EHC being drugs, heart disease and strokes, and, for males, alcohol and, for females, cancer. Note that the extent of the study period is limited so deaths for only a minority of the EHC are recorded. As the EHC age further the distribution of cases of death will likely vary and so these cases may not ultimately be the main causes of death across the whole EHC.

Differences in mortality due to drug-related conditions between the EHC and the controls were higher for people who have multiple homelessness assessments, than

for the differences for those who have exactly one homelessness assessment during the study period.

11.6.2 Proportion of study with no drugs, alcohol or mental health issues

Chapters 3–9 were concerned with examining the differences in health activity between the cohorts for a number health activity datasets. Chapter 10 focused instead on individuals, and what health activity they had experienced during the study across multiple datasets.

A majority of the EHC did not have any evidence of mental-health, drugs or alcohol health related activity during the study period (51%), which is lower than for both control cohorts (MDC 74%, LDC 86%).

Just under a third of the EHC (30%) have had a mental health issue which excludes drug- or alcohol-related issues. This was higher than in the control groups.

There was evidence of drug and/or alcohol-related interactions for the remaining fifth of people (19%). Of these, the vast majority (94%) also had evidence of mental health issues.

11.6.3 Overlap of drugs, alcohol and mental health issues

In total, 49% of the EHC had a least one mental-health, drugs or alcohol health related activity during the study period. These did not occur independently – i.e., having one issue meant that an individual was more likely to have another.

More people in the EHC had drug-related issues than alcohol-related issues. However, in the controls these were comparable. Of those that had drugs and/or alcohol related issues, a higher proportion in the EHC had both than in the controls.

5.9% of the EHC had evidence of mental-health, drugs and alcohol related issues during the study period, which is considerably more than for both control cohorts. A higher proportion of males have all three issues than females for the EHC. Furthermore, the proportion of people with all three issues is much higher among those that have had multiple homelessness assessments (11.4% compared with 3.8% for once-only homeless).

11.6.4 Proportion of EHC by background flags (prison, sleeping rough, previously looked after by a local authority)

Chapter 10 examined the overlap between people in the EHC who experienced mental-health, drugs and alcohol issues during the study with a range of other background attributes.

Higher proportions of people who had been looked after, had slept rough, or had been recently discharged from prison had evidence of all three mental-health, drugs and alcohol issues during the study. Higher proportions of drug-related issues amongst these groups are consistent with published work.

11.4 Possible further work

Further work may wish to use the data from this study to:

- Create a predictive model using healthy activity data to identify people at risk of homelessness.

- Consider the health activity of people who were not assessed as homeless. These people applied to local authorities for assistance but were excluded from the study as they were not assessed as homeless or threatened with homelessness.
- Investigate how health activity varies with the time spent when people are in open homeless cases and at other times.
- Investigate the health activity of people who were in homeless applications as children. How many of these children subsequently became the main applicant of a future homelessness assessment?

Additional datasets could be brought into the study to consider the impact of factors such as prison leavers, leaving care and the justice system on health and homelessness. Survey data might also be useful to consider what background factors may impact upon health activity and homelessness.

Further work may wish to consider whether homelessness can be used as an individual indicator of deprivation to help target resources.

11.5 Summary

In summary:

- At least 8% of the Scottish population (as at 30 June 2015) had experienced homelessness at some point in their lives.
- Of those who had experienced homelessness:
    - over half (51%) had no evidence of health conditions relating to drugs, alcohol or mental health conditions. This was much lower than in the control groups (MDC 74%, LDC 86%).
    - Around 30% had evidence of a mental health problem at some point during the study period (with no evidence of drug or alcohol-related conditions at any point). This was higher than in the control groups.
    - There was evidence of drug and/or alcohol-related interactions for the remaining fifth of people (19%). Of these, the vast majority (94%) also had evidence of mental health issues.
    - In particular, around 6% of people experiencing homelessness had evidence of all three of the following conditions – a mental health condition, a drug-related condition and an alcohol-related condition – although not necessarily concurrently. This was much higher than in the control groups. The figure was markedly higher for those experiencing repeat homelessness.
- Increased health activity preceded people becoming homeless
- A peak in health activity was seen around the time of the first homelessness assessment.
- Increased health activity was seen after some people had become homeless, although this may be due to factors other than the person being homeless.

- Based on their use of services, people who go on to become homeless have poorer health than others. This is likely to be due to a wide range of complex factors.

Annex A: Alternative measures of homelessness in Scotland

The HL1 data provides a rich source of homelessness data. However, other data sources exist that could provide useful information in addressing the research questions.

PREVENT1 returns

When households seek assistance for housing-related issues from their Local Authority, they may be presented with advice on a range of housing options, including the opportunity to make a homelessness application. This approach, which is known as Housing Options, began to be implemented from around 2009, and more so after 2012, when the priority need test was abolished – this widened access to settled accommodation for all people experiencing homelessness. The aim of the Housing Options approach is to ensure that households are better aware of their options for accommodation, in order to make a more informed choice.

The PREVENT1 dataset was introduced in April 2014 as a way of capturing information on Local Authorities' Housing Options work.

Whilst local authorities have a general prevention duty under section 2 of the Housing (Scotland) Act 2001, Housing Options itself is not specifically defined within a legislative framework. As such, there is no single definition of Housing Options operating across all Local Authorities. Because of the differing approaches to deliver their duty, the local authority figures are not directly comparable with each other.

In direct contrast, the homelessness legislation provides an assessment framework and each assessment decision gives a statutory entitlement to some form of assistance. The operation of the homelessness legislation can therefore be evaluated, by benchmarking against this framework. For example, the proportion of unintentionally homeless households who secure settled accommodation can be tracked over time.

A single year of PREVENT1 data covering 2014/15 was obtained for the study. However, it was decided to omit it from the analysis as it was felt that this would not significantly add to the pool of HL1 data gathered. In addition, the statutory framework surrounding the HL1 data also ensured a consistent definition of homelessness across Scotland and the people included in the study.

Scottish Household Survey

The Scottish Household Survey (SHS) has previously captured data on homelessness in Scotland. For example, in 2015 and 2016, the Random Adult component[52] accommodation section contained multiple questions on homelessness and housing experiences. This includes asking the random adult "Have you ever been homeless, that is, lost your home with no alternative accommodation to go to?" According to the Scottish Household Survey published in 2012, 5.3% of adults living in Scotland said that they had ever been homeless, with 1.9% saying that this has happened to them in the previous two years. This means that about 50,000 adults

[52] The SHS questionnaire is structured into three section: Household, Random Adult and Physical inspection of dwelling (http://www.gov.scot/Resource/0049/00496603.pdf)

(1.1% of the adult population) experience homelessness each year[53]. This is based on a sample of 9,890 adults[54].

During 2015/16, there were around 36,000 homeless applications to Local Authorities. In the same year, just under 30,000 cases were assessed as homeless or threatened with homelessness. This suggests that not all those who have experienced homelessness may necessarily apply to their Local Authority for assistance.

We have not used the Scottish Household Survey in this study because:

- People self-report themselves as homeless which may lead to differences between what respondents mean when they describe themselves as homeless. No consistent definition is applied across all people in the survey.
- The number of people reporting themselves as ever experiencing homelessness in the survey is relatively small, typically only around 500 people each year.
- We would need to have obtained personal identifiable information about the survey respondents in order to enable data linkage with the health data.

[53] Crisis. Homeless Monitor 2015. Fitzpatrick S. et al. (https://www.crisis.org.uk/media/236831/the_homelessness_monitor_scotland_2015.pdf)

[54] Scotland's People Annual report: Results from 2012. Scottish Household Survey http://www.gov.scot/Resource/0044/00442767.pdf

Annex B: The homelessness data used in the Study (The HL1 Dataset)

Population Data	
Data controller:	Scottish Government
A record represents:	A homeless application
Data collection start:	The system went live nationally on 10 December 2001, with major changes to changes to the questions in 2007
Frequency of collection:	Quarterly from Local Authorities
Number of annual records:	52,000 in 2002/03 reducing to 34,000 in 2016/17
Geography coverage:	Scotland
Population coverage:	All homeless applications in Scotland

Study Data	
Data period:	Varies by Local Authority. First assessment is dated 4 June 2001 and last assessment is dated 7 November 2016. Note: some Local Authorities were able to go live before the national rollout in 2001.
Number of records:	429,078 applications which were assessed as homeless or threatened with homelessness[55]
Hereafter referred to as:	Homelessness Data
Population coverage:	The study dataset contains all HL1 applications which were matched to records in the H2H dataset and filtered to include only those which were assessed as homeless or threatened with homelessness.

Variables	
LACODE	Q1: Local Authority code
APPREF	Q3: Application Reference
APPDATE	Q2: Date of application
PREVAPP	Q4: Application reference of the most recent of any associated applications
GENDER1	Q9.1: Gender of main applicant
MILITARY	Q10c: Whether any member of the applicant household was formerly a member of the armed services
LKDAFTER	Q10d: Whether any member of the applicant household aged under 25 years was looked after as a child by their local authority
ROUGH	Q12: Has any member of the applicant household slept rough during the 3 months preceding their application
ROOFLESS	Q13: Did any member of the applicant household sleep rough on the night immediately preceding the date of application
PROPERTY	Q14a: From what type of property did the main applicant become homeless / threatened with homelessness?
REASON	Q16: Reason (pre- 1 April 2007)
RSNTECH	Q16a: Technical reason for application
ASSESS	Q17: Statutory assessment decision
ASSDATE	Q18: Date of assessment decision
SPTNDS1	Q20b.1: Reasons for support needs - Mental health problem
SPTNDS2	Q20b.2: Reasons for support needs - Learning disability
SPTNDS3	Q20b.3: Reasons for support needs - Physical disability
SPTNDS4	Q20b.4: Reasons for support needs - Medical condition
SPTNDS5	Q20b.5: Reasons for support needs - Drug or alcohol dependency
SPTNDS6	Q20b.6: Reasons for support needs - Basic housing management / independent living skills
OUTCOME	Q22: Duty discharge action taken by authority
CLOSDATE	Q27: Date of last action taken and case being closed

[55] These records correspond to the number that can be attributed to the study's analysis population. This is defined in Section 2.5.4 – Analysis Cohorts.

HHTYPE	Household Type. Derived variable based on the number of adults and children in the applicant household

Annex C: Health Activity Datasets used in the Study

Accident and Emergency data (A&E2)

The A&E datamart was established in June 2007 to monitor the compliance of each NHS Board against the 4 hour wait standard. In July 2010, the A&E datamart was extended further to collect items such as diagnosis, several injury fields and an alcohol involved flag - which is used to identify whether the patient's alcohol consumption was a factor in the attendance. There are two types of data submitted to the A&E datamart: episode and aggregate level data. Sites that submit episode level data account for around 94% of all attendances at A&E. For more information, see the Accident and Emergency Datamart (A&E2) webpage.

Population Data

Data Controller:	NHS National Services Scotland
A record represents:	An A&E attendance
Data collection start:	June 2007. Rebuilt and re-launched to NHS Boards in January 2011
Frequency of collection:	Monthly
Number of annual records:	1,000,000+
Geography coverage:	Scotland
Population coverage:	All Emergency Departments and departments that provide Accident and Emergency (A&E) services in Scotland.

Study Data

Data period:	1 January 2011 to 31 December 2016
Number of records:	2,118,143 records[56]
Hereafter referred to as:	Deaths
Population coverage:	The study dataset contains A&E2 data for all HL1 and PREVENT1 households, and for the matched pairs from the most and least deprived cohorts.

Variables
Arrival_Date
Board_of_Treatment (NHS Health Board)
Age
Gender

Inpatients and Day Cases (SMR01)

A day case is a patient who has an *elective* admission to a specialty for clinical care, and sees a professional and requires supervised recovery in the place of treatment. The patient is not expected to, and does not, remain overnight. An inpatient is a patient who occupies, or is expected to occupy, an available staffed bed in a hospital for one or more nights. Inpatients also include all those admitted as an emergency or urgent case. An inpatient or day case admission marks the start of the episode. The patient undergoes the full admission procedure and is accepted by the hospital, the

[56] These records correspond to the number that can be attributed to the study's analysis population. This is defined in Section 2.5.4 – Analysis Cohorts.

specialty and the consultant for care. For more information, see the General Acute Inpatient and Day Case (SMR01) webpage.

Population Data

Data Controller:	NHS National Services Scotland
A record represents:	An inpatient or day case episode
Data collection start:	1960 onwards (computerised from 1968)
Frequency of collection:	Continuously
Number of annual records:	~1,400,000
Geography coverage:	All residents in Scotland that receive care in hospital and general acute specialities.
Population coverage:	All Inpatients/ Day cases in Scotland

Study Data

Data period:	1 April 2002 to 31 March 2015
Number of records:	2,266,144 records
Hereafter referred to as:	Acute Admissions
Population coverage:	The study dataset contains SMR01 data for all HL1 and PREVENT1 households, and for the matched pairs from the most and least deprived cohorts.

Variables:
- HBtreat_current_data (NHS Health Board)
- Age_in_years
- Sex
- Admission_date (used to determine an overlap with a homelessness episode)
- Discharge_date (used to determine an overlap with a homelessness episode)
- Length_of_stay
- Conditions relating to the admission (1 if related):
  - *Alcohol*
  - *Drugs*
  - *IorP* (Injury and Poisonings)
  - *MH* (Mental and behavioural Disorders)
  - *Resp* (Diseases of the Respiratory System)
  - *Other*. (If an admission has one of the above conditions then this is set to FALSE, otherwise TRUE).

Notes: The study assumes that the health conditions relate directly to the person themselves, even though this may not always be the case. For example, a person hospitalized by a drunk driver would be an alcohol-related admission, but the patient does not necessarily have an alcohol dependence issue themselves. See section 4.3 of the original PBPP application for how the condition flags were assigned using ICD10 codes.

Outpatient data (SMR00)

The Outpatients (SMR00) dataset collects episode level data from patients on new and follow up appointments at outpatient clinics in all specialities (except A&E and Genito-Urinary Medicine). For more information, see the Outpatient appointments and Attendances (SMR00) webpage.

Population Data

Data Controller:	NHS National Services Scotland
A record represents:	An outpatient appointment/attendance
Data collection start:	Returns started in 1990s and routinely available from 1997 onwards.
Frequency of collection:	Data supplied continually, with a six week submission target.
Number of annual records:	~4,400,000 (1.6 million new outpatients and 2.8 million return outpatients).

Geography coverage:	All people offered a new or follow up outpatient appointment at a Scottish NHS hospital.
Population coverage:	New outpatient appointments (consultant led clinics). The submission of all return attendances is mandatory regardless of whether or not a procedure is performed.

Study Data

Data period:	1 April 2002 to 31 March 2015
Number of records:	9,014,864 records
Hereafter referred to as:	Outpatient attendances
Population coverage:	The study dataset contains SMR00 data for all HL1 and PREVENT1 households, and for the matched pairs from the most and least deprived cohorts.

Variables:
Age_in_years
Sex
Clinic_date (used to determine an overlap with a homelessness episode)
Clinic_attendance (categories ; 1 = 'Patient was seen', 5 = 'Patient attended but was not seen (CNW: Could Not Wait)', and 8 = 'Patient did not attend and gave no prior warning (DNA))
Referral_Source
GPPRAC_Currentdate (NHS Board Code)

Prescribing Information System

The Prescribing Information System (PIS) is the definitive data source for all prescribing relating to all medicines and their costs that are *prescribed and dispensed* in the community in Scotland. The information is supplied by Practitioner & Counter Fraud Services Division (P&CFS) who is responsible for the processing and pricing of all prescriptions dispensed in Scotland. These data are augmented with information on prescriptions written in Scotland that were dispensed elsewhere in the United Kingdom. Note that prescriptions dispensed within hospitals are not included. For more information, see the Prescribing Information System webpage.

Population Data

Data Controller:	NHS National Services Scotland
A record represents:	A prescription
Data collection start:	From April 1993 onwards
Frequency of collection:	Monthly
Number of annual records:	Around 100 million data items are loaded per annum
Geography coverage:	Scotland
Population coverage:	Every prescription dispensed in the community.

Study Data

Data period:	14 January 2009 to 31 March 2015. The study was that CHI linkage may not have been possible with data prior to 2009
Number of records:	9,488,022 records
Hereafter referred to as:	Prescriptions
Population coverage:	The study dataset contains PIS data for all HL1 and PREVENT1 households, and for the matched pairs from the most and least deprived cohorts.

Variables:
PrescDate (Prescribed date)
BNFSubSectionCode (British National Formulary (BNF) Subsection Code)
Prescribed drugs flag for:
Mental health conditions (BNF Subsections - Hypnotics and Anxiolytics (4.1), Psychoses (4.2), Antidepressants (4.3) and Dementia (4.11))
Alcohol Dependence (BNF Subsections: 4.10.1)
Opioid Dependence (BNF Subsections: 4.10.3)

Tuberculosis (BNF Subsection 5.1.9)

Notes*:* where comparable data are available, the prescriptions dataset for the 1.3 million people in the cohort for the above conditions typically accounts for fewer than 2% of all prescriptions across Scotland in any given year.

Mental Health Inpatient and Day Case (SMR04)

The Mental Health Inpatient and Day Case dataset (SMR04) collects episode level data on patients who are receiving care at psychiatric hospitals at the point of both admission and discharge. The majority of mental health episodes will be dealt with first by GPs and then by Community Health Workers. Only the most acute cases will appear in SMR04. For more information, see the Mental Health Inpatient and Day Case webpage.

Population Data

Data Controller:	NHS National Services Scotland
A record represents:	A mental health inpatient or day case episode
Data collection start:	Collected since the 1960s. Available from 1981 onwards. Routinely available from 1997
Frequency of collection:	Continuously
Number of annual records:	Approximately 21,000 records per year
Geography coverage:	The Mental Health Inpatient and Day Case dataset covers everyone admitted to psychiatric hospitals in Scotland (non-residents of Scotland as well as residents)
Population coverage:	All mental health hospital inpatients/day cases in Scotland.

Study Data

Data period:	1 April 2002 to 31 March 2015
Number of records:	100,055 records
Hereafter referred to as:	Mental Health Admissions
Population coverage:	The study dataset contains SMR04 data for all HL1 and PREVENT1 households, and for the matched pairs from the most and least deprived cohorts.

Variables:
- HBtreat_current_data (NHS Health Board)
- Age_in_years
- Sex
- Admission_date (used to determine an overlap with a homelessness episode)
- Admission_referral_from (source of referral)
- Discharge_date (used to determine an overlap with a homelessness episode)
- Length_of_stay (days)
- Conditions relating to the admission (1 if related, based on main, second and third admission diagnosis):
  - *Alcohol*
  - *Drugs*
  - *IorP* (Injury and Poisonings)
  - *MH* (Mental and behavioural Disorders)
  - *Resp* (Diseases of the Respiratory System)
  - *Other*. (If an admission has one of the above conditions then this is set to FALSE, otherwise TRUE).

Scottish Drug Misuse Database (SDMD) (SMR24 and SMR25a)

The Scottish Drug Misuse Database (SDMD) offers a profile of the misuse of drugs based on information about drug clients seen at a broad range of services across Scotland. Services contributing to the Database consist mainly of specialist drug

services, general practitioners and prison drug services. For more information, see the Scottish Drug Misuse Database webpage.

Population Data

Data Controller:	NHS National Services Scotland
A record represents:	A drugs misuse assessment
Data collection start:	A variety of data has been collected from 1996 onwards. See Technical Guidance for more information. April 2006, SMR25a (covering new assessments) were introduced to reflect the need for more in depth and focussed information from clients.
Frequency of collection:	Continuously through web submissions, electronic uploads of batch files of data collected from local systems and formerly on paper forms.
Number of annual records:	Approximately 12,000 new assessments and 13,000+ follow-up assessments per year.
Geography coverage:	Scotland
Population coverage:	Drug users

Study Data

Data period SMR24:	1 April 2002 to 31 March 2006
Data period SMR25a:	1 April 2006 to 31 March 2015
Number of records:	89,281 records
Hereafter referred to as:	SDMD
Population coverage:	The study dataset contains SDMD data for all HL1 and PREVENT1 households, and for the matched pairs from the most and least deprived cohorts.

Variables: Date_assessment
For PRESCRIPTION DRUGS PROFILE, 6 different drugs are recorded and for each one there is drug code, drug name, daily dosage and measure.
For ILLICIT DRUGS PROFILE, 8 different drugs are recorded and for each on there is drug code, drug name, main route, other route, how often, daily quantity and measure.

Note: drugs captured in the illicit fields relate to the drugs taken inappropriately that have resulted in the misuse episode. Drugs captured in the prescription fields relate to the treatment of addiction.

National Records of Scotland – Deaths

The NRS produces general publications for Vital Events, specifically, for births, deaths and marriages in Scotland. The dataset covers all death occurring in Scotland and is collected weekly. For more information, see the National Records of Scotland (NRS) – Deaths Data webpage.

Population Data

Data Controller:	National Records of Scotland
A record represents:	A death event
Data collection start:	1974
Frequency of collection:	Weekly
Number of annual records:	Approximately 55,000 deaths registered annually
Geography coverage:	Scotland
Population coverage:	All Deaths occurring in Scotland

Study Data

Data period:	1 April 2002 to 31 March 2015
Number of records:	23,718 records
Hereafter referred to as:	Deaths

Population coverage: The study dataset contains all death data for all H2H individuals, and for the matched pairs from the most and least deprived cohorts.

Variables: Date_of_death
Primary_cause_of_death (ICD10[57])
Secondary_cause_of_death (0–9)

Notes: The ICD10 code set allows for more than 14,400 different codes to describe diseases and related health problems. The study mapped the ICD10 code for the primary cause of death to the following groupings:

- alcohol related conditions[58];
- drug related conditions[59];
- mental and behavioural disorders[60];
- diseases of the respiratory system[61];
- Neoplasms (Cancer)[62];
- Diseases of the circulatory system (Heart Disease and Strokes)[63];
- Intentional Self-Harm[64];
- Assault[65] ;
- Diseases of the digestive system[66], and;
- All other deaths.

There were no deaths recorded in the dataset with ICD10 codes beginning with S or T (Injury of Poisonings)[67].

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[57] ICD10 is the International Statistical Classification of Diseases and Related Health Problems 10th Revision. More information on this is available at: http://apps.who.int/classifications/icd10/browse/2010/en

[58] See http://www.isdscotland.org/Health-Topics/Drugs-and-Alcohol-Misuse/Publications/2012-05-29/2012-05-29-alcoholhospitalstats2012-report.pdf

[59] http://www.isdscotland.org/Health-Topics/Drugs-and-Alcohol-Misuse/Drugs-Misuse/Drug-Related-Deaths-Database/

[60] https://en.wikipedia.org/wiki/ICD-10_Chapter_V:_Mental_and_behavioural_disorders

[61] http://en.wikipedia.org/wiki/ICD-10_Chapter_X:_Diseases_of_the_respiratory_system . This also includes tuberculosis (A15-A19).

[62] https://en.wikipedia.org/wiki/ICD-10_Chapter_II:_Neoplasms

[63] https://en.wikipedia.org/wiki/ICD-10_Chapter_IX:_Diseases_of_the_circulatory_system

[64] Codes X60 to X84 as detailed at: https://en.wikipedia.org/wiki/ICD-10_Chapter_XX:_External_causes_of_morbidity_and_mortality#(X60–X84)_Intentional_self-harm

[65] Codes X85 to Y09 as detailed at: https://en.wikipedia.org/wiki/ICD-10_Chapter_XX:_External_causes_of_morbidity_and_mortality#(X85–Y09)_Assault . In the deaths dataset, there were no deaths recorded as X85 to X90.

[66] https://en.wikipedia.org/wiki/ICD-10_Chapter_XI:_Diseases_of_the_digestive_system

[67] https://en.wikipedia.org/wiki/ICD-10_Chapter_XIX:_Injury,_poisoning_and_certain_other_consequences_of_external_causes

Annex D: The H2H Personal Identifiable Data, the Matching Process and Creating the Controls.

H2H: Personal identifiable data of homelessness applications

In order to conduct the study across Scotland, it was first necessary to obtain personal identifiable information – first name, last name, date of birth, gender and postcode - for people who had made homelessness applications (HL1) and sought assistance on housing related issues (PREVENT1). This information is not submitted to the Scottish Government as it is not required for monitoring of homelessness legislation at the national level. However, it is held on the same IT systems used to generate the HL1 returns as Local Authorities need this information for case management purposes.

In order to carry out this study, Local Authorities were invited to submit personal identifiable information to the National Records of Scotland (NRS) Indexing Service for all people with HL1 homeless applications and for all people with PREVENT1 returns, in accordance with the H2H data specification[68]. Due to uncertainty around the quality of the data and how much data each Local Authority would submit, all HL1 and PREVENT1 data was asked for.

The H2H data specification was created specifically for this data linkage exercise. This involved signing Data Processing Agreements with each Local Authority to enable data delivery and subsequent data processing. The 32 local authority specific H2H datasets were combined to create a single dataset.

The H2H dataset contains the following information:

- Local Authority Code
- PREVENT1 Approach Reference Number
- HL1 Application References Number
- First Name
- Middle Name
- Last Name
- Date of Birth
- Gender
- Postcode of current address or last settled address

Using this personal identifiable information, the H2H records could be linked back to the HL1 and PREVENT1 datasets through the application reference numbers which were common to both datasets. A person could appear multiple times within the H2H dataset if they appeared in more than one homelessness application or PREVENT1 approach.

It is important to note that the H2H data *only* contains personal identifiable information from HL1 and PREVENT1 cases. There is no payload data relating to these cases. As such, it is not possible to tell from the H2H data alone which people

[68] The H2H Data specification can be found at: http://www.gov.scot/Resource/0049/00493380.doc

were assessed as statutory homeless and which people were assessed as not statutory homeless.

Matching health and homelessness data

In order to create a link between homelessness data and health data, a separation of function approach was used. A separation of function approach is used to ensure that no single party or individual has access to all of the data. It involves a trusted third party – in this case the Indexing Service at the National Records of Scotland[69] – performing the matching exercise with *only* the necessary personal identifiable information required for matching. Importantly, the party performing the matching does not have access to the payload data. Following the matching exercise, the matched results can be re-combined with the payload data and the personal identifiable data is removed. This dataset is then accessed by the analysis party in a separate and secure environment.

To achieve this, the H2H data, which only contains the HL1 and PREVENT1 references numbers beyond personal identifiable information, was submitted to the NRS Indexing Service. Using this personal identifiable information, each person in the H2H dataset was matched to the Research Indexing Spine (RIS) (Table 2.2). The Research Indexing Spine is a population compiled by NRS that uses information based on GP Registrations as at June 2016 (for this study) as a snapshot of the Scottish population.

All health datasets in Scotland contain the Community Health Index (CHI) number – a variable used to trace an individual's usage of various health services. The RIS does not contain the CHI number. However, the NRS Indexing Service has access to a separate lookup table which links the people on the RIS to their CHI Number. Once the H2H data was linked to the RIS, this lookup table was used to obtain the CHI Number for each person.

Table D.1: Results from National Records of Scotland's Indexing Service

	Number of H2H Input Records	1,031,841	
	Number of Input Records with valid LA code:	1,031,824	
	Number of Matches to Research Indexing Spine	**973,578**	94.4%
Step	**These records were matched to the Research Indexing Spine as follows:**		
0	Exact matches on Forename, Surname, DOB, Sex & postcode	423,385	
1	Exact matches on Forename & Surname Initials, DOB, Sex & postcode	32,470	
2	Exact matches on DOB, Sex & postcode	5,864	
3	Exact matches on Forename, Surname, DOB, Sex & 2-character postcode	223,355	
4	Exact matches on Forename, Surname, DOB, & Sex	224,529	
5	Exact matches on first 4 characters of both Forename & Surname, Year of Birth, & Sex	55,373	
6	Exact matches on first 4 characters of both Forename & Surname, Month & Day of Birth, & Sex	7,754	
7	Exact matches on first 4 characters of both Second Forename & Surname, Year of Birth, & Sex	332	
8	Exact matches on first 4 characters of both Third Forename & Surname, Year of Birth, & Sex	501	

[69] The Indexing Service at the National Records of Scotland acts as the Trusted Third Party for data linkage projects across Scotland

9	Exact matches on first 4 characters of both Forename & Alternative Surname, Month & Day of Birth, & Sex	15	
		973,578	
	Number of Matches to CHI Lookup	969,667	99.6%
	Number of unique persons (CHI numbers) amongst matched homeless records	**564,501**	
	Age-sex Matched Controls		
	Number of age-sex matched CHI numbers from SIMD1 cohort	563,207	99.8%
	Number of age-sex matched CHI numbers from SIMD5 cohort	564,501	100.0%
	Total Index Numbers provided for health data	**1,692,209**	

Table 2.3 shows the results from the linking exercise, provided by NRS's Indexing Service. In total, over 1 million records were received in the H2H dataset, containing identifiable information relating to people who made homelessness applications (HL1) and sought assistance on housing related issues (PREVENT1). Of these, just over 970,000 were matched to the Research Indexing Spine: a 94.4% match rate. The majority of these (99.6%) were successfully linked to the CHI lookup and were assigned their CHI number.

As mentioned previously, by design, the H2H is known to contain duplicate individuals as one might appear multiple times within the H2H dataset if they appeared in more than one homelessness application or PREVENT1 approach. Using the CHI number obtained from the CHI lookup, the dataset was then de-duplicated to identify 564,501 unique individuals.

Creating control groups

In order to measure and understand the impacts of health activity on homelessness, as well as homelessness on health activity, it is necessary to create a control group to compare with the homelessness group.

The Indexing Service created two control groups for the study by linking the H2H dataset (564,501 unique individuals) to individuals on the RIS on age (assumed age at 31st March 2015[70]) and sex. The first control group was defined by only containing individuals living in the 20% most deprived areas of Scotland (SIMD1), and the second control group as only containing individuals living in the 20% least deprived areas of Scotland (SIMD5). Area deprivation was calculated using the Scottish Index of Multiple Deprivation (SIMD) 2012, based on the postcodes on the Research Indexing Spine at June 2016.

Note: an individual is not able to be in the H2H dataset as well as in one of the two control groups. Therefore, homeless individuals residing in these SIMD1 and SIMD5 areas are not available for selection as a control. In essence, the sampling frame of potential controls is the true underlying SIMD1 and SIMD5 populations minus all H2H individuals. The impact of this on the study is explored in Section 2.9.1.

[70] An assumed age was used as some people in the cohort may have died before reaching the end of the study period.

As a result, just under 1.7 million people were selected from the Scottish population to be used in the study (Table 2.3, 'Age-sex Matched Controls'). They can be classified in one of the following three groups:

- 564,501 unique individuals sourced from H2H
- 563,207 unique individuals from the 20% most deprived SIMD1 areas, with the same age and sex distribution as the H2H group. However, the size of the H2H group was so large that there were not enough people on the RIS in SIMD1 areas, with the same age and sex breakdown, to create a complete control group.
- 564,501 unique individuals from the 20% least deprived SIMD5 areas, with the same age and sex distribution as the H2H group.

It is important to note that the matched controls were identified randomly by age and sex only. No other factors were controlled for between the three different groups. Known factors exist beyond age and sex that will influence one's level of health activity, such as, for example, economic activity and household structure. It likely there will be differences in these between those individuals in the homeless group, and those in the 20% most and least deprived quintiles. As this study does not control for these factors, there may be biases in the results which could be explained by these factors.

The dataset containing these individuals was then transferred by the NRS Indexing Service to the National Services Scotland National Safe Haven, a secure environment located at the Farr Institute, Scotland. Here, the study's analysis team accessed the de-identified data and conducted analyses.

Annex E: Temporal analysis: health activity relative to the date of first homelessness assessment

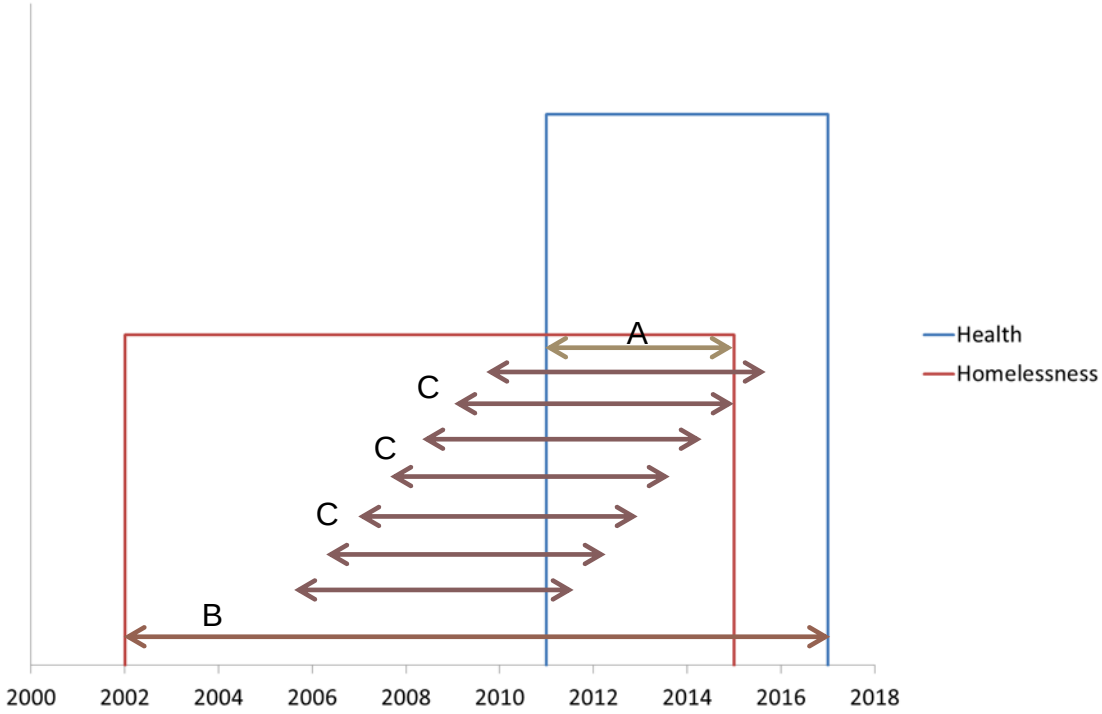
In order to perform the temporal analysis the date of the health activity needs to be considered. The date of health activity itself is not primarily of interest. What is of interest is when the health activity occurred relative to when that person became homeless. The date of the first homelessness assessment will be used as a proxy for the date of becoming homeless. The date of the first homelessness assessment can then be subtracted from the date of the start of the health activity (if an episode), or simply the date of health activity. Positive values will indicate health activity that occurs after the homelessness assessment, negative values indicate health activity prior to the homelessness assessment. Any activity that happens at the same time will have a value of zero. Thus $t_r = t_{he} - t_{ho}$, where t_{he} is the time of the health activity and t_{ho} is the time of the first homelessness assessment.

We can therefore plot activity as a function of the relative time t_r. The structure of this plot will not only be dependent on the direction of causality with respect to the homelessness episode. It will also depend on the relative timing of the availability of the data. Even if health activity rate and the rate of homelessness assessments were constant over time, there would still be variation seen in activity over t_r. For example, suppose that health data covered the period from the start of 2011 to the start of 2017, and homelessness data went from 2002 to 2015 (see Figure E.1). The range of t_r would then be from -4 to 15 years. Activity could happen at $t_r = -4$ if there was someone who had a homelessness assessment at the start of 2015 and had a health episode at the start of 2011 (indicated by the arrow (A) on Figure E.1). It would not be possible for $t_r < -4$ as this would require either that the homelessness assessment happened later than this, or the health activity happened earlier than this, neither of which are possible given the availability of data. Similarly the maximum possible value of $t_r = 15$, as indicated by the arrow (B) on Figure E.1. In general then $t_{r,max} = t_{he,max} - t_{ho,min}$, and $t_{r,min} = t_{he,min} - t_{ho,max}$, where max and min indicate the largest and smallest possible values given the data available. Therefore the range of t_r (i.e. the difference between its maximum and minimum values) is given by:

$$t_{r,range} = t_{r,max} - t_{r,min}$$
$$= \left(t_{he,max} - t_{ho,min}\right) - \left(t_{he,min} - t_{ho,max}\right)$$
$$= t_{he,max} - t_{he,min} + t_{ho,max} - t_{ho,min}$$
$$= t_{he,range} + t_{ho,range}$$

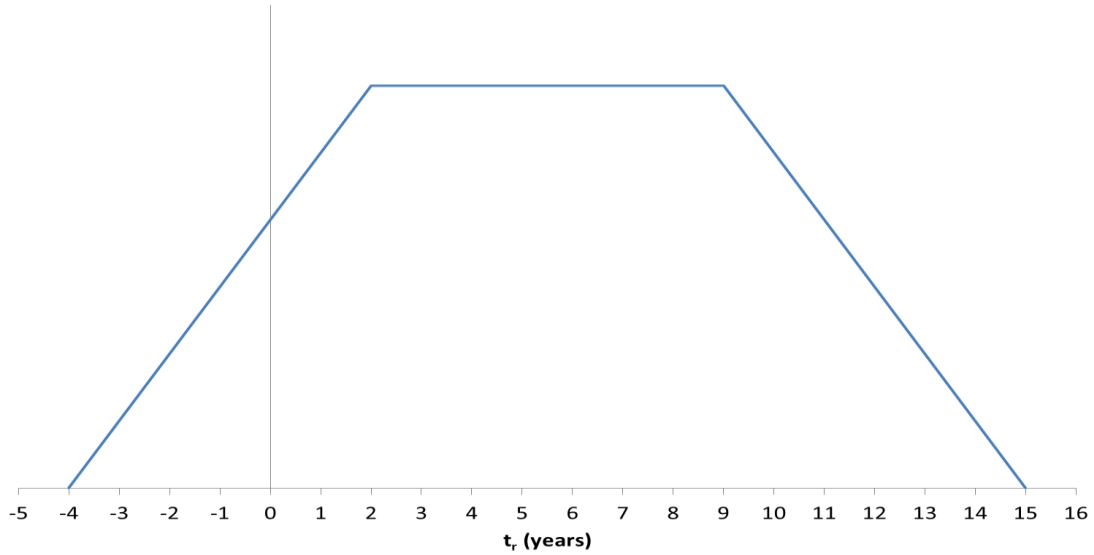
In this case the range would be 19 years, which is the sum of the range of the homelessness data (6 years) and that of the health data (13 years).

Figure E.1: Impact of different time periods in datasets on calculating the date relative to the first homelessness assessment



It can also be seen that the amount of activity that happens will not be constant over this range. For example there is only one possible combination of dates that will result in $t_r = 15$ years. However there are many possible dates that result in $t_r = 6$ years, as indicated by the multiple arrows (C) in Figure E.1. In general the number of possible combinations of dates that leads to particular values of t_r will increase as t_r diverges from its maximum and minimum values. Eventually this increase will stop and the number of combinations will remain constant. For example if we imagine the orange arrows in Figure E.1 being extended to the left slightly then there would be a similar number of combinations as there are for the orange arrows themselves. Therefore plotting the number of possible combinations of dates over t_r would result in the plot in Figure E.2. This is also the graph that would be seen when plotting the count of health episodes as a function of t_r if the rates of homelessness assessments were constant over times, and the rate of health episodes were constant over time for these people.

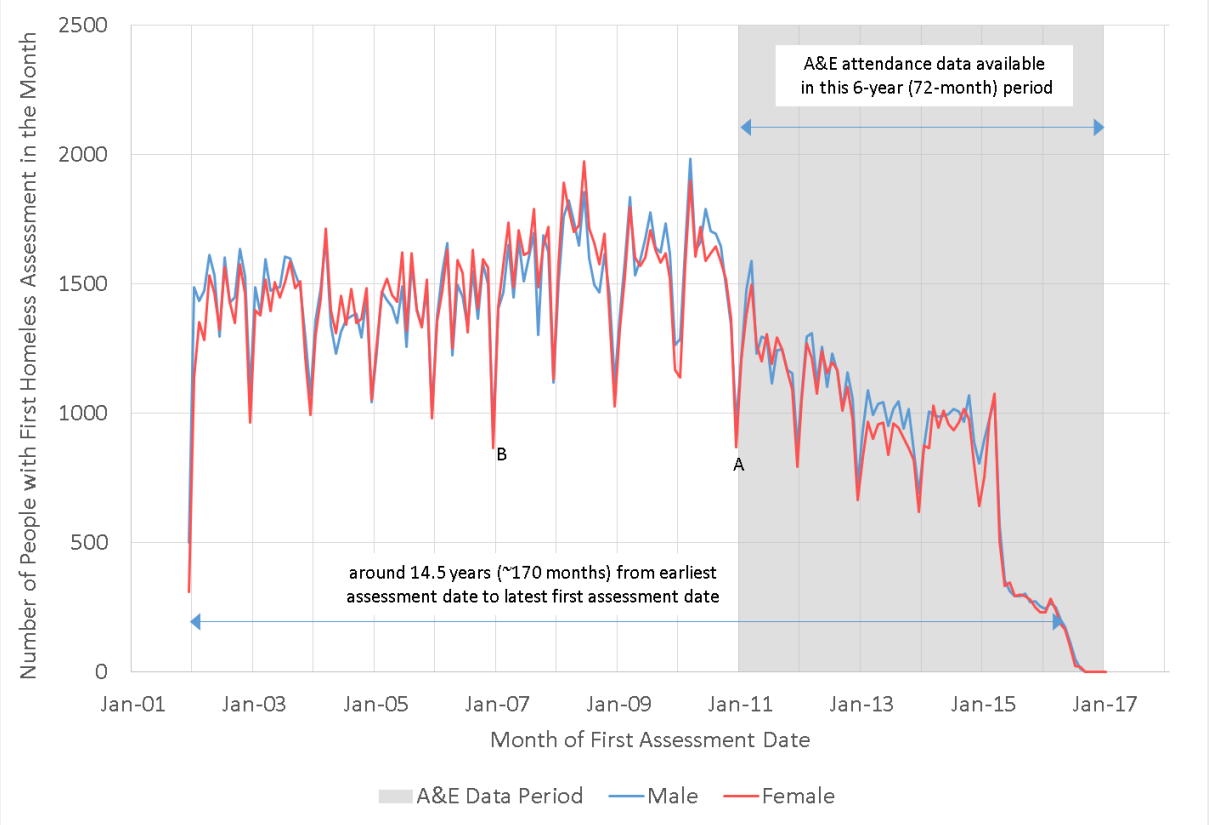
Figure E.2: Theoretical shape of the count of health activity episodes relative to the date of first homelessness assessment



In this way the resulting pattern would be the convolution[71] of the health data and the homelessness data. In the actual analysis the shape will be complicated further by variations in the number of events over time. Figure E.3 below shows the actual distribution of the number of people with homelessness assessments in each month over the time period (along with the time period of the A&E dataset for reference). It can be seen that this is not constant. There is significant seasonality with fewer homelessness assessments in December of each year. Furthermore there are fewer homelessness assessments each year after 2011 than there were before then. This will make the trend of the health activity as a function of t_r even more complex than that seen in Figure E.2.

[71] See https://en.wikipedia.org/wiki/Convolution for a further explanation of convolution.

Figure E.3: Number of Homeless People by Month of First Homeless Assessment



There will also be variations in the health activity rates that will not be related to the homelessness episode. For example it may be that health activity rates increase over time as people age. This would make the trend increase with t_r as each person included would have more activity at later times than at earlier times.

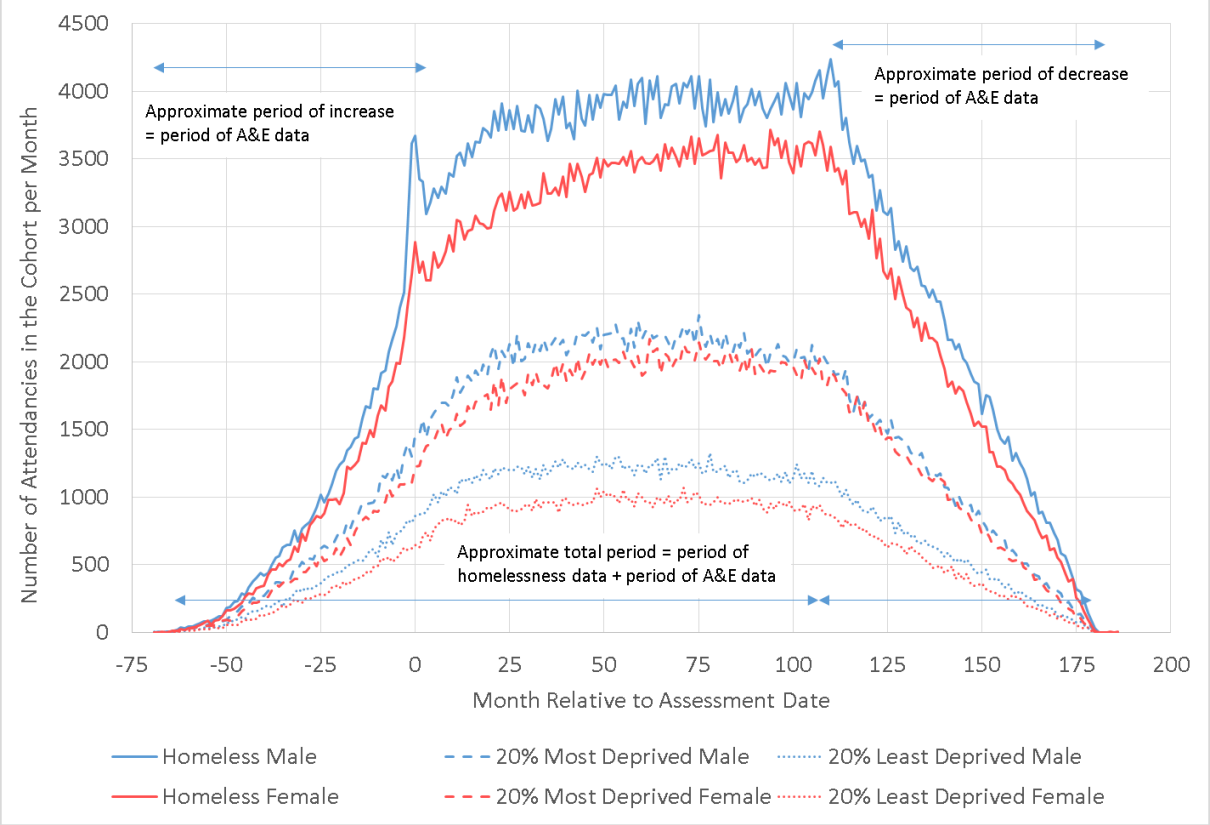
Fortunately it is possible to control for both these effects to more clearly isolate the relationship between homelessness and health activity. To do this we make use of the controls. For each person in the EHC there are two controls with the same age who are known to be alive [although not necessarily present in the Scottish population] at the date of the EHC person's first homelessness assessment. We therefore use the date of first assessment of the EHC person and assign this to each of the two controls. Using this date a value of t_r can be calculated for all the activity of the controls. These people will therefore have exactly the same range of possible values of t_r as the EHC people. Furthermore, these controls are the same age as the people in the EHC. Therefore the effects of the convolution of the datasets and of the aging cohort will affect the EHC and the controls equally.

As an example, Figure E.4 shows what happens when this temporal analysis is performed on the homelessness data and the is below that when this is done the rough shape of the trend is similar across the cohorts. Therefore we divide the values seen in the EHC by those seen in the LDC. This would divide out the shape of the trend simply due to these effects, making it much flatter. Whatever structure remains would therefore be more directly related to the homelessness itself.

In some cases the activity levels among the LDC may fluctuate substantially from month to month. This is especially the case for activity relating to services that are less used by people in the LDC. To avoid carrying that fluctuation in to the ratios the

LDC values are smoothed before being used as a denominator. To do this a triangular smoothing kernel was used, with a width of 20 months.

Figure E.4: A&E Attendances per month relative to first assessment date by cohort:



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The views expressed in this report are those of the researcher and do not necessarily represent those of the Scottish Government or Scottish Ministers.

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