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# HOUSING, HEALTH AND SERVICE USE OF THE HOMELESS IN HELSINKI, FINLAND

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ACADEMIC DISSERTATION

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# ABSTRACT

Life without a home of your own, a place to rest, store personal belongings and feel safe is a stressful situation that complicates everyday life in many ways. Through several national and local development programmes during the last decades, Finland has successfully managed to reduce the number of long-term homeless. About 8000 persons are estimated to be homeless in Finland. Of them, the majority are staying temporarily with friends and acquaintances and only a small group sleeps in shelters or on the streets.

Previous studies from other countries have shown that homelessness is associated with increased morbidity and mortality, as well as increased use of hospital and emergency department services. Yet, the health situation of the homeless in Finland has not received much attention from the medical community or health research field. The aim of this study was to examine the housing situation, morbidity, mortality and healthcare service use of the homeless shelter population in Helsinki, Finland.

By combining data from both local and national registers three cohorts of shelter users were followed. In Study I and II all 617 men staying in Herttoniemi shelter during 2004 were followed for ten years. The long-term outcomes, in terms of housing situation, morbidity and overall as well as cause-specific mortality were assessed and compared with an age-matched control group from the general population (N=1240). In Study III, the 683 men and women who stayed in Hietaniemenkatu shelter during one year (1.9.2009–1.9.2010) were followed for 4.5 years. The duration of homelessness in this cohort was assessed and analysed in relation to their use of specialized healthcare services. The use of specialized healthcare services was also compared to that of an age- and gender-matched group (N=1316). In Study IV, the use of primary healthcare services among 158 persons who stayed in shelters in the Helsinki metropolitan area was assessed for a period of three years. The relationship between mental disorders and the use of primary healthcare services was analysed.

The results show that homeless shelter users had high morbidity compared with the control group, and that especially psychiatric morbidity (including substance use disorders) was high. During the ten-year follow-up period about half of those who had stayed in shelter had died, which is a fivefold risk of death for the homeless compared with the controls. The risk of death from diseases and medical conditions was more than threefold compared with the control group, and the risk of death from external causes was over tenfold. The large majority of those still alive at the end of follow-up were staying in supported housing, with only a small group being still or again homeless. Six per cent were independently housed. Being married and staying only briefly in shelter predicted being independently housed, among other factors. Conversely, the protective effects of marriage, employment and

education on mortality risk that was found among controls was not observed among the homeless.

Compared with controls, the homeless had over 40 times more hospital days in psychiatric hospitals, 10 times more hospital emergency department visits and over six times more medical/surgical hospital days. Also, those who were only temporarily homeless had a high use of emergency department and hospital services. Mental disorders were strongly associated with primary healthcare service use. This association was particularly strong for dual diagnosis (concurrent substance use disorder and other mental disorder). The homeless visited primary care for mental health- and substance use-related problems, traumas and infections, but there seemed to be undertreatment of chronic conditions such as hypertension and diabetes.

This study shows that, also in the Finnish setting, having experienced homelessness and having stayed in shelter is strongly associated with adverse health outcomes and that the prognosis for the homeless in shelters is poor both in terms of being independently housed and mortality. The high use of hospital and emergency department services and relatively low use of outpatient care, as well as undertreatment of chronic conditions, indicate that access to timely and appropriate care is insufficient, leading to high use of specialized care. Current and recently homeless persons should be recognized as a vulnerable group with high needs. Better, targeted healthcare services are needed to prevent avoidable hospitalizations, ill health and premature death.

# TIIVISTELMÄ

Elämä asunnottomana, ilman paikkaa, jossa levätä, säilyttää henkilökohtaista omaisuuttaan ja kokea turvallisuuden tunnetta, on stressaava elämäntilanne, joka monella tapaa hankaloittaa jokapäivästä elämää. Viimeisten vuosikymmenten aikana Suomeessa on tehty paljon kehittämistyötä asunnottomuuden vähentämiseen liittyen, ja onnistuttukin vähentämään pitkäaikais-asunnottomuutta. On arvioitu, että tällä hetkellä Suomessa on noin 8000 asunnotonta henkilöä. Heistä valtaosa asuu tilapäisesti tuttavien tai perheenjäsenten luona. Ainoastaan pieni osa yöpyy ulkona, ensisuojissa tai tilapäismajoituksessa.

Aiempi kansainvälinen tutkimus on osoittanut, että asunnottomuuteen liittyy kohonnut sairastavuuden ja kuolleisuuden riski, sekä lisääntynyttä päivystys- ja sairaalapalvelujen käyttöä. Asunnottomien terveys on kuitenkin saanut hyvin vähän huomiota suomalaisessa lääketieteellisessä yhteisössä tai tutkimuksessa. Tämän väitöstutkimuksen tavoite on tuottaa tietoa pääkaupunkiseudun ensisuojissa yöpyneiden asunnottomien asumisesta, sairastavuudesta, kuolleisuudesta ja terveyspalvelujen käytöstä.

Yhdistämällä rekisteritietoja niin paikallisista kuin kansallisistakin rekisteritietokannoista tutkimuksessa seurattiin kolmea ensisuojassa yöpyneiden ryhmää. Väitöskirjan tutkimuksissa I ja II seurattiin kymmenen vuoden ajan kaikkia niitä 617 miestä, jotka yöpyivät Herttoniemen asuntolassa vuoden 2004 aikana. Heidän asumistilannettaan, sairastavuuttaan ja kuolleisuuttaan 10 vuoden seurannan kuluessa verrattiin väestörekisteristä poimittuun ikävakioituun verrokkiryhmään (N=1240). Tutkimuksessa III 683 miestä ja naista, jotka yöpyivät Hietaniemenkadun palvelukeskuksessa yhden vuoden aikana (1.9.2009–1.9.2010), seurattiin 4,5 vuoden ajan. Tämän ryhmän asunnottomuuden kestoa selvitettiin ja sitä analysoitiin suhteessa erikoissairaanhoidon palvelujen käyttöön. Erikoissairaanhoidon palvelujen käyttöä verrattiin myös ikä- ja sukupuolivakioituun verrokkiryhmään (N=1316). Tutkimuksessa IV 158:n pääkaupunkiseudun ensisuojissa yöpyneen henkilön perusterveydenhuollon lääkäripalvelujen käyttöä tutkittiin kolmen vuoden ajan, minkä lisäksi tutkimuksessa selvitettiin perusterveydenhuollon palvelujen käytön suhdetta mielenterveyshäiriöihin.

Tutkimuksen tulokset osoittavat, että asunnottomilla on verokkiryhmään nähden suurempi sairastavuus, koskien etenkin psykiatrisia häiriöitä (mukaan lukien päihdehäiriöt). Kymmenen vuoden seurannan aikana noin puolet ensisuojassa yöpyneistä kuoli, mikä tarkoittaa noin viisinkertaista kuolemanriskiä verrokkiryhmään verrattuna. Asunnottomien riski kuolla tauteihin oli yli kolminkertainen ja ulkoisiin syihin yli kymmenkertainen verrokkeihin nähden. Seurannan lopussa elossa olleista valtaosa asui tuetun asumisen piirissä ja vain pieni joukko tutkittavista oli yhä tai jälleen

asunnottomina. Kuusi prosenttia alkuperäisestä asunnottomien ryhmästä asui itsenäisesti. Muun muassa parisuhde ja lyhyt ensisuojassa vietetty aika ennustivat itsenäistä asumista kymmenen vuoden jälkeen. Verrokkiryhmässä parisuhde, koulutus ja työssä käyminen olivat kuolemanriskiä alentavia tekijöitä, mutta näillä samoilla tekijöillä ei ollut vaikutusta kuolemanriskiin asunnottomilla.

Verrokkiryhmään nähden asunnottomilla oli yli nelikymmenkertaisesti sairaalapäiviä psykiatrisessa sairaalahoidossa, kymmenkertaisesti sairaalapäivystyskäyntejä ja yli kuusinkertaisesti sairaalapäiviä somaattisessa erikoissairaanhoidossa. Myös he, jotka olivat vain tilapäisesti asunnottomia, käyttivät paljon sairaala- ja päivystyspalveluja. Mielenterveyshäiriöt olivat vahvasti yhteydessä perusterveydenhuollon käyttöön. Tämä yhteys oli erityisen voimakas heillä, joilla oli sekä päihdeongelma että muu mielenterveyden häiriö (kaksoisdiagnoosi). Asunnottomat henkilöt kävivät perusterveydenhuollon lääkärin vastaanotolla mielenterveys- ja päihdeongelmien, traumojen sekä infektioiden takia, sen sijaan krooniset taudit vaikuttivat olevan alihoidettuja.

Tämä tutkimus osoittaa, että myös Suomessa asunnottomien ensisuojassa yöpymiseen liittyy hyvin usein terveysongelmia ja selvästi kohonnut kuolemanriski, ja että näiden asunnottomien ennuste koskien itsenäistä asumista on heikko. Runsas sairaala- ja päivystyspalvelujen käyttö sekä suhteellisen pieni poliklinisten palvelujen käyttö yhdistettynä kroonisten tautien alihoitoon viittaavat siihen, että oikea-aikaisen ja asianmukaisen hoidon saatavuus on asunnottomilla riittämätöntä, mikä johtaa suureen erikoissairaanhoitopalvelujen käyttöön. Asunnottomat ja äskettäin asunnottomana olleet henkilöt tulisi tunnistaa haavoittuvaksi ryhmäksi, jolla on todennäköisesti suuri tuen tarve. Parempia, kohdistettuja terveyspalveluja tarvitaan vähentämään ennaltaehkäistävissä olevia sairaalajaksoja, huonoa terveyttä ja kohonnutta ennenaikaisen kuoleman riskiä.

# SAMMANFATTNING

Att leva utan ett eget hem, där man kan vila, förvara sin privata egendom och känna sig trygg, innebär en stressig livssituation och gör mycket av vardagen besvärlig. Genom flera nationella ovh lokala utvecklingsprojekt under de senaste decennierna har Finland lyckats minska antalet långtidsbostadslösa. Ungefär 8000 personer i Finland uppskattas vara hemlösa. Av dessa, bor majoriteten hos bekanta och familjemedlemmar och bara en liten del övernattar i härbärgen eller på gatan.

Tidigare forskning från andra länder har visat att hemlöshet är förknippad med ökad sjuklighet och dödlighet, samt större användning av sjukhus och jourtjänster. Hälsosituationen för de hemlösa har trots detta inte fått mycket uppmärksamhet från det finska medicinska samfundet eller hälsoforskningsområdet. Målet med den här studien var att utforska bostadssituationen, sjukligheten, dödligheten samt användandet av hälsovårdstjänster hos hemlösa på härbärgen i den finska huvudstadsregionen.

Genom att kombinera data från lokala och nationella register följdes tre grupper av hemlösa på härbärgen. I studie I samt II följdes de 617 män som övernattade på Hertonäs härbärge under år 2004 i tio år. Deras bostadssituation, sjuklighet och dödlighet under uppföljningstiden jämfördes med en åldersmatchad kontrollgrupp från befolkningsregistret (N=1249). I studie III följdes i 4,5 år de 683 hemlösa personer som under ett år (1.9.2009–1.9.2010) övernattade på Sanduddsgatans servicecentral. Hemlöshetens längd under uppföljningstiden beräknades och dess relation till användandet av specialsjukvårdstjänster analyserades. Användandet av special-sjukvårdstjänster jämfördes också med en köns- och åldersmatchad kontrollgrupp (N=1316). Slutligen, i studie IV, analyserades användandet av primärvårdstjänster hos 158 hemlösa som övernattade på något av de fyra härbärgena i huvudstadsregionen under två utvalda nätter år 2008.

Resultaten visar att hemlösa som övernattat på härbärge har en stor sjuklighet jämfört med kontrollgruppen, särskilt då det gäller psykiska störningar (inklusive beroendestörningar). Under den tio år långa uppföljningen dog ungefär hälften av de hemlösa, vilket motsvarar en fem gånger så stor dödlighet jämfört med kontrollgruppen. Risken att dö av sjukdomar var mer än tredubbel och risken att dö av yttre orsaker, så som av förgiftningar och olyckor, var mer än tio gånger så stor som för kontrollgruppen. Den stora majoriteten av de som överlevde bodde i stödboende, och bara en liten del var fortfarande eller pånytt hemlösa. Sex procent bodde självständigt. Att vara gift eller stanna bara några få nätter på härbärge var associerat med självständigt boende tio år senare. Däremot hade de skyddande faktorerna mot dödlighet som observerades hos

kontrollgruppen så som att ha ett arbete och hög utbildningsnivå ingen effekt bland de hemlösa.

Jämfört med kontrollgruppen, hade de hemlösa över 40 gånger fler psykiatriska sjukhusdygn, 10 gånger fler sjukhusjourbesök och sex gånger fler medicinska och kirurgiska sjukhusdygn. Även de som var bara tillfälligt hemlösa använde mycket specialistsjukvårdstjänster. Mentala hälsoproblem var starkt associerat med användandet av primärvårdstjänster. Detta var särskilt framträdande för personer med samtidig missbruksrelaterad diagnos och annat mentalt hälsoproblem (så kallad dubbeldiagnos). De vanligaste orsakerna att besöka läkare i primärhälsovården bland de hemlösa var problem relaterade till mental hälsa och missbruk, trauma och infektioner. Däremot verkade vården av kroniska sjukdomar vara bristfällig.

Denna studie visar att även i Finland är hemlöhet och att ha övernattat i härbärge starkt relaterat till negativa hälsoeffekter. Prognosen för de hemlösa i härbärgen är dålig såväl då det gäller att få ett självständigt boende som då det gäller dödlighet. Den stora användningen av jour- samt sjukhustjänster kombinerat med relativt liten användning av poliklinisk service och undervård av kroniska sjukdomar indikerar att tillgängligheten till ändamålsenlig vård vid rätt tidpunkt är otillräcklig. Detta leder till stor användning av specialistsjukvård. Hemlösa samt nyligen hemlösa personer borde betraktas som en sårbar grupp med stort vårdbehov. Bättre och riktade hälsovårdsinitiativ behövs för att kunna undvika sjukhusinläggningar som kunde förebyggas, för att minska den dåliga hälsan bland hemlösa samt förhindra förtidig död.

# CONTENTS

# LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following publications:

I       Stenius-Ayoade A, Haaramo P, Kautiainen H, Sunikka S, Gissler M, Wahlbeck K, Eriksson JG. *Morbidity and housing status 10 years after shelter use - follow-up of homeless men in Helsinki, Finland.* European Journal of Public Health 2018 (28) 1092-1097.

II      Stenius-Ayoade A, Haaramo P, Kautiainen H, Gissler M, Wahlbeck K, Eriksson JG. *Mortality and causes of death among homeless in Finland: a 10-year follow-up study.* Journal of Epidemiology and Community Health 2017 (71) 841–848.

III     Stenius-Ayoade A, Eriksson JG, Kautiainen H, Gissler M, Haaramo P. *Duration of homelessness and its relationship to use of hospital and emergency department services among homeless in Helsinki, Finland.* Accepted for publication in Scandinavian Journal of Public Health.

IV      Stenius-Ayoade A, Haaramo P, Erkkila E, Marola N, Nousiainen K, Wahlbeck K, Eriksson JG. *Mental disorders and the use of primary health care services among homeless shelter users in the Helsinki Metropolitan Area, Finland.* BMC Health Services Research 2017 (17) 428.


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# ABBREVIATIONS

| | |
|---|---|
| ARA | Housing Finance and Development Centre of Finland |
| CCI | Charlson Comorbidity Index |
| CI | Confidence interval |
| COPD | Chronic obstructive pulmonary disease |
| ED | Emergency department |
| ETHOS | European Typology of Homelessness and housing exclusion |
| FEANTSA | European Federation of National Organisations Working with the Homeless |
| GEE | Generalized estimating equation |
| HCV | Hepatitis C virus |
| HBV | Hepatitis B virus |
| HIV | Human immunodeficiency virus |
| HR | Hazard ratio |
| HUS | Hospital district of Helsinki and Uusimaa |
| ICD-10 | International Classification of Diseases, 10th revision |
| IRR | Incidence rate ratio |
| MRR | Mortality rate ratio |
| NGO | Non-governmental organization |
| OR | Odds ratio |
| PIC | Personal identification code |
| PHER | Primary healthcare emergency room |
| RR | Relative risk |
| RCT | Randomized controlled trial |
| SD | Standard deviation |
| sHR | Sub-hazard ratio |
| SMR | Standardized mortality rate |
| SUD | Substance use disorder |
| WHO | World Health Organization |

# 1   INTRODUCTION

We all have some kind of perception of who the "homeless" are. Many of us would picture an older person in rough and dirty clothes walking the streets with somewhat unsteady steps, carrying plastic bags, with a haunted look, much like the homeless commonly portrayed in films. But homelessness is of course much more than this stereotype: it can be the medical student who broke up with his girlfriend and is sleeping temporarily on a friend's sofa; the immigrant lady cleaning your office who is having trouble finding a flat because of a racially discriminating housing market; the lonely, slightly demented former sailor who did not understand his internet banking and was evicted because of unpaid rent, and a thousand other stories of persons with bigger and smaller misfortunes.

Most persons who experience homelessness are homeless only for a short period, after which they find some kind of home. Most importantly, being homeless is not a personal characteristic or a disease, but often a temporary social situation that complicates the practicalities of life. That said, I will in this thesis refer to people who have experienced homelessness as homeless persons or even only as "the homeless", well aware that this is an oversimplification that can also be considered an offensive way to describe persons who have been homeless at some point. I hope that the reader understands that this is done in order to make the text readable, and remember that the term includes persons in very differing life situations with many other qualities and identities than being homeless.

Cross-sectional studies have shown that homelessness is associated with many medical conditions and risks, though the causality remains unclear. It is not known to what extent homelessness is a consequence of disease or if and how homelessness itself affects the course of diseases. Especially the homeless staying in shelters or sleeping rough are an extremely marginalized group that has been found to have high morbidity, mortality and healthcare service use (Fazel, Geddes et al. 2014).

As homelessness includes persons in varying life situations, finding a common definition of homelessness that can be used in statistics and research has been a great challenge. Consequently, the definitions and subgroups of the homeless included differ between studies. Previous cohort studies on homeless persons have typically collected samples from shelters, meal programmes, targeted health and social services and on the streets, and as such the literature on homelessness is dominated by these groups of homeless, and the results presented in the literature review are not necessarily representative of the homeless staying temporarily with friends or in institutions.

Overall, research on health outcomes among the homeless has been scarce in Europe as most of the studies on homelessness and health have

been conducted in the USA or Canada (Busch-Geertsema, Edgar et al. 2010). However, the few European studies that do exist, combined with the author's clinical experience from working with the homeless in Helsinki, show that also in the European and Finnish context the homeless in shelters constitute a highly vulnerable group with not only housing needs, but also many different healthcare needs (Beijer, Andreasson 2010, Nielsen, Hjorthoj et al. 2011).

By combining data from different registers, this study followed three cohorts of homeless shelter users in Helsinki metropolitan region, Finland, describing the housing, morbidity, mortality and healthcare service use outcomes of these study cohorts. The aim of this thesis is to present data on the health situation of the homeless in Finland, a group that has been largly neglected by the Finnish medical research community in the past. This new data on the risks associated with homelessness can be used by policy makers and health professionals to plan and produce better social and healthcare services for the homeless.

# 2   THE CONCEPT OF HOMELESSNESS

## 2.1   DEFINITIONS AND CLASSIFICATIONS OF HOMELESSNESS

As mentioned in the Introduction, being without a home and not having a place of your own is a state that includes many very different life situations. Not only those who sleep rough, but also persons staying in shelters, living temporarily with family and friends and persons living in institutions without a home outside the institution can be considered homeless. Despite attempts to agree on a global definition of homelessness, the ways of defining homelessness vary across countries (US Congress 2009, Busch-Geertsema, Edgar et al. 2010, Baptista, Benjaminsen et al. 2012, Fazel, Geddes et al. 2014, Busch-Geertsema, Culhane et al. 2016).

The European Federation of National Organisations Working with the Homeless (FEANTSA) and the European Observatory on Homelessness have developed the European Typology of Homelessness and Housing Exclusion (ETHOS), which forms a conceptual framework describing a typology of both homelessness and housing exclusion (Edgar, Meert 2005). In this typology homelessness and housing exclusion are divided into rooflessness, houselessness, insecure housing and inadequate housing. Based on the ETHOS typology, the harmonized definition of homelessness, ETHOS light, was developed in 2007 (Table 1) (Edgar, Harrison et al. 2007). The ETHOS light definition is a pragmatic tool that can be used in surveys and statistical research (Busch-Geertsema, Benjaminsen et al. 2014). Compared to the ETHOS light definition of homelessness, the definition used in official statistics on the number of homeless in the USA does not recognize people living in institutions (ETHOS light category 4) as homeless (Henry, Watt et al. 2017).

Annual statistics on the number of homeless in Finland have been gathered since 1987 by the Housing Finance and Development Centre of Finland (ARA) (Helskyaho, Ohisalo et al. 2018). ARA classifies the homeless into: 1) persons staying outside in staircases and shelters; 2) persons in dormitories and boarding houses; 3) persons in institutional units; 4) persons staying temporarily with friends or relatives and 5) homeless families. The Finnish definition of homelessness is among the few used in Europe that includes all groups in the ETHOS light categories (Busch-Geertsema, Benjaminsen et al. 2014).

This study examines three cohorts of homeless persons, all sampled from shelters for the homeless. Hence, this study focuses on the homeless in category 2) and 3) of the ETHOS light definition and groups 1) and 2) in the Finnish classification of homelessness, and the study findings should not be considered representative for homelessness in other categories.

**Table 1.**     The ETHOS light definition of homelessness.

| Operational Category | | Living Situation | | Definition |
|---|---|---|---|---|
| 1 | People living rough | 1 | Public spaces / external spaces | Living in the streets or public spaces without a shelter that can be defined as living quarters |
| 2 | People in emergency accommodation | 2 | Overnight shelters | People with no place of usual residence who move frequently between various types of accommodation |
| 3 | People living in accommodation for the homeless | 3 | Homeless hostels | Where the period of stay is time limited and no long-term housing is provided |
| | | 4 | Temporary accommodation | |
| | | 5 | Transitional supported accommodation | |
| | | 6 | Women's shelter or refuge accommodation | |
| 4 | People living in institutions | 7 | Healthcare institutions | Stay longer than needed due to lack of housing |
| | | 8 | Penal institutions | No housing available prior to release |
| 5 | People living in non-conventional dwellings due to lack of housing | 9 | Mobile homes | Where the accommodation is used due to a lack of housing and is not the person's usual place of residence |
| | | 10 | Non-conventional buildings | |
| | | 11 | Temporary structures | |
| 6 | Homeless people living temporarily in conventional housing with family and friends (due to lack of housing) | 12 | Conventional housing, but not the person's usual place of residence | Where the accommodation is used due to a lack of housing and is not the person's usual place of residence |

Source: (Edgar, Harrison et al. 2007)

## 2.2  THE DYNAMICS OF HOMELESSNESS

Homelessness is rarely a chronic state, as persons experiencing homelessness typically have different pathways in and out of homelessness with periods of being housed in between (Clapham 2003, Fitzpatrick 2013a). In 1998 Kuhn and Culhane created a typology of homelessness, based on cluster analyses on the homeless in shelters in New York and Philadelphia, that has been most commonly used in studies focusing on health outcomes (Kuhn, Culhane 1998). Kuhn and Culhane identified and described three types of homeless shelter users: the transient, episodic and chronically homeless. They found that the transient homeless constituted the majority of shelter users (about 80%) and they stayed in the shelter system for only a short period and rarely returned. The transient homeless had a relatively low prevalence of mental

disorders, were younger and more often white. The episodically homeless (about 10% of the shelter population) shuttled in and out of the shelter system, with periods of living on the street, in jail, in detoxification services and being housed in between. This group was also relatively young, but the episodically homeless were more likely to have a mental disorder or other medical problems. The chronically homeless represented about 10% of the homeless population, they stayed in the shelters for long periods, were older and more likely to have mental disorders and substance use disorders (SUD). Although the chronically homeless represented a small number of all homeless shelter users, they constituted a relatively large proportion of shelter users at any time point due to their long stays (Henry, Watt et al. 2017). The chronically homeless were found to take up 47% of the total shelter nights in the study by Kuhn and Culhane (Kuhn, Culhane 1998). A Danish study testing the same typology in shelters found that 15% were chronically homeless, and that this group was responsible for a total of 59% of all shelter nights (Benjaminsen, Andrade 2015).

Homelessness is associated with increased morbidity independent of the length of homelessness, but chronically homeless individuals have worse health outcomes than individuals who are homeless for a shorter time period (Kertesz, Larson et al. 2005, Fazel, Geddes et al. 2014). Therefore, most interventions have focused on those chronically and episodically homeless (Kuhn, Culhane 1998, Caton, Dominguez et al. 2005, Tsemberis 2010, Benjaminsen, Andrade 2015, Pleace, Culhane et al. 2015). Benjaminsen and Andrade tested the typology of Kuhn and Culhane in Denmark and found that the division of transient, episodic and chronic homelessness was similar in the Danish shelter system, but the transient homeless in Denmark had a higher tendency to suffer from mental disorders and SUD than the transient homeless in the USA.

## 2.3  THE EPIDEMIOLOGY OF HOMELESSNESS IN HIGH-INCOME COUNTRIES

Homelessness is closely linked to poverty and welfare structures (Stephens, Fitzpatrick 2007, Benjaminsen, Andrade 2015). The vast majority of the homeless in the world live in low-income countries, where conflicts, urbanization and migration are often the main reasons for homelessness. There is very little data on the number of homeless in low-income countries, and for comparability reasons I have limited myself to the epidemiology of homelessness in high-income countries.

In addition to differing ways of defining homelessness, the methods of tracking and counting the homeless also vary largely between countries. Some countries (e.g. Sweden and the USA) perform point in time counts to estimate the number of homeless, others gather data on homelessness while conducting censuses (e.g. Poland and Portugal) or perform national surveys

(e.g. Finland and Denmark) (Henry, Watt et al. 2017, Socialstyrelsen 2017, Baptista, Benjaminsen et al. 2012, Helskyaho, Ohisalo et al. 2018, Benjaminsen 2017). In addition to national counts and surveys some countries, such as Denmark, Slovenia and Ireland, also have national databases on the number of people using shelters for the homeless (Busch-Geertsema, Benjaminsen et al. 2014). The statistics on the number of homeless can therefore vary greatly, not only due to real differences in the prevalence of homelessness but also, to a large extent, due to varying definitions of homelessness and methods used to obtain the data. It is therefore very difficult, if not impossible, to reliably calculate and compare the prevalence of homelessness in different countries (Busch-Geertsema, Benjaminsen et al. 2014).

Keeping in mind the difficulties related to counting and comparing the number of homeless described above, the latest OECD report on homelessness, based on data from 2016, reports that at any given time between 0.004% in Japan (6235 persons) and 0.94% in New Zealand (41207 persons) are homeless, with prevalence numbers in most countries between 0.03 and 0.22% of the population (OECD Affordable Housing Database 2017). The high reported figure from New Zealand is explained by the broad definition of homelessness used, which also includes persons living in uninhabitable housing (Statistics New Zealand 2014).

While exact figures on how many persons live in a state of homelessness are currently impossible to present, certain demographic characteristics seem to be true in most settings. For example, the majority of the homeless are men. The exact proportion of men and women vary from country to country, again depending on the definition of homelessness, sampling method and probably also on the composition of homeless populations. Therefore, not many conclusions can be drawn nor relevant comparisons made from these figures. National reports from 2017 in the USA and Sweden, for instance, report that 61% and 62%, respectively, are men, while the equivalent reports from Denmark and Finland state that 75% and 77% of the homeless population are men (Socialstyrelsen 2017, Henry, Watt et al. 2017, Benjaminsen 2017, Helskyaho, Ohisalo et al. 2018).

There is evidence suggesting that women are less likely to stay in emergency shelters or sleep rough, and that women therefore are under-represented in statistics that are based largely on data from service users. There is evidence that there exists a larger hidden homelessness among women staying with acquaintances and friends, whom current services do not reach, possibly explaining part of the difference in prevalence rates between the genders (May, Cloke et al. 2007, Baptista 2010, Pleace, Bretherton et al. 2016, Pleace 2016).

Most countries, including Finland, do not gather the exact age of the homeless population, but data is presented on age group level. The countries that do gather such data, such as Sweden, report an average age for the homeless that is similar to the average age of the general population: 41 years

for men and 39 years for women (Socialstyrelsen 2017). Studies on homeless shelter populations show an average age of 40 years for men and 37 years for women at first contact in Denmark (Nielsen, Hjorthoj et al. 2011) and 36 years for men in Toronto (Hwang 2000). The homeless population in the USA seems to be ageing (Culhane, Metraux et al. 2010) while the mean age for the homeless has gone down in Sweden (Socialstyrelsen 2017), and the number of homeless aged under 25 years has risen dramatically in Finland and Denmark during the last decade (Benjaminsen 2017, Helskyaho, Ohisalo et al. 2018).

Among the homeless population, persons with an immigrant background, aboriginal groups and in the USA, African Americans, are over-represented (Belanger, Awosoga 2013, Socialstyrelsen 2017, Henry, Watt et al. 2017, Helskyaho, Ohisalo et al. 2018). In Sweden, 43% of all homeless were born outside the country and in Finland 26% of all homeless were classified as immigrants, though a large percentage of the undocumented immigrant population is not included in the Finnish statistics, and thus the percentage in Finland would probably be larger if this group was included in the statistics (Helskyaho, Ohisalo et al. 2018).

## 2.4 SUPPORTIVE HOUSING AND THE HOUSING FIRST MODEL

The traditional approach to housing homeless people in high-income countries can be described as linear or staircase shaped. In this approach homeless people are expected to ascend from sleeping on the streets to regular housing via emergency shelters, category housing (i.e. houses for specific categories, such as homeless male alcoholics), training flats and transitional flats, as they show more 'housing readiness' and their behaviour becomes more 'normal' (Sahlin 2005, Gulcur, Stefancic et al. 2003). This approach is founded on a 'treatment first' philosophy which assumes that sobriety and/or psychiatric stability are necessary preconditions for independent living. The linear Continuum of Care model in the USA and the staircase model applied in, for instance, Sweden have been criticized for their high attrition rates and for making little allowance for the complex realities of many individuals' lives, especially the often 'haphazard' (non-linear) process of recovery from addiction or mental illness (Hurlburt, Wood et al. 1996). The staircase model also includes strong elements of surveillance and social control over the homeless and previously homeless people, where the previously homeless are expected to conform with social norms and be motivated to remain sober in order to 'deserve' housing. The model has therefore been described as rather exclusive and unforgiving (Fitzpatrick 2013b).

In the last two decades several countries have introduced housing programmes following 'Housing First' principles, where permanent

supportive housing is offered to highly vulnerable homeless individuals without requiring sobriety or treatment compliance from the clients (Busch-Geertsema 2014, Aubry, Tsemberis et al. 2015, Kertesz, Austin et al. 2017). The Housing First concept was developed in New York (by the organization Pathways to Housing) and targeted the homeless with severe mental illness and a history of substance abuse (Tsemberis, Eisenberg 2001, Tsemberis 2010). In short, Housing First provides immediate or near immediate rehousing without any requirement that participants show themselves to be 'housing ready' before they are housed. Medical and social support is provided to clients in their own home, and use of that support is something over which clients have considerable choice and control.

Housing First has been proven an efficient way of reducing homelessness and emergency room visit costs and possible hospitalization costs for the homeless with severe mental illness and a history of substance abuse (Rog, Marshall et al. 2014, Aubry, Nelson et al. 2015, Ly, Latimer 2015). Evidence on whether the overall costs are reduced remain contradictory, and whether the model also works for the homeless without severe mental illness is also still unclear (Culhane 2008, Kertesz, Crouch et al. 2009, Ly, Latimer 2015). Moreover, the model has been criticised for simplifying the problem of homelessness and not addressing broader health and well-being outcomes, for instance, substance abuse (Stanhope, Dunn 2011, Kertesz, Crouch et al. 2009).

There has also been discussion on the relative lack of fidelity to the original Housing First model in the versions of Housing First that have been introduced in Europe. A certain dilution of the original concept can be seen as services call themselves Housing First, but do not offer the extent of support originally included in the model, something that risks lessening its effectiveness and raises further questions on the efficacy of model in the European context (Watson, Orwat et al. 2013, Pleace, Bretherton 2013). Despite the criticism of the Housing First model described above, the model has gained political popularity and has been introduced in many European countries in different versions, including Finland.

## 2.5 HOMELESSNESS IN FINLAND

Finnish society can be described as a social democratic welfare state, where all residents have the legal right to basic income support if they have no other income or wealth, and where the public sector is responsible for offering affordable healthcare for all. The Finnish constitution also includes a subjective right to housing, described in Section 19 as the right to accommodation (housing) if life or health is in danger without arranged accommodation (Helenelund 2008).

In Finland, as in most other high-income countries, the homeless population and service network have undergone large changes during the

past decades. The rapid urbanization and structural transformation in post-Second World War society resulted in a rather large homeless population between 1950-1970 (Taipale 1982, Tainio, Fredriksson 2009). During these decades homelessness was largely associated with alcoholism and unemployment, and an extensive basic shelter network was developed, mainly by faith-based and other charitable organisations, in response to the need to accommodate the homeless (Tainio, Fredriksson 2009). The amount of beds in temporary accommodations in Helsinki grew from around 1500 in the years after the war to over 4000 in the early 1970's (Taipale 1982). This shelter network has then, after the 1970's, gradually been replaced by other housing solutions, and by 2008 there were 558 shelter beds remaining in Helsinki and only 100 beds by 2017 (Tainio, Fredriksson 2009, Helskyaho, Ohisalo et al. 2018).

Official statistics on the number of homeless, gathered annually by ARA, show a significant decrease in the number of homeless from over 18000 homeless in 1987, when the first estimate was made, to 7112 in 2017 (Figure 1). Out of the 7112 reported homeless in Finland, the great majority were living with acquaintances or relatives and only a total of 415 persons lived outside or in shelters. The number of the long-term homeless was 1893 (Helskyaho, Ohisalo et al. 2018).
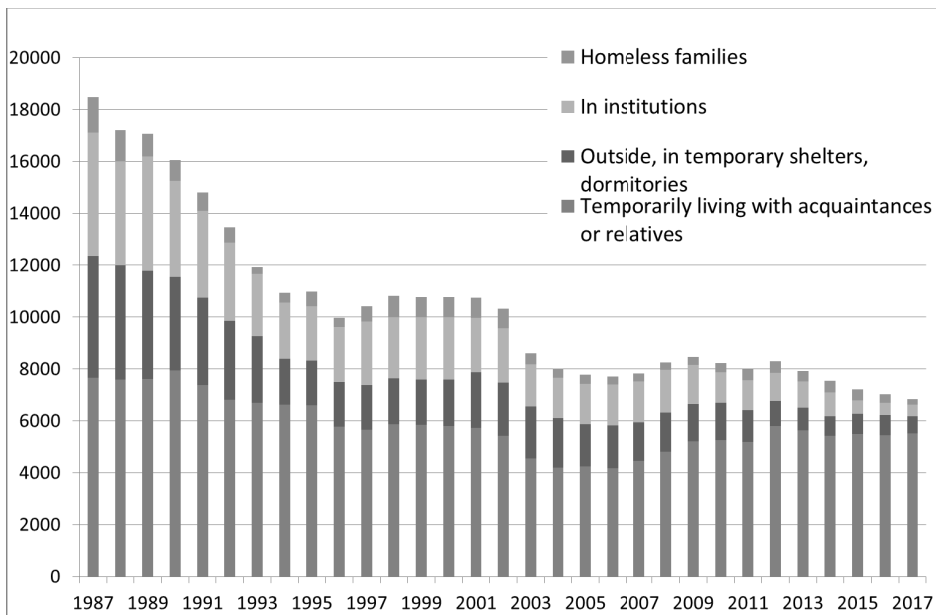


Source: ARA

**Figure 1**     The number of homeless in Finland 1987-2017.

The Finnish statistics are cross-sectional estimates representing the number of homeless each November. The figures are gathered separately in each municipality by the local authorities using different sources of information and varying methods and are then compiled by ARA. Thus, despite their apparent preciseness they are estimates and the exactness can be questioned (Pitkänen 2010). The statistics, however, show that Finland is among the few countries in Europe that has managed to reduce homelessness in recent years, largely due to successful national strategies described below (Pleace, Culhane et al. 2015, Pleace 2017).

The elimination of homelessness became a government objective in Finland for the first time in 1987-1991. During this time period services for the homeless became a core part of the municipalities' services and more supported housing services were developed (Tainio, Fredriksson 2009). In addition to the supported housing services developed and produced by the municipalities themselves, the municipalities and other organizations joined to form a foundation (the Y Foundation) which acquired decentralized flats for the municipalities to relet to those in need of homes.

### 2.5.1  THE FINNISH VERSION OF HOUSING FIRST

The development of the Finnish Housing First model started in parallel and independent of the American model in the late 1990's when the first housing units that did not require sobriety were established (Tainio, Fredriksson 2009, Kaakinen 2013). The new services targeted those who were difficult to house in the then present housing services that required sobriety, and as the new services were developed, the treatment philosophy shifted towards housing-led solutions.

As the decline in the number of homeless stopped in the middle of the first decade of the new millennium, an expert group was appointed and in 2007 their report concluded that the "easy" part of homelessness was solved. However, those who were still homeless had significant social and health problems and therefore, in addition to housing, they also needed extensive support (Kaakinen, Haapanen et al. 2007). Following this report, programmes to reduce and eliminate long-term homelessness (PAAVO I 2008-2011, and PAAVO II 2012-2015) were introduced (Sunikka, Nousiainen 2009, Pleace, Culhane et al. 2015). With large investment and cooperation programmes, shelter type accommodation was reduced and replaced with housing units and scattered housing following Housing First principles. The effect of the programmes was significant: over 2500 new apartments in scattered housing and housing units were constructed and acquired, and 350 persons employed to provide support to the previously homeless. The number of long-term homeless was reduced by 1200 persons between 2008 and 2014 (Pleace, Culhane et al. 2015).

The Finnish Housing First version differs from the US model in several ways and has been criticized for its low fidelity to the US model (Kettunen

2013, Pleace, Culhane et al. 2015). Firstly, the Finnish model, especially during the PAAVO I programme between 2008-2011, produced mainly communal housing of grouped flats in one building as opposed to scattered housing in the USA model. Secondly, the model did not include mobile multiprofessional support teams, which meant that while a certain amount of social support was usually provided in the housing units, the previously homeless had to rely on the local health services for their medical treatment (Pleace, Culhane et al. 2015). Thirdly, the focus of the PAAVO programmes in Finland was on all long-term homeless, independent of the presence of a possible severe mental illness or not, while the Housing First services in the USA have mainly targeted the homeless with severe mental illness and a possible history of SUD, which leads to a different selection of clients (Kaakinen 2013, Pleace, Knutagård et al. 2016).

There has been limited research on the cost effectiveness or health outcomes of the Finnish Housing First version. A study comparing costs, before and after moving to a Housing First unit, among 39 previously homeless showed an increase in costs among those with SUD and a decrease in costs for persons with severe mental illness who moved into supported housing (Sillanpää 2013). However, the low number of persons who consented to participate in this study (20% in the SUD group and 35% in the severe mental illness group) affected the representativeness of the results. Conversely, a similar study on 15 persons with long-term homelessness and alcohol problems who moved into a Housing First unit in the city of Tampere showed a decrease in costs (Ministry of Environment 2011). The possible health effects related to Housing First have not been studied in Finland. One survey of 483 persons in Housing First units showed that subjective well-being was relatively good, but direct health outcomes were not assessed (Kainulainen, Saari et al. 2013).

## 2.6 PREVIOUS RESEARCH ON HOMELESSNESS AND HEALTH IN FINLAND

The homelessness research field in Finland, as in the rest of Europe, has been dominated by academics with a background in social policy, whereas psychology and medicine have dominated the North American research on homelessness (Busch-Geertsema, Edgar et al. 2010). This situation has led to quantitative methods dominating in the USA and qualitative research in Europe. There are therefore only few European studies that have followed homeless populations over time looking at health outcomes among the European homeless. To my knowledge, there are no recent Finnish studies on the health situation of homeless populations. In fact, one has to go as far back as the early 1970's to the studies of Mäkelä and Murto in Tampere, and Taipale at the beginning of the 1980's to find studies on the health of the homeless in Finland (Mäkelä 1978, Murto 1978, Taipale 1982). In the

research by Mäkelä and Murto on homeless alcoholics in Tampere at the beginning of the 1970's, 202 homeless and unemployed men with alcohol problems were examined and interviewed, it was found that many of the homeless suffered from somatic diseases as well as conditions related to alcohol problems. Taipale, for his part, described the situation of the homeless in Helsinki and reviewed the literature on homelessness, alcoholism and service structures for the homeless from a historical perspective during the period 1937-1977. Taipale's research, as well as the mostly qualitative research on homelessness conducted in Finland, has produced relevant knowledge on the effects of social and health policies on homelessness and the experiences of homeless persons. Since this current study focuses on health outcomes, the previously conducted research on homelessness from Finland, which is not directly linked to health outcomes, is not systematically covered in the literature review. The recent Finnish studies on housing pathways among the homeless are covered in Chapter 3.2.

# 3   REVIEW OF THE LITERATURE

Despite the varying definitions of homelessness and life situations that homeless persons find themselves in, this literature review, and consequently this study, has as its premise that being without a home is a state that is comparable across high-income countries. When reviewing the literature, it became clear that the varying definitions of homelessness and methods used in the studies make direct comparisons difficult or even impossible between studies. The process has, however, helped to specify my own research questions and given more understanding of to how to interpret the results. The literature shows that many of the problems that the homeless face are similar across countries, thus supporting the premise that homeless populations in different high-income countries face similar challenges which are at least theoretically comparable.

The literature review covers quantitative studies examining housing outcomes, morbidity, mortality and healthcare service use of homeless populations. I have focused on studies published in the last three decades and included studies published in English and Finnish. For reasons of comparability to the Finnish context, I included in the review literature from Western high-income countries and excluded studies conducted in Asia, South America and Africa.

## 3.1   CAUSES AND RISK FACTORS FOR HOMELESSNESS

There are structural factors in both society and welfare systems as well as individual factors that cause homelessness (Busch-Geertsema, Edgar et al. 2010). Access to affordable housing, employment opportunities and income support are important structural factors that can prevent homelessness (Burt, Aron et al. 2001). As an example of the importance of structural factors that prevent homelessness, a comparison of policies in seven countries showed that countries with more policies to reduce economic inequalities also have smaller rates of homelessness (Shinn 2007). When these structural factors are not in place, individuals with vulnerabilities are at a higher risk of becoming homeless.

Several, mostly American, studies have identified the following individual factors associated with homelessness: early childhood adversities; poverty; SUD and other mental health problems; personal history of violence and previous incarceration (Shelton, Taylor et al. 2009, Greenberg, Rosenheck 2010, Roos, Mota et al. 2013, Thompson, Wall et al. 2013). In people under the age of 25, poor family relationships, school adjustment problems, multiple runaway episodes, non-traditional family structures, lower

educational attainment, experiences of victimization, non-heterosexual sexual identity as well as having been a client in foster care are risk factors for homelessness (van den Bree, Shelton et al. 2009, Corliss, Goodenow et al. 2011, Dworsky, Napolitano et al. 2013, Sznajder-Murray, Jang et al. 2015). In one study from the USA permissive parenting style and being Hispanic was shown to be a protective factor (Sznajder-Murray, Jang et al. 2015).

Factors associated with becoming homeless have also been examined in relation to risk populations such as the vulnerably housed, adolescents at risk of becoming homeless, mental health patients, drug users and other groups (Folsom, Hawthorne et al. 2005, Kemp, Neale et al. 2006, Bearsley-Smith, Bond et al. 2008, Benjaminsen 2016, To, Palepu et al. 2016). Benjaminsen et al. studied the risk of shelter use in the whole Danish population and found significantly higher risk amongst immigrants, individuals with low income, those unemployed, with low education, mental illness, drug or alcohol abuse or with a previous imprisonment (Benjaminsen 2016). However, while psychiatric morbidity increases the risk of homelessness, this study also shows that only a minority, even in high-risk groups, such as drug abusers and people with a dual diagnosis where SUD co-occurs with another mental illness, are likely to become shelter users.

## 3.2 THE PROGNOSIS OF HOMELESSNESS IN TERMS OF HOUSING

In Chapter 2.2 I described the results from cluster analyses on shelter populations that have shown that most of the persons staying in shelter are there only briefly and then move on, either because they find housing or they prefer sleeping rough, enter healthcare or correctional institutions or move in with relatives or acquaintances. Attempts have been made to describe the exits from homelessness. Due to the complex problem and dynamic state of homelessness it is rarely a straightforward 'recovery' into independent housing, making it difficult to define an unambiguous exit from homelessness. Tracing homeless people for follow-up studies can also be a tedious and difficult task and there are, therefore, only a few longer follow-up studies on homeless people and the dropout rate in these studies has typically been high. Hence, little is known about the long-term prognosis in terms of housing, and the prognosis is likely to vary greatly depending on the study setup, housing market and welfare structures in the particular setting.

Smaller studies have shown that repeated homelessness is common and that many homeless people require different levels of support after being housed. A three-year follow-up study from Munich, Germany, managed to reach 185 out of 247 alive after three years for follow-up interviews and found that out of the previously homeless, 29% had a privately rented apartment, 24% still lived on the streets or in emergency shelters and 39% in different types of rehabilitation or housing services (Fichter, Quadflieg

2005). A Swedish five-year follow-up study of 82 homeless men with mental illness found that after five years only six out of the 61 men still alive and living in Sweden were no longer homeless, and 75% were still homeless or living in temporary institutions or shelters (Beijer, Andreasson et al. 2007). Caton et al. traced and re-interviewed 42 out of 58 originally included individuals at 18 months after entering a community-based housing programme and found that 44% of them had at some point returned to the homeless shelters (Caton, Wyatt et al. 1993).

A few Finnish studies have examined housing pathways on different homeless samples, arriving at very different results depending on which homeless sample was chosen. This illustrates the complexity of homelessness and the different situations the different subgroups of homeless live in, especially when it comes to finding housing on the free rental market. First, Sunikka followed a cohort of 107 shelter users for 2.1 years and found that 12% remained homeless during the whole study period and 80% moved to some form of supported housing, though out of them more than 25% lost it again before the end of the study period (Sunikka 2016). This study also showed that very few of the shelter users got a rental contract on the free market. Second, Niemi and Ahola followed the housing pathways and transitions of young persons (aged 19-27) registered as homeless in Helsinki and receiving income support. They found that out of 719 young persons, the majority made the transition out of income support and only 44 (6%) moved into supported housing, compared to 80% of the shelter population in Sunikka's study (Niemi, Ahola 2017).

Kostiainen and Laakso examined the housing pathways of the 6000 persons registered as having no permanent place of residence in the population register in Helsinki, using register data and questionnaires (Kostiainen, Laakso 2013, Kostiainen, Laakso 2015). They found that for the majority the homelessness periods were brief: lasting less than one year, and that the homelessness period was shorter among women and young persons compared with the duration of homelessness of men and older persons.

### 3.2.1   FACTORS PREDICTING EXITING HOMELESSNESS

American and Australian studies have looked at predicting factors of exiting homelessness, defined as being stably housed after 1-3 years of follow-up. These studies have identified younger age, female gender, having income, being employed, having a larger social network and family support, not having a SUD, having lower rates of acute care, no previous arrests and having access to subsidized housing as being associated with exiting homelessness (Brown, Miao et al. 2015, Zlotnick, Tam et al. 2003, Caton, Dominguez et al. 2005, Johnson, Scutella et al. 2015, Aubry, Duhoux et al. 2016). An 18-month follow-up study that focused upon physical and mental illness, as well as healthcare service use, found higher rates of ill health and service use among those who remained homeless compared to those who had

housing, although the differences did not reach the level of statistical significance (Schanzer, Dominguez et al. 2007). These previous studies have all used exiting homelessness as an outcome, and not assessed the type of housing or possible support included in the housing service.

## 3.3  MORBIDITY OF HOMELESS POPULATIONS

There are several factors contributing to the poor health of homeless persons. Many of the same risk factors that are associated with poor health in the general population are also risk factors for the homeless, such as adverse childhood experiences, poverty, mental illness, lack of family support and unemployment (Caton, Hasin et al. 2000, Lehmann, Drake et al. 2007, Montgomery, Cutuli et al. 2013, Lebrun-Harris, Baggett et al. 2013). Further, being homeless is a challenging life situation where the focus on taking care of one's health competes with several other, and often more urgent, priorities, such as finding shelter, food, a place to wash oneself etc. (Gelberg, Gallagher et al. 1997, Baggett, Singer et al. 2011). Life on the streets or in shelters also means exposure to communicable diseases, lack of sleep, increased risk of trauma and difficulties in complying with treatment, circumstances that all contribute to ill health and a higher risk of morbidity (Beijer, Wolf et al. 2012, Topolovec-Vranic, Ennis et al. 2012, Coe, Moczygemba et al. 2015, Chang, Fisher et al. 2015). In this chapter I will describe the literature on psychiatric morbidity among the homeless, followed by the literature on somatic morbidity and the main somatic diseases that research on morbidity has focused on among the homeless.

### 3.3.1  PSYCHIATRIC MORBIDITY

The prevalence of mental disorders, including SUD, among the homeless has been assessed in several studies and settings with heterogeneous results, depending on sampling methods, screening methods and follow-up times. A systematic literature review from 2008 showed that the most prevalent mental disorders were alcohol dependence (prevalence between 8.1% to 58.1%) and drug dependence (prevalence between 2.8% and 54.2%) (Fazel, Khosla et al. 2008). This review also found that the prevalence of psychotic illness and depression were similar (prevalence between 2.8% and 42.3% for psychotic illness and 0.0% and 40.9% for depression), while the prevalence of psychotic illness in the general population is lower than that of depression. Another important finding in this review was that studies with lower participation rates also reported a lower prevalence of psychosis, suggesting that reasons for non-participation may be related to mental illness, a phenomenon that has also been shown in studies on prevalence in the general population (Lundberg, Damström Thakker et al. 2005, Haapea, Miettunen et al. 2007).

Since the publication of the above-mentioned review some European studies have been published presenting prevalence rates that are at the higher end of those included in the review: a systematic review and meta-analysis covering 11 German studies on the prevalence of psychiatric disorders among the homeless showed a pooled prevalence of any mental illness of 77.4% (95% CI 71.3 to 82.9) (Schreiter, Bermpohl et al. 2017). Consistent with the review by Fazel et al. (Fazel, Khosla et al. 2008), this meta-analysis found that SUD was the most common type of disorder, albeit with a higher pooled prevalence of 60.9% (95% CI 53.1 to 68.5) (Schreiter, Bermpohl et al. 2017). A smaller Irish study found that 70% of the screened homeless population had at some point received a formal diagnosis of a mental health condition (Keogh, O'Brien et al. 2015). Conversely, a recent French study showed clearly lower prevalence rates where only one-third of the homeless had a severe psychiatric disorder, only one in five were alcohol dependent and an even smaller percentage drug dependent (Laporte, Vandentorren et al. 2018). The comparatively low prevalence rates in the French study were probably partly affected by the relatively low response rate (71%), the screening method and the exclusion of non-French speakers in this study. Since studies on psychiatric morbidity in the homeless are usually local, conducted with different methodologies and almost always lacking a control group in the general population, it is very difficult to compare the results and present exact figures. This said, the literature clearly shows that the burden of psychiatric disease is large in homeless populations, and especially so for SUD and psychotic illness.

Knowing that injected drug use is a risk factor for many complications and infections associated with drug use, some studies from the USA, UK and Ireland have also examined the extent of injected drug use in homeless populations (Cheung, Hanson et al. 2002, Klinkenberg, Caslyn et al. 2003, Sherriff, Mayon-White 2003, Lambert, Murtagh et al. 2019). The results show that a significant proportion of the homeless (between 35% and 57%) reported having ever injected drugs, and around a fifth of the respondents in these studies reported having shared needles in the past.

The prevalence of psychiatric disorders among the homeless in Scandinavia has also been examined using hospital discharge registers. A large Danish study from 2011 examined the presence of lifetime registered psychiatric diagnoses in the discharge registers from 32711 homeless people, and showed that 62.4% of the men and 58.2% of the women had a registered psychiatric disorder (Nielsen, Hjorthoj et al. 2011). Also, in this study the most frequently presenting diagnosis was SUD (49% of the men and 37% of the women) (Nielsen, Hjorthoj et al. 2011). Similar prevalence figures for psychiatric disorders were found in the Swedish study by Beijer et al. where the hospital discharge registers of 1704 homeless persons were analysed between 1996 and 2002, showing that 52% of women and 46% of men had a mental disorder, compared with 3% and 4%, respectively, among controls (Beijer, Andreasson 2010).

There are also several studies showing that psychiatric comorbidity and especially dual diagnosis are common in homeless populations (Nielsen, Hjorthoj et al. 2011, Hodgson, Shelton et al. 2013, Bharel, Lin et al. 2013). For example, Bharel et al. found that 48% of individuals using healthcare services for the homeless had a co-occuring mental illness and SUD (Bharel, Lin et al. 2013). Comparing the findings in the study by Bharel et al. with those found in the study by Nielsen et al., that probably largely due to very different methodology and with a stricter definition of dual diagnosis in the study by Nielsen et al. (schizophrenia spectrum disorder combined with SUD), the prevalence of dual diagnosis among the homeless was found to be much lower in Nielsen's study with 10.9% among men and 7.3% among women (Nielsen, Hjorthoj et al. 2011, Bharel, Lin et al. 2013).

While psychiatric morbidity is more prevalent in homeless populations than in the general population, little can be said about the causality as most studies are cross-sectional (Hodgson, Shelton et al. 2013). Some longitudinal studies have explored the relationship between homelessness and psychopathology, and findings suggest that psychiatric morbidity is a risk factor for homelessness and that a significant proportion of those discharged from psychiatric hospitals experience homelessness in the coming years (Embry, Vander Stoep et al. 2000, Shelton, Taylor et al. 2009). It has also been shown that being homeless worsens already existing psychiatric morbidity (Martijn, Sharpe 2006).

### 3.3.2 SOMATIC MORBIDITY

Somatic morbidity has been studied from different perspectives in many settings, usually focusing on a specific disease or group of diseases in a particular group of homeless persons. The population samples have typically been gathered in health services for the homeless, shelters or among hospital or emergency department (ED) users.

Three Scandinavian studies have examined the risk of somatic morbidity among the homeless compared to the general population using hospital discharge registers (Beijer, Andréasson 2009, Beijer, Bruce et al. 2016, Benjaminsen, Birkelund 2018). Beijer et al. showed in 2009 and 2016 that homeless men and women using shelters in Stockholm had an increased risk of hospitalization for many diseases, such as infectious diseases, liver disease, respiratory disease, dermatological conditions and injuries, compared to the general population. Benjaminsen and Birkelund examined the excess morbidity of 14730 homeless shelter users in Denmark using hospital discharge registers, and the increased risks for hospitalization in the different disease groups were very similar to those in the Swedish studies. However, the Danish study also showed that after adjusting for socioeconomic factors and psychiatric disease, the risks for hospitalization were significantly reduced and concluded that 80% of the excess morbidity among the homeless was attributable to risk factors other than homelessness

(Benjaminsen, Birkelund 2018). This study showed that especially SUD and lack of employment can explain a large part of the excess morbidity. Keeping this in mind, the fact remains that morbidity is high among the homeless. In this chapter the literature on morbidity of the homeless by disease groups are presented, focusing on the disease groups most extensively studied in homeless populations.

### 3.3.2.1 Communicable diseases

The prevalence of several infectious diseases is elevated among the homeless (Raoult, Foucault et al. 2001). This can be explained by the challenges related to hygiene, exposure to communicable diseases and the relatively prevalent use of intravenous drugs, factors that increase the risk of skin infections, Hepatitis C virus (HCV) and Human immunodeficiency virus (HIV) infections, as well as septicaemia (Wiessing, Ferri et al. 2014, Tavitian-Exley, Vickerman et al. 2015, Larney, Peacock et al. 2017). Dermatological infections are common among the homeless, as are pulmonary infections including tuberculosis (Raoult, Foucault et al. 2001). A systematic review on the prevalence of tuberculosis, HCV and HIV in homeless populations reported great heterogeneity between the studies with a prevalence between 0.2% to 7.7% for tuberculosis, 3.9% to 36.2% for HCV infection and 0.3% to 21% for HIV infection (Beijer, Wolf et al. 2012). A recent study in the USA comparing prevalence rates of HIV, HCV and HBV (Hepatitis B virus) among the homeless and non-homeless veterans found significantly higher prevalence rates in the homeless group (Noska, Belperio et al. 2017).

### 3.3.2.2 Cardiovascular morbidity

Homeless persons have an increased risk of cardiovascular morbidity and mortality (Baggett, Liauw et al. 2018). Several studies have shown that many of the risk factors for cardiovascular disease, such as hypertension, high cholesterol and diabetes, seem to be equally prevalent compared with other low-income populations, but these risk factors are often poorly controlled in the homeless samples (Lee, Hanlon et al. 2005, Schanzer, Dominguez et al. 2007, Kim, Daskalakis et al. 2008, Bernstein, Meurer et al. 2015). For example, the self-reported prevalence of diabetes among the homeless in Toronto, Canada, was 7%, but in 43% of cases the diabetic patient had poor glycaemic control as defined by a HbA1c level above 8.4% (Lee, Hanlon et al. 2005). Homeless persons also have an increased risk of cardiovascular disease due to the very high rates of smoking and use of alcohol and stimulants leading to increased risks of atherosclerosis, cardiomyopathy and cardiac arrests (Awtry, Philippides 2010, Tsai, Rosenheck 2012, Lee, Hanlon et al. 2005).

### 3.3.2.3  Geriatric syndromes and frailty among the homeless

As the USA homeless population has become older, frailty and geriatric syndromes among the homeless have become an area of interest among researchers (Brown, Kiely et al. 2013b). There is evidence that older homeless adults are more likely to have frailty, depression, visual impairment and urinary incontinence, compared with the general population (Brown, Kiely et al. 2012). Falls are common among the older homeless, contributing to the high prevalence of traumas. In a study on homeless women over 40 years of age, 43.8% reported having fallen in the past three months, and another study of the homeless over 50 years reported that 53% had fallen in the past year (Salem, Ma-Pham et al. 2018, Brown, Kiely et al. 2012). The homeless are also hospitalized at a younger age for many conditions and although these homeless are chronologically younger than geriatric patients, the constellation of health and functional problems of older homeless adults resemble those of geriatric persons in the general population (Gelberg, Linn et al. 1990, Adams, Rosenheck et al. 2007, Ní Cheallaigh, Cullivan et al. 2017). Several factors, such as low educational attainment, SUD, poor nutrition, diabetes and arthritis, are associated with an increased number of geriatric syndromes among the homeless (Brown, Kiely et al. 2013b, Salem, Nyamathi et al. 2014).

### 3.3.2.4  Other somatic diseases of interest in studies on the homeless

In addition to the conditions described above, there have also been some studies on pulmonary disease, dermatological disease and alcohol-related somatic diseases among the homeless.

A French study found that 50% of the homeless in shelters had pulmonary manifestations, with chronic bronchitis being the most common, followed by acute bronchitis and chronic obstructive pulmonary disease (COPD) (Badiaga, Richet et al. 2009). A smaller study in San Francisco reported a high prevalence of obstructive lung disease and underdiagnosis of these conditions among the homeless (Snyder, Eisner 2004).

Dermatological conditions, such as infestation of body lice, bacterial infections and tinea pedis are common in homeless populations, due to difficulties with both hygiene and the commonly presenting SUD (Badiaga, Menard et al. 2005). An association between homelessness and allergies and skin problems has also been shown in a cross-sectional survey (Shiue 2014b).

A German study including 102 homeless found that one in four had alcoholic liver disease and equally as many polyneuropathy (Salize, Dillmann-Lange et al. 2002). Having been homeless in the past has also been shown to be associated with increased odds of self-reported liver problems (Shiue 2014a). Correspondingly, chronic liver disease has been found to be over-represented as a cause of death among the homeless (Hwang 2000, Hwang, Wilkins et al. 2009, Roncarati, Baggett et al. 2018).

### 3.3.2.5   Comorbidity

Apart from the many diseases being prevalent among the homeless, a significant comorbidity has also been reported. Psychiatric morbidity often co-occurs with physical medical complaints (Salize, Dillmann-Lange et al. 2002, Schanzer, Dominguez et al. 2007). The total disease burden and somatic comorbidity is also high, with many homeless reporting several chronic conditions (Garibaldi, Conde-Martel et al. 2005, Bharel, Lin et al. 2013). The methods used to define somatic comorbidity have varied between studies, from self-reported medical disease and physical examination by physicians, to standardized scores such as Medical Outcomes Study 36-Item Short Form Health Survey and Diagnostic Cost Groups (Ware Jr, Sherbourne 1992, Pope, Kautter et al. 2004).

### 3.3.2.6   Injuries and assaults

Traumas and injuries are a common cause for morbidity and ED visits among the homeless (Mackelprang, Graves et al. 2014). Few studies have examined the rates of injuries, but rather compared reasons for visits between homeless and non-homeless patients seeking care (Fazel, Geddes et al. 2014). Most typically, injury-related visits to ED by the homeless are due to injuries to the lower extremities and burns (Mackelprang, Graves et al. 2014). However, traumatic brain injuries are also relatively common and have been shown to be associated with increased mortality, cognitive impairment, somatic complaints and mood disorders among the homeless (McMillan, Laurie et al. 2015, Schmitt, Thornton et al. 2017). A systematic review that examined eight studies on traumatic brain injuries among the homeless showed prevalence rates between 8% and 53% (Topolovec-Vranic, Ennis et al. 2012). Two studies examining self-reported traumatic brain injuries showed that in most cases the first traumatic brain injury precedes homelessness (Hwang, Colantonio et al. 2008, Oddy, Moir et al. 2012).

Life on the streets increases the risk of sexual and physical assault, and studies from the USA and Australia have shown that between 27% and 52% of the homeless experienced physical or sexual assault during the previous year (Kushel, Evans et al. 2003, Larney, Conroy et al. 2009, Meinbresse, Brinkley-Rubinstein et al. 2014). Women and transgender persons, as well as the homeless with mental illness, sex workers and persons who had been homeless for a longer time are at the greatest risk of violence (Meinbresse, Brinkley-Rubinstein et al. 2014, Kushel, Evans et al. 2003).

Injuries and victimization among the homeless are more common among the homeless with SUD, and victimization is also associated with psychotic illness and depression among the homeless (Hammig, Jozkowski et al. 2014, Larney, Conroy et al. 2009).

## 3.4  MORTALITY OF HOMELESS POPULATIONS

Homeless persons, like other socially excluded and marginalized groups such as prisoners and sex workers, have a high risk of death (Aldridge, Story et al. 2018). In this chapter I will describe the literature on the overall mortality, followed by a review on the identified risk factors of mortality among the homeless and finally the causes of death in homeless populations.

### 3.4.1  OVERALL MORTALITY AMONG THE HOMELESS

Mortality rates for the homeless compared with the general population have been estimated to be between 2.0 and 9.8, depending on the setting and method used (Table 2).

These studies are of varying quality and use different methods, making it difficult to draw strong conclusions or make comparisons between countries. Looking at the mortality rates, lower figures are reported from North America and Australia (between 2.0 and 3.8) and slightly higher mortality rates (between 2.8 and 6.7) from Western Europe. An exception to this is the recent study by Roncarati et al. from Boston, USA, where even higher mortality rates were found (Standardized Mortality Ratio, SMR 9.8), but in this study the sample was the unsheltered homeless who were in contact with healthcare services for the homeless in 2000, and thus not directly comparable to other studies which have typically sampled the homeless from shelters (Roncarati, Baggett et al. 2018).

Four studies report higher mortality for homeless women than men (Barrow, Herman et al. 1999, Babidge, Buhrich et al. 2001, Nielsen, Hjorthoj et al. 2011, Nusselder, Slockers et al. 2013), and one study reports opposite findings with higher mortality rates for men, though the difference between the genders in this study was not statistically significant (Beijer, Andreasson et al. 2011). A literature review from 2004 found no significant difference in the mortality between homeless men and women in younger age groups, but a slightly higher mortality for men compared to women in older age groups (Cheung, Hwang 2004).

Several studies have shown that excess mortality is higher in younger age groups compared to older (Hibbs, Benner et al. 1994, Hwang 2000, Cheung, Hwang 2004, Roy, Haley et al. 2004, Baggett, Hwang et al. 2013, Nusselder, Slockers et al. 2013, Feodor Nilsson, Laursen et al. 2018), while some studies have shown no excess mortality among the homeless over the age of 55 or 65 years (Hibbs, Benner et al. 1994, Nordentoft, Wandall-Holm 2003, Baggett, Hwang et al. 2013).

**Table 2.** Studies on overall mortality in adult homeless cohorts compared with the general population.

| Publication | Setting | Sample description | Comparison group | Total homeless, N (Men %) | Homeless deaths, N | Time period | Follow-up time in years, Max (mean) | Method of estimation | Mortality rate (SMR, or HR) |
|---|---|---|---|---|---|---|---|---|---|
| Hibbs, Benner et al. 1994 | Philadelphia, USA | Homeless using shelter and mental health services | The general population in Philadelphia, data from 1987 census | 6308 (63) | 97 | 1985-1988 | 4 (1.2) | Age, gender and race standardized comparison with the general population (SMR) | 3.5 |
| Barrow, Herman et al. 1999 | New York City, USA | Single adult shelter residents in New York City | The general population of New York City | 1260 (75) | 161 | 1987-1994 | 7.3 (n/r[1]) | Age and gender standardized comparison with the general population (SMR) | 2.2 (men) 3.7 (women) |
| Babidge, Buhrich et al. 2001 | Sydney, Australia | Homeless who were referred to a psychiatric clinic | The general population of New South Wales | 708 (95) | 83 | 1988-1998 | 11 (n/r[1])[2] | – " – | 3.1 (men) 3.8 (women) |
| Nordentoft, Wandall-Holm 2003 | Copenhagen, Denmark | All homeless staying in one shelter during 1991 | The general population in Copenhagen | 579 (88) | 141 | 1991-2002 | 11.5 (n/r[1]) | – " – | 3.8 |
| Fichter, Quadflieg 2005 | Munich, Germany | A representative sample of homeless men sleeping on the streets or using shelters | The general population of Germany, expected numbers of deaths between 1995-1998 | 265 (100) | 18 | 1995-1999 | 3.3 (n/r[1]) | – " – | 4.4 |
| Beijer, Andreasson et al. 2007 | Stockholm, Sweden | Homeless men contacted by outreach teams | The general population, expected numbers of deaths 1996-1992 | 82 (100) | 16 | 1995-2001 | 6 (n/r[1]) | – " – | 4.7 |
| Hwang, Wilkins et al. 2009 | Canada | Homeless in shelters and hostels over age 25 years and enumerated in Canadian census mortality study | 15% of the Canadian population that partook in the 1991 Canadian census mortality follow-up study | 15100 (70) | 3280 | 1991-2001 | 10.5 (n/r[1]) [3] | Age standardised mortality rates compared with the total general population in the study (SMR) | 2.0 |

(Continues)

[1] n/r = not reported, [2] Median follow-up period 9.5 years, [3] total person years at risk among the homeless 97 690

**Table 2**    Continued

| Publication | Setting | Sample description | Comparison group | Total home-less, N (Men %) | Home-less deaths, N | Time period | Follow-up time in years, Max (mean) | Method of estimation | Mortality rate (SMR, HR of RR) |
|---|---|---|---|---|---|---|---|---|---|
| Morrison 2009) | Glasgow, Scotland | All homeless presenting to Glasgow City Council in year 2000 | A matched random sample of the local non-homeless population in Glasgow (N=12451) | 6323 (65) | 457 | 2000-2005 | 5.8 (5.1) | HR (Cox proportional hazards model) | 4.5 |
| Beijer, Andreasson et al. 2011 | Stockholm, Sweden | Homeless with contacts to homeless social services and hostels | The general population in Stockholm County | 2283 (77) | 421 | 1995-2005 | 10 (n/r)[1][2] | Age standardized comparisons with the general population (SMR) | 2.8 |
| Nielsen, Hjorthoj et al. 2011 | Denmark | All homeless shelter users | The general population in Denmark | 32711 (70) | 4790 | 1999-2009 | 11 (5.9) | Age and gender standardized comparison with the general population (SMR) | 5.6 (men) 6.7 (women) |
| Nusselder, Slockers et al. 2013 | Rotterdam, Netherlands | All persons in the population register who had used services for homeless in 2001 | The general population in Rotterdam | 2096 (88) | 265 | 2001-2010 | 9.5 (8.4) | RR (Poisson regression model) | 3.5 |
| Feodor Nilsson, Laursen et al. 2018 | Denmark | All shelter users in Denmark aged 15 years and older | The Danish adult population (5.1 million equalling 51 892 324 person years) | 29058 (70) | 4354 | 2000-2011 | 12 (n/r)[1][3] | Age standardized comparison with the general population (SMR) adjusted for gender | 5.8 |
| Roncarati, Baggett et al. 2018 | Boston, USA | Homeless adults who slept outdoors and were in contact with Boston health care for homeless in year 2000 | The general population in Massachusetts | 445 (72) | 134 | 2000-2009 | 10 (8.2) | Age standardized comparison with the general population (SMR) | 9.8 |

[1] n/r = not reported, [2] total person yeas at risk among the homeless 19 547, [3] total person years at risk among homeless 173 592

The risk of death among the homeless has also been estimated in relation to other disadvantaged populations, and it has been shown that mortality is higher for the homeless compared with persons in the lowest income group, persons in socioeconomically disadvantaged areas and persons with a psychiatric diagnosis (Morrison 2009, Hwang, Wilkins et al. 2009, Feodor Nilsson, Laursen et al. 2018). A study on USA veterans found that homelessness in this group increased the mortality risk with a hazard ratio (HR) of 2.9 (Schinka, Leventhal et al. 2018). Although the exact relationship between the exposure to homelessness and mortality risk is difficult to establish, attempts have been made to show that homelessness is an independent risk factor for death even after adjusting for morbidity and socioeconomic factors (Morrison 2009, Feodor Nilsson, Laursen et al. 2018).

Further, there have been discussions on whether homelessness is associated with mortality as well as comparison with persons with SUD: Beijer et al. studied the mortality risk of the homeless in Stockholm compared with patients treated for SUD, found no significant difference in mortality risk between the two groups and concluded that the excess mortality among the homeless was due to SUD (Beijer, Andreasson et al. 2011). Morrison also found no further risk of mortality when compared to those with an already present alcohol diagnosis in Glasgow, Scotland (Morrison 2009). However, contradicting these findings a recent large Danish study showed that being homeless is associated with increased mortality, even when compared to non-homeless persons with a SUD (Feodor Nilsson, Laursen et al. 2018). They found that while adjustment for psychiatric morbidity decreased the mortality rate ratio (MRR) by 50% among the homeless, the MRR remained high. The differing results can partly be attributable to comparison group used: while the Swedish study compared homeless to non-homeless persons treated in inpatient care for alcohol or drug problems, the Danish study compared mortality among the homeless to that of persons with a SUD diagnosis in hospital discharge registers. It is possible that the severity of SUD and the consequent mortality risk among those treated in inpatient care for alcohol and drug problems is specifically higher than the SUD problem among those with a SUD-related diagnosis in the hospital discharge registers. In hospitals also persons with less severe SUD, that do not require inpatient detoxification, will also be diagnosed, thus explaining the higher mortality among the comparison group in the Swedish study.

Some research has focused on the effect of seasons on mortality among the homeless, since homeless persons are more susceptible to cold weather on the streets. Studies from France and the USA found that homeless deaths were more common during the winter season (Hawke, Davis et al. 2007, Vuillermoz, Aouba et al. 2016). Similarly, Romansczko et al. studied meteorological conditions as a risk for homeless deaths in Poland and found that even moderate cold stress increased mortality of the homeless with a relative risk (RR) of 1.84 (Romaszko, Cymes et al. 2017). A 4-year follow-up

study of mortality among homeless shelter users in Canada found no difference in mortality between seasons, however, in this study the housing status at the time of death was not known (Hwang 2000).


### 3.4.2 RISK FACTORS FOR DEATH AMONG THE HOMELESS

Factors related to both socioeconomic situation and morbidity have been shown to be risk factors for death among the homeless. Identified risk factors are presented in Table 3. Many studies have shown the presence of SUD to be a risk factor for mortality (Hibbs, Benner et al. 1994, Hwang, Lebow et al. 1998, Barrow, Herman et al. 1999, Nordentoft, Wandall-Holm 2003, Roy, Haley et al. 2004, Beijer, Andreasson et al. 2007, Nielsen, Hjorthoj et al. 2011, Beijer, Andreasson et al. 2011, Baggett, Hwang et al. 2013, Baggett, Chang et al. 2015, Schinka, Curtiss et al. 2016, Feodor Nilsson, Laursen et al. 2018). Only one study, that examined predictors of mortality among older homeless veterans in the USA, reported being drug dependent as a protective factor of mortality, while alcohol use in this study was a predictor of mortality (Schinka, Curtiss et al. 2016).

Interestingly, while having a psychiatric disorder is a known risk factor for premature death in the general population (Walker, McGee et al. 2015), some studies have reported that among the homeless having a psychiatric illness other than SUD, or having a schizophrenia spectrum disorder, is associated with lower mortality compared to the homeless on average or the homeless with a SUD (Hwang, Lebow et al. 1998, Barrow, Herman et al. 1999, Nordentoft, Wandall-Holm 2003, Beijer, Andreasson et al. 2007, Nielsen, Hjorthoj et al. 2011). One explanation for this paradoxical result that has been put forward is that it is possible that persons with a psychiatric illness, other than SUD, more frequently come into contact with healthcare providers or spend time in hospitals, both of which may facilitate treatment for chronic disease and prevent premature death (Hwang, Lebow et al. 1998, Nielsen, Hjorthoj et al. 2011). Another explanation might be that there are a lot of underdiagnoses in homeless populations and that the undiagnosed population might include many persons with untreated disease, contributing to the high mortality rates among the undiagnosed homeless (Nielsen, Hjorthoj et al. 2011). Contrary to the results above, a recent large register study from Denmark showed that compared with the homeless with no psychiatric diagnosis, schizophrenia spectrum disorder is associated with increased mortality among the homeless (Feodor Nilsson, Laursen et al. 2018). This study also showed that dual diagnosis is associated with increased risk of death among the homeless.

**Table 3.**        Identified risk factors for death in homeless populations.

| Factors associated with increased mortality | Publications |
| --- | --- |
| SUD | Hibbs, Benner et al. 1994, Hwang, Lebow et al. 1998, Barrow, Herman et al. 1999, Nordentoft, Wandall-Holm 2003, Roy, Haley et al. 2004, Beijer, Andreasson et al. 2007, Nielsen, Hjorthoj et al. 2011, Beijer, Andreasson et al. 2011, Baggett, Hwang et al. 2013, Baggett, Chang et al. 2015, Schinka, Curtiss et al. 2016, Feodor Nilsson, Laursen et al. 2018 |
| Dual diagnosis | Nielsen, Hjorthoj et al. 2011, Feodor Nilsson, Laursen et al. 2018 |
| HIV infection | Hwang, Lebow et al. 1998, Roy, Haley et al. 2004 |
| Serious health issue/several chronic diagnoses | Hwang, Lebow et al. 1998, Schinka, Curtiss et al. 2016 |
| Young Age | Barrow, Herman et al. 1999, Nordentoft, Wandall-Holm 2003, Schinka, Curtiss et al. 2016 |
| White race | Hibbs, Benner et al. 1994, Baggett, Hwang et al. 2013 |
| Immigration from Finland to Sweden | Beijer, Andreasson et al. 2011 |
| Father died before the interviewee was 17 | Nordentoft, Wandall-Holm 2003 |
| Unemployment during the previous three years | Schinka, Curtiss et al. 2016 |
| Previous incarceration | Barrow, Herman et al. 1999 |
| Extended homelessness | Barrow, Herman et al. 1999, Beijer, Andreasson et al. 2007, Metraux, Eng et al. 2011 |
| Repeated and short shelter stays | Nordentoft, Wandall-Holm 2003, Nielsen, Hjorthoj et al. 2011 |
| **Factors associated with decreased mortality** | |
| Psychosis/schizophrenia | Hwang, Lebow et al. 1998, Nordentoft, Wandall-Holm 2003 |
| Psychiatric morbidity other than SUD or dual diagnosis compared with not having any psychiatric diagnosis | Nielsen, Hjorthoj et al. 2011 |
| Having a mental health problem (other than SUD) compared with the whole group | Barrow, Herman et al. 1999 |
| Being drug dependent | Schinka, Curtiss et al. 2016 |
| Having dental problems | Schinka, Curtiss et al. 2016 |
| Having income from employment | Nielsen, Hjorthoj et al. 2011 |
| Immigrant background (other than from Finland to Sweden) | Beijer, Andreasson et al. 2011 |
| Immigrant from low-income county | Nielsen, Hjorthoj et al. 2011 |
| Non-fluency in English | Hwang, Lebow et al. 1998 |
| Being non-white | Schinka, Curtiss et al. 2016 |

Being an immigrant in Europe or black in the USA has been shown to be associated with decreased risk of death among the homeless (Nielsen, Hjorthoj et al. 2011, Beijer, Andreasson et al. 2011, Baggett, Hwang et al. 2013). It has been argued that the homeless with an immigrant background have a lower threshold to homelessness and more often become homeless for reasons other than psychiatric morbidity, such as poverty or discrimination, and thus have fewer health-related problems contributing to a risk of early death (Chiu, Redelmeier et al. 2009, Nielsen, Hjorthoj et al. 2011).

Being unmarried and having low educational attainment are known predictors of mortality in the general population, but the possible effect of these factors on mortality has not been studied among the homeless (Martikainen, Blomgren et al. 2007, Roelfs, Shor et al. 2011b).

Few studies have examined the length of homelessness in relation to mortality risk, as most studies are based on cross-sectional samples followed over time, not knowing the housing status changes of the cohort during the follow-up. There is evidence that extended homelessness prior to baseline is associated with increased mortality (Barrow, Herman et al. 1999, Beijer, Andreasson et al. 2011). Further, the unsheltered homeless have been shown to have a higher mortality than the sheltered homeless (Roncarati, Baggett et al. 2018). Danish studies have also found that repeated and short stays in shelters are associated with increased mortality (Nordentoft, Wandall-Holm 2003, Nielsen, Hjorthoj et al. 2011).

There are, however, two studies that have examined mortality risk during periods of homelessness: 1) a Canadian study found that the mortality risk increased during the shelter periods, though the effect was only small (Hwang 2002). In this same study there was no significant association between the pattern of homelessness in the preceding year (chronic, episodic or transient) and mortality risk. 2) A study from the USA showed that episodic or long-term homelessness was associated with increased mortality and that exits into stable housing decreased mortality (Metraux, Eng et al. 2011). However, as the authors of several of these studies conclude, the causal relationship between homelessness periods and mortality risk are still unclear as there are many unmeasured confounding factors in these studies, and typically homelessness periods are defined as periods in shelters where persons sleeping rough are assumed to be non-homeless.

### 3.4.3 CAUSES OF DEATH

The causes of death in homeless populations have been examined in several studies, showing increased risk of death for several diseases and external causes (Hibbs, Benner et al. 1994, Hwang 2000, Babidge, Buhrich et al. 2001, Nordentoft, Wandall-Holm 2003, Hwang, Wilkins et al. 2009, Beijer, Andreasson et al. 2011, Nielsen, Hjorthoj et al. 2011, Baggett, Hwang et al. 2013, Slockers, Nusselder et al. 2018). Since the examined causes of death

vary between studies, with different groupings of diagnoses, direct comparisons of the reported risks are difficult to make between studies.

Focusing on death from diseases and medical conditions, a study on causes of death among homeless in Stockholm with a total relative risk of death of 3.1, reported relative risk of death from cardiovascular diseases of 2.6 (95% CI 2.1 to 3.2), from respiratory disease 5.4 (95% CI 4.3 to 9.0) and from digestive disease 6.3 (95% CI 4.3 to 9.0), compared to the general population (Beijer, Andreasson et al. 2011). Likewise, a Canadian study with a total mortality rate ratio of 2.01 (95% CI 1.92 to 2.09) for shelter users compared to the general population reported similar relationships, albeit lower rates, between the mortality rate ratios for different causes of death (Hwang, Wilkins et al. 2009). Here, too, digestive diseases had the highest MRR of 3.07 (95% CI 2.58 to 3.65) among diseases and medical conditions. A recent Dutch study on the homeless in Rotterdam reported higher mortality rates in all disease groups. In this study the highest reported SMRs were found for infectious disease (SMR 10.0, 95% CI 5.2 to 17.5) and for digestive diseases (SMR 6.6, 95% CI 4.0 to 10.4).

The reported rates for death by external causes are generally higher compared to the mortality rates for diseases and medical conditions, and high mortality rates have been reported for poisoning, suicide, homicide and accident (Hwang 2000, Babidge, Buhrich et al. 2001, Nordentoft, Wandall-Holm 2003, Hwang, Wilkins et al. 2009, Beijer, Andreasson et al. 2011, Baggett, Hwang et al. 2013, Slockers, Nusselder et al. 2018). Mortality rates for death by poisoning are especially high, though with great variation, ranging from 5.5 in a Swedish study to 40.2 in a Dutch study (Beijer, Andreasson et al. 2011, Slockers, Nusselder et al. 2018). Feodor Nilsson et al. looked at predictors of death by unintentional injuries, including poisonings, and reported that schizophrenia, having a psychiatric contact, personality disorder and alcohol and drug use disorders are all predictors of death by unintentional injuries among homeless men (Feodor Nilsson, Hjorthoj et al. 2014). A later study showed that death by external causes is particularly strongly associated with dual diagnosis among homeless women. For external causes, women with a history of homelessness and dual diagnosis had a MRR of 107.00 (95% CI 79.15 to 144.64), compared to non-homeless persons without any psychiatric diagnosis (Feodor Nilsson, Laursen et al. 2018).

## 3.5 HEALTHCARE SERVICE USE OF HOMELESS POPULATIONS

The high morbidity described in homeless populations, combined with the aforementioned competing priorities and in many countries difficulties in accessing primary healthcare lead to high rates of emergency healthcare use and hospitalization (Fazel, Geddes et al. 2014). The homeless often have

unmet medical care needs, and many barriers to care on different levels have been described, such as emotional, geographic, financial and structural barriers (Lester, Bradley 2001, Lebrun-Harris, Baggett et al. 2013, Campbell, O'Neill et al. 2015). These factors combined with lower adherence to medication and outpatient treatment lead to high rates of acute and inpatient care (Kidder, Wolitski et al. 2007). The studies on healthcare service use among the homeless have mostly been conducted in the USA and Canada, with only a few studies from the UK and one smaller study from Belgium (Victor, Connelly et al. 1989, Verlinde, Verdee et al. 2010, Ní Cheallaigh, Cullivan et al. 2017). In this chapter I will describe the literature on healthcare service use by level of care followed by a review on the literature on the effect of housing on healthcare service use among the homeless.


### 3.5.1  HOSPITAL SERVICE USE

High hospitalization rates among the homeless compared to the general population have been reported in the USA and Canadian homeless populations (Bharel, Lin et al. 2013, Hwang, Chambers et al. 2013). Hwang et al. compared the healthcare utilization of 1165 homeless using shelter and meal services in Toronto, Canada, to a matched control group and found that the homeless had rate ratios of 8.48 (95% CI 6.72 to 10.70) for medical/surgical hospitalizations and 9.27 (95% CI 4.42 to 19.43) for psychiatric hospitalizations, with an average of 0.2 medical/surgical hospitalizations and 0.1 psychiatric hospitalizations per person year (Hwang, Chambers et al. 2013). Bharel et al. looked at healthcare use among the homeless using healthcare services for the homeless and found that in this group of homeless the average number of hospitalizations was 1.0 annually (standard deviation ±2.4) (Bharel, Lin et al. 2013).

The length of stay is longer and costs are higher for hospital admissions among the homeless, compared with non-homeless hospitalized patients (Salit, Kuhn et al. 1998, Hwang, Weaver et al. 2011). The study of Salit et al. showed that many of the hospitalizations were related to SUD and other psychiatric diseases, but also hospitalizations due to diseases of the respiratory system and HIV infections were more common among the homeless.

Several factors have been shown to be associated with hospitalization and length of stay among the homeless, such as older age, white race, psychiatric morbidity, chronic medical problems, tobacco and alcohol use, having a primary care provider and using their services and having health insurance (Wenzel, Bakhtiar et al. 1995, Kushel, Vittinghoff et al. 2001, Chambers, Katic et al. 2013, Brown, Kiely et al. 2013a, Russolillo, Moniruzzaman et al. 2016). Being non-Latino African American and being accompanied by a partner or having dependent children have been shown to be factors associated with a lower number of hospitalizations (Kushel, Vittinghoff et al. 2001, Chambers, Katic et al. 2013b). Homeless persons also have many

readmissions to hospital after discharge and evidence suggests that homelessness is an independent risk factor for hospital readmission (Buck, Brown et al. 2012, Mackelprang, Qiu et al. 2015, Saab, Nisenbaum et al. 2016, Titan, Graham et al. 2018, Kushel 2018). Being discharged to the streets or shelter versus other living situations is associated with increased odds of hospital readmission among the homeless (Doran, Ragins et al. 2013).

### 3.5.2   EMERGENCY DEPARTMENT SERVICE USE

Studies on the use of EDs in homeless populations have been conducted primarily in North America, showing annual numbers of visits between 2.0 and 6.0 (Table 4). The samples had been gathered from EDs, hospitals, health services for the homeless or meal programmes and shelters, and their generalizability to the total homeless population can be questioned. In only one study was a comparison made with the general population, and here the relative risk of ED visit for the homeless was 8.48 (95% CI 6.72 to 10.70) (Hwang, Chambers et al. 2013).

European studies examining ED use in homeless cohorts are lacking. An Irish study looked at the number of homeless among persons in EDs and found that in comparison with housed individuals in the hospital catchment area, homeless individuals had higher rates of ED attendance (0.16 attendances per person/annum vs 3.0 attendances per person/annum, respectively) (Ní Cheallaigh, Cullivan et al. 2017). However, in this study the annual rates were calculated by comparing the total number of visits made by persons registered as homeless to the hospital with the estimated total homeless population sleeping rough in shelters in the catchment area, rather than by following a cohort of homeless, a method that may include a significant margin of error. The study by Ní Cheallaigh et al. also showed that the rate of leaving ED before assessment was higher in homeless individuals and that the homeless patients were younger than the housed patients.

The use of EDs is unevenly divided within the homeless population and a small proportion of them are responsible for the majority of visits (Kushel, Perry et al. 2002, Chambers, Chiu et al. 2013, Hwang, Chambers et al. 2013, Fazel, Geddes et al. 2014, Raven, Tieu et al. 2017). For instance, the top ten per cent of the homeless in the study by Hwang et al. was responsible for more than 60% of all ED encounters, with a mean rate of 12.1 visits per person year (Hwang, Chambers et al. 2013). Victimization, arrests, HCV infection, chronic medical conditions and mental disorders, especially SUD, have been shown to be associated with frequent use of EDs (Kushel, Perry et al. 2002, Lebrun-Harris, Baggett et al. 2013, Bharel, Lin et al. 2013, Thakarar, Morgan et al. 2015).

**Table 4.**  Studies reporting emergency department (ED) use in homeless cohorts.

| Publication | Setting | Sample description | Exclusion criteria | Total N | Time period | Follow-up time, years | ED data source | ED visits/ person year | % of homeless with at least 1 ED visit |
|---|---|---|---|---|---|---|---|---|---|
| D'Amore, Hung et al. 2001 | New York City, USA | All homeless presenting at ED during a 8-week period, who gave their consent | No consent given, critically ill, injured, or incapacitated patients, or patients <21 years of age | 252 | 1999 | n/a[1] | Self-reported ED use in the past | 6.0 | 100% |
| Kessell, Bhatia et al. 2006 | San Francisco, USA | Homeless applicants to supportive housing, followed two years prior to application and two years after they received housing, here is included the use prior intervention | Not reported | 249 | 1997-1999 | 2 | The Community Health Network records covering one ED in San Francisco | 2.15 | 71% |
| Sadowski, Kee et al. 2009 | Chicago, USA | Homeless aged over 18 years with chronic illness in hospitals referred by social worker to a RCT[2] offering supportive housing, here reported results for the usual care group | No consent given, referred <24 hours before hospital discharge, non-fluent in English or Spanish, being the guardian of minor children, no chronic medical illness, incapable of self-care | 205 | 2003-2007 | 1,5 | Medical records from two hospitals and based on hospital use reported in interviews records from 66 other hospitals | 5.7 (during 18 months) | not reported |
| Bharel, Lin et al. 2013 | Boston, USA | Homeless presenting at a primary healthcare clinic for the homeless with Medicaid | Those who did not have Medicaid (approximately 20%) | 6494 | 2010 | 1 | MassHealth eligibility, claims, and encounter data from 2010 | 4.0 | 69% |
| Hwang, Chambers et al. 2013 | Toronto, Canada | A representative cohort of homeless adults from shelter and meal programmes in Toronto | Non-fluent in English, no consent given, persons without a provincial health insurance number | 1165 | 2005-2009 | 3.9 | National Ambulatory Care Reporting System, including all visits to hospital EDs | 2.0 | 76.7% |

[1]n/a = not applicable, [2]RCT= Randomized controlled trial

Due to difficulties accessing primary care it has been argued that the homeless in many settings seek ED care for their primary healthcare needs (Little, Watson 1996, O'Toole, Gibbon et al. 1999a, White, Newman 2015). While it is undoubtably true that the many barriers to care that homeless experience lead to inadequate primary care, studies on the service delivery and estimated benefit of care for the homeless in EDs are similar to that of non-homeless patients (Pearson, Bruggman et al. 2007, Feral-Pierssens, Aubry et al. 2016). This can be explained by the high morbidity in homeless populations, and the competing priorities and stigma, leading to many seeking treatment late when the condition is already severe and requiring acute treatment.

Research on why the homeless seek ED services is scarce. One study that compared the characteristics of ED visits between the younger and older homeless to the ED found that the most common discharge diagnosis was SUD, followed by injuries and other psychiatric diagnoses (Brown, Steinman 2013). A similar pattern was found in a study comparing homeless and non-homeless patients in the ED. The most common diagnoses that homeless patients presented with were: laceration (14%); alcohol intoxication (9%); contusion, haematoma or abrasion (8%); alcohol withdrawal (8%) and fracture, dislocation or subluxation (6%), again showing the large part that SUD and trauma play in reasons for visits among the homeless (Pearson, Bruggman et al. 2007).

### 3.5.3 PRIMARY HEALTHCARE SERVICE USE

As shown above, studies quantifying the use of hospital and ED services by homeless populations are few, especially in the European context, and many struggle with methodological challenges. When it comes to studies aiming at quantifying the use of primary healthcare services in homeless populations, the studies are even fewer, and this also holds true in the North American context.

Two register-based studies examined the use of ambulatory or primary healthcare services and found increased use in homeless populations. In Canada the use of ambulatory services among the homeless was associated with a RR of 1.76 (95% CI 1.58 to 1.96) compared with low-income controls, and a Belgian study reported higher risks for seeking primary healthcare services among the homeless compared to the general population (OR 3.6, 95% CI 2.2 to 6.1) (Verlinde, Verdee et al. 2010, Hwang, Chambers et al. 2013). While Hwang et al. found increased use of ambulatory services in Canada, a previous study focusing specifically on the provision of primary care found that less than half of the homeless in Canada reported having a family doctor, and that the chances of having a family doctor decreased with every year of homelessness (Khandor, Mason et al. 2011).

The US studies on homelessness and primary healthcare services have mostly focused on describing care experiences and barriers to care, and few

have tried to quantify the use of primary healthcare services or assessed the reasons for seeking care (Gelberg, Gallagher et al. 1997, Wright, Tompkins 2006, Jego, Abcaya et al. 2018). One study from Baltimore compared the self-reported use of ambulatory services among 51 homeless to that of 1338 non-homeless persons, and found that homeless persons used less ambulatory services than the general population (Fischer, Shapiro et al. 1986). A study examining the use of ambulatory services among HIV patients with alcohol problems found that among those homeless the use of ambulatory care did not differ from those non-homeless, as opposed to the use of ED and hospital services which was higher in the homeless cohort than among the non-homeless (Kim, Kertesz et al. 2006). It has been speculated that in healthcare systems with no universal access to healthcare (such as in the USA), the homeless are less likely to receive primary healthcare, while this trend would be reversed in systems with universal healthcare, however, more studies are needed to confirm this speculation (Fazel, Geddes et al. 2014).

As a response to the identified barriers to primary care described in many settings, several cities have developed primary care practices with services that specifically target the homeless. There is suggestive evidence that these might be more efficient in reaching the homeless and in reducing the number of inappropriate ED visits and hospitalizations (Hwang, Bugeja 2000, Wright, Tompkins 2006, McGuire, Gelberg et al. 2009, O'Toole, Buckel et al. 2010, Kertesz, Holt et al. 2013, O'Toole, Johnson et al. 2016).

### 3.5.4   SUD TREATMENT USE

Barriers to care have been described not only in primary healthcare but also for treatment for SUD in homeless populations (Wenzel, Audrey Burnam et al. 2001, Canavan, Barry et al. 2012, Upshur, Jenkins et al. 2018). There exists, however, very little data on the amount of SUD treatment that the homeless use. To my knowledge, there appear to be no studies comparing the use of SUD treatment in homeless populations with that of the general population. Some studies have looked at the use of SUD treatment in specific homeless populations. For instance, a study on 326 homeless persons with alcohol or drug use disorders in Houston, USA, reported that only 5.6% had made any outpatient visits during the previous year and 27.5% had received residential or inpatient treatment for SUD (Wenzel, Audrey Burnam et al. 2001). Another, more recent study from the US on homeless women reported that over 60% of women with both alcohol and drug use disorders used some type of SUD service, while 52% with a drug only disorder and 44% with an alcohol only disorder used services (Upshur, Jenkins et al. 2018).

Some studies have looked at the number of homeless in SUD treatment. For instance, a Scottish study showed that 36% of persons entering drug treatment were homeless (Kemp, Neale et al. 2006). A Finnish survey that counts all intoxicant-related cases has reported that 11% of patients in SUD

treatment services are currently homeless, showing that the homeless also represent a significant group in Finnish SUD treatment, although it is not known how big a proportion of the homeless access SUD treatment in Finland (Kuussaari, Kaukonen et al. 2014).

Considering that homeless populations constitute a group with multimorbidity and social exclusion, they are likely to be in need of harm reduction initiatives. There is little data on the number of clients in opiate substitution treatment who are homeless, but an Irish survey reported that in 2014, 7% of clients in substitution treatment were registered as homeless (Glynn, Lynn et al. 2017). Homelessness has also been found to be associated with discontinuation of methadone maintenance therapy (Lo, Kerr et al. 2018). An Australian study reported that homelessness is also common among persons using needle exchange programmes: 19% of clients in needle exchange programmes were currently homeless and 77% had been homeless in the past (Topp, Iversen et al. 2013). Further, unstable housing or homelessness has been found to be a risk factor for injection risk behaviour in US syringe exchange programmes, showing the vulnerability and high-risk behaviour among homeless drug users and the need for harm reduction initiatives that the homeless can easily access (Des Jarlais, Braine et al. 2007).

### 3.5.5 THE RELATIONSHIP BETWEEN HOUSING AND HEALTHCARE SERVICE USE AMONG THE HOMELESS

Previous studies on healthcare service use have typically measured homelessness at one point, not knowing the duration of homelessness in the past nor during the follow-up (Padgett, Struening et al. 1995, Han, Wells 2003, Ku, Scott et al. 2010, Beijer, Andreasson 2010, Hwang, Chambers et al. 2013, Beijer, Bruce et al. 2016). Thus, the relationship between healthcare service use and length of homelessness is not well known. A Canadian study interviewed homeless and vulnerably housed individuals regularly over four years on housing status and ED use and found that residential stability was significantly associated with lower odds of ED utilization within the previous 12 months, but no association was found with lifetime duration of homelessness prior to baseline (Jaworsky, Gadermann et al. 2016). This study, however, did not attempt to quantify the service use.

Several studies have examined the effect of supportive housing on the use of hospital and ED services, with findings suggesting that offering supportive housing reduces the use of these services and costs (Raven, Tieu et al. 2017, Brown, Miao et al. 2015, Kerman, Sylvestre et al. 2018, Moore, Rosenheck 2017, Martinez, Burt 2006, Culhane, Metraux et al. 2002, Sadowski, Kee et al. 2009, Larimer, Malone et al. 2009). However, there are also studies that have not been able to find an association between supportive housing and the use of healthcare services (Schanzer, Dominguez et al. 2007, Kessell, Bhatia et al. 2006).

The type of homelessness might also affect service use: homeless persons who spend their nights primarily in hotels or doubling up with friends or family are less likely to use ED services compared to those living on the streets or in shelters (O'Toole, Gibbon et al. 1999b, Kushel, Perry et al. 2002). Overall, though it is known that chronic homelessness is associated with poor health outcomes, little is known about the relationship between the length of homelessness and healthcare service use (Kertesz, Larson et al. 2005).

## 3.6 SUMMARY OF THE LITERATURE AND GAPS IN KNOWLEDGE

Both structural factors in society and individual factors affect the risk of homelessness and exits into stable housing. Homelessness is often a temporary situation, but studies have also described that in some cases homelessness is repeated or episodic, though only few studies have quantified the proportion of temporarily homeless and repeatedly homeless in longitudinal studies. Previous studies have generally examined exits from homelessness into stable housing, but not looked in detail at the type of housing the previously homeless move into, especially in a longer perspective. Thus, it is not known how many are in need of supported housing and how many live independently, and which factors predict being independently housed.

It is clear that homeless persons have increased morbidity of both medical conditions and particularly psychiatric disorders. Among psychiatric disorders, SUD is the most commonly presenting disorder in homeless populations, but the prevalence of psychoses and dual diagnosis is also high. It remains unclear, however, how the morbidity is related to the housing outcomes in a longer perspective. There is also only limited data on how the morbidity affects healthcare service use, especially the use of primary healthcare.

Mortality in homeless populations is elevated compared to both the mortality in general populations and other disadvantaged populations. Death from external causes is especially common in homeless populations. However, most previous studies have lacked a comparison group in the general population, but rather standardized the mortality in the homeless cohort to the rates reported in general populations within age bands. The use of a comparison group improves the precision of risk estimates above standardization, particularly in populations with high mortality. Further, using a comparison group makes it possible to account for competing risks, which also become relevant in populations with elevated mortality, but is something that has not been done in mortality studies among the homeless.

The possible associations between predictors and mortality are also possible to compare with the general population only in case-controlled setups.

Homeless persons use more healthcare services than the general population. This is true particularly for hospital and ED services in the USA, while data on the use of these services in Europe is largely lacking. Likewise there are no comprehensive studies focusing on the use of SUD treatment among the homeless in either North America or Europe. Furhter, there is a big gap in knowledge on the use of primary healthcare services among homeless or reasons for visiting primary healthcare in any setting. While it has been shown that the use of hospital and ED services is high in homeless populations, previous studies quantifying healthcare service use in representative samples of the homeless have classified participants as homeless at baseline only and not looked at how health service utilization is affected by the duration of homelessness during the follow-up.

The quantitative research on homelessness struggles with challenges related to the poor statistics and registers on the homeless, as well as varying definitions of homelessness, making it difficult to present reliable data on the prevalence of homelessness and make comparisons between countries. Also, many studies struggle with accurate linkage to healthcare registers. Since there are rarely good public registers in most countries, apart from the Nordic countries, the samples are usually drawn from shelters or meal services or from healthcare service providers, either targeted healthcare services for the homeless or the homeless in EDs or hospitals. Using samples from healthcare services biases the selection towards the homeless, who already have health problems, and does not include the possibly healthy homeless population and might therefore show too poor health outcomes. Many studies also lack comparison groups in the general population, making it difficult to compare the morbidity and healthcare service use of the homeless with the the the general population.

As comprehensive register data on the homeless is rarely present, several of the studies are interview-based, and as such they exclude those in the sample that do not give consent, and in follow-up studies tracing the cohort is a challenge. Further, the reliability of self-reports can be questioned. Several studies also focus only on certain subgroups of the homeless population, such as veterans, homeless with HIV, the older homeless or the homeless placed in supportive housing, and again these groups are probably not representative of all the homeless. Also, as mentioned before, almost no studies include data on the duration of homelessness prior to sampling or during the follow-up, making it difficult to draw conclusions of the effect of homelessness on health outcomes.

Overall, when looking at the literature on homelessness and health it is easier to describe what is known than to describe the gaps in knowledge as the gaps are more and wider than the knowledge. The studies on homelessness and health outcomes are few, often small, with several limitations and commonly addressing one particular question related to

homelessness and health, and there remain many aspects and questions that have not been covered in the present literature. More studies are needed to gain more understanding on the health situation of the homeless outside North America, and utilizing the good register data available in the Nordic countries would also provide an excellent opportunity to follow this highly mobile group.

# 4 AIMS OF THE STUDY

The overall aim of the study was to examine the housing situation, morbidity, mortality and healthcare service use of the homeless shelter population in the metropolitan area of Helsinki, Finland.

The specific aims were:
1. To describe the housing situation 10 years after shelter use, and to identify factors associated with being independently housed at the end of follow-up (Study I).
2. To describe the morbidity of the homeless in shelters (Study I and IV).
3. To examine the overall and cause-specific mortality among homeless men and to identify factors associated with overall mortality risk among the homeless (Study II).
4. To estimate the use of hospital and ED services by the homeless compared with a general population control group, and to examine the relationship between the time spent homeless during the follow-up and the use of healthcare services (Study III).
5. To describe reasons for visiting primary healthcare and the prevalence of mental disorders among the homeless, and to estimate the associations between mental disorders and the use of primary healthcare services (Study IV).

# 5 MATERIALS AND METHODS

## 5.1 SUBJECTS AND GENERAL STUDY DESIGN

In this study three cohorts of homeless shelter users in the Helsinki metropolitan area were followed over time. Data from several registers were linked with each other to examine the morbidity, mortality, housing and healthcare service use of the homeless persons who had used shelters. In Studies I-III the same data was also collected for a gender- and age-matched control group, retrieved from the Population Register Centre.

The focus in this study is on shelter populations in walk-in shelters. By focusing on those in emergency shelters, this study aimed at sampling as many of the most disadvantaged groups of homeless as possible. Other temporary accommodation at the time would have required promissory notes from a social worker. The shelters included were all run by the municipalities. At the time of sampling, all shelters were free of charge and they had no sobriety requirements, but use of alcohol or drugs was not allowed on the premises. Upon registration in the shelters, the clients had to give their Personal Identification Codes (PICs) and the registered PICs were used to define the samples. PICs are unique codes given to all persons registered in Finland, and these were used to link the register data. The shelter services were not available for homeless non-residents of the municipalities in the Helsinki metropolitan area, and consequently the migrant homeless population is not represented in this study.

Studies I-III focus on homeless persons staying in night shelters which provide shelter services on a walk-in basis for residents of the City of Helsinki. In 2004, there were about 559 000 inhabitants in the City of Helsinki, rising to about 616 000 by the end of follow-up in 2014. Studies I and II examine the cohort composed of all those staying in the Herttoniemi male shelter during 2004. Herttoniemi shelter was closed in June 2009 and replaced by Hietaniemenkatu shelter. The second cohort (Study III) is composed of all those who stayed in Hietaniemenkatu shelter between September 1st 2009 and September 1st 2010.

In Study IV the shelters in the other municipalities (City of Vantaa and City of Espoo) forming the Helsinki metropolitan area, with a total population of about 1.1 million, were also included. The third cohort is composed of all those who stayed in one of the four shelters operating at the time, during two selected nights (16th of June 2008 and 16th of September 2008).

The samples and follow-up times of the publications are presented in Table 5.

**Table 5.**  Composition of study populations and follow-up times in the original publications.

| Study number | Study sample | Study group (N) | Control group (N) | Baseline year | Follow-up time |
|---|---|---|---|---|---|
| Study I | All homeless men staying in Herttoniemi shelter during 2004, excluding those that moved away from Helsinki during the follow-up | 552 | 946 | 2004 | 10 years |
| Study II | All homeless men staying in Herttoniemi shelter during 2004 | 617 | 1240 | 2004 | 10 years |
| Study III | All the homeless staying in Hietaniemenkatu shelter between September 1st 2009 and September 1st 2010 | 683 | 1316 | 2009-2010 | 4.5 years |
| Study IV | All the homeless staying in one of the four shelters operating in the Helsinki metropolitan area during two selected nights in 2008 | 158 | - | 2008 | 3 years |

## 5.1.1  THE HERTTONIEMI COHORT (STUDIES I-II)

The focus of Study I is on the housing situation at the end of follow-up and the morbidity of the homeless. Study II examines the overall mortality and causes of death among the homeless. The study samples in these studies consist of all men that stayed in Herttoniemi shelter in 2004. During 2004, Herttoniemi shelter was the only male shelter in Helsinki operating on a walk-in basis. The shelter could accommodate a maximum of 75 men each night. The shelter was located in an industrial area in the suburbs and offered very basic services: thin mattresses on the floor without blankets, only one meal of porridge served in the afternoon, sauna once a week and no healthcare personnel in the house. In 2004 the homeless women were accommodated in a shelter operated by a NGO, the register data of which were not accessible, and homeless women are therefore not included in this cohort.

A total of 624 men stayed in Herttoniemi shelter during 2004. The PICs of the study population were retrieved from the shelter register. The register contained data on the total number of nights each person spent in the shelter during each year, but not the exact dates for each person. Thus, study entry was set at July 1st 2004 for everyone (i.e. halfway through the year). A control group consisting of 1248 men matched at a ratio of 2:1 by age and place of domicile was retrieved from the Population Register Centre. Subjects who had emigrated or died before baseline were excluded, as were the control persons who were homeless at baseline (Figure 2). In Study I, where the housing situation 10 years after shelter use was examined, all those who moved away from Helsinki during the follow-up were excluded, since it was only possible track the housing situation of those still residing in Helsinki.

The tracking was done based on the data from the social service and primary healthcare registers, and there was only access to these registers of the City of Helsinki. This resulted in final samples of 552 homeless and 946 controls in Study I and 617 homeless and 1248 controls in Study II.
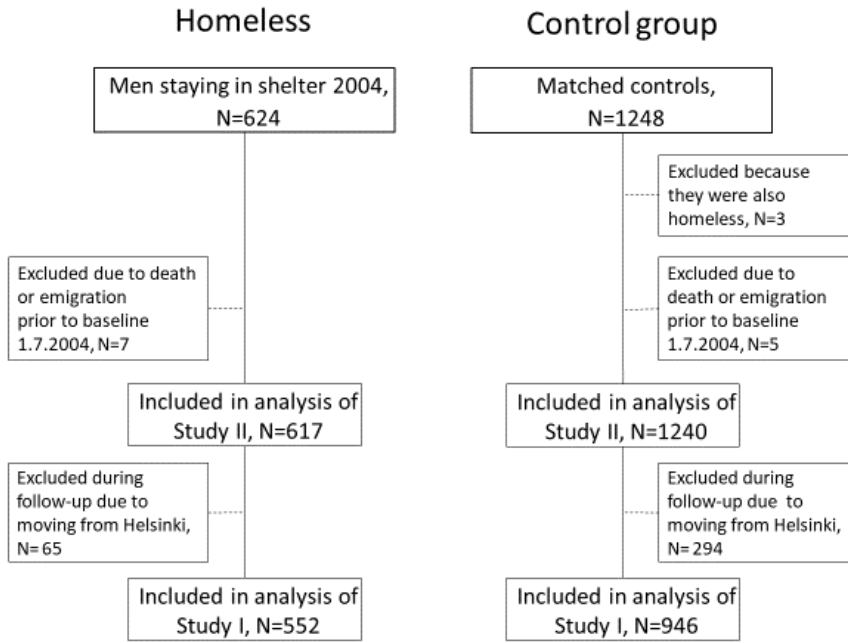


**Figure 2**    Flow chart for the samples of Study I and II.

### 5.1.2 THE HIETANIEMIKATU COHORT (STUDY III)

In June 2009 the Herttoniemi shelter was closed and the emergency shelter services moved to the centrally located facilities in Hietaniemikatu shelter. Compared to Herttoniemi shelter, Hietaniemenkatu shelter has far better services: the emergency shelter has beds rather than thin mattresses on the floor, breakfast is served free of charge and cheap meals are served twice a day. Hietaniemenkatu shelter also has a sauna (open daily) and clean clothes are given out when needed, and has healthcare staff and social workers every weekday. In addition to the emergency shelter with a maximum capacity of 60 persons/night, there are 50 single rooms in temporary accommodation with shared bathrooms which had a fee of 12.60 euros/night in 2009 and 2010. The emergency shelter is free of charge, and the temporary accommodation is paid either by the client him/herself if he/she has enough funds or as part of the income support if the client is eligible to income support.

The aim of Study III was to examine the relationship between time spent homeless and healthcare service use. The study cohort consists of all 826 homeless men and women who stayed in the shelter for at least one night between September 1st 2009 and September 1st 2010. As was the case for Herttoniemi shelter in 2004, in 2009 and 2010 Hietaniemenkatu shelter was the only shelter in Helsinki operating on a walk-in basis, as other temporary accommodations required promissory notes from a social worker.

A control group consisting of 1652 persons matched at a ratio of 2:1 by gender, age and place of domicile was retrieved from the Population Register Centre. As opposed to the register kept in Herttoniemi shelter, the Hietaniemikatu shelter register contained the exact dates for the nights spent in shelter during the inclusion year, thus the start of follow-up was set as the first night spent in shelter during the inclusion year. Follow-up was continued until December 31st 2014, or until death or emigration, whichever came first.

The housing and homelessness situation in the cohort was followed using data from the social service client registers of the City of Helsinki. Because there was only access to the social service client registers for those residing in Helsinki, the 143 homeless (17.3%) and 336 control persons (20.3%) who moved away from Helsinki during follow-up were excluded, resulting in study populations of 683 homeless and 1316 control persons.

### 5.1.3 THE PRIMARY HEALTHCARE STUDY (STUDY IV)

Study IV examines the prevalence of mental disorders among the homeless and the associations between mental disorders and the use of primary healthcare services. The cohort consists of all 158 homeless men and women who stayed in the four shelters operating in the Helsinki metropolitan area during two selected nights (June 16th and September 16th 2008). The four shelters were Herttoniemi shelter (Herttoniemen asuntola)

and Myllypadontien asumisyksikkö in Helsinki, Olarinluoman vastaanottokoti in Espoo and Koisonrannan palvelukeskus in Vantaa. In 45 cases the person stayed in the shelters during the both inclusion nights, and in these cases the latter night was used as the sample date. In this study the data used were from the primary healthcare electronic records of each city. The healthcare records and their textual content were analysed for a period of three years prior to the sample night.

## 5.2 REGISTERS USED

### 5.2.1 THE SOCIAL SERVICE CLIENT REGISTERS (STUDIES I-IV)

The social service client register of the City of Helsinki was used to gather the PICs of the cohort for Studies I-III, and in Study IV, in addition to the register of City of Helsinki, the social service client registers of the Cities of Espoo and Vantaa were also used for this purpose. In Studies I-III information on the number of nights in shelter, housing placement decisions and inpatient detox treatment data were retrieved from the social service client register of the City of Helsinki.

In Study IV the background demographic data were gathered by a social worker from the social service client registers of the Cities of Helsinki, Espoo and Vantaa, but these data were available on a cohort level only and could not be linked to the healthcare service data.

### 5.2.2 POPULATION REGISTER CENTRE (STUDIES I-III)

The PICs of the control groups in Studies I-III were retrieved from the Population Register Centre at a rate of 2:1, matching criteria being gender, place of domicile and being born in the same month. Data on marital status at baseline were also retrieved from this register.

### 5.2.3 CARE REGISTER FOR HEALTHCARE (STUDIES I-III)

The National Care Register for Health Care (HILMO) register contains information on all hospital discharges in Finland, including inpatient and outpatient episodes and diagnoses. The register is kept by the National Institute for Health and Welfare and contains physician given diagnoses registered by the main and contributing diagnosis codes for each contact with specialized healthcare, using the International Classification of Diseases, 10th revision (ICD-10) code for each contact (WHO 2018). Data on healthcare contacts with specialized healthcare prior to baseline (Studies I and II) and during follow-up (Study III) were retrieved from this register. Diagnoses during follow-up were used to assess morbidity in Study I.

### 5.2.4 STATISTICS FINLAND'S REGISTERS (STUDIES I-III)

The registers of Statistics Finland were used for baseline information on socioeconomic status and educational attainment in Studies I-III. Statistics Finland also keeps the Causes of Death Register, which was used for data on time and cause of death. The Causes of Death Register is compiled from death certificates, which in deaths from medical causes are completed by the treating physician and in unclear deaths, or when there exists a possibility of death from external causes, by a physician or medicolegal officer based on medical or forensic autopsy (Ylijoki-Sorensen, Boldsen et al. 2014).

### 5.2.5 PRIMARY HEALTHCARE CLIENT NOTES (STUDIES I AND IV)

In Study I the electronic primary healthcare client notes from the City of Helsinki (Pegasos) were used to complete the information on housing situation at the end of follow-up.

The electronic primary healthcare client notes from the Cities of Helsinki (Pegasos), Espoo (Effica) and Vantaa (Finstar) were the main data sources in Study IV for determining the use of primary healthcare services and the morbidity of the cohort.

## 5.3 OUTCOME VARIABLES

### 5.3.1 HOUSING SITUATION (STUDY I)

The main outcome variable in Study I was housing situation 10 years after shelter use. To define housing status at the end of follow-up in Study I, on the 31st of December 2014, the social service client register and primary healthcare notes of the City of Helsinki were analysed for all the homeless and controls that had any contact with the social services during the follow-up. The categories used to describe the situation at the end of follow-up were: 1) being independently housed; 2) living in supported housing; 3) being homeless and 4) deceased. The supported housing category (2) was further divided into: 2a) nursing homes; 2b) Housing First unit homes and 2c) low-intensity support housing. The third category, low-intensity support housing (2c), includes several very different housing services ranging from abstinent housing services, provided after completed SUD rehabilitation treatment, to supported shared housing, where substance use was allowed. The level of support in this category varied from daily visits by support workers to situations where the only support given was that of guaranteeing a rental contract, but with no other follow-up.

In cases where there was an ongoing placement decision for supportive housing at the end of the follow-up, the corresponding category was noted (183 among the previously homeless and 27 among controls). For those 82 in the previously homeless study group and 47 in the control group who had

had contact with the social services, but did not have an ongoing placement, the client notes in the social client service register were analysed. The housing situation at the end of follow-up was described in the notes in 64 cases in the study group and in 25 of the controls, and again, the corresponding category was noted. In 17 cases in the study group and in 1 case among the controls there was no current reference to the housing situation but an older reference, and in these cases the preceding status was noted. In one case in the study group and in 21 cases among controls there was no reference to housing at all and these men were assumed to be independently housed. The same assumption was made for those 723 men in the control group who did not have any contact with social services during the follow-up.

### 5.3.2   MORBIDITY (STUDIES I AND IV)

In Study I the psychiatric morbidity and somatic comorbidity of the study cohort and controls were defined based on the presence of diagnoses in the Care Register for Health Care during the follow-up. Psychiatric morbidity was defined as the presence of a psychiatric diagnosis (including SUD) as a primary or secondary diagnosis during the 10-year follow-up (ICD-10 codes F10-F69). The prevalence of SUD (F10-19), psychotic disorders (F20-F29) and dual diagnosis (defined as the presence of both SUD and a psychotic disorder) were separately calculated. Somatic comorbidity was estimated using the Charlson Comorbidity Index (CCI). The CCI was originally created to help predict long-term mortality (Charlson, Pompei et al. 1987), and it has been found reliable in predicting mortality and hospitalization (Yurkovich, Avina-Zubieta et al. 2015, Librero, Peiro et al. 1999). The CCI consists of 17 chronic somatic conditions, each with a value of 1 to 6, where less serious conditions are given a score of 1 and the most severe conditions 6.

In Study IV data on morbidity were collected from the electronic primary healthcare patient notes. The presence of a disease was defined as the presence of a diagnosis during the study period (three years) either in the diagnosis field or in the textual documentation. All diagnoses stated were grouped according to the ICD-10 classification system. Only diseases mentioned by physicians were included. To assess the prevalence of SUD, obvious references by physicians to substance use disorders in the patient notes such as "alcoholic" or "problematic drug user" were accepted, but more subtle references, such as "patient smells of alcohol" or "patient denies having problems with alcohol" were not included. Patients who had been in inpatient detox treatment of sobering up units during the study period were also considered as having a SUD. The sample was grouped into persons with: 1) no mental disorder; 2) SUD; 3) mental disorder other than a SUD and 4) dual diagnosis, defined as the presence of both a SUD and other mental disorder.

### 5.3.3 MORTALITY AND CAUSES OF DEATH (STUDY II)

The main outcome variables in Study II were all-cause and cause-specific mortality. To define cause-specific mortality the main cause of death in the Causes of Death Register was used. The causes of death were divided into death by diseases and medical causes, and death by external causes. The causes of death used in the competing risk analysis and their corresponding ICD-10 codes are shown in Table 7 in the result section on page 71. In order to estimate the number of deaths due to alcohol use disorders, all alcohol-related deaths were separately analysed (ICD-10: E244, F10, G312, G621, G721, I426, K292, K700-709, K860, O354, P043, Q860, Y15, X45). This group was not included in the competing risk analysis.

### 5.3.4 TIME SPENT HOMELESS (STUDY III)

For all persons in the study group, the homelessness status at each month of the follow-up (max 62 months) was determined and classified as homeless or not homeless. The definition of being homeless in that month was at least two shelter nights in the emergency shelter or at least seven nights in temporary accommodation during the month in question.

Duration of homelessness was defined as percentage of months spent homeless of the total of follow-up months. Temporarily homeless was defined as being homeless for less than 2% of the follow-up time, representing those who were homeless for the first month only.

### 5.3.5 HOSPITAL SERVICE USE AND ED VISITS (STUDY III)

Using the data on hospital and ED contacts in the Care Register for Health Care, all the days the study and control groups spent in hospital during the follow-up, as well as outpatient visits to hospitals, were counted. The hospital days and outpatient visits were grouped into days in psychiatric wards, days in medical/surgical wards (i.e. all non-psychiatric hospital days), psychiatric outpatient visits and medical/surgical outpatient visits, based on information on the medical specialty in the Care Register for Health Care. Likewise, all registered visits to EDs during the follow-up for both groups were counted.

Treatment for SUD in Finland is organized separately from psychiatric care, traditionally by the social services in the municipalities. In the Helsinki metropolitan region SUD treatment is provided by both the municipalities themselves and third-sector provider, who all use different client registers. Only a small amount of outpatient and inpatient treatment for SUD will be found in the Care Register Health Care. As the SUD treatment is scattered over many different providers and not compiled in one register, gathering comprehensive data on service use is very difficult. Further, the City of Helsinki introduced electronic patient notes for the SUD treatment provided by the municipality as late as 2012. Because of the above-mentioned

challenges, data on the number of visits to SUD clinics is not included in this study.

### 5.3.6 PRIMARY HEALTHCARE USE (STUDY IV)

The municipalities in Finland are responsible for organizing and providing primary healthcare. In addition to primary healthcare centres providing daytime services, most municipalities also have out-of-hours primary healthcare emergency rooms (PHERs). The PHERs typically handle minor medical emergencies that are not likely to require hospitalization, such as minor trauma and less severe infections, treatable by generalists. In the Helsinki metropolitan area there were 43 daytime primary healthcare centres and 6 PHERs operating during 2008. The City of Helsinki also organized psychiatric and internal medicine specialist level outpatient care and hospital services. The diagnostic data from these specialist care services were used to determine the morbidity of the part of the cohort that was registered in Helsinki (N=89), but the reasons for visits to specialized care were not determined.

All visits to primary healthcare during the study period (three years) were counted and grouped according to place of healthcare delivery (i.e. daytime primary healthcare centres and out-of-hours visits to PHERs) and the main reasons for seeking help. Only visits were included where the patient had seen a physician face-to-face: no-shows, phone calls or visits to other healthcare professionals were not included. If the patient had been seen by several physicians it was counted as one visit, except in cases where the patient was transferred from one unit to another, e.g. from primary healthcare centre to PHER, in these cases the visit was counted as two visits.

The reasons for visits were grouped into: 1) mental health and substance use-related problems; 2) traumas; 3) infections; 4) intoxication and convulsions; 5) diseases of the musculoskeletal system; 6) diseases of the gastrointestinal system and 7) other reasons. Visits where the main reason remained unclear and visits to the emergency room primarily because of homelessness were also included in group 7. Initially, a separate group for planned check-ups due to hypertension and diabetes was formed, since these are among the most common reasons for visiting primary healthcare in the general population (Mölläri, Saukkonen et al. 2018). The homeless, however, made altogether only 14 visits for these reasons, representing 1% of all visits, and these visits were grouped in group 7.

## 5.4 COVARIATES

### 5.4.1 SOCIODEMOGRAPHIC FACTORS (STUDIES I-III)

To identify factors predicting being independently housed 10 years after shelter stay (Study I) and overall mortality (Study II), the associations of sociodemographic factors and healthcare use prior to baseline with the main outcome variables were examined. The following sociodemographic factors at baseline were included in the models: age (as a continuous variable); education (higher than the basic level education of 9 years or not); employment (employed/student or not) and marital status (married/living in a registered partnership or not) and the total number of nights in shelter during 2004 (defined as 1–3 nights in shelter or at least four nights, included in the model only in Study I).

### 5.4.2 HEALTHCARE SERVICE USE PRIOR TO BASELINE (STUDIES I AND II)

To examine the effects of previous healthcare contacts on being independently housed 10 years later and on mortality, healthcare contacts six months prior to baseline were also controlled for. The following healthcare contacts were included in the models: ED visits; outpatient visits to specialized healthcare; hospitalizations, and in Study I, also inpatient detox treatments. In Study II, in which the outcome was mortality, the hospitalizations were divided by cause into hospitalization due to psychiatric diagnosis (ICD-10 codes F00-F99), hospitalization due to traumas and injuries (ICD-10 codes S00-T99) and other hospitalizations. All factors except for age were used dichotomously in the negative binomial regression models used in the studies.

### 5.4.3 SOMATIC COMORBIDITY

In Study IV the effect of somatic comorbidity on primary healthcare use was also assessed. To define somatic comorbidity, CCI was calculated based on the diagnoses present in the diagnosis field or as textual documentation by physicians in the primary healthcare patient notes during the study period.

## 5.5 STATISTICAL METHODS

The characteristics of the study populations are presented as means with standard deviations (SD) and counts with percentages. The statistical significance of a difference in categorical variables between the homeless and controls was tested with $\chi^2$ test or Fisher-Freeman-Halton test. Continuous

variables with a normal distribution were analysed with a t-test, or bootstrap t-test (5 000 replications) if the data were highly skewed. If more than two groups were compared, ANOVA was used. For all tests a P value <0.05 was considered significant. When appropriate the normality of the variables was tested using the Shapiro-Wilk W test.

In Studies III and IV the Poisson regression model was tested using goodness-of-fit tests of the models, and the assumptions of overdispersion in Poisson model was tested using the Lagrange multiplier test. Analyses in Studies I-III were performed using STATA 15.0 (StataCorp LP, College Station, TX, USA), and analyses in Study IV were performed using IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, NY, USA).

### 5.5.1   STUDY I

Logistic regression models were used to determine the predictive effects of sociodemographic factors and healthcare use on being independently housed 10 years after shelter stay. Univariate logistic regression models on the homeless study group for all variables were performed separately, as well as multivariate forward stepwise regression models including all variables. In the multivariate forward stepwise model results are shown only for those variables that entered the final model. In all regression models performed, those independently housed at the end of follow-up were compared with all others in the previously homeless group, including those deceased.

### 5.5.2   STUDY II

When assessing mortality among the homeless, time at risk was calculated from the number of days between study entry and date of death, emigration or end of follow-up (31st December 2014), whichever came first. Kaplan-Meier failure function was used for the time to event analysis.

Cox proportional hazards model was used to calculate the overall hazard ratio (HR) for death. To account for competing risks when estimating the sub-hazard ratios (sHR) for risk of death from the different causes of death, the Fine and Gray competing risks proportional hazards model was used (Fine, Gray 1999). The effects of the chosen variables on the HR were calculated using Cox proportional hazards model, this analysis was performed separately for the control group and for the homeless population. The results are presented as HR and sHR with 95% confidence intervals (CIs).

### 5.5.3   STUDY III

The proportion of the study cohort that was homeless each month after inclusion was estimated using generalized estimating equation (GEE) models

with logit link. Due to overdispersion in the highly skewed data on healthcare service use, negative binomial regression model was used to calculate the risk of use of hospital and ED services during follow-up for the study group and controls. Results are shown as incidence rate ratios (IRRs) with 95% CI. Negative binomial regression model was also used to estimate the effect of potential confounding factors on healthcare service use in both groups separately. Three models were formed: Model 1, a crude model; Model 2, adjusted for age and gender and Model 3, further adjusted for baseline employment, marital status and educational attainment.

The use of hospital and ED services by the homeless in relation to the duration of homelessness was calculated using an unadjusted Poisson regression model. Results are presented continuously as hospital days and ED visits per person year over percentage of time spent homeless with 95% CI.

To calculate the IRR for hospital days and ED visits for the 210 persons in the study group who were temporarily homeless (less than 2% of the follow-up time), a separate negative binomial regression model on this group compared with all controls was performed.

### 5.5.4 STUDY IV

Negative binomial regression model was used to estimate the associations between mental disorders and visits to daytime primary healthcare and to out-of-hours PHERs. Three models were examined: Model 1, a crude model; Model 2, adjusted for age and gender and Model 3, further adjusted for somatic comorbidity using CCI. The results are shown as IRRs with 95 % CIs.

## 5.6  ETHICAL CONSIDERATIONS

Ethical approval for Studies I-III was granted by the coordinating ethical committee of the Hospital district of Helsinki and Uusimaa (HUS). The Data Protection Ombudsman approved the study, and research permits from Population Register Centre, Statistics Finland, the City of Helsinki and the National Institute for Health and Welfare were obtained.

For Study IV a separate ethical approval was granted by the coordinating ethical committee of the Hospital district of Helsinki and Uusimaa (HUS), the Ministry of Health approved the study plan, and research permits for Study IV were granted by the Cities of Helsinki, Espoo and Vantaa.

According to Finnish law informed consent from the patients was not needed, as the research data in all studies consisted of aggregated register data, no patients were contacted, and the data were analysed anonymously.

# 6  RESULTS

The baseline characteristics of all three study cohorts are presented in Table 6. The homeless in shelters were mostly men (82% in Study III and 73% in Study IV) and the mean age varied between 46 and 49 years (range 18-90 years). Only few were married or employed, and the educational attainment was generally low among the homeless.

In Study IV the source of income was assessed using the notes in the social service client register for the homeless persons. It was found that 45% of those staying in shelters received pensions or were on sick leave, 28% had social assistance or no income, 15% had earnings related to income allowance, 3% had salaries or earned income and in 9% of the cases the source of income could not be determined.

## 6.1  DURATION OF HOMELESSNESS AND SHELTER STAY (STUDIES I-IV)

The duration of homelessness was assessed in three different ways in the studies. In Study IV the length of homelessness and reasons for homelessness prior to shelter stay were examined using the client notes in the social service register. In Studies I and II, the shelter nights during the baseline year were assessed to estimate the predictive effects of shelter stay on being independently housed 10 years later and on mortality. In Study III the months spent homeless during the 4.5-year follow-up after the shelter stay were calculated.

### 6.1.1  LENGTH OF HOMELESSNESS PRIOR TO SHELTER STAY AND REASONS FOR HOMELESSNESS (STUDY IV)

Of the 158 homeless in the four shelters in Study IV, 38% had been homeless for less than one year, 32% between one and five years and 23% for more than five years. In 7% of the cases the length of homelessness could not be determined. Looking at the reasons for homelessness and evictions stated in the social service client notes, the most common was disturbing lifestyle, which was the reason in 31% of cases. Eviction due to disturbing lifestyle was followed by unpaid rent (19%), divorce or separation (18%), termination of temporary tenancy agreement (8%) and voluntary termination of tenancy contract (5%). The reason for homelessness could not be determined in 30% of the cases.

**Table 6.** Sociodemographic characteristics among the homeless and controls in the four studies.

| | Study I (Herttoniemi cohort) | | | Study II (Herttoniemi cohort) | | | Study III (Hietaniemenkatu cohort) | | | Study IV (primary healthcare cohort) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Homeless (N=552) | Controls (N=946) | p-value | Homeless (N=617) | Controls (N=1240) | p-value | Homeless (N=683) | Controls (N=1316) | p-value | Homeless (N=158) |
| Men, N (%) | 552 (100) | 946 (100) | matching criteria | 617 (100) | 1240 (100) | matching criteria | 566 (83) | 1080 (82) | matching criteria | 116 (73) |
| Age (years), mean (SD) | 49 (11) | 50 (11) | matching criteria | 49 (11) | 49 (11) | matching criteria | 46 (13) | 46 (13) | matching criteria | 47 (13) |
| Married/in registered partnership, N (%) | 26 (5) | 496 (52) | <0.001 | 33 (5) | 649 (52) | <0.001 | 38 (6) | 625 (47) | <0.001 | 13 (8) |
| Education years, mean (SD) | 10.2 (1.8) | 12.7 (3.3) | <0.001 | 10.3 (1.9) | 12.7 (3.3) | <0.001 | 10.2 (1.7) | 12.8 (3.0) | <0.001 | |
| Basic level of education only, N (%) | 354 (64) | 302 (32) | <0.001 | 390 (63) | 379 (31) | <0.001 | 412 (60) | 292 (22) | <0.001 | |
| Employed or studying, N (%) | 28 (5) | 592 (63) | <0.001 | 33 (5) | 824 (66) | <0.001 | 59 (9) | 936 (71) | <0.001 | |

### 6.1.2 NIGHTS IN SHELTER DURING THE BASELINE YEAR (STUDIES I AND II)

The majority (51%) of the persons staying in shelter during the inclusion year of Studies I and II (2004) stayed in the shelter for less than four nights during that year. Of the cohort, 26% stayed between 4 to 10 nights, 12% stayed 31 to 90 nights and 11% stayed over 90 nights.


### 6.1.3 MONTHS SPENT HOMELESS DURING FOLLOW-UP (STUDY III)

The mean duration of homelessness after entering the study was 8.5 months (median being 4 months). Using a GEE model the proportion of the cohort that was homeless in each month of the 62-month follow-up was estimated (Figure 3).

The majority was no longer homeless after the first month, and the proportion declined steadily for the first 24 months, after which the decline stopped and the proportion remained around 7% for the rest of the follow-up. Focusing more closely on the distribution of the homelessness months, it was found that 33% were homeless only during the first month and did not return to the shelter after that. However, 31% of those alive at 24 months still had periods of homelessness after two years. Very few were homeless for the whole period, only eight persons (1.4%) had more than 50 homeless months during the follow-up.
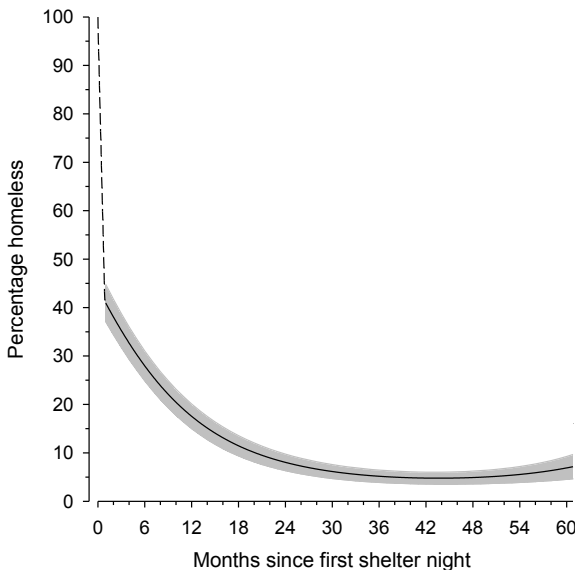


**Figure 3**    The percentage of the 683 homeless that was still or again homeless in each month after start of follow-up, Helsinki, Finland 2009-2014 (Study III).

## 6.2 STATUS AT 10 YEARS AFTER SHELTER USE (STUDIES I AND II)

By analysing the Causes of Death Register, the data in the social service client register and the primary healthcare notes, the situation of the 617 men staying in Herttoniemi shelter and their control group at the end of follow-up was determined. The housing status and percentage deceased are shown in Figure 4. While two-thirds of the control group were independently housed after 10-year follow-up, this was the case for only 6% of the previously homeless. Similarly, the proportion of deceased was high among the homeless, particularly from external causes. Almost half of the study group died during the 10-year follow-up. Of those previously homeless that were still alive at 10 years, the majority stayed in some form of supported housing, and only 4% were homeless at the end of follow-up.

Study group

Control group

| Independently housed 5 % |
| Death by external causes 16% |
| Supported housing 34% |
| Death by medical causes* 31% |
| Moved away from Helsinki 10% |
| Homeless 4% |

Low-intensity support housing 7.5%

Housing First unit 12.5%

Nursing home 13.6%

| Death by external causes 1% |
| Death by medical causes* 10% |
| Moved away from Helsinki 24 % |
| Independently housed 62% |
| Homeless 0.08% |
| Supported housing 3% |

Low-intensity support housing 0.7%

Housing First unit 0.4%

Nursing home 1.5%

*Deaths from unknown cause are included in the group of death by medical causes.

**Figure 4**     Status at 10 years after staying at Herttoniemi shelter (N=617) and that of the age-matched control group (N=1240), Helsinki, Finland, 2004-2014 (Studies I and II ).

### 6.2.1 PREDICTORS OF BEING INDEPENDENTLY HOUSED (STUDY I)

To identify factors predicting being independently housed 10 years after shelter stay, logistic regression analysis on the previously homeless was performed (excluding those who had moved away but including those deceased). In the univariate analysis all factors tested were associated with being independently housed except for age, outpatient visits to hospital and inpatient detoxification treatment. The multivariate analysis showed the strongest associations with being independently housed for being married (OR 8.3, 95% CI 3.0 to 23.2) and staying only briefly in shelter (OR 9.1, 95% CI 2.7 to 30.8), but also for having no emergency room visits (OR 3.6, 95% CI 1.2 to 10.8) and having more than basic-level education (OR 2.3, 95% CI 1.1 to 5.0).

## 6.3 MORBIDITY OF THE HOMELESS STUDY POPULATION (STUDIES I AND IV)

In Study I the 10-year prevalence of psychiatric disorders and chronic somatic disease was assessed using the diagnoses registered in the hospital discharge register. It was found that 78% of the homeless had a psychiatric disorder (ICD-10 codes F10-F69), compared with 16% in the control group. The most prevalent psychiatric disorder was SUD, which had a prevalence of 75%, compared with 8% among controls. Also, psychotic disorders and dual diagnosis were more prevalent in the study group compared with the control group (13% and 12%, respectively, among the homeless, and 2% and 0.5% among the controls). The somatic morbidity, assessed using CCI, was also significantly higher among the homeless compared with controls. The mean CCI in the homeless group was 1.3 (SD 2.0) compared with 0.7 (SD 1.6) in the control group (p<0.001).

In Study IV, patient notes taken by physicians in primary care were analysed over a period of three years and the noted diagnoses were used to determine the morbidity of the homeless. In Study IV it was found that 89% had a diagnosis in the ICD-10 group F (mental and behavioural disorders). Also, here SUD was the most commonly presenting diagnosis, with a 3-year prevalence of 82%. Alcohol use disorders were the most commonly presenting SUD (59% of the study group), followed by drug use disorder (15%) and alcohol use disorder in combination with benzodiazepines (8%). The prevalence rate of psychotic disorders in Study IV was similar (12%) to that in Study I (13%). In Study IV the prevalence rate of mood and anxiety disorders (ICD-10 codes F30-F40) and personality disorders (F60-F69) were also assessed, and these were found to be 20% and 9%, respectively. The definition used for dual diagnosis in Study IV was different from that in

Study I: in Study I dual diagnosis was defined as a psychotic disorder and SUD, while in Study IV the definition for dual diagnosis was SUD and any other mental disorder. The prevalence of dual diagnosis using the method and definition in Study IV was 31%, compared to 12% in Study I.

In Study IV, four mutually exclusive groups were formed based on the prevalence data. Of the study cohort, 11% had no mental disorder, 51% had SUD only, 8% had mental disorders other than SUD and 31% had a dual diagnosis. To estimate the effect of somatic comorbidity on the use of primary healthcare services, the CCI was also assessed in Study IV based on the 3-year prevalence of diagnoses in the primary healthcare records. The mean CCI using this method was 0.46 (SD 1.0), with 28% having a score of 1 or more (range 0-6).

### 6.3.1   MORBIDITY IN RELATION TO HOUSING STATUS (STUDY I)

In Study I the psychiatric morbidity and the CCI were analysed. The prevalence of any psychiatric disorder among the study group was higher than among the controls for those independently housed and those in nursing homes (p<0.001, in both cases). The prevalence of psychiatric morbidity for all end points is presented in Figure 5. The Figure shows that the prevalence of psychiatric disease increased as the level of support in the housing services increased, being highest among those in nursing homes and lowest among the independently housed. The same trend was seen for the CCI.
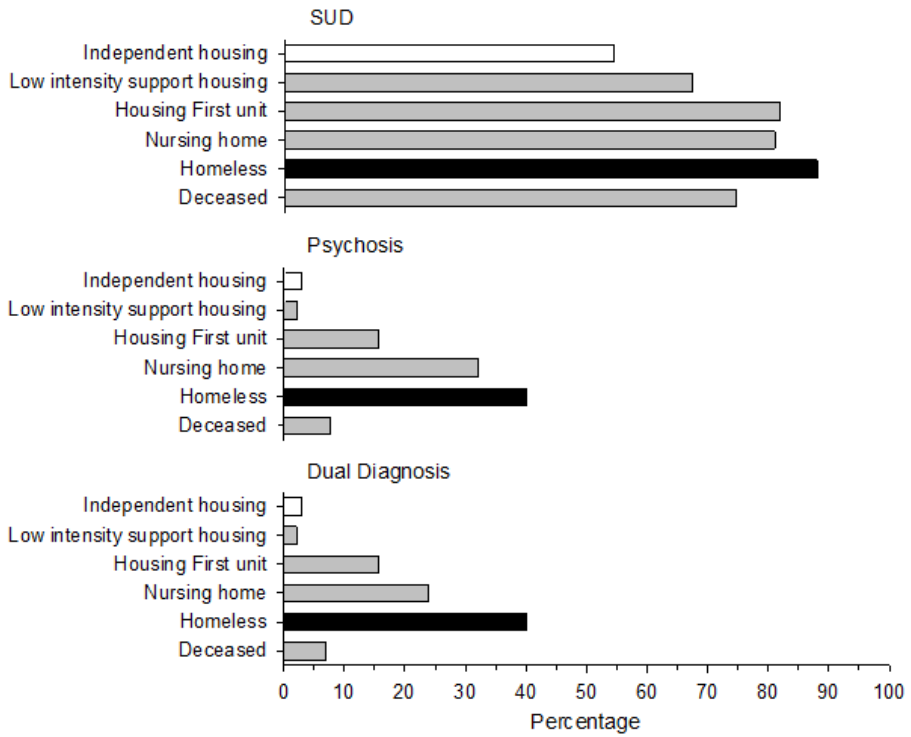
**Figure 5**    The prevalence of psychiatric disease among the study group (N=552) depending on the status at the end of 10-year follow-up, Helsinki, Finland, 2004-2014 (Study I).

## 6.4 MORTALITY AND CAUSES OF DEATH (STUDY II)

In Study II the overall and cause-specific mortality of those staying in Herttoniemi shelter in 2004 was examined. Out of 617 men, 287 (47%) died during the 10-year follow-up, compared with 138 controls (11%). The mean age at death was 56.5 years in the study group and 63.7 years among the controls. There were no significant seasonal differences in time of death in either group (data not shown). The HR of death calculated in the Cox proportional regression model was 5.4 (95% CI 4.4 to 6.6) for all-cause mortality among the homeless persons when compared with the controls (Figure 6).
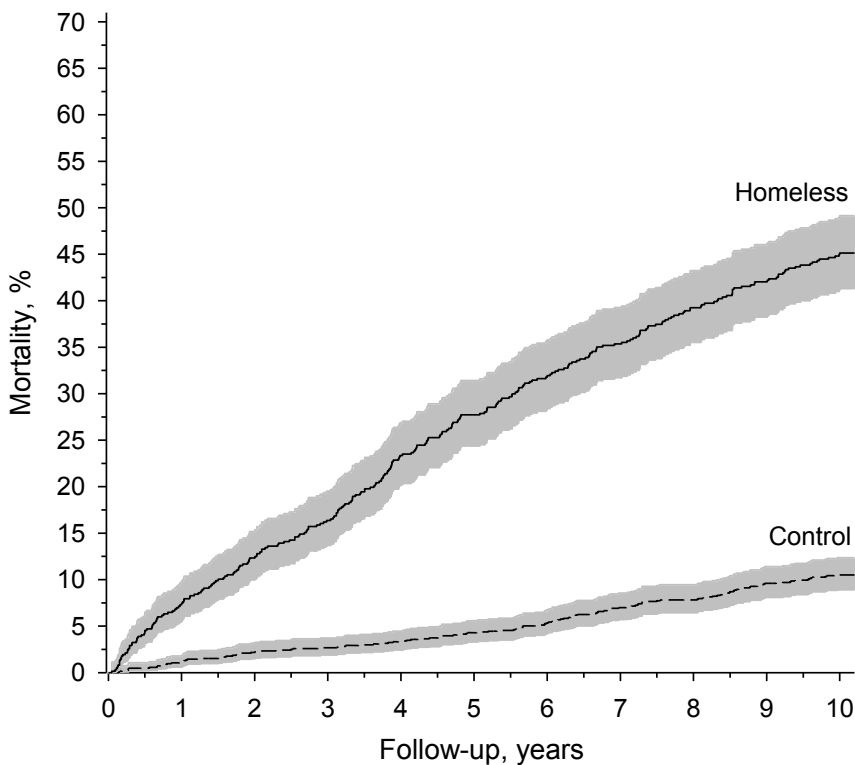


**Figure 6**    The mortality rate of the homeless (N=617) and control group (N=1240) by time, Helsinki, Finland, 2004-2014 (Study II).

Especially among the younger homeless the mortality was high (Figure 7). Of those under 50 years of age at baseline, 38% were dead by the end of follow-up, compared with 5% among controls.
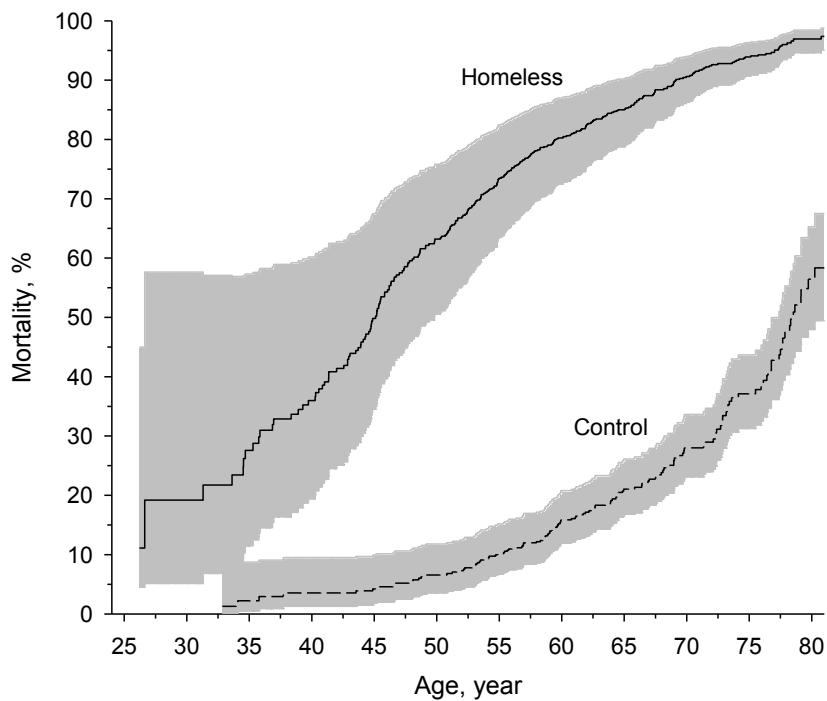


**Figure 7**    Mortality curves using age as timescale for the homeless (N=617) and controls (N=1240) in Helsinki, Finland, 2004-2014 (Study II).

The HR for overall mortality among those under 50 years of age at baseline was 9.8 (95% CI 6.4 to 14.8) in the study group compared with the controls (Figure 8). The risk of death from external causes was even higher for those under 50 years of age at baseline.
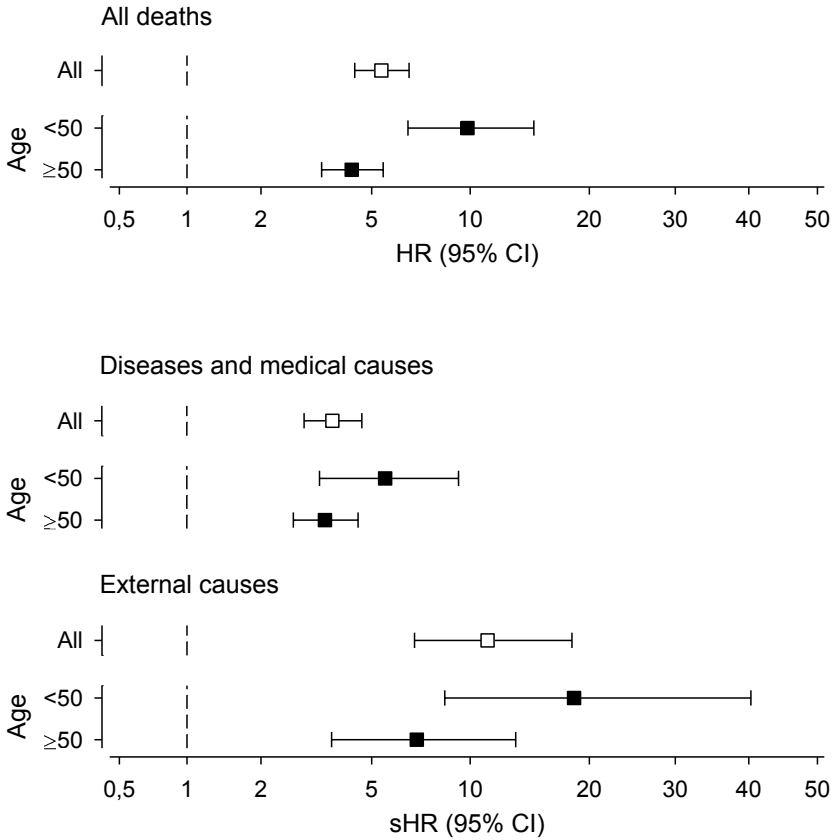


**Figure 8**   The all-cause mortality and mortality by medical causes and external causes for homeless men compared with the control group. Hazard ratios (HR) and sub-hazard ratios (sHR) with 95% confidence intervals (CI). Results are shown for the total sample (617 homeless and 1240 control persons) and presented by age group (Study II).

The competing risk analysis for causes of death is shown in Table 7. The risk of death was elevated for the homeless, compared with controls, in all diagnostic groups examined. Among diseases and medical causes, the risk of death was highest for diseases of the digestive system with a sHR of 8.2 (95% CI 4.1 to 16.4), largely attributable to the many deaths from alcohol-induced liver cirrhosis. External causes were responsible for 98 deaths in the homeless group, corresponding to 34% of all homeless deaths, half of these were due to accidental poisoning (sHR 25.5, 95% CI 9.2 to 70.5).

**Table 7.** Causes of death among homeless men (N=617) and controls (N=1240) in Helsinki 2004-2014. Fine and Grey age-adjusted competitive risk model (Study II).

| | ICD-10 code | Homeless, N (% of all deaths among the homeless) | Control group, N (% of all deaths among controls) | sHR (95% CI) |
|---|---|---|---|---|
| **Diseases and medical causes** | | **183 (64)** | **114 (83)** | |
| Cardiovascular system | I00–I99 | 51 (18) | 42 (30) | 2.5 (1.7 to 3.8) |
| Neoplasms | C00–D99 | 38 (13) | 39 (28) | 2.0 (1.3 to 3.1) |
| Digestive system | K00-K99 | 40 (14) | 10 (7) | 8.2 (4.1 to16.4) |
| Respiratory system | J00–J99 | 15 (5) | 9 (7) | 3.4 (1.5 to 7.5) |
| Other deaths from diseases and medical causes | | 39 (14) | 14 (10) | 5.7 (3.1 to 10.5) |
| **External causes** | **V01-Y98** | **98 (34)** | **19 (14)** | |
| Accidental poisoning | X40-X49 | 49 (17) | 4 (3) | 25.5 (9.2 to 70.5) |
| Other external causes | V01-X39, X50-Y98 | 49 (17) | 15 (11) | 6.8 (3.8 to 12.1) |
| **Unknown cause** | | **6 (2)** | **5 (4)** | 2.4 (0.7 to 7.9) |

### 6.4.1 DEATH BY DISEASES AND MEDICAL CAUSES

The causes of death by diseases and medical causes and their corresponding ICD codes are shown in Table 8. The most common cause of death from diseases and medical causes among the homeless was alcoholic liver disease, while among the controls the most common causes were ischaemic heart disease and neoplasms.

**Table 8.** Deaths by diseases and medical causes among the homeless (N=617) and controls (N=1240), Helsinki, Finland, 2004-2014 (Study II).

| | ICD-10 code | Homeless, N (% of all deaths among the homeless) | Control group, N (% of all deaths among controls) |
|---|---|---|---|
| **Cardiovascular system** | **I00–I99** | **51 (18)** | **42 (30)** |
| Ischaemic heart disease | I20-I25 | 24 (13) | 32 (28) |
| Other diseases of the heart | I30-I52 | 14 (8) | 6 (5) |
| Cerebrovascular diseases | I60-I69 | 9 (5) | 0 |
| Other diseases of the cardiovascular system | I00-I15, I26-I28, I70-I99 | 4 (2) | 4 (4) |
| **Neoplasms** | **C00–D99** | **38 (13)** | **39 (28)** |
| Malignant neoplasm of the lungs | C32-C34 | 13 (7) | 8 (7) |
| Other neoplasms | C00-C31, C35-D99 | 25 (14) | 31 (27) |
| **Digestive system** | **K00-K99** | **40 (14)** | **10 (7)** |
| Alcoholic liver disease | K70 | 36 (20) | 7 (6) |
| Other diseases of the digestive system | K00-K69, K71-K99 | 4 (2) | 3 (3) |
| **Respiratory system** | **J00–J99** | **15 (5)** | **9 (7)** |
| Pneumonias | J12-J18, J849 | 6 (3) | 2 (2) |
| Bronchitis and chronic obstructive pulmonary disease | J40-J44 | 7 (4) | 6 (5) |
| Other diseases of the pulmonary system | J00-J11, J19-J39,J45-J848, J85-J99 | 2 (1) | 1 (1) |
| **Other deaths from diseases and medical causes** | | **39 (14)** | **14 (10)** |
| Infectious diseases | A00-B99 | 10 (5) | 0 |
| Mental disorders due to SUD | F10-F19 | 13 (7) | 1 (1) |
| Dementia | F01, F03, G30, R54 | 2 (1) | 6 (5) |
| Other deaths | E00-E99, Q00-Q99, G00-G29, G31-G99 | 14 (8) | 7 (6) |
| **All diseases and medical causes** | | **183 (64)** | **114 (83)** |

## 6.4.2 DEATH BY EXTERNAL CAUSES

The causes of death by external causes and their corresponding ICD codes are shown in Table 9. In the study group half of all deaths due to external causes occurred due to poisoning. Looking more closely at these it was observed that 35 were due to alcohol poisoning and 14 were poisoning by other substances. Accidents by falling were also fairly common in the study population, and in 12 out of the 17 deaths due to accidents by falling, an alcohol-related diagnosis was noted as a secondary cause of death.

**Table 9.** Deaths by external causes among the homeless (N=617) and controls (N=1240) Helsinki, Finland, 2004-2014 (Study II).

|  | ICD-10 code | Homeless, N (% of all deaths among the homeless) | Control group, N (% of all deaths among controls) |
|---|---|---|---|
| **Accidental poisoning** | **X40-X49** | **49 (17)** | **4 (3)** |
| Alcohol poisoning | X45 | 35 (36) | 3 (16) |
| Accidental poisoning (other than alcohol) | X40-X44, X46-X49, | 14 (14) | 1 (5) |
| **Other external causes** | **V01-X39, X50-Y98** | **49 (17)** | **15 (11)** |
| Accident by falling | W00-W19 | 17 (17) | 3 (16) |
| Suicide | X60-X84 | 7 (7) | 8 (42) |
| Homicide | X85-Y09 | 7 (7) | 1 (5) |
| Drowning | W69-W70 | 4 (4) | 0 |
| Aspiration of food or gastric contents | W78-W79 | 4 (4) | 0 |
| Exposure to excessive heat of man-made origin | W92 | 3 (3) | 0 |
| Pedestrian traffic accident | V01-V99 | 3 (3) | 0 |
| Hypothermia | X31 | 2 (2) | 0 |
| Other accidents | Y86,V14, W83, Y89 | 2 (2) | 3 (16) |
| **All external causes** | **V01-Y98** | **98 (34)** | **19 (14)** |

### 6.4.3   ALCOHOL-RELATED DEATHS

Alcohol-related deaths were counted separately as described on page 57. It was found that they accounted for 30% (N=87) of all homeless deaths and 11% (N=15) of all deaths in the control group.

### 6.4.4   ASSOCIATIONS BETWEEN SOCIODEMOGRAPHIC FACTORS AND HEALTHCARE SERVICE USE ON MORTALITY

Cox regression models were performed separately on the homeless and control groups to assess the effect of age, gender, marital status, employment and healthcare service use on overall mortality. In the control group, not being employed, not being married and having only basic education significantly increased the risk of death over the ten years (Figure 9). The same factors had no effect among the homeless. Looking at the effects of healthcare service use prior to baseline, it was found that psychiatric hospitalization six months prior to baseline predicted death among the controls, but not among the homeless. The only factors predicting death among the homeless were somatic hospitalization and age (HR 1.5, 95% CI 1.1 to 2.0 and HR 1.03, 95% CI 1.02 to 1.04, respectively), but for these factors the effect was also stronger among the controls. The effect of staying less than four nights in shelter was also estimated separately among the homeless, but no significant association between brief stay in shelter and mortality was observed (HR 1.2, 95% CI 0.9 to 1.5) (data not shown).
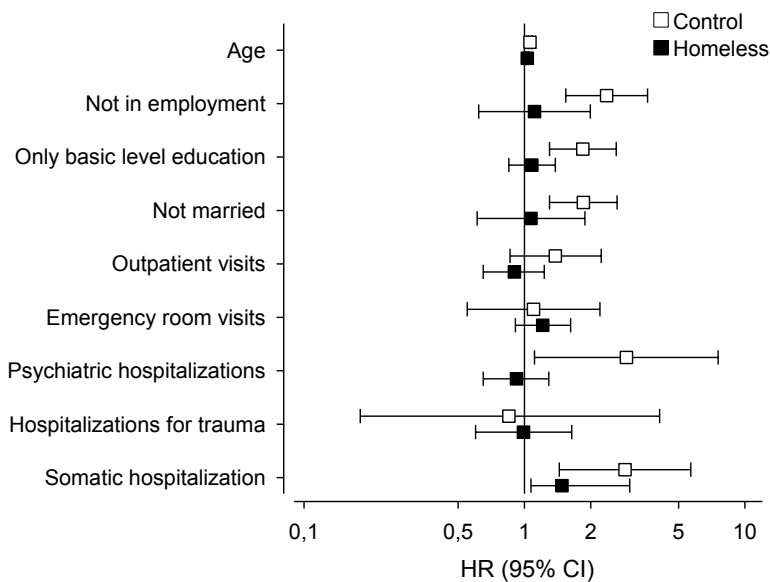


**Figure 9**   Baseline predictors of 10-year mortality among 617 homeless men and 1240 control persons, Helsinki, Finland, 2004-2014. Cox proportional hazard model (Study II).

## 6.5 HEALTHCARE SERVICE USE (STUDIES I-IV)

Healthcare service use was assessed in all studies. In Studies I and II the number of hospital emergency department visits, hospital days and outpatient visits to hospitals prior to baseline were counted and their associations with being independently housed 10 years later and mortality were assessed. In Study III the main outcome was hospital and ED service use during follow-up and its association with the duration of homelessness. In Study IV the focus was on the use of daytime primary healthcare services and PHERs out-of-hours. In this chapter the results on healthcare service use from the different studies are presented by level of care.

### 6.5.1 HOSPITAL SERVICE USE (STUDIES I-III)

In Studies I and II the homeless were found to have increased use of hospital services prior to baseline. Of the homeless, 32% had been hospitalized during the six-month period analysed, compared with 5% in the control group (p<0.001) (Study I cohort). The mean number of days in hospital was 5.5 days (SD 18.1) in the six-month period, and when broken down by main diagnosis it was found that the mean number of hospital days for psychiatric diagnosis (excluding SUD) was 1.7 (SD 10.9), for SUD 1.1 (5.9), for trauma 1.1 (8.3) and for all other diagnoses 1.7 days (8.2). The means were higher in all diagnostic groups among the homeless persons compared with the control group (p<0.001). However, the mean number of outpatient visits to hospitals did not differ between the homeless and controls (on average 0.4 visits during the six months examined in both groups). In Study III the healthcare service use during the 4.5-year follow-up was analysed and results are presented in Table 10. Also, in this study the homeless used more hospital services than the control group, except for outpatient visits to medical/surgical clinics where there was no significant difference between the groups.

**Table 10.**    Hospital service use during 4.5-year follow-up, Helsinki, Finland, 2004-2009 (Study III).

|  | Homeless, N=683 | Controls, N=1316 | p-value |
|---|---|---|---|
| Persons with any medical/surgical hospital days, N (%) | 426 (62) | 371 (28) | <0.001 |
| Medical/surgical hospital days/person years, mean (SD) | 7.16 (6.9) | 1.16 (19.2) | <0.001 |
| Persons with any psychiatric hospital days, N (%) | 181 (27) | 18 (1) | <0.001 |
| Psychiatric hospital days/person years, mean (SD) | 7.89 (32.6) | 0.18 (2.9) | <0.001 |
| Persons with any medical/surgical outpatient visits, N (%) | 378 (55) | 607 (46) | <0.001 |
| Medical/surgical outpatient visits/person years, mean (SD) | 0.99 (2.6) | 0.86 (2.8) | 0.30 |
| Persons with any psychiatric outpatient visits, N (%) | 183 (27) | 62 (5) | <0.001 |
| Psychiatric outpatient visits/person years, mean (SD) | 4.4 (20.7) | 0.3 (2.7) | <0.001 |

Negative binomial regression models on the risk of hospital service use among the homeless compared with controls was performed in Study III, using three different models (Table 11). The risk of hospital service use was higher among the homeless for all services, compared with the use in the control group, except for medical/surgical outpatient visits where the risk of service use did not differ between the groups. The risk for psychiatric hospital service use was particularly increased (IRR 43.1, 95% CI 23.0 to 80.7) compared with controls. Similarly, the risk for psychiatric outpatient service use was high (IRR 15.1, 95% CI 8.6 to 26.4). When controlled for age, gender and socioeconomic factors (Model 3) the risk decreased, but the IRRs for all services examined (excluding medical/surgical outpatient visits) remained high.

**Table 11.** Risk of hospital service use among 683 homeless participants compared with 1316 age- and gender-matched control individuals in Helsinki, Finland 2009-2014. Negative binomial regression model (Study III).

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | IRR | 95% CI | IRR | 95% CI | IRR | 95% CI |
| **Medical/surgical hospital days** | | | | | | |
| Control group | 1 (ref.) | | 1 (ref.) | | 1 (ref.) | |
| Homeless | 6.2 | 4.7 to 8.2 | 9.0 | 6.9 to 11.8 | 4.7 | 3.3 to 6.6 |
| **Psychiatric hospital days** | | | | | | |
| Control group | 1 (ref.) | | 1 (ref.) | | 1 (ref.) | |
| Homeless | 43.1 | 23.0 to 80.7 | 43.9 | 21.0 to 91.7 | 11.2 | 5.8 to 21.7 |
| **Medical/surgical outpatient visits** | | | | | | |
| Control group | 1 (ref.) | | 1 (ref.) | | 1 (ref.) | |
| Homeless | 1.1 | 0.9 to 1.4 | 1.3 | 1.1 to 1.6 | 1.1 | 0.9 to 1.5 |
| **Psychiatric outpatient visits** | | | | | | |
| Control group | 1 (ref.) | | 1 (ref.) | | 1 (ref.) | |
| Homeless | 15.1 | 8.6 to 26.4 | 6.8 | 3.3 to 14.0 | 2.1 | 1.1 to 4.2 |

Model 1: crude model; Model 2: adjusted for gender; Model 3: adjusted for gender, age, employment, educational attainment and marital status
IRR=Incidence rate ratios, CI=confidence interval, ref.=reference group

### 6.5.2 HOSPITAL EMERGENCY DEPARTMENT USE (STUDIES I- IV)

The visits to hospital EDs in the six-month period prior to baseline were calculated in the Herttoniemi cohort (Studies I and II) to assess possible associations between ED use and independent housing and mortality. During this period, 36% of the homeless had ED visits compared with 6% of the control group (p<0.001) (Study II). The mean number of ED visits was 0.8 (SD 1.6) for the homeless and 0.1 (SD 0.4) for the controls (p<000.1).

In Study III, visits to hospital EDs during the 4.5-year follow-up in the Hietaniemenkatu cohort were analysed and compared with the control group. Of the homeless, 84% had at least one ED visit compared with 33% in the control group (p<0.001). The mean number of ED visits per person year was 1.9 (SD 3.1) among the homeless and 0.21 (SD 0.7) among controls (p<0.001). The risk for ED visits for the homeless was high compared with controls (IRR 10.2, 95% CI 8.8 to 11.9). Adjusting for age, gender and socioeconomic factors in Model 3 decreased the risk, but the risk still remained high (IRR 6.0, 95% CI 4.9 to 7.3).

### 6.5.3 ASSOCIATION BETWEEN DURATION OF HOMELESSNESS AND HEALTHCARE SERVICE USE (STUDY III)

In Study III the association between the proportion of follow-up time spent homeless with the use of hospital and ED services in the same period was assessed. While the number of medical/surgical hospital days increased as homelessness was prolonged, the opposite pattern was true for psychiatric hospital days (Figure 10).
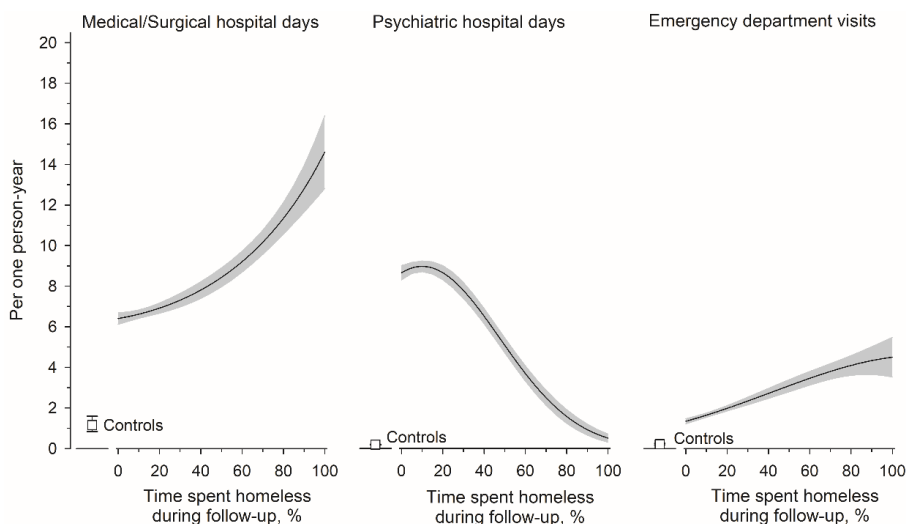


**Figure 10**  Hospital days and emergency department visits among homeless persons in relation to the percentage of time spent homeless during the follow-up, N=683, Helsinki, Finland 2009-2014 (Study III).

The risk for hospital and ED use for those temporarily homeless (less than 2% of follow-up time) was separately compared with the control group (Table 12). The use of hospital and ED services was also increased for the temporarily homeless.

**Table 12.** Risk of hospital and ED service use among the temporarily homeless (N=210) and all homeless (N=683) compared with the control group (N=1316), 2009-2014. Negative binomial regression model (Study III).

| | Temporarily homeless | | All homeless | |
|---|---|---|---|---|
| | IRR | 95% CI | IRR | 95% CI |
| **Medical/surgical hospital days** | | | | |
| Control group | 1 (ref.) | | 1 (ref.) | |
| Homeless | 5.1 | 3.1 to 8.4 | 6.2 | 4.7 to 8.2 |
| **Psychiatric hospital days** | | | | |
| Control group | 1 (ref.) | | 1 (ref.) | |
| Homeless | 34.2 | 6.5 to 179.2 | 43.1 | 23.0 to 80.7 |
| **Emergency department visits** | | | | |
| Control group | 1 (ref.) | | 1 (ref.) | |
| Homeless | 6.5 | 4.9 to 8.5 | 10.2 | 8.8 to 11.9 |

IRR=Incidence rate ratios, CI=confidence interval, ref.=reference group

### 6.5.4  USE OF DAYTIME PRIMARY HEALTHCARE SERVICES AND PRIMARY HEALTHCARE EMERGENCY ROOMS OUT-OF-HOURS (STUDY IV)

In Study IV, the reasons for daytime visits to physicians in primary healthcare and out-of-hours in PHERs during a three-year period were examined in a cohort of 158 homeless persons staying in four shelters in the Helsinki metropolitan region. The reasons for visits were analysed and the associations between mental disorders and visits to PHERs were assessed.

The 158 homeless persons in the study made altogether 1410 visits to primary healthcare physicians during the three-year study period. Out of the 1410 visits, 823 (58%) were to daytime primary healthcare centres and 587 (42%) to PHERs out-of-hours.

### 6.5.5  REASONS FOR VISITS

The two most common reasons for visiting a physician in daytime primary healthcare were mental health and substance use-related problems (40% of all daytime visits) and infections (18% of visits) (Figure 11). The most common reasons for visiting PHERs were trauma (38% of visits to PHERs) and intoxication and convulsions (19% of visits), followed by infections (11% of visits) and mental health and substance use-related problems (11% of visits).
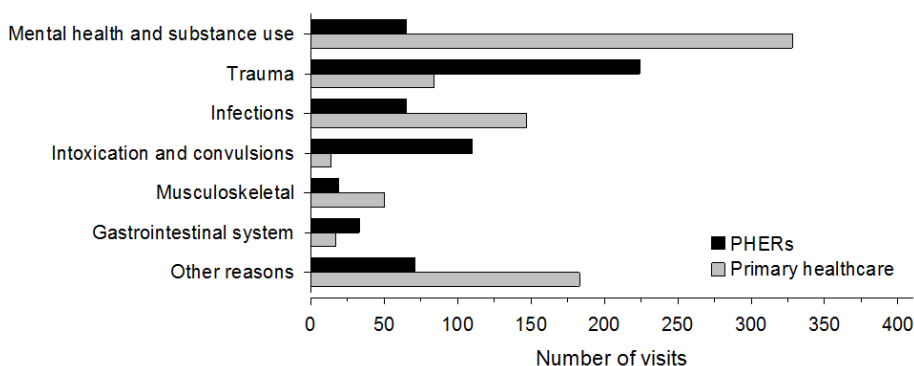


**Figure 11**   Visits to physicians in primary healthcare by main reasons for visits made by homeless persons in Helsinki metropolitan area, 2005-2008 (N=158) (Study IV).

### 6.5.6 THE ASSOCIATION BETWEEN MENTAL DISORDERS AND VISITS TO DAYTIME PRIMARY HEALTHCARE AND PHERS OUT-OF-HOURS (STUDY IV)

Negative binomial regression model was performed to assess the association between mental disorders and primary healthcare use (Table 13). Dual diagnosis was found to be strongly associated with daytime visits to primary healthcare centres (IRR 11.0, 95% CI 5.9 to 20.6), when compared with those with no mental disorder. Further, having a SUD without any other mental disorder and having a mental disorder other than SUD also increased the risk of daytime visits, but to a lesser degree (IRR 4.9, 95% CI 2.5 to 9.9 and IRR 5.0, 95% CI 2.4 to 10.8, respectively).

Looking at out-of-hours visits to PHERs, strong associations between visits were found for both dual diagnosis (IRR 14.1, 95% CI 6.3 to 31.2) and SUD (IRR 11.5, 95% CI 5.7 to 23.3) when compared with those without any mental disorder. Adjustment for age, gender and somatic comorbidity had only small effects on the results.

**Table 13.** Associations between mental disorders and number of daytime visits to primary healthcare centres and out-of-hours visits to PHERs among 158 homeless persons in Helsinki metropolitan area, 2005-2008. Negative binomial regression model (Study IV).

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | IRR | 95% CI | IRR | 95% CI | IRR | 95% CI |
| **Visits to primary healthcare centres daytime** | | | | | | |
| No mental disorder (ref.) | 1 | | 1 | | 1 | |
| SUD without other mental disorder | 4.9 | 2.5 to 9.9 | 5.7 | 2.7 to 11.9 | 4.5 | 2.2 to 9.0 |
| Mental disorder without SUD | 5.0 | 2.4 to 10.8 | 5.2 | 2.5 to 11.0 | 5.0 | 2.5 to 10.0 |
| Dual diagnosis | 11.0 | 5.9 to 20.6 | 12.4 | 6.6 to 23.4 | 10.4 | 5.6 to 19.3 |
| **Visits to PHERs out-of-hours** | | | | | | |
| No mental disorder (ref.) | 1 | | 1 | | 1 | |
| SUD without other mental disorder | 11.5 | 5.7 to 23.3 | 9.5 | 4.6 to 19.5 | 9.1 | 4.4 to 18.8 |
| Mental disorder without SUD | 2.6 | 1.1 to 6.2 | 2.6 | 1.0 to 6.5 | 2.6 | 1.0 to 6.4 |
| Dual diagnosis | 14.1 | 6.3 to 31.2 | 11.7 | 5.3 to 25.9 | 11.5 | 5.1 to 25.6 |

Model 1: crude model; Model 2: adjusted for age and gender; Model 3: adjusted for age, gender and Charlson Comorbidity Index
ref.=reference group, CI=confidence interval

# 7   DISCUSSION

This study examined three different cohorts of homeless shelter users, following them longitudinally by combining data from different registers. The aim of this study was to examine the housing outcomes, morbidity, mortality and healthcare service use of the homeless and factors associated with the respective outcomes.

## 7.1   SUMMARY OF THE MAIN RESULTS

The study revealed that being homeless and having stayed in shelter was associated with increased morbidity and mortality, low probability of being independently housed even after a long time and high use of emergency department and hospital services. Dual diagnosis and SUD were associated with increased healthcare service use. The main findings are summarised below:

*First*; the large majority of those still alive after ten years stayed in supported housing, with only a small group still or again homeless. Six per cent of the total sample was independently housed. Being married and staying briefly in shelter predicted being independently housed.

*Second;* the homeless had increased morbidity, especially psychiatric morbidity was common with 78% of the homeless having a psychiatric disorder, compared with 16% of the general population controls.

*Third;* ten years after shelter stay about half of the homeless were dead, and compared with the controls the homeless had a fivefold risk of mortality. Especially deaths from accidental poisoning and alcohol-related liver disease were common. Excess mortality was particularly high among the homeless under the age of 50. Being homeless eliminated the protective effects of marriage, employment and education on mortality risk seen among controls.

*Fourth;* the use of ED and hospital services was high among the homeless. Compared with controls, the homeless had over 40 times more hospital days in psychiatric hospitals, 10 times more ED visits and over six times more medical/surgical hospital days. The amount of medical/surgical hospital days and ED visits per person year increased as homelessness was prolonged, but the pattern was reversed for psychiatric hospital days. Also, those who were only temporarily homeless had a high use of ED and hospital services.

*Fifth;* the homeless visited primary care for mental health and substance use-related problems, traumas and infections, but there was undertreatment of chronic conditions, such as hypertension and diabetes. Dual diagnosis was particularly strongly associated with daytime primary healthcare visits among homeless persons staying in shelters, while out-of-hours visits to PHERs were strongly associated with both dual diagnosis and SUD.

## 7.2  THE PROGNOSIS OF SHELTER USERS IN TERMS OF HOUSING, MORBIDITY AND MORTALITY

### 7.2.1  THE HOUSING SITUATION AND MORBIDITY AMONG PREVIOUS SHELTER USERS

In this study shelter users were followed over time, looking at several aspects that describe the health and life situation of this vulnerable population. It was found that, similar to previous studies, most are in shelter only for a short period and then move on (Kuhn, Culhane 1998, Benjaminsen, Andrade 2015). However, it was also seen that many later return to shelter, showing that the risk of relapsing into homelessness is significant, supporting the findings from a previous study on the housing pathways in Finnish shelters (Sunikka 2016). The cluster analyses by Kuhn et al. and Benjaminsen et al. from the USA and Denmark, respectively, showed that in these populations about 80% are transiently homeless, while in this study over 30% still had periods of homelessness after two years. Although there is a significant difference in methodology, these results indicate that in the Finnish setting the proportion of those that could be considered transiently homeless is smaller than that found in the USA and Danish studies.

Focusing on the housing situation 10 years after shelter use (Study I), it was found that only 6% were living independently. This finding strengthens the results from previous studies, that in the Finnish housing market very few previous shelter users access housing in the non-supported rental market (Sunikka 2016). Half of the study population died during the follow-up, and a majority of those surviving lived in some form of supportive housing. The supported housing services that this cohort lived in had a rather intensive support level, typically nursing homes or Housing First units, with only a small group living in low-intensity support housing. This shows the chronic nature of the health problems in this population: even after a long time the majority need support in their everyday life.

Although access to the free housing market is clearly limited for this population, another important result was that only 5% (9% of those still alive) were still or again homeless at ten years after shelter use. Previous research from other countries looking at housing outcomes in a 1 to 5-year perspective have shown that between 19% and 61% are still homeless at the end of follow-up (Kertesz, Larson et al. 2005, Fichter, Quadflieg 2005, Caton, Dominguez et al. 2005, Schanzer, Dominguez et al. 2007, Spicer, Smith et al. 2015, Johnson, Scutella et al. 2015, Aubry, Duhoux et al. 2016). The low number of homeless after 10 years observed in this cohort can be seen as a successful result of the housing programmes implemented by the government during the last decades: some kind of housing solution had been found for over 90% of those staying in shelter that were still alive after ten years. In comparison, a Swedish study following 82 homeless men for 5 years showed that 75% were still homeless at the end of follow-up (Beijer,

Andreasson et al. 2007). It is likely that had it not been for the intensive efforts to reduce long-term homelessness, undertaken by the Finnish municipalities and governments during the last decade, there would also have been a much bigger proportion still homeless in this study.

The morbidity in the Finnish shelter population is high, and this is especially true for psychiatric disorders and SUD. Swedish and Danish studies that have looked at prevalence of disease in homeless populations using hospital discharge registers have found rates of 42% and 49%, respectively, for SUD, compared to 75% in the Herttoniemi cohort (Study I) and 81% in the primary healthcare cohort (Study IV) (Beijer, Andreasson 2010, Nielsen, Hjorthoj et al. 2011). The higher prevalence rates found in this study compared to the Swedish and Danish studies are probably partly attributable to differences in methodology. The study by Beijer et al. sampled their homeless cohort from the social welfare offices for the homeless and not from shelters, and this cohort probably contained more persons living with friends and families, most likely with fewer psychiatric disorders than the shelter population. The follow-up period in the study by Beijer et al. was also shorter, describing the five-year prevalence rather than the 10-year prevalence used in this study. The study by Nielsen et al., on the other hand, used hospital discharge and outpatient data from psychiatric care only, thus being able to reach only the homeless who had had contact with specialized psychiatric care, not including SUD diagnosed by other healthcare providers. The high prevalence of SUD in this study, and especially in the primary healthcare study (Study IV), can partly be explained by the more sensitive method of gathering morbidity data. Using primary healthcare records reaches all those who had had contact with primary healthcare, and it is likely that a bigger proportion of those with SUD would have contact with primary healthcare than with specialized care, since only the most severe cases would be treated in hospitals. It is, of course, also possible that the Finnish shelter population had a higher prevalence of SUD than those in Denmark or Sweden, however, due to the differences in methodology used, strong conclusions cannot be drawn based on these findings. The author's clinical experience from working in the shelter does, however, confirm the high rates of psychiatric morbidity and especially SUD among shelter users.

For mental disorders other than SUD, the prevalence rates found in this study were similar to those in previous studies (Fazel, Khosla et al. 2008). When looking at the prevalence rates of both psychiatric disorders and somatic comorbidity by housing situation at the end of the follow-up in Study I, one can see that the morbidity level is lowest among those living independently and grows higher with the level of support in the housing services, except for those still and again homeless which included the highest proportion of persons with a psychiatric disorder. Those still or again homeless included a particularly large proportion of persons with psychosis and dual diagnosis. This shows that there was still a group of homeless, albeit small, for whom the existing supported housing services did not offer

adequate or enough support to be able to end their homelessness. A recent study on the very long-term shelter users in Helsinki showed that they had usually been offered housing but, for one reason or another, did not want to accept (Tolmunen 2018). More research is needed to find out the motives for declining housing, and possible solutions required to house this very vulnerable group.

### 7.2.2  THE RISK OF DEATH AMONG THE HOMELESS STAYING IN SHELTERS

To my knowledge, this is the first case-controlled study examining causes of death among the homeless. The overall risk of death was fivefold compared with controls (HR 5.4). Comparable rates have been reported in homeless populations in other Western European countries (Fichter, Quadflieg 2003, Beijer, Andreasson et al. 2007, Morrison 2009, Nielsen, Hjorthoj et al. 2011, Feodor Nilsson, Laursen et al. 2018), and slightly lower rates among the homeless in North America (Hibbs, Benner et al. 1994, Barrow, Herman et al. 1999, Hwang, Wilkins et al. 2009).

Similar to previous studies, this study showed that excess mortality is particularly high among the younger homeless (Hibbs, Benner et al. 1994, Hwang 2000, Cheung, Hwang 2004, Roy, Haley et al. 2004, Baggett, Hwang et al. 2013, Nusselder, Slockers et al. 2013, Feodor Nilsson, Laursen et al. 2018). However, this study found the risk to be significant also among the older homeless, contrary to some previous studies that have found no elevated risk for the homeless over the age of 55 or 65 (Hibbs, Benner et al. 1994, Nordentoft, Wandall-Holm 2003, Baggett, Hwang et al. 2013). Considering this age effect described in this and previous studies, the high overall risk of death in this cohort is even more striking, since the mean age in the Herttoniemi cohort was relatively high (49 years) compared to the mean age in previous studies.

The risk of death was increased for the homeless in all of the examined causes of death groups. Among diseases and medical causes, the highest risk was found for diseases of the digestive system (sHR 8.2, 95% CI 4.1 to 16.4) compared with the control group. Among the 40 deaths in this group in the homeless cohort, 36 were attributable to alcohol-induced liver disease. Altogether, 30% of all deaths among the homeless were due to alcohol-related causes. This shows the key role of SUD in the high mortality rates, corresponding with previous findings that SUD is responsible for a large proportion of excess mortality among the homeless (Beijer, Andreasson et al. 2011, Feodor Nilsson, Laursen et al. 2018).

The risk of death due to diseases and medical causes was over threefold compared to the control group (sHR 3.7, 95% CI 2.9 to 4.6), and while this increased risk of death was significant, the increased risk of death was even bigger for death from external causes (sHR 11.2, 95% CI 6.9 to 18.3). This risk of death from external causes among the homeless in Finland is high

compared to the reported risk of death from external causes among the homeless in Sweden and Canada (Hwang, Wilkins et al. 2009, Beijer, Andreasson et al. 2011), and similar to the risk reported in Denmark (Nielsen, Hjorthoj et al. 2011). However, due to the different ways of grouping the external causes of death and methodological differences in calculating the rates, exact comparisons to these studies cannot be made. A closer look at the causes of death from external causes show that accidental poisoning was responsible for half of the deaths from external causes in the homeless population, with a sHR of 25.5. Alcohol poisoning was the dominant substance used in these deaths.

Due to the relatively small number of deaths by suicide and homicide, it was not possible to calculate sHR for these causes of death. However, looking at the number of deaths by suicide among the homeless and controls the risk was less than two for suicides compared with the controls. Danish studies have reported SMR of 6.0 and 7.3 for suicide among the homeless, while a Canadian study found the risk to be between 2.3 and 3.3 depending on the age group (Nordentoft, Wandall-Holm 2003, Hwang, Wilkins et al. 2009, Nielsen, Hjorthoj et al. 2011). On the other hand, the number of homicides in this study was relatively large, with an equal number of deaths by suicide and homicide (N=7 for each cause of death). The relationship in the general population of Finland between death due to suicide and death due to homicide is about 8:1, similar to that found in the control group (Official Statistics of Finland, 2018). Out of the seven homicides in the homeless cohort, six were due to stabbing with a sharp object and in all these cases alcohol was also involved.

Of a total of 98 deaths due to external causes only two were due to hypothermia, despite the harsh climate in Finland. This low number might be a consequence of the Finnish legislation obliging municipalities to provide all residents with some shelter every night. Similar to the previous Canadian study on shelter users (Hwang 2000) an increase in deaths during the cold seasons was not observed, possibly due to the long follow-up and the fact that the study group were not homeless for the whole period. Another previous study that examined mortality risk during times of homelessness found an association between cold weather and mortality risk (Romaszko, Cymes et al. 2017).

### 7.2.3   IS IT POSSIBLE TO PREDICT THE PROGNOSIS FOR HOMELESS SHELTER USERS USING REGISTER DATA?

This study examined the associations between several baseline factors and the likelihood of being independently housed or dead after 10 years. The factors included in the study were marital status, educational attainment, employment status, number of days in shelter and healthcare service use prior to baseline. It was found that several baseline factors were associated with being independently housed, most importantly being married, staying

only a few days in shelter and higher educational attainment. However, these same factors were not associated with mortality among the homeless. The only factors associated with increased risk of death among the homeless were medical/surgical hospitalization prior to baseline and older age, although this association was smaller among the homeless than among the controls. Among the controls, on the other hand, being married, having employment and having higher educational attainment were also associated with decreased risk of death, effects that have been seen in other studies on the general population (Martikainen, Blomgren et al. 2007, Roelfs, Shor et al. 2011a, Roelfs, Shor et al. 2011b). This lack of association, between this study's predictors and mortality in the homeless population, shows that being homeless and staying in shelter in Finland means marginalization to a point where the protective effects of education, marriage and employment are eliminated.

This study did not see a statistically significant protective effect of employment, previously found in a Danish study (Nielsen, Hjorthoj et al. 2011), possibly due to the small number of persons employed in this Finnish cohort. Nor did the number of nights spent in shelter during the sampling year affect mortality. Previous studies examining the relationship between length of homelessness and mortality risk have shown partly contradictory results, with some showing that short and repeated stays in shelter are associated with an increased risk of death, but also that extended homelessness is a risk factor for death (Barrow, Herman et al. 1999, Nordentoft, Wandall-Holm 2003, Beijer, Andreasson et al. 2007, Metraux, Eng et al. 2011, Nielsen, Hjorthoj et al. 2011). More research is needed to understand the relationship between duration of homelessness and shelter use and their effect on the risk of death. This study contributes to the current knowledge by showing that a few nights in a shelter is already a sign of marginalization where the mortality is as high as for those homeless who stayed longer in shelters.

It seems that predicting who has a bigger chance of being independently housed is easier than predicting the risk of death among the homeless in shelters. Especially those who stay only briefly in shelter and those who are married have an increased chance of being independently housed. This finding corresponds with the previous finding that having a larger social network predicts exiting homelessness, as it is likely that the ones who only stayed a few nights in shelter still had a friend or two with a sofa where they could sleep, indicating a larger social network (Zlotnick, Tam et al. 2003, Caton, Dominguez et al. 2005, Aubry, Duhoux et al. 2016). One can only speculate on why the examined factors were associated with independent housing but not with mortality. It is possible that mortality, and especially death due to SUD, is a more random event compared with acquiring independent housing. Possibly the skills acquired by education, or the capacity that entering a marriage shows, increases the chances of securing and keeping independent housing, while these same skills and capacities do

not protect from the risk of premature death. Had this study been able to assess the severity of SUD at baseline there might have been an association observed between this and the mortality risk, however, the register data this study had access to did not allow for this.

## 7.3 WHAT HEALTHCARE SERVICES DO THE HOMELESS USE?

Two of the substudies focused on healthcare service use.In Study III the use of hospital and ED services among the homeless compared with the control group was examined, and Study IV focused on the reasons for visiting daytime primary healthcare and PHERS out-of-hours among the homeless, as well as on the associations between mental disorders and primary healthcare service use.

Similar to findings from previous studies the use of inpatient hospital and ED services is high among the homeless in Finland (D'Amore, Hung et al. 2001, Kessell, Bhatia et al. 2006, Sadowski, Kee et al. 2009, Hwang, Chambers et al. 2013, Bharel, Lin et al. 2013, Fazel, Geddes et al. 2014, Brown, Miao et al. 2015, Beijer, Bruce et al. 2016). This was particularly true for psychiatric hospital use, illustrating the burden of psychiatric disorders in this population. To be admitted into psychiatric hospital in Finland a serious mental disorder is usually required and, for instance, detoxification treatments are not provided by psychiatric hospitals but by addiction clinics not included in this data. Although SUD probably contributed to the other psychiatric disorders in this cohort, the high use of psychiatric hospital services by the homeless also shows the significant burden of psychiatric disease other than SUD among the homeless in Finland.

The risk of outpatient visits to medical/surgical hospitals was not increased in the homeless population, despite the high morbidity and mortality from diseases and medical conditions shown in this study. Previous studies on the use of ambulatory healthcare services among the homeless have not looked specifically into the outpatient visits to hospitals, but have rather examined the total use of ambulatory care services, showing a slight increased use of ambulatory services in Canada and decreased use in the USA, compared to non-homeless persons (Fischer, Shapiro et al. 1986, Kim, Kertesz et al. 2006, Hwang, Chambers et al. 2013). This study's data did not allow for the examination of the number of no-shows, and thus it is not known to whether outpatient visits are few because they are not scheduled or because of no-shows. However, this study's finding that the use of medical/surgical outpatient visits is not increased among the homeless while the use of hospital and ED services is highly increased, when compared with the control group, is in line with previous findings and indicates that there are several barriers to care, and that the homeless turn to EDs and hospitals for their healthcare needs (Little, Watson 1996, O'Toole, Gibbon et al. 1999a,

White, Newman 2015). Homeless persons should be recognized in the healthcare system as a group with high medical needs who have difficulties utilizing current outpatient services, and consequently specialized services and tailored solutions are needed to better reach this population and prevent avoidable ED visits and hospitalizations.

The homeless in this study had relatively few annual ED visits, with a yearly mean of 1.9 visits compared to previous reported rates between 2.0 and 6.0 (D'Amore, Hung et al. 2001, Kessell, Bhatia et al. 2006, Sadowski, Kee et al. 2009, Bharel, Lin et al. 2013, Hwang, Chambers et al. 2013). This seemingly low number of ED visits can be explained partly by differing sampling methods, as the studies reporting annual rates higher than 2.5 have examined the homeless already using EDs, healthcare services for the homeless or the homeless with chronic disease (D'Amore, Hung et al. 2001, Sadowski, Kee et al. 2009, Bharel, Lin et al. 2013). Another explanation for the finding could be that in Finland not all emergencies and accidents are seen by hospital EDs, but all minor accidents and conditions treatable in outpatient care are cared for by the PHERS, to whose registers this study did not have access (Study IV). The homeless, however, had more than 10 times more visits to the EDs compared to the control group, showing that despite the relatively low mean rate of visits, the use was still high when compared with the control group. Similar rate ratios for ED visits have been reported in a Canadian study on healthcare use among the homeless (Hwang, Chambers et al. 2013).

In Study IV, the reasons for visiting daytime primary healthcare and PHERs out-of-hours were examined. The most common reasons for homeless persons to visit a daytime primary healthcare physician were problems related to mental health and SUD, infections and trauma. Visits to PHERs out-of-hours, on the other hand, were most commonly due to trauma, intoxication and convulsions. The PHERs in Helsinki do only in rare cases prescribe medication for mental disorders, including SUD, and rather these patients are referred to either primary healthcare centres or specialized addiction treatment. Thus, this at least partly explains the relatively low number of visits due to mental disorders and SUD in the PHERs among the homeless. While relatively few of the visits to PHERs were primarily due to mental health disorders and SUD, one can assume that SUD was in many cases a contributing factor to the trauma, convulsion or intoxication that was the primary cause for visiting PHERs.

Looking at the reasons the homeless persons had for visiting a primary healthcare physician, either daytime or out-of-hours, it was found that a large proportion of the visits were due to acute conditions such as trauma, infection and intoxication , and planned check-up visits due to diabetes and hypertension were very few (only 14 out of 1410 visits in total). Considering that 22 persons were hypertensive and 8 had diabetes (out of 158 persons in the Study IV cohort), both, which according to national guidelines, should be monitored annually, one would expect the number of check-up visits to be

significantly higher (Hypertension: Current Care Guidelines 2014, Type 2 Diabetes: Current Care Guidelines 2016). This finding shows that there is an undertreatment of chronic conditions among the homeless in Helsinki. It is likely that the same barriers that affect the low use of hospital outpatient services by the homeless cohort found in Study III also hamper the treatment of chronic conditions in the daytime primary healthcare centres. More research is needed to gain understanding on why the use of pre-scheduled outpatient services in both hospitals and primary healthcare is low among the homeless.

Study IV also showed that although SUD was present in 82% of the homeless in this study cohort, only 39% had been in detox treatment in the past three years, indicating that there is an undertreatment of SUD among the homeless. Lower thresholds to SUD treatment and outreach work to shelters would be needed to better reach the homeless.

### 7.3.1 THE POSSIBLE ASSOCIATION BETWEEN THE DURATION OF HOMELESSNESS AND HEALTHCARE SERVICE USE

As mentioned before, some data exists showing that a longer homelessness period prior to assessment and longer shelter stays are associated with poorer health outcomes (Kuhn, Culhane 1998, Kertesz, Larson et al. 2005, Caton, Dominguez et al. 2005, Fazel, Geddes et al. 2014, Benjaminsen, Andrade 2015). Many of the support interventions have therefore targeted the chronically or long-term homeless, including Housing First (Tsemberis 2010, Pleace, Culhane et al. 2015). There are, however, only few studies that have examined the association between the length of homelessness and healthcare service use.

Study III in this thesis focused on the association between the duration of homelessness and healthcare service use, with rather interesting results. Firstly, it was seen that also the temporarily homeless used a lot of hospital and ED services, showing that even a brief shelter period is associated with high healthcare utilization, compared with the control group. Secondly, it was found that as the shelter period was prolonged, the use of medical and surgical hospital as well as ED services increased, while the opposite was true for psychiatric hospital services.

Combining these findings with the housing outcomes found in Study II is thought-provoking. Study II showed that the large majority of those still living moved into rather intensely supported housing. Thus, knowing that the temporarily homeless also probably end up in supported housing rather than the free housing market and that the healthcare service use of the temporarily homeless does not differ significantly from those that were homeless for longer, it raises the question of whether it is the homelessness itself which is the determining factor for the increased healthcare service use. Or is homelessness only one symptom of social exclusion that is associated with poor health outcomes? This study does not answer these questions, but

adds to the current knowledge by showing that resorting to shelter, even briefly, is an indication of having a high healthcare service need. Further, these findings raise the question whether the healthcare support provided in the supported housing services is sufficient, as it seems that the healthcare service needs are similar among those who stay in shelter and those who move on, presumably to supported housing. How much does life in supported housing differ from life in shelter? As most Housing First units and low-intensity support housing solutions apply a harm reduction approach where substance use is allowed, it is possible that the rehabilitative effect of these housing services is small. This concern has been raised before by several researchers, fearing that 'Housing First' becomes 'housing only' (Perälä, Jurvansuu 2016, Pleace, Culhane et al. 2015). Does the current system enable real rehabilitation? Many of the homeless and previously homeless suffer from SUD, with subsequent health risks. This study showed that the supported housing services offered to this group of homeless are mostly communal housing units, rather than scattered housing. What are the possibilities of treating SUD in these settings, where your neighbours or flatmates also have an active SUD? If one returns to these living environments, even after a long detox or rehabilitation period, can one be expected to stay sober? Is one even offered rehabilitation, if it is known that this person will return to the same living environment that does not support sobriety? More scattered housing solutions and greater flexibility in the housing services are needed so that sober housing can be offered after rehabilitation, without the risk of becoming homeless if one relapses into using drugs or alcohol again. The fact that many have shelter periods after two years also indicates repeated homelessness and that problems leading to evictions, such as disturbing lifestyle and problems paying rent, sometimes also remain after being housed.

Stephen and Fitzpatrick have presented a theory that in countries with extensive welfare services fewer persons become homeless, but those that do have higher healthcare needs compared to the homeless in countries with less extensive welfare policies, where homelessness is more often a result of poverty alone (Stephens, Fitzpatrick 2007). Benjaminsen et al. examined morbidity among shelter users in Denmark, finding support for this theory (Benjaminsen, Andrade 2015). This study's finding that the temporarily homeless in Finland had a very high use of hospital and ED services compared with the control group further strengthens this theory, showing that in the Finnish setting not only the long-term homeless, but also those who are in shelter only briefly and then move on, are a vulnerable group with high healthcare needs.

Focusing on the finding that the risk of ED visits and medical/surgical hospital service use is increased as homelessness is prolonged shows the somatic disease burden of those staying in shelter for very long. From the clinical experience of the author working in shelters, the very long-term homeless often have severe SUD, something that probably increases the use

of EDs and medical/surgical hospitalization. This study does not give answers to why the risk of psychiatric hospital service use was not increased for the very long-term homeless, but several possible explanations can be considered. It is possible that persons with psychiatric disorders, severe enough to require psychiatric hospitalization, are more actively housed, and that the very long-term homeless do not suffer from disorders requiring psychiatric hospitalization, but are adequately treated in somatic care and possibly SUD treatment. Another, less optimistic, interpretation is that the very long-term homeless are marginalized to the point where the psychiatric healthcare system can no longer reach them.

Psychotic disorders have been shown to be associated with decreased mortality among homeless populations (Hwang, Lebow et al. 1998, Barrow, Herman et al. 1999, Nordentoft, Wandall-Holm 2003, Beijer, Andreasson et al. 2007, Nielsen, Hjorthoj et al. 2011). It could be that psychiatric illness, other than SUD, is also a predictor of being housed and as such of shorter duration of homelessness.

### 7.3.2 THE RELATIONSHIP BETWEEN MENTAL DISORDERS AND PRIMARY HEALTHCARE SERVICE USE AMONG THE HOMELESS

In Study IV the association was assessed between mental disorders and visits to daytime primary healthcare centres and out-of-hours to PHERs. The results showed a strong association between mental disorders and primary healthcare service use among the homeless.

There are very few previous studies on primary healthcare service use in homeless populations. Previous studies on the use of healthcare services in homeless populations have also shown that the homeless with mental illness and SUD use more hospital and ED services. However, these studies did not particularly assess the use of primary healthcare services (Kushel, Vittinghoff et al. 2001, Bharel, Lin et al. 2013, Chambers, Chiu et al. 2013).

It was found that dual diagnosis is particularly strongly associated with daytime visits to primary healthcare centres, while both dual diagnosis and SUD without other mental illness are associated with visits to PHERs. Whereas it is natural that persons with illness seek healthcare, the very strong associations found between dual diagnosis and number of visits show the large healthcare service need among this particular group of homeless. The most common reasons for visiting physicians in PHERs, trauma, intoxication and convulsions, and mental health and SUD, are all more likely among persons with SUD and thus explaining the strong association between dual diagnosis and SUD and the number of visits. This corresponds with previous findings on the use of EDs in homeless populations, which have shown that many of the visits are directly related to SUD (Pearson, Bruggman et al. 2007). Better interventions, such as case management

programmes, could reduce the number of visits to PHERs among the homeless (McCormack, Hoffman et al. 2013).

## 7.4 METHODOLOGICAL CONSIDERATIONS – STRENGTHS AND LIMITATIONS

This thesis is composed of four studies following three different cohorts of homeless shelter users using data from several local and national registers. In Studies I-III the outcomes were compared with an age- and gender-matched control group. This methodology has several strengths, but also some weaknesses, both which will be addressed in this chapter.

### 7.4.1 COMPILING THE STUDY COHORTS

The main limitation of this study is the definition of homelessness. All cohorts were gathered from homeless shelters, and by doing so it is possible to get a representative sample of shelter users, but not all homeless will be included. Looking at the classifications of homelessness presented in Chapter 2.1, one can see several types of homeless persons who do not necessarily use shelters. The majority of the Finnish homeless stay with family members and acquaintances, and the results presented in this study should not be considered representative for these homeless (Helskyaho, Ohisalo et al. 2018). Further, the homeless living in institutions without a home outside the institution, and persons sleeping rough all year round are not included in the shelter cohorts. However, due to the rough climate the number of persons living on the street all year round is estimated to be small, and most persons sleeping outside would seek shelter at least in the coldest period and thus enter the cohorts in Studies I-III (Helskyaho, Ohisalo et al. 2018). It is likely that the health outcomes for persons who still have a friend's sofa to sleep on is significantly better than for those marginalized to the point of having to resort to shelter services. Currently there are no registers of persons homeless staying with friends and family members, in institutions or sleeping rough in Finland or, to my knowledge, in any other country. Thus, gathering representative data on all these homeless is not possible. However, future research should examine possibilities to look at health outcome data that include not only the shelter population but also other groups of homeless, especially the homeless staying with friends or family members, as this group of homeless is even less studied than the shelter population.

Studies I and II examined all the homeless who stayed in the only male emergency shelter in Helsinki during 2004, thus forming a representative cohort of male shelter users. Study III followed the persons staying in the only emergency shelter in Helsinki during one year between September 1st 2009 and September 1st 2010, and does also include some women. However, the total number of women included in Studies III and IV is small (117 and

42, respectively), and little can be said about the situation of homeless women based on these results. A longer sampling period using several shelters would enable study of possible gender differences among the homeless.

The cohort in Study IV consists of all those who stayed in shelter during two selected nights. This almost cross-sectional sampling method gave a slightly skewed cohort with more long-term homeless included, compared to the cohorts in Studies I-III in which all who stayed in shelter at any point during the whole sampling year are represented. This method used in Study IV might contribute to the higher morbidity figures found in this study as chronic homelessness has been found to be associated with higher healthcare needs (Kuhn, Culhane 1998, Kertesz, Larson et al. 2005, Caton, Dominguez et al. 2005, Fazel, Geddes et al. 2014, Benjaminsen, Andrade 2015).

As shown in Studies I and III, homelessness did not last the whole follow-up period and most of the study subjects stayed in shelters only briefly. This has also been the case in most previous follow-up studies examining homelessness, and defining exits from homelessness has been a challenge. Study III was able to address the association between the duration of homelessness and healthcare service use, something that has not been done before, and the results add new important knowledge on homelessness and health outcomes, as described in the previous chapter. This method of defining homelessness months can be rightfully questioned as it uses shelter stay as an indication of homelessness, and again fails to capture periods spent outdoors or temporarily with acquaintances and family members. The method, however, also provides new data describing the duration of homelessness in a cohort over time in a novel way that gives new insights.

### 7.4.2   DATA SOURCES

Using register data as a data source has several benefits compared to interview-based follow-up studies. The representativeness of the cohort is good as cases are not lost to follow-up or due to those who decline to give consent. However, register-based setups are limited to the data available in the registers. When it comes to health outcomes, only diagnoses of persons who have sought help will therefore be present in the registers, leading to underdiagnosis of many diseases. On the other hand, the diagnoses are confirmed by healthcare personnel and not relying on self-reports as is often the case in interview-based studies.

This study used both local (social service client register and primary healthcare records) and national register data (death register and Care Register for Health Care). The quality of the national registers has been found to be good (Gissler, Haukka 2004). The results in Study II on overall and cause-specific mortality are further strengthened by the tradition in Finland to perform relatively many medicolegal autopsies (Lunetta,

Lounamaa et al. 2007). By using PICs the linkage can also be performed accurately.

Combining data from several sources enabled getting detailed information on, for instance, housing outcomes. It would have been interesting and relevant to also study the access to and use of SUD treatment in this group, in which the majority suffered from SUD. Unfortunately, the City of Helsinki introduced electronic healthcare records for SUD treatment services as late as in 2012, and the City also buys some of the services from third-sector providers not included in the register kept by the City. Thus, this study was unable to include SUD treatment in the analyses looking at healthcare service use. Surveys have showed that homelessness is common among persons in SUD treatment: a national count of all persons with intoxicant-related cases in healthcare services found that 11% of patients in SUD treatment and 8% of all persons seeking healthcare services for problems related to SUD were currently homeless (Kuussaari, Kaukonen et al. 2014). In the future, as the available register data will hopefully improve, analysing the access to and use of SUD treatment among the homeless should be a focus for research to fill in this gap in knowledge.

In Studies II-IV data were used from the local registers in the City of Helsinki, the social service client notes and primary healthcare patient notes to gather information on housing situation, primary healthcare service use and morbidity. These sources of information included much more detailed data than the national registers on specialized healthcare use and death register, thus providing more information on the situation of the homeless. However, this method also meant that this study had to exclude those who had moved away from Helsinki during the follow-up (Studies II and III) as it was not possible to determine the housing situation for these individuals. It is possible that some of those who moved away had gained housing somewhere else or that their healthcare service use was smaller. As a sensitivity analysis in Study II, also examined was the morbidity of those who moved away (data not shown) and it was found that it did not differ significantly from those who stayed in Helsinki, and therefore it is likely that the situation of the excluded participants was not significantly different from those that stayed.

Study IV focused on primary healthcare service use among the homeless, analysing the patient notes taken by physicians in primary healthcare. As diagnoses are not always entered by the physicians in primary care, the content of the text was coded into main reasons for the visit. This was not always a straightforward process and it was, for instance, impossible to separate visits related to SUD from visits related to other mental disorders, as these often co-occur. In the primary healthcare setting, especially in the PHERs, there is rarely time for in-depth psychiatric diagnosis, and it is therefore likely that there is an underdiagnosis of many psychiatric disorders, producing inaccurate prevalence estimates. For example, only 9% had a personality disorder mentioned in the patient notes, which is a figure similar

to that found in the general population, though it is likely that the true figure is higher in the homeless population (Fazel, Khosla et al. 2008, Tyrer, Reed et al. 2015, Schreiter, Bermpohl et al. 2017).

This study did not have access to registers from the private healthcare sector or occupational healthcare. Had this information been available more morbidity data on especially the control group would have been available. Due to poverty and unemployment it is likely, however, that the proportion of the homeless that used private or occupational healthcare was rather small and the morbidity data on the study population would probably not have been much affected had there been access to these registers.

Being limited to data existing in the registers meant that there were many factors that could not be adjusted for. It would have been interesting and important to examine in all studies, for instance, length of homelessness prior to shelter use, undiagnosed disorders, adverse childhood experiences, housing skills, family and social relationships and many other factors. A longer follow-up prior to baseline might have improved the baseline data available in Studies I-III, however, many of the registers were fairly new and, for instance, data from childhood would not have been available in the registers for this fairly old population.


### 7.4.3   OTHER METHODOLOGICAL CONSIDERATIONS

Studies I and II followed the homeless for ten years, giving a uniquely long follow-up period as most previous studies have typically examined, especially housing outcomes, in a much shorter perspective. The long perspective offers novel data on the housing situation of this vulnerable group that will be useful for both care workers and policy makers dealing with the homeless, as it shows that even after a long time period most persons staying in homeless shelters are in need of support in their daily life.

Using a matched control group in Studies I-III provided the possibility of direct comparison to a general population sample, giving more exact estimations of health and mortality outcomes than comparison to standardized data within age groups. In the mortality study (Study II) this enabled calculation of cause-specific risks also accounting for competing risks. This has not been done in previous studies on mortality among the homeless. Morrison followed a cohort of Scottish homeless and compared the results with a control group, but this study did not examine the cause-specific risks (Morrison 2009). Matching the controls locally to place of domicile also reduces the risk of local coding differences in determining the cause of death. The long follow-up in Studies I and II gives new knowledge on how mortality and housing develops over time, but the time lag also reduces the effect of predictors on the outcomes, possible partly explaining why an association between the predictors and mortality was not seen in Study II.

The structural changes that have taken place in the services for the homeless in Helsinki since 2004 might to some degree affect the composition

of the shelter population of today, compared with that during the sampling periods between 2004 and 2010 (Studies I-IV), thus affecting the generalizability to the situation of the current shelter population.

The large investment cooperation projects implemented between 2008 and 2015 have probably contributed to the large proportion of the cohort of 2004 that was housed ten years later. According to social workers working with the homeless, the queues to supported housing have since grown and it is not unlikely that a follow-up study conducted between 2014 and 2024 would show a larger proportion still homeless at the end of follow-up, as fewer would have received supported housing.

Further, the staff in shelters have described that the shelter users of today are younger and suffer more from drug dependence disorders than alcohol dependence disorders, compared with the homeless staying in shelters in 2004. There are, however, no figures to support this observation from the shelters, but surveys on clients in drug treatment show that the proportion of opioid users has increased compared with persons with alcohol-related problems (National Institute for Health and Welfare 2017). This possible shift also in shelters would naturally affect both the morbidity, mortality and the healthcare service use among the homeless and further research is needed to confirm this observation and its possible effects on health outcomes. There is also a concern that the proportion of persons in shelters who suffer from psychotic disorders and dual diagnosis has grown in the last decade as psychiatric hospital beds have been reduced.

Although it is important to keep these possible changes in mind when interpreting the results, it is unlikely that they would to a large degree affect the main results showing a high morbidity, mortality and healthcare service use level among the homeless in Helsinki, Finland.

# 8 CONCLUSIONS AND FUTURE IMPLICATIONS

This study is the first in decades to describe the health situation of homeless persons in Finland. It was found that, similar to findings from other countries, the Finnish homeless who have used shelter services had high morbidity and significant risk of early death. Only few were homeless after ten years, and most lived in supported housing. There was a significant proportion of the homeless who still had periods of homelessness after two years. The homeless were also big users of hospital and ED services.

The study contributes to the international literature on homelessness in several ways. *Firstly*, by showing that even in a long perspective of 10 years only few became independently housed. This finding illustrates the chronicity of the problems associated with homelessness and shelter stay, as even after a long time many are in need of support in their day-to-day life. Being married and staying only briefly in shelter increases the chances of being independently housed. *Secondly*, the study corroborates previous findings that mortality is very high among the homeless, and this is particularly true for the younger homeless. The risk of death was elevated not only for external causes but also for diseases and medical causes. *Thirdly*, this is the first European study examining hospital use among the homeless and it shows that, similar to other previous studies from the USA, the use of ED and hospital services is also high among the homeless in Finland.

Further, this study showed that those staying only briefly in shelter also had an increased mortality risk and high use of specialized healthcare services compared with the control group. The fact that the duration of stay in shelter prior to baseline did not affect mortality, and that the hospital service use was also high for the temporarily homeless raises the question of causality between homelessness and adverse health outcomes. This study does not provide answers on the question of whether homelessness leads to poor health or poor health to homelessness. Does homelessness itself increase the risk of premature death and disease? Or, to what extent is homelessness and shelter stay only one symptom of severe marginalisation in a larger population suffering from poverty, social exclusion, unemployment, SUD and multimorbidity? Further studies examining the possible causality, reverse causality or simultaneity are needed to fully understand the relationship between homelessness and adverse health outcomes.

These findings also lead to the following question: if mortality and healthcare service use are largely unaffected by whether one is in shelter for a short or a long duration, and it is known that most of the homeless in shelters are later housed in supported housing, what are really the health benefits of moving into supported housing? More studies on possible health outcomes of the supported housing services in Finland would be of

importance to answer this question. The housing efforts by the Finnish government and municipalities have been efficient in reducing long-term homelessness and providing Housing First solutions for the long-term homeless. But the findings from this study underline the previously raised concern that the current system might provide not Housing First but rather "housing only", and that the life situation for the housed individuals is not improved to the level of also affecting health outcomes (Perälä, Jurvansuu 2016, Pleace, Culhane et al. 2015).

Not only is SUD responsible for increased mortality and morbidity risk, but this study shows that the risk of death is also increased for diseases and medical conditions. Further, this study found that while there was a high use of hospital and ED services among the homeless, the use of hospital outpatient care was not increased compared with controls and that there was undertreatment of chronic conditions in primary healthcare. Possible barriers to care need to be examined, and new practices that evade these barriers, tested and introduced. Targeted, low threshold and integrated healthcare services, not only in the shelters, but also in the housing services are needed. Considering that the homeless have multiple comorbidities, the targeted health services should have competence to deal with both medical and psychiatric conditions, addiction problems, housing and social care, so that unnecessary hospitalizations and preventable deaths could be avoided.

Special attention is also needed in hospital settings for the homeless and previously homeless, keeping in mind that outpatient care is challenging when living in shelters or in supported housing and capacity for self-care for is lowered due to high prevalence of mental disorders and SUD. Coordination between specialized care, primary healthcare providers and housing services are needed to make possible treatment of chronic conditions and full recovery after hospitalization. The current and previously homeless should be recognized as a high-risk group with special needs on all levels of healthcare.

Based on this study, recommendations for future research include:

1. Identifying factors predicting homelessness and interventions that effectively prevent homelessness.
2. Investigating the health situation of other groups of homeless, such as those sleeping rough, those staying in institutions and among family members and friends.
3. Assessing the long-term housing outcomes of shelter populations in other settings than Finland.
4. Assessing the effects of supported housing on mortality, morbidity and healthcare service use in the Finnish context.
5. Identifying better predictors of mortality among the homeless.
6. Investigating the barriers to outpatient hospital care and to treatment of chronic conditions in primary healthcare among the homeless.

7. Assessing the use of and effects of SUD treatment in the homeless population.
8. Assessing whether the housing outcomes and health status of the homeless shelter population have changed over time.
    a. Has access to supported housing decreased in the period after the investment programmes in 2008-2015 when new housing services were built and inhabited?
    b. Can an increase in the prevalence of psychotic disease be seen in the homeless population as the number of psychiatric beds has been reduced?

Based on this study, the policy recommendations include:

General recommendations:
1. Policies to prevent homelessness should be developed and implemented.
2. Develop a national register on persons staying in shelters
3. Explore and develop methods of accurately gathering data on the homeless sleeping rough, in institutions without a home outside institutions and with acquaintances and family members.

Recommendations for municipalities and other service providers:
4. Targeted, low-threshold health services with competence to deal with multimorbidity are needed in shelters, on the streets, as well as in supported housing units. All persons that enter shelters should be considered high-risk individuals and likely to be in need of social and healthcare services. Interventions, such as case management programmes, should be developed and if proven efficient taken into use.
5. Better integration between social work, housing services, primary care and specialized care is needed to avoid overlapping and non-coordinated care, where the treatment responsibility becomes unclear.
6. The homeless and previously homeless should be recognized in hospitals, addiction treatment units and primary care as a vulnerable group with special needs that requires tailored solutions and better access to care.

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