The Physical and Mental Health Effects of Housing Homeless People: A Systematic Review

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Author Contributions

CFS proposed the need for this review. HO drafted the manuscript, planned and conducted the search, screening, selection, data extraction and data analysis stages. CFS checked the search, screening and selection process, checked data extracted and analysed for risk of bias. All authors read, revised and

approved the manuscript. CFS gave the final approval of the version to be published. HO agreed to be guarantor of the review.

ABSTRACT

Housing is a significant determinant of health and is widely accepted as a key solution to address some of the health disparities that exist among the homeless. It is estimated that 150 million people worldwide are homeless, and approximately 1.8 billion lack adequate housing. However, understanding of *how* housing has a positive impact on the health of the homeless remains unclear and underdeveloped. This systematic review investigates intervention studies that report on the physical and mental health effects of housing homeless persons. A search of PubMed, PsycINFO, EBSCOHost-Academic Search Complete, and the Cochrane Library was conducted for peer-reviewed articles published in English from 1999 to 2020 that had a combination of at least one housing intervention and health outcome, with a homeless sample. Three previous reviews and 24 studies were included for analysis. Most of the studies ($n = 20$) encompassed permanent supportive housing interventions that emphasised placing homeless people with mental illness directly into affordable housing with access to support services. The primary health outcomes reported were general physical and mental health, wellbeing, and quality of life. Despite inconsistent findings and significant issues identified in the reviewed literature, housing (in the short term) improves some aspects of health in homeless populations with HIV, anxiety and depression.

Keywords: Homelessness, housing, health, anxiety, depression

WHAT IS KNOWN ABOUT THIS TOPIC

- Poor physical and mental health is more pronounced in homeless people.

- Housing is widely accepted as a key solution to address the problem of homelessness and some of the physical and mental health disparities that exist in homeless populations.

- Not all systematic reviews meet the criteria for reproducibility, and no systematic reviews have been published that investigate the impact of *various* housing interventions on both the physical and mental health of homeless people.

WHAT THIS PAPER ADDS

- A careful and systematic identification and review of current areas of literature in the fields of homelessness, housing, and health.

- Current knowledge of permanent supportive, transitional, social, and community housing, and their effect on homeless peoples' physical and mental health.

- Some evidence for Permanent Supportive Housing and Social Housing models providing positive benefits for homeless peoples' anxiety and depressive states.

INTRODUCTION

Globally, an estimated 150 million people are homeless (United Nations Human Rights Council [UNHRC], 2020) and 1.8 billion lack adequate housing (UNHRC, 2019). Housing is a significant determinant of health (Fitzpatrick, Bramley, & Johnsen, 2013; Gibson et al., 2011; Thomson, Thomas, Sellstrom, & Petticrew, 2013). The relationship between homelessness and poor health is well documented (Fazel, Geddes, & Kushel, 2014; Fazel, Khosla, Doll, & Geddes, 2008; Johnson & Chamberlain, 2011; Munoz, Crespo, & Perez-Santos, 2005). Homeless people are prone to similar health problems that occur in the general population. However, poor physical and mental health is often associated with poverty and is more pronounced in homeless people (Fazel et al., 2014).

Physical illnesses that may result from, or are commonly associated with homelessness include malnutrition (Wright, 1990), chronic pain (Hwang et al., 2001), skin diseases (Stratigos, Stern, Gonzalez, Johnson, O'Connell, & Dover, 1999), musculoskeletal disorders (Hwang, 2001) and poor dental health (Figueiredo, Hwang, & Quinonez, 2013). Due to difficult living conditions (rough sleeping, overcrowded accommodation), homeless people are also vulnerable to many respiratory disorders such as community-acquired pneumonia (CAP) (Jones, Gundlapalli, Jones, Brown, & Dean, 2013), asthma and chronic obstructive pulmonary disease (COPD) (Lewer et al., 2019), and infectious diseases such as tuberculosis, hepatitis C virus, HIV (human immunodeficiency virus), and AIDS (acquired immune deficiency syndrome) (Fazel et al., 2014; Raoult, Foucault, & Brouqui, 2001).

In 2012, Beijer, Wolf and Fazel conducted a systematic review and meta-analysis to establish the prevalence of tuberculosis, hepatitis C virus, and HIV in homeless people based on 43 studies (n = 59,736) that reported tuberculosis estimates ranging from 0.2% to 7.7%. This prevalence was lower than HIV (0.3% to 21.1%) and hepatitis C (3.9% to 36.2%) estimates (Beijer et al., 2012), but, were reported to be "at least 20 times higher, and for USA studies, they were more than 40 times higher" than in the general population (Fazel et al., 2014, p. 6).

When considering the prevalence of mental health disorders among the homeless, Fazel et al. (2008) systematically analysed 29 studies ($N = 5684$) from seven Western countries (North America, Western Europe, Australia, and New Zealand). They found that alcohol (8.5% to 58.1%) and drug (4.7% to 54.2%) dependence were the most common mental health disorders. These results are consistent with reported alcohol (21.3%) and substance (13.5%) dependence estimates in homeless populations in the United Kingdom (Bowen et al., 2019) and Australia, which are more than three times higher (18%) than the general population (5%) (Australian Bureau of Statistics [ABS], 2008). In addition, Fazel et al. (2008) found that prevalence estimates for psychosis among the homeless were between 2.8% and 42.3%, which is significantly higher than the estimates obtained in community samples that are typically 1% to 2% (Kessler, Chiu, Demler, Merikangas, & Walters, 2005). Similar estimates (up to 41%) were found for major depression (Fazel et al., 2008), and are comparable to that of homeless populations in Australia, where 39% reported having an anxiety disorder and 28% a mood disorder, compared to 14% of the general population who reported having an anxiety disorder and 6% a mood disorder (ABS, 2008).

Homelessness is also linked to an increase in morbidity (Nielsen, Hjorthoj, Erlangsen, & Nordentoft, 2011) and multi-morbidity (Bowen et al., 2019), and longitudinal studies (Aldridge et al., 2019; Nordentoft & Wandall-Holm, 2003; Seastres et al., 2020; Stenius-Ayoadeet al., 2017) show that homelessness is associated with higher mortality. For example, the homeless in Copenhagen hostels are four times more likely than the general population to die early (Nordentoft & Wandall-Holm; 2003), while homelessness in Finland is linked to a five-fold increase in mortality (Stenius-Ayoadeet al., 2017). In Australia, homelessness was related with an almost two-fold greater risk of mortality over a 15-year period and an approximately 12-year reduction in age at death when compared to non-homeless emergency department attendees (Seastres et al., 2020). When compared to the general population, this is estimated to be a nearly four-fold increase in mortality.

Access to safe, secure, and affordable housing is widely accepted as a key solution to address the problem of homelessness and some of the health disparities that exist in homeless populations (Gaetz & Dej, 2017; Henwood, Cabassa, Craig, & Padgett, 2013). Housing, combined with support services to help homeless people remain housed (known as Housing First [HF]), has been identified as the foundation for meeting the needs of homeless people with mental illness (Tsemberis, 1999; 2011). However, understanding of *how* housing has a positive impact on the physical and mental health of homeless people remains unclear and underdeveloped.

The use of reviews to synthesise evidence is increasing in the areas of homelessness, housing, and health (Evans, Wells, & Moch, 2003; Foster, Gronda, Mallett, & Bentley, 2011; Gibson et al., 2011; Gronda, Mallett, & Bentley, 2011; Hwang, Tolomiczenko, Kouyoumdjian, & Garner, 2005; Kertesz, Crouch, Milby, Cusimano, & Schumacher, 2009; Kyle & Dunn, 2008; Rog et al., 2014; Woodhall-Melnik & Dunn, 2016; Ziersch & Due, 2018). However, not all systematic reviews meet the criteria for reproducibility (Rog et al., 2014; Woodhall-Melnik et al., 2016). Systematic reviews focused on defining housing intervention research and their effect on both the physical and mental health of homeless people have received little attention (Aubry et al., 2020; Baxter, Tweed, Katikireddi, & Thomson, 2019; Fitzpatrick-Lewis et al., 2011). Furthermore, no reviews have been published to our knowledge that investigate the impact of *various* housing interventions on the physical and mental health of homeless people. While Baxter et al.'s (2019) review presents new data on the health effects of HF, it does not provide other housing measures, leaving a void in the existing literature. There is a need to examine what is already known about the effects of current housing interventions (HF), as well as to identify other possible housing interventions and their impact on the physical and mental health of homeless people, as well as identify areas where new research might be needed, in order to determine future study priorities.

Therefore, the objectives of this systematic review were to: 1) identify and synthesise data available in the literature on *various* housing interventions and to examine their impact on the physical

and mental health of homeless people, and 2) during the review process, identify any significant gaps that can direct future research.

METHODS

This systematic review was conducted according to a pre-planned protocol based on the 2015 Statement of Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) (Moher et al., 2015) and the updated guide to the 2020 PRISMA Statement (Page et al., 2020) (see Online Supplementary File 1 for PRISMA-P 2015 Checklist). In addition, the PICOS (Population, Intervention, Comparison, Outcomes and Study design) framework (Schardt, Adams, Owens, Keitz, & Fontelo, 2007) guided the formulation of the review criteria and is found in Table 1 (Online Supplementary File 2).

Search Strategy

The search strategy for this systematic review was developed by one reviewer (HO) to identify eligible studies on the effectiveness of *various* housing interventions on the physical and mental health of homeless people. Four multidisciplinary, electronic databases: PubMed, PsycINFO, EBSCOHost-Academic Search Complete, and the Cochrane Library, were searched up to May 2020 using a combination of search terms from Medical Subject Headings (MeSH) that included: home*, homeless, homelessness, hous*, housing, health, physical health, mental health, anxiety, and depression. The search strategy for some of the databases is found in Online Supplementary File 3.

Other potentially eligible articles not identified in the electronic databases were sought by reference to organisations and websites in the areas of homelessness, housing and health. Organisations included the American Psychological Association (APA), the Australian Housing and Urban Research Institute (AHURI), Homes North Community Housing, the Institute of Global Homelessness (IGH), and the World Health Organisation (WHO). Websites included

https://aihw.gov.au, https://endhomelessness.org, http://www.homelessnessaustralia.org.au, http://www.missionaustralia.com.au

Search inclusion and exclusion criteria

This systematic review included all peer-reviewed journal articles published in English from January 1999 to May 2020 that included a combination of at least one housing intervention and health outcome, with a homeless sample. Pilot research or studies that focussed on a particular population (veterans, youth) or clinical measure (psychosis) that were considered too specific to the key areas of homelessness and physical and mental health were excluded.

Screening and selection of studies

Before the screening process, a Word spreadsheet was created to record the details of each search. All references were imported into Endnote X9.1 and categorised to make the process of searching, screening and selecting transparent and reproducible. After duplicates were removed, one reviewer (HO) independently screened titles and abstracts, then reviewed the full texts of all potentially eligible articles, excluding the studies that did not meet the specific inclusion criteria for this review (Online Supplementary File 2). A second reviewer (CFS) independently screened more than 10% (35) of the excluded articles to ensure that no relevant studies were erroneously excluded. Figure 1 shows the PRISMA flow diagram detailing the process of searching, screening and selecting the three previous reviews and 24 included studies, with exclusion reasons at the full-text selection level (see Online Supplementary File 4 for a list of the excluded articles).

Data analysis

Two data extraction tables were created to outline the key characteristics and main findings of the three previous reviews (Table 2/Online Supplementary File 5) and each study (Table 3) included in this review. All data were extracted by one reviewer (HO) and checked by a second reviewer (CFS). The extracted data included: author and year of publication, city and country in which the study was

conducted, journal in which the study was published, the focus of the study, study design and sample size, housing intervention (model) used, health measures used and health outcomes reported, and main study findings (Table 3).

To estimate potential bias at the individual study level (Higgins, Altman, & Sterne, 2017), two reviewers (HO and CFS) independently used the revised Cochrane Risk-of-Bias for Randomised Trials (RoB 2) (Sterne et al., 2019) and the Risk of Bias in Non-randomised Studies of Interventions (ROBINS-I) (Sterne et al., 2016) tools. Justifications for judgements of risk of bias (low, high, some concerns) for each study were recorded and any discrepancies were resolved by both reviewers. The ROBVIS (visualisation tool for risk of bias assessments in a systematic review) (McGuinness, & Higgins, 2020) tool was then used to create "traffic light" plots of the domain-level judgements for each individual result (Figure 2/Online Supplementary File 7, Figure 3/Online Supplementary File 8, Figure 4/Online Supplementary File 9).

RESULTS

Database searches identified 5,230 records, and after removing duplicates, 2,338 records remained eligible for the screening of titles and abstracts. Google Scholar records (n = 18,301) were also screened to add in any further relevant records. During the screening of titles and abstracts, 1,976 database records were excluded because they were not relevant to the focus of this systematic review. After reviewing the remaining full texts (n = 362), six reviews and 329 articles were excluded because they did not meet the inclusion criteria (Online Supplementary File 2). A total of three systematic reviews and 24 peer-reviewed research articles were eligible to be included in this systematic review (Figure 1).

Summary of findings from the three previous reviews included in this review

Two systematic reviews (Aidala et al., 2016; Bassuk, DeCandia, Tsertsvadze, & Richard, 2014) and one systematic review and meta-analysis (Baxter, Tweed, Katikireddi, & Thomson, 2019)

that focussed on the health effects of housing on homeless persons were included. Bassuk et al. (2014) investigated the effects of Housing First (HF) with assertive community treatment (ACT) and intensive case management (ICM) among homeless people and families. Aidala et al. (2016) explored the relationship between housing status (adequacy, stability, security, and affordability), medical care, and health outcomes for homeless people living with HIV (PLWH). Baxter et al. (2019) systematically reviewed the evidence from randomised controlled trials on the effects of HF on health and wellbeing. A summary of the key characteristics of each review is found in Table 2 (Online Supplementary File 5).

The overall findings from these previous reviews were that HF successfully improves housing stability for homeless people (Baxter et al., 2018) and may improve some aspects of short-term health (HIV) (Aidala et al., 2016). However, no significant differences in substance use were observed between the HF and treatment as usual (TAU) groups (Baxter et al., 2018), and the long-term effects of HF are unknown. Aidala et al.'s (2016) review provided insight into the physical health outcomes associated with homeless PLWH that may be relevant to a broader homeless population. Unstable (or inadequate) housing was associated with inconsistent utilisation of HIV care, reduced treatment effectiveness and HIV transmission risk behaviours. However, as housing status improved, access to care and maintaining treatment also improved.

The weak evidence of HF's positive impact on the health of homeless people and families was emphasised in all three reviews. The absence of information about certain HF approaches (Baxter et al., 2018) and methodological limitations of individual studies in the reviews (Aidala et al., 2016; Bassuk et al., 2014) makes it difficult to draw conclusions about the effectiveness of housing on homeless people's physical and mental health. Furthermore, the absence of non-HF housing interventions and the reporting of physical health outcomes other than HIV are two significant gaps that were identified in the three reviews.

Summary of findings from the 24 studies included in this review

Detailed summaries of each study ($n = 24$) included in this review are found in Table 3. Also, an outline of the key characteristics of the 24 studies included in this review is found in Table 4 (Online Supplementary File 6).

Risk of bias assessments

Of the 24 studies included in this review, only two (Buchanan et al., 2009; Tsemberis et al., 2004) were primary randomised control trials. If 'high' risk of bias was reported in at least one domain of bias, then the study was given an overall 'high' rating (see Online Supplementary File 7). Ten studies (Aquin et al., 2017; Aubry et al., 2015; Aubry et al., 2016; Collins et al., 2016; Kerman et al., 2020; Kirst et al., 2015; O'Campo et al., 2016; Somers et al., 2015; Stergiopoulos et al., 2014; Urbanoski et al., 2018) were secondary randomised control trials. If the study was judged to have 'some concerns' for multiple domains in a way that substantially lowered confidence in the result, then the study was given an overall 'high' risk of bias (see Online Supplementary File 8). For the remainder of the studies (Brown et al., 2015; Collard et al., 2014; Driscoll et al., 2018; Hall et al., 2019; Karim et al., 2006; Kirst et al., 2014; Schick et al., 2019; Sharpley et al., 2019; Siegal et al., 2006; Spector et al., 2020; Tsai et al., 2019; Whittaker et al., 2015) if the study was judged to be at 'low' or 'moderate' risk of bias for all domains, then the study was given an overall 'moderate' risk of bias, as the study provided sound evidence for a non-randomised study but could not be considered comparable to a well-performed randomised trial (see Online Supplementary File 9).

Housing interventions identified in the 24 studies included in this review

Housing interventions (models and support services) identified in the 24 studies reviewed here varied across different locations and were categorised into four types of housing: 1) Permanent supportive housing, 2) Transitional housing, 3) Social housing, and 4) Community housing. An overview of each type of housing can be found in Table 5.

Health outcomes reported in the 24 studies included in this review

In the included 24 studies, various measuring instruments were used to examine health outcomes. Detailed information on how often each tool was used in the identified study pool is found in Table 6 (Online Supplementary File 10). The primary health outcomes examined in the 24 studies are listed below and grouped by domain: physical health outcomes and mental health outcomes. Other outcomes that were related to health (substance use) were also recorded.

Physical health outcomes

Health-related quality of life (HR-QoL) was reported in two studies (Spector et al., 2020; Tsai et al., 2019) and is a multi-dimensional concept that encompasses self-reported physical, mental, emotional, and social functioning domains (Wilson & Cleary, 1995). When measuring HR-QoL (SF-12; SF-36), analysis of the Physical Component Summary (PCS) in both studies revealed that when permanent supportive housing (PSH) was provided, chronically homeless individuals did not show any significant improvement ($p < .001$).

General physical health was reported in two studies based on self-reported physical symptoms (stress/Post-traumatic stress disorder [PTSD], blood pressure, depression, seizures, and acute and chronic pain) (Driscoll et al., 2018) or PCS analyses (SF-12) (Whittaker et al., 2015). The results of the two studies found no significant effects of HF (or stable housing) on the general physical health of chronically homeless individuals.

HIV/AIDS was examined in two studies (Buchanan et al., 2009; Hall et al., 2019) that reported on the physical health benefits of PSH for homeless people with HIV and AIDS. After one year, 55% of people who received PSH compared to 34% of people who received usual care were alive and had intact immunity ($p = .04$) (Buchanan et al., 2009). People living with HIV (PLWH) who were not placed into PSH had a higher risk of death or an AIDS diagnosis at the end of the study than those

who received PSH (AHR 1.84 [1.40, 2.44], *p* < .001) (Hall et al., 2019). The results of both studies showed that PSH was effective for homeless PLWH.

Mental health outcomes

Anxiety was reported in three studies (Karim et al., 2006; Sharpley et al., 2019; Siegal et al., 2006) as a primary mental health outcome, and explored in another study (Driscoll et al., 2018) as a secondary measure. In the retrospective study by Sharpley et al. (2019), the results were mixed for previously homeless persons' self-reported anxiety scores (Generalised Anxiety Disorder-7 [GAD-7]) after they were housed. Specifically, 52.9% of the participants had the same anxiety score before being housed and at the time of survey, 15.5% reported an increase in anxiety before being housed (*M* = 2.72, *SD* = 0.82) and after being housed (*M* = 8.63, *SD* = 2.02), and 31% reported a decrease in anxiety before being housed (*M* = 7.52, *SD* = 1.38) and after being housed (*M* = 6.67, *SD* = 1.47).

In the study by Karim et al. (2006), 85 homeless families underwent a mental health assessment following admission into two hostels, and again four months later (*n* = 35) when they were rehoused in the community. The results showed that the mothers' initial anxiety scores (Hospital Anxiety and Depression Scale [HADS]) (*p* = .62) did not change significantly after they were rehoused in the community (*p* = .67). Likewise, when Siegal et al. (2006) compared PSH to community housing (CH), they found that anxiety symptoms at the beginning of the study had a sustained impact throughout the study period for the participants of both interventions. These results resemble the exploratory analysis by Driscoll et al. (2018) that showed no significant improvement in participants' anxiety (*p* < .001) when placed in HF.

Depression was measured in four studies (Brown et al., 2015; Karim et al., 2006; Schick et al., 2019; Siegal et al., 2006) with mixed results. After 12-months of follow-up, 41% of homeless geriatric people who received PSH had fewer depressive symptoms than those who remained homeless (*p* = .02) (Brown et al., 2015). Likewise, changes in Patient Health Questionnaire-9 (PHQ-9) scores indicated that only participants who received PSH with a single coordinated care plan reported

significant reductions in depression from baseline (M = 10.09, SD = 6.98), at 18-months (M = 8.05, SD = 6.10), and 30-months (M = 7.25, SD = 4.78) follow-up (Schick et al., 2019). In contrast, no significant change in depression was found in families who were rehoused in the community (p = .53) and families who remained in a hostel (p = .86) (Karim et al., 2006). Depressive symptoms in homeless people at the start of the study increased the risk of poor outcomes regardless of the type of housing (PSH and CH) (Siegal et al., 2006).

Psychiatric symptoms (PSx) based on the Colorado Symptom Index (CSI) were reported in two studies (Aubry et al., 2015; Tsemberis et al., 2004). After performing a repeated-measures analysis to compare the HF and COC models, Tsemberis et al. (2004) found no significant difference in PSx between the two groups at time points (baseline, 6, 12, 18 and 24 months) (F 4,137 = .348, p = .85). Similarly, when comparing HF and TAU groups' one-year results, Aubry et al. (2015) found that the HF and TAU groups decreased in the severity of their PSx (HF: Baseline M = 39.87, SD = 12.89; 6 months M = 34.93, SD = 12.34; 12 months M = 33.26, SD = 11.90) (TAU: Baseline M = 40.81, SD = 12.62; 6 months M = 36.31, SD = 12.34; 12 months M = 34.51, SD = 12.48), but differences between groups were not significant.

Suicidal ideation and *suicide attempts* were reported in two studies (Aquin et al., 2017; Collins et al., 2016). Collins et al. (2016) provided the first documentation of suicide in a sample of chronically homeless people with alcohol problems. Changes in suicidal behaviour were measured after participants moved into housing (HF). From the initial assessment to the two-years follow-up, participants' suicidal ideation decreased by 43% (Wald X^2 [1, N = 85] = 4.84, p = .03) and none of the participants in the study committed suicide during the two-year study period. On the contrary, when Aquin et al. (2017) compared the HF and TAU groups for suicidal ideation and attempts, they found no significant differences between these groups (p = .51). Therefore, this study was unable to find evidence to support HF as an effective intervention to reduce suicidal ideation and attempts in chronically homeless people.

General mental health, wellbeing and ***quality of life (QoL)*** were reported in a cluster of studies (Aubry et al., 2015; Aubry et al., 2016; Driscoll et al., 2018; Kerman et al., 2020; Kirst et al., 2014; O'Campo et al., 2016; Stergiopoulos et al., 2014; Urbanoski et al., 2018) based on wellbeing and quality of life (QoL) measures that included the European Quality of Life-5D (QoLEQ-5D), Lehman Quality of Life Scale (LQoL), and Quality of Life Interview-20 (QoLI-20). As part of the QoL evaluation in Driscoll et al.'s (2018) study, participants were asked non-clinical questions about their general mental health. The HF group described their mental wellbeing in terms of "grief, therapeutic drugs, having a place to sleep securely and their goals for the future" (Driscoll, et al., 2018, p. 37). A significant number of participants reported an increase in their wellbeing (less time feeling depressed and anxious, more time enjoying activities and feeling light-hearted) ($p < .05$). In contrast, O'Campo et al. (2016) measured general mental health using QoLEQ-5D scores and found that both the HF (+ACT) and TAU groups did not improve in QoL ($p > .05$) at 24-months follow-up.

Whittaker et al. (2015) reported self-rated mental health based on Mental Component Summary (MCS) (SF-12) scores. The results showed no significant improvement in self-rated mental health for homeless persons who injected drugs (PWID) (AOR - 95% CI = 0.98, $p < .001$), compared to PWID in stable housing. When stratifying the sample by PSH configuration (fixed- and scattered-site), significant differences in MCS (SF-36) scores were found (Spector et al., 2020). Specifically, participants in fixed-site housing (47.5%) reported significantly higher levels of mental wellbeing than participants in scattered-site housing (44.2%) ($p < .001$). Similarly, Stergiopoulos et al. (2014) found that approximately one third (30%) of participants receiving HF improved significantly in their mental health at 6-months (mean change from baseline: −2.56 *vs.* -6.26, $p = .043$), compared with the participants in the TAU group. These results were similar to those from Kerman et al.'s (2020) study which examined the effects of HF on homeless adults with mental illness who frequently use emergency departments (FEDU). Although a decrease in the severity and frequency of mental health symptoms over 24 months was found for all three groups (HF and TAU, FEDU, non-FEDU) ($d =$

0.43; $p < .001$), FEDUs reported more severe and frequent symptoms than non-FEDUs ($d = 0.32$; $p < .001$). In contrast, Aubry et al. (2016) reported mental health symptoms for two groups (HF and TAU) and found a small difference between the groups at 12-months follow-up that supported the TAU group (ASMD = .17, CI = .05-.30, $p = .01$).

Other health outcomes

Substance use (SU) was reported in 14 studies (Aubry et al., 2015; Aubry et al., 2016; Driscoll et al., 2018; Hall et al., 2019; Kerman et al., 2020; Kirst et al., 2015; O'Campo et al., 2016; Spector et al., 2020; Somers et al., 2015; Stergiopoulos et al., 2014; Tsai et al., 2019; Tsemberis et al., 2004; Urbanoski et al., 2018; Whittaker et al., 2015). Data from Driscoll et al.'s (2018) study showed that, in participants with HF, the frequency of daily drinking decreased after 12 and 18 months from 51% to 31%, and the frequency of drinking less than once a week increased from 7% to 16%. Similarly, Kirst et al. (2015) examined the effect of HF on SU in chronically homeless people. They found a significant treatment by time interaction in all of the HF groups (ACT, ICM or Ethno Racial-ICM) that showed less SU after 12 months ($p < .05$) compared with the TAU group. However, no significant differences were found between the groups after 24 months. Interestingly, there were significant differences in the patterns of SU between the HF and TAU groups, as opium use was significantly higher in the TAU group ($p < .05$). Other studies (Aubry et al., 2015; Aubry et al., 2016) showed that both HF and TAU groups reported a decrease in substance use problems, but over time (one and two years), the differences between the groups were not significant ($p = -.01$). Finally, when Somers et al. (2015) studied the effect of HF on daily substance use (DSU) in chronically homeless people, the HF groups (CONG, ACT and ICM) did not differ significantly in DSU compared to the TAU group at 12-and 24-months follow-up. Likewise, when comparing the effectiveness of HF and COC for the chronically homeless, Tsemberis et al. (2004) found no significant differences between the groups' alcohol ($p =.35$) or drug ($p = .42$) use.

DISCUSSION

Summary of findings

Four types of housing interventions: Permanent supportive housing (PSH), Transitional housing (TH), Social housing (SH), and Community housing (CH) were investigated regarding their effects on the health of homeless people. With a few exceptions for HIV/AIDS, anxiety and depression, research to date has not comprehensively assessed the effectiveness of housing on physical and mental health outcomes for persons experiencing homelessness. Apart from one review (Aidala et al., 2016) and two studies (Buchanan et al., 2009; Hall et al., 2019) that focussed on HIV homeless populations, it is difficult to identify data that report on the significant impact housing has on other aspects of physical health. Only four studies (Driscoll et al., 2018; Spector et al., 2020; Tsai et al., 2019; Whittaker et al., 2015) were reviewed here that focussed on physical health via self-reports. Regardless of the type of housing, no improvements were found in general physical health or health-related quality of life (HR-QoL) for homeless individuals after 6-, 12- and 18- months of being housed.

PSH, notably Housing First (HF), has emerged in the United States and Canada as the leading approach to housing homeless people with mental illness who are traditionally viewed as being "hard-to-house" (Gaetz, Scott, & Gulliver, 2013, p. 1). While HF was found to decrease the number of days spent homeless for individuals with serious mental illness in some of the reviewed studies (Aubry et al., 2016; Stergiopoulos et al., 2014), this did not translate into significant improvements in mental health. For example, as part of the At Home/Chez Soi (AHCS) study, most researchers (Aubry et al., 2015; Aubry et al., 2016; Driscoll et al., 2018; Kerman et al., 2020; Kirst et al., 2014; O'Campo et al., 2016; Stergiopoulos et al., 2014; Urbanoski et al., 2018) compared homeless individuals assigned to HF, assertive community treatment (ACT) or intensive case management (ICM), and treatment as usual (TAU). After 6-, 12-, 18-, and 24-month periods, individuals in the HF programmes remained housed for more days than the TAU groups, but no significant differences were found between the

HF groups and TAU group at 12- and 24-month follow-up for the severity of mental health symptoms, self-rated mental health status, wellbeing, QoL, or substance use (Aubry et al., 2015; Aubry et al., 2016; Driscoll et al., 2018; Kirst et al., 2014; O'Campo et al., 2016). Similarly, when chronically homeless individuals were assigned to two separate housing conditions (HF and Continuum of Care [COC]), individuals in the HF group spent more days housed (Tsemberis et al., 2004), but no significant differences were found for substance use or psychiatric symptoms between the groups. These results reflect Aubry et al.'s (2015) study findings where no significant improvement in substance use or psychiatric symptoms was found for chronically homeless individuals placed in HF.

Overall, PSH was successful for 41% of homeless geriatric people who reported fewer depressive symptoms after being housed (Brown et al., 2015), and for people who received a single, coordinated plan of care, where significant reductions in depression at 18- and 30-months follow-up were evidenced (Schick et al., 2019). Likewise, 31% of previously homeless persons reported a decrease in anxiety after being housed (Sharpley et al., 2019).

Key issues identified in the reviewed literature

A key issue identified in the reviewed literature was the use of different methods to implement the same housing model. For example, HF and support services offered across different sites and nations (primarily the United States and Canada) are not always clearly defined or fully reported. This discrepancy makes it difficult to draw solid conclusions about the effectiveness of the model in the reviewed literature and is an important issue that has been acknowledged elsewhere (Baxter et al., 2019; Kertesz et al., 2009; Rog et al., 2014; Woodhall-Melnik & Dunn, 2016). One possible explanation for this is that some studies made it difficult to assess the impact of housing because the control group was given different services that may not be available to people in other places. For example, in the AHCS studies in Canada, TAU groups also had access to existing services in their communities of housing and wider facilities that may not be available in the United States.

Another important issue identified in the reviewed literature is the difficulty of controlling for confounding variables, which can lead to two common conceptual issues in housing and health research: moderation and mediation (Evans et al., 2003). Simply put, moderation and mediation analyses aim to better understand the relationship between independent and dependent variables when working on a third variable (MacKinnon, 2011). For example, in some studies (Aubry et al., 2016; Driscoll et al., 2018; Tsemberis et al., 2004) there were certain participant variables such as age, sex, socioeconomic status, race or ethnicity that were not considered to play a moderating role in the relationship between housing and physical and mental health. However, one study that analysed some moderating variables (Siegel et al., 2006) found that self-reported anxiety and depression at the beginning of the study were consistently correlated at many time points with housing dissatisfaction, regardless of the housing (CH) situation. With mediation, a previous review (Baxter et al., 2019) and study (Karim et al., 2006) examined several underlying psychosocial processes that might otherwise explain how and why housing can affect physical and mental health. When Karim et al. (2006) analysed the mediating variables of domestic violence, neighbour harassment, and relationship breakdown, they were able to explain how and why housing affected the anxiety and depression of homeless families living in two different housing environments (hostels and CH).

Methodological limitations and strengths identified in the reviewed literature

Several methodological limitations were identified in the reviewed literature. These include the heterogeneity of participant groups (Baxter et al., 2019) and the relatively short-term follow-up periods (Aubry et al., 2015; Karim et al., 2006; Tsemberis et al., 2004). The data, which were limited to a 4- and 6-month follow-up period, provided only short-term results and limited testing observations for any medium- and long-term health effects of housing. Likewise, studies without a comparison group (Hall et al., 2019) were unable to draw specific causal conclusions about the effects of PSH on HIV-related health outcomes *per se*. In addition, any study involving a homeless (or other

vulnerable) sample is inevitably at risk of high attrition rates, as evidenced by Urbanoski et al.'s (2018) study. Studies with small sample sizes (Aubry et al., 2016; Karim et al., 2006) and specific populations (suicidal) (Aquin et al., 2017; Collins et al., 2016) are low on generalisability to other homeless populations with different characteristics.

Another limitation in methodology is the use of self-report measures, which was evidenced in all of the studies. Self-report measures are often prone to inadequacies due to cognitive impairment (Langenbucher & Merrill, 2001), memory biases (Garry, Sharman, Feldman, Marlatt, & Loftus, 2002), social desirability (Caputo, 2017), and prompt wording (Bickart, Phillips, & Blair, 2006). In the case of Buchanan et al.'s (2009) study, self-reports of the use of alcohol and drugs and treatment services were found to be susceptible to bias reporting. The results showed that there was a high discrepancy between self-reporting and participant observations regarding substance use and the utilisation of substance abuse treatment services. Similarly, memory errors, non-disclosure, concerns about social desirability, and intentional misrepresentation were shown in Kirst et al.'s (2015) study, and underreporting was evidenced in Tsemberis et al.'s (2004) research.

In addition to the main limitations identified, some of the strengths described in the reviewed literature should be emphasised. The use of the logic model in Baxter et al.'s (2019) review allowed for testing of the theoretical impact that HF had on health when housing stability was analysed as the mediator. Large, multisite sample populations with two-year longitudinal data and comprehensive participant follow-up strengthened Aquin et al.'s (2017) and Urbanoski et al.'s (2018) research findings. Finally, the wide range of health outcomes (depression, anxiety, stress, substance use, physical health, mental health, wellbeing, and QoL) examined in the same study (Driscoll et al., 2018; Siegal et al., 2006; Urbanoski et al., 2018) was a notable strength demonstrated in the reviewed literature.

Strengths and limitations of this systematic review

The main strengths of this systematic review are the comprehensive searches conducted in multidisciplinary databases to include all relevant studies, plus the strict use of well-defined guidelines including PRISMA-P 2015 Statement and Checklist (Moher et al., 2015) and the updated guideline for PRISMA 2020 Statement (Page et al., 2020). Additionally, the PICOS design framework (Schardt, Adams, Owens, Keitz, & Fontelo, 2007) used to formulate the review criteria, plus the use of recognised, standardised tools (RoB2 [Sterne et al., 2019]; ROBINS-I [Sterne et al., 2016]) by two reviewers to assess the risk of bias in each included study, minimised any potential biases and allowed for a transparent process (MacLure, Paudyal, & Stewart, 2016). However, this systematic review did not consider non-peer-reviewed data that may have potentially provided further insights into the effects of housing on the health of homeless people.

Implications for future research

Based on the key issues and identified limitations mentioned above, adopting PSH (especially HF) in other nations may require caution. As most of the data included in this review are from the United States and Canada, research findings may not be easily generalised to other nations. According to the HF principles, participants are selected based on complex health needs such as mental illness or substance use (Tsemberis, 2011). Therefore, this may limit the generalisation of these review findings to homeless people with other complex health needs (physical), or to homeless people without complex health needs. For primary research, a defined report of the housing model should be a starting point to ensure an identifiable and replicable model of intervention. Perhaps incorporating more detailed, quantitative standards of housing before and after individuals are placed may produce more robust evidence (Evans, Wells, Chan, & Saltzman, 2000). Future studies may also consider longer observation periods so that information on long-term health effects may be collected. Finally, self-reported health is an important indicator and strongly associated with mortality (DeSalvo, Bloser,

Reynolds, He, & Muntner, 2006). However, beyond the scale of self-reporting, future research might use a more objective and comprehensive assessment of health. For example, the use of biomarker data can provide an "objective indication of medical state that can be measured accurately and reproducibly" (Strimbu & Tavel, 2010, p. 1).

Conclusion

This systematic review identified three systematic reviews and twenty-four individual studies that assessed the impact of housing on the physical and mental health of homeless people. With a few exceptions to HIV/AIDS, anxiety and depression, research to date has not comprehensively assessed the effectiveness of housing on physical and mental health outcomes for people with experience of homelessness. Although HF was found to reduce the number of days spent homeless for people with severe mental illness, and the permanent supportive housing and social housing models showed some benefits for homeless individuals' anxiety and depressive states, this did not translate into significant improvements in mental (or physical) health status in most of the reviewed studies. The lack of objective assessments of the impact of housing on the anxiety and depression of homeless people represents a significant gap in the literature, especially when anxiety and depression are two of the most common mental health problems in homeless populations (ABS, 2008; Fazel et al., 2008), and significant contributors to the overall global burden of disease (Ferrari et al., 2013; Friedrich, 2017; Vos et al., 2017). Perhaps the use of biomarker data as an objective measure for assessing physical and mental health changes before and after homeless people are housed could better inform future research studies.

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Figure 1

PRISMA Flow Diagram Outlining the Systematic Review Search, Screening, and Selection Process

```
Identification
  ┌─────────────────────────────┐   ┌─────────────────────────────┐
  │ Records identified through  │   │ Additional records          │
  │ database searching          │   │ identified through other    │
  │ (n = 5,230)                 │   │ sources (n = 18,301)        │
  └─────────────┬───────────────┘   └──────────────┬──────────────┘
                │                                   │
                └──────────────┬────────────────────┘
                               ▼
              ┌──────────────────────────────────┐
Screening     │ Records after duplicates removed  │
              │ (n = 2,338)                       │
              └───────────────┬──────────────────┘
                              ▼
              ┌──────────────────────┐      ┌─────────────────────────┐
              │ Records screened     │─────▶│ Records excluded through │
              │ (n = 2,338)          │      │ title or abstract        │
              └──────────┬───────────┘      │ (n =1,976)               │
                         │                  └─────────────────────────┘
Eligibility              ▼
              ┌──────────────────────┐      ┌─────────────────────────┐
              │ Full-text articles   │─────▶│ Full-text articles       │
              │ assessed for         │      │ excluded, with reasons   │
              │ eligibility          │      │ (n = 335)                │
              │ (n = 362)            │      │ ▪ Non-homeless sample/   │
              └──────────┬───────────┘      │   population             │
                         │                  │ ▪ Pilot/protocol study   │
                         ▼                  │   design                 │
              ┌──────────────────────┐      │ ▪ No housing intervention│
Included      │ Peer-reviewed        │      │ ▪ Irrelevant outcomes    │
              │ articles included    │      └─────────────────────────┘
              │ (n = 24)             │
              └──────────┬───────────┘
                         ▼
              ┌──────────────────────┐
              │ Systematic reviews   │
              │ included             │
              │ (n = 3)              │
              └──────────────────────┘
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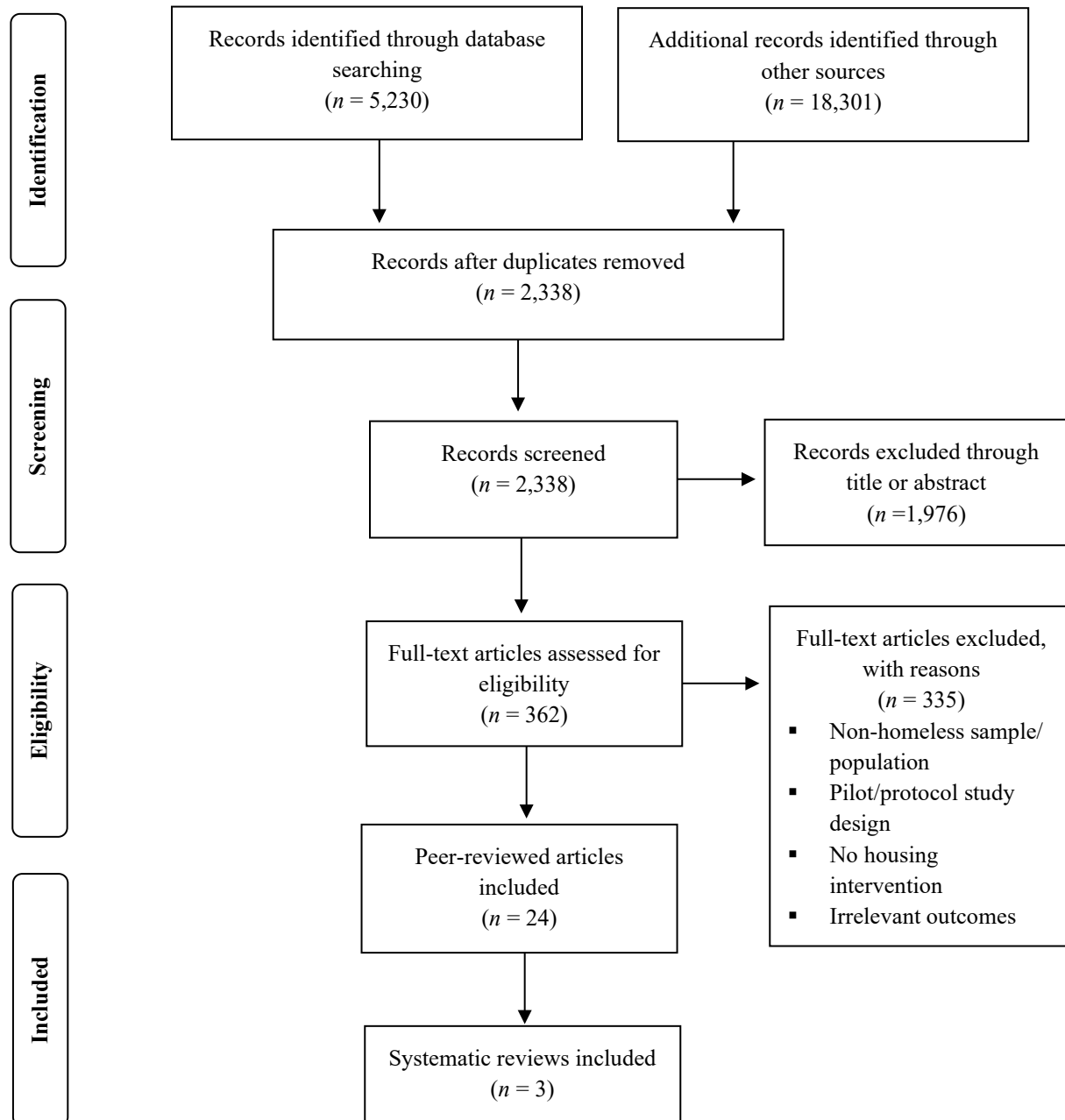
Table 3

Detailed Summaries of the 24 Studies Included in this Review

Author(s) Year	Study Location; Journal	Study Focus	Study Sample; Size; Design	Housing Method(s)	Health Outcomes; Measures	Main Findings
Tsemberis et al. (2004)	NY: USA; AJPH	Investigate the effectiveness of HF and COC models	Chronically homeless and mentally ill persons; ($N = 225$); QQM	HF; COC	CC and RS; SU (DAFBC); SA (TSI); PSx (CSI)	CC: significant time group status effect ($p < .001$). RS: COC group significantly faster decreases in homeless status and increases in stably-housed status than HF ($p < .001$). SU: no significant differences in either group for alcohol ($P = .35$) or drug use ($P = .42$). SA: significant differences at 6, 18, 24 months ($p < .025$); and 12 months ($p < .05$). PSx: no significant differences between COC and HF groups ($P = .35$)
Karim et al. (2006)	UK; IJSP	Assess MH and PD before and after housing	Homeless families; ($N = 81$); Four-month follow-up ($n = 35$); QQM	Hostel and Community Rehousing	MH (HADS); Child behavioural problems (ECBI); Clinical and psychosocial (HoNOSCA); PD (PDHS)	No significant change on HADS ($P = .58$), ECBI ($P = .20$), or PDHS ($p = .05$). Children rehoused showed no significant changes on ECBI or HoNOSCA scores. Rehoused family's (59%) perceived improvement in MH, 18% described the continuation of MH problems, compared to 54% still in hostels.
Siegel et al. (2006)	NY: USA; PS	Compare SH and CR with housing satisfaction and wellbeing	Persons with a history of homelessness and mental illness; ($N = 157$); Quasi	SH: live alone, studio apartment with ACT; CR: renovated residential hotel in a studio apartment with onsite support	Days in initial placement (self-report); Housing satisfaction (autonomy/social); Clinical outcomes: ED, crisis service use (BASIS 3); Wellbeing (SIS, UCLA Loneliness Scale 3, Overall Choice and Empowerment Scale (LQoL)	Tenants still in initial placement at 12-18 months: SH (72-87%; 64-80%); CR (62-71%; 37-71%). Participants in SH have fewer thought disorders, SA, and extensive histories of hospitalisation. Tenure in housing did not differ by housing type. Higher depression/anxiety scores at entry had sustained impact for study persons in both housing models: less housing satisfaction, greater use of crisis services, more isolation, less community integration, empowerment, poorer QoL

Buchanan et al. (2009)	CHI: USA; *AJPH*	Health benefits of PSH for homeless persons hospitalised with a chronic medical illness	Homeless persons hospitalised with a chronic medical illness; (N = 105); QQM	PSH without time limits combined with the CHHP model	HIV Clinical Health: Primary: Survival with intact immunity, alive 12 months after enrollment with a CD4 count of ^= 200 and viral load ~100000. Secondary - CD4 counts, viral loads, patients with undetectable viral loads	Outcomes for 94 of 105 participants (90%): Of 54 interventions participants, 35 (65%) reached permanent housing in programme housing agencies. After one year, 55% of the intervention and 34% of the usual care groups were alive and had intact immunity (P = .04). Seventeen intervention (36%) and nine usual care (19%) participants had undetectable viral loads (P = .051). Median viral loads were 0.89 lower in the intervention group (P = .03). There were no statistical differences in CD4 counts
Collard et al. (2014)	ATL: USA; JE-BSW	Length of residency in SH and subjective wellbeing	Low-income adults in recovery from addiction; (N = 103); QQM	SH: Remington House (n = 35); Darmouth House (n = 35); Non-SH (n = 33)	Subjective wellbeing: Sobriety (duration); Self-efficacy (GESS-R/DTCQ-8); Employment (employed/unemployed rate)	Significant findings for SH and sobriety. The difference in means for duration of sobriety for participants in group 1: M = 18.30, SD = 17.04, Group 2: M = 14.10, SD = 9.11, and Group 3: M = 7.39, SD = 3.54; F = 7.80, P=.001. SH and self-efficacy not supported, and χ^2square revealed a significant difference (P = .000, p < .05) in means for SH and employment.
Kirst et al. (2014)	TOR: CAN; BMJO	Housing and hope for recovery	Homeless adults with mental illness; (N = 60); HF (n = 36) or TAU) (n = 24)	HN: HF + ACT; MN: HF + ICM; or TAU	Hope/optimism for future recovery; Hope and personal goal-setting; Independence and control; Health and wellbeing; Relationship rebuilding	Hope/optimism for recovery in future displayed in goalsetting, rebuilding self-esteem and finding meaning through relationships and symbolism ("door-key"). Perspectives on hopes to regain control over their lives and sense of independence would facilitate achieving self-acceptance, rebuilding and developing new relationships, as well as help to reclaim their lives in the community
Stergiopoulos et al. (2014)	TOR: CAN; BioMed Central	HF and early trajectories of health and social functioning	Homeless adults or precariously housed persons with serious mental disorder with or without	HN: HF + ACT; MN: HF + ICM	Physical community integration (CIS-physical subscale); Psychological community integration (CIS-psychological subscale); MH (MCSI);	Almost two-thirds of participants followed the expected trajectory of improvement for physical (60%) and psychological (62%) community integration. Remainder experienced a decrease in their physical (40%) and psychological (38%) community integration from initial assessment to 6 months following. Additionally, almost 30% of

					SU (GAIN-SS); CF (MCAS); QoL (QoLI-20)	participants reported increased MH symptom severity and more than 28% experienced increased problems due to SU from baseline to six-months. Improvement in CF and QoL 67% and 66%, respectively. 33% decrease in CF and 34% a decrease in QoL at the 6-month interview. Participant isolation was a prominent theme among participants and service providers
			a concurrent SU problem; (N = 301)			
Aubry et al. (2015)	MONC, MON, TOR, VAN, WPG: CAN; PS	Report one-year findings from AHCS Study	Homeless adults; HF (n = 469), TAU (n = 481); QQM	HF + ACT or TAU	Primary: Housing (RTLFB, QoLI-20); Secondary: PSx (CSI); SU (GAIN-SS); CF (MCAS)	One-year follow-up: 73% of HF participants and 31% of TAU participants resided in stable housing (p < .001, odds ratio=6.35, covariate-adjusted difference =42%, 95% CI =36-48%). Improvement in QoL was significantly greater for HF participants compared with TAU participants (p < .001, d=.31, CI=.16-.46). HF participants also showed greater improvements in CF compared with TAU participants (P = .003, d=.25, CI=.09-.41).
Brown et al. (2015)	BS, MA: USA; AJPH	Examine housing and health status, geriatric conditions and decreased use of acute care	Older homeless adults with geriatric conditions; (N = 250); QQM	Housing status: Currently living in own place that was not part of a transitional housing programme or homeless shelter	Primary: Number of KADLs; Number of IADLs; Depressive symptoms (PHQ-9); Symptoms of urinary incontinence. Secondary: Acute care utilisation; General health; Medical and psychiatric comorbidities: Health-related behaviours; Geriatric conditions	At 12-month follow-up, 41% of participants obtained housing and had fewer depressive symptoms and lower acute care utilisation than participants who remained homeless at follow-up (unadjusted mean PHQ-9 score =6.0 [housed] vs 7.6 [homeless]; P = .02). Other measures of health status did not differ by housing status. Participants who obtained housing had a lower rate of acute care use, with an adjusted annualised rate of acute care visits of 2.5 per year (95% CI=1.8,3.3) among participants who obtained housing and 5.3 per year (95% CI=3.9,6.2) among participants who remained homeless
Kirst et al. (2015)	TOR: CAN; DAD	Investigate the effect of HF on SU	Homeless adults with mental illness; (N = 575) HF (n = 301)	HF + ACT, ICM, or ER-ICM	SU (GAIN-SS, ASI)	Reductions in overall SU with significance at 24 months (IRR=0.80; CI:0.66, 0.97; p < 0.05). Significant treatment by time interaction, with the HF having experienced less SU at 12 months (IRR=0.74; CI: 0.58,0.94; p < 0.05) than TAU

			TAU ($n = 274$)			participants, but not at 24 months. Differences in SU patterns between the HF and TAU: more TAU participants used opiates, and a general decrease in the amount of money spent on drugs was observed at 18 months ($\beta = -102.13$; CI=-199.34, -4.92; $p < 0.05$)
Somers et al. (2015)	VAN: CAN; Addiction	Examine the effect of HF on DSU	Mentally ill homeless adults; ($N = 497$; HN $n = 297$; or MN $n = 200$) (HN-ACT $n = 90$; HF-CONG $n = 107$; HN-TAU $n = 100$; or MN-ICM $n = 100$; MN-TAU $n = 100$)	HF + ACT, ICM or CONG; TAU	DSU (MAP)	Compared with HN (TAU), neither CONG (AOR=0.73, 95% CI=0.39-1.37) nor ACT (AOR =1.22, 95% CI=0.61-2.45) differed on DSU at 24 months, and MN (TAU) did not differ from ICM (AOR=0.78, 95% CI=0.37-1.63). No differences at 12 months, when analyses were restricted to participants who indicated SU at baseline, or when considering the duration of stable housing. No evidence of a difference in effectiveness between HF and TAU on DSU
Whittaker et al. (2015)	AUS; DAR	Assess the effect of housing status and SU in PWID	PWID; ($N = 923$); QQM	Housing status: "Homeless" or "Stably housed"	SU (SF-12)	Almost one-quarter (23%) reported that they were homeless. Homeless PWID were significantly more likely to be unemployed (AOR=2.83, 95% CI=1.26, 6.34), injecting in public (AOR=2.01, 95% CI=1.38, 3.18), have poorer MH (AOR=0.98, 95% CI=0.97, 1.00), report schizophrenia (AOR=2.31, 95% CI=1.16, 4.60) and have a prison history (AOR=1.53, 95% CI=1.05, 2.21) than stably housed PWID. Homeless PWID had poorer self-reported MH and were more than twice as likely to report schizophrenia: Rate of schizophrenia among homeless PWID was 18 times that of the general population (0.5%)
Aubry et al. (2016)	MONC, MON, TOR, VAN,	Report two-year findings from AHCS study	HN adults with severe mental illness; ($N = 950$)	HF +ACT; TAU	Primary: Housing stability (RTLFB); QoL (QoLI-20); Secondary:	HF participants spent more time in stable housing than TAU participants (71% versus 29%, AAD=42%, $p < .01$).Compared with TAU participants, HF participants entered housing more

	WPG: CAN; PS		HF + ACT (n = 469) or TAU (n = 481)		PSx (CSI); SU (GAIN-SS); CF (MCAS)	quickly (73 versus 220 days, AAD=146.4, $p < .001$), had longer housing tenures at the study end-point (281 versus 115 days, AAD=161.8, $p < .01$), and rated the quality of their housing more positively (ASMD=.17, $p < .01$). HF participants reported higher QoL (ASMD=.15, $p < .01$) and had better CF (ASMD=.18, $p < .01$) over two years. HF participants showed more significant gains in CF and QoL in the first year, and at the end of the second year, attenuated differences between groups. No intervention effect on MH symptoms or SU problems
Collins et al. (2016)	WASH: USA; SLTB	Assess the impact of HF on suicidality	Homeless adults with alcohol problems; (N = 134); QQM	HF: immediate; permanent; low-barrier or TAU	Suicidal ideation; intent; plans; prior attempts	Suicidal ideation was significant (W^2 1, N = 85, 4.84, P = .03). Time was a significant predictor (time IRR=.57, SE = .15, p = .03), indicating participants' level of suicidal ideation decreased by 43% from baseline to 2-year follow-up. Suicidality as interfering with daily life declined by 67% from baseline across 2-year follow-up (time OR=.33, SE = .09, $p < .001$). Suicidal intent was also significant (W^2 1, N = 85, 3.96, P = .047). Participants reporting some intention to act on their ideation decreased by 55% from baseline across 2-year follow-up (time OR=.45, SE = .18, P = .046)
O'Campo et al. (2016)	TOR: CAN; BMJO	Examine the effect of HF and contact with the justice system, healthcare usage and health outcomes	Homeless adults with mental illness; (N = 197) HF + ACT (n = 97), TAU (n = 100); QQM	HF + ACT or TAU	Primary: Housing stability (RTLFB); Secondary: QoL (EQ-5D); Functional ability (MCAS); Exploratory: community integration; MH; SU; justice and healthcare use	Primary: HF (ACT) group spent more time stably housed compared to the TAU group with a mean difference between groups of 45.8% (95% CI=37.1% to 54.4%, $p < .0001$). Secondary: QoL living subscale, a significant mean change from baseline was detected at 6 months (0.94, 95% CI+0.20-1.68, P = .013). QoL global at18 months (0.61, 95% CI=−0.01-1.23, P = .055). No differences between HF (ACT) and TAU groups for health service usage, community integration and substance use

Aquin et al. (2017)	MONC, MON, TOR, VAN, WPG: CAN; CJOP	Investigate the effect of HF on suicidal ideation and attempts	Homeless adults with mental illness; (N = 2255) HF (n = 1265), TAU (n = 990); QQM	HF or TAU	Suicidal ideation (MCSI); Suicidal attempts (MINI 6.0)	Decreased past-month suicidal ideation (estimate = −.57, SE = .05, p < .001), with no effect of treatment group: HF vs. TAU (estimate = -.04, SE = .06, P = .51). No effect of treatment status (estimate = −.10, SE = .16, P = .52) on prevalence of suicide attempts: HF = 11.9%, TAU = 0.5%) during 2-year follow-up period
Driscoll et al. (2018)	AK: USA; JSDH	Examine the impact of HF on service costs and QoL	Homeless adults; (N = 94), 12-18-month follow-up (n = 68); QQM	Two HF facilities (converted hotels with 45 studio apartments and case management provided onsite)	PH: PTSD, high blood pressure, depression/bipolar, seizures, acute/chronic pain; MH: grief, anxiety; SA: daily/weekly consumption; Emergency services: police, fire, community, shelter; Legal services: correctional facilities; Health care services: emergency room, inpatient/outpatient services, detox	30-day prevalence of most health problems diminished from baseline to 12-18-month follow-up, but declines were only statistically significant for lice/bed bug complaints (P = .033). Significant reductions at follow-up in number of physical exams (from 76.6 to 53.6%), emergency room visits (from 60.9 to 42.9%), MRI/CT scans (from 43.8 to 30.4%). At follow-up, daily drinking declined to 31%, with 43% of tenants reported drinking less frequently, while only 14% reported drinking more often. HF was effective at enhancing security, access to health care services, supportive staff, and social connections. Significant improvements in medication adherence and increase in outpatient medical service use
Urbanoski et al. (2018)	MONC, MON, TOR, VAN, WPG: CAN; Addiction	Assess the effect of HF on SUD	Homeless adults with comorbid SUD; (N = 2154); QQM	HF + ACT; HF + ICM; TAU	Primary: housing stability (days housed (RTLFB); CF (MCAS) Secondary: General health (QoLI-20); MH (CSI)	During the 24 months, people with SUD spent less time in stable housing in both HF and TAU. The effect of HF did not vary significantly by SUD status (OR = 1.17, 95% CI = 0.77, 1.76). CF of HF over TAU did not vary by SUD status (β =.75, 95% CI = 0.36, 1.87). QoL increased in all groups. No significant changes in the effect of the intervention between those with and without SUD (β = .01, 95% CI = 0.03, 0.02). MH symptoms decreased for all participants during the study period. However, no significance of HF over TAU, and no differential

						effect of the intervention-associated SUD status (β = 0.43, 95% CI = 0.99, 1.86)
Hall et al. (2019)	NY: USA; Aids and Behaviour	Assess SH, incarceration, and health service use on markers of HIV infection for PLWH, mental illness or SUD	Chronically homeless HIV persons; (N = 696), SH (n = 333) Not placed (n = 268); Quant	Housing Status: New York III program; Not placed; Other SH Incarceration; ED visit; PH/MH; SUD Hospitalisation: PH/MH Inpatient/Outpatient SUD Treatment	Survivor time without AIDS; Achievement of undetectable viral load; Maintenance of viral suppression	Persons not placed in SH had a higher risk of death or AIDS diagnosis at the study endpoint than NY III tenants (AHR 1.84 [1.40, 2.44], p < .001). Incarceration (AHR 0.70 [0.54, 0.90], P = .006) and outpatient SUD treatment (AHR 0.71 [0.57, 0.89], P = .003] associated with lower risk of survivor time until death or AIDS diagnosis. Hospitalisation with a PH diagnosis associated with a greater risk of death or AIDS diagnosis (AHR 1.53 [1.20, 1.96], P = .001). Overall, 60% of NY III tenants, 52% of not placed persons, and 62% of other SH tenants achieved undetectable viral load during the follow-up period, and outpatient SUD/MH/ED care for SUD/PH had longer periods of suppression
Schick et al. (2019)	HOU: TEX; AJPH	Investigate the impact of collaborative care on HR-QoL of individuals in PSH	Formerly chronically homeless persons; (N = 323); Natural-Quant	Intervention group: Partnering FQHC case management with a nurse and HER; Comparison Group: No FQHC or HER (no single coordinated plan of care)	HR-QoL (SF-36v2 with MCS and PCS); Depression (PHQ-9); ED use (for intervention group only)	No differences between the groups at 6 months. At 18 and 30 months, significant increase in MCS (p < .01) and PCS scores (p < .01) with a slower rate of deceleration over time for both MCS (p < .05) and PCS scores (p < .05). Group status was related to a linear decrease in PHQ-9 scores (p < .01), with intervention group reporting greater reductions in PHQ-9 scores over time relative to the comparison group. Intervention group ED use decreased by 70%. Overall, participants in the intervention group with a single, coordinated plan of care reported greater improvements in HR-QoL and a decrease in depressive symptoms relative to the comparison group
Sharpley et al. (2019)	NSW: AUS; JSDH	Assess the effect of housing transition upon participants'	Previously homeless persons - Residents of Homes North	Social housing	Anxiety (GAD-7)	Subgroups of participants who showed: (a) no change, (b) an increase, and (c) a decrease in GAD-7 scores. a) 52.9% of participants had same score before being housed and currently b) 11 participants (15.5%) reported increase in GAD-7 score (M =

		self-reported levels of anxiety	Community Housing; (N = 71); Retrospective pre-test - Quant			2.72, SD = 0.82) before being housed and (M = 8.63, SD = 2.02) after being housed c) 22 participants (31.0%) reported a decrease in GAD-7 score (M = 7.52, SD = 1.38) before being housed and (M = 6.67, SD = 1.47) after being housed. Post-hoc tests showed significant difference between pre-housing GAD-7 scores for "increase" and "decrease" subgroups (Mean difference = 9.79, SE = 2.32, p < .001) but not for their after-housing GAD-7 scores (Mean difference = 1.97, SE = 2.54, P = .720)
Tsai et al. (2019)	CHATT: TN; CHI, IL; COLS: OH; DEN: CO; FTL: FL; LA: CA; MTZ: CA; NY: NY; PHL: PA; PDX: OR; SF: CA; JGIM	Examine the associations between changes in physical health, housing status, and trust in primary care providers	Chronically homeless adults; (N = 756); 3 months (n = 682) 6 months (n = 649) 9 months (n = 618) 12 months (n = 583); Observational/ Quant	CICH: Provision of PSH to participants with clinical supports and increased access to integrated mental health and primary care services	Days housed; PH status (SF-12, HR-QoL); Number of medical conditions; Number of treated medical conditions; Relationship with medical provider; MH status (BSI-Psychoticism, Depression, Anxiety subscales)	Participants had significant improvements in housing outcomes over time, with increased nights in their housing. Substantial reductions in the number of medical problems reported and increases in the number of preventive procedures they received. No significant changes in trust in primary care providers, therapeutic alliance with MH providers, SF-12 HR-QoL PCS scores, or the number of medical problems treated. Longitudinal analysis revealed increases in the number of days in own housing were not significantly associated with improvement in SF-12 HR-QoL PCS (p < .001), number of medical problems (p < -.003), number of medical issues treated (p < -.002), or the amount of preventive procedures received (p < -.001). Changes in trust in the primary care provider significantly associated with an increase in the number of medical problems reported. Change in therapeutic alliance with MH providers significantly related to an increased number of preventive procedures (p < .01)
Kerman et al. (2020)	MONC, MON, TOR, VAN, WPG:	Examine how effective HF is in improving housing stability,	Homeless adults with mental illness; (N = 2,111); QQM	HN: HF + ACT, MN: HF + ICM, TAU	Housing stability (RTFLB; Behavioural health and functioning (CSI, GAIN-SPS, MCAS); Service use	FEDU in HF spent 66.4% (95% CI 63.5% to 69.2%) of their nights in stable housing post-randomisation. FEDU in TAU were stably housed 34.7% (95% CI 31.5% to 37.8%) of the time. An interaction effect was found in the LMM predicting housing stability

	CAN; APMHM HSR	behavioural health and functioning, and reducing use of hospital services			(HSJSU, RTFLB); Frequency of ED use (FEDU/NFEDU)	between intervention and ED use ($p < .001$). FEDU in HF had lower housing stability rates from the 15-month time point onwards compared to NFEDU in TAU ($p \leq .01$), no significant differences between groups. CF and SU showed significant main effects of time ($p < .001$) and interaction effects between intervention and ED use ($P = 0.02$, $p < .001$). All groups improved in severity and frequency of mental health symptoms over 24 months ($d = 0.43$; $p < .001$); however, FEDU reported more severe and frequent symptoms than NFEDU ($d = 0.32$; $p < .001$)
Spector et al. (2020)	CHI:IL; QoLR	Understand the factors associated with HR-QoL and PSH	Chronically homeless adults currently in PSH; ($N = 855$); Quant	PSH: fixed-site (single building) or scattered-site (with rent vouchers. Service model: LICM, ICM, ACT or behavioural health	HR-QoL (SF-36, PCS/MCS); Individual/Environmental characteristics; Housing satisfaction (SAMHSA-HSS); Perceived access to healthcare (ACS)	Mean scores for PCS and MCS were 39.4 and 46.1, (out of 100) with higher scores indicating better physical and mental HR-QoL. Those in fixed-site housing reported significantly higher mental wellbeing than those in scattered-site (47.5 vs. 44.2; $p < .001$). No difference in PCS scores by PSH. For service models, significant differences in both the unadjusted PCS and MCS scores ($p < .001$). PCS and MCS highest among those receiving LICM. Older age and being on disability associated with worse PCS. PLWH had better PCS than their counterparts. Being in PSH for longer durations associated with better MCS. Those with more depressive symptoms associated with worse PCS and MCS. Overall, PSH service intensity not significantly associated with physical or mental health.

Abbreviations: ACS, Access to Care Scale; ACT, assertive community treatment; ADL, activities of daily living; AHCS, At Home Chez Soi study; AJPH, American Journal of Public Health; AK, Alaska; APMHMHSR, Administration and Policy in Mental Health and Mental Health Services Research; ASI, Addiction Severity Index; ATL, Atlanta; AUS, Australia; BASIS-32, Behaviour and Symptom Identification Scale – 32; BMJO, British Medical Journal Open; BS, Boston; BSI, Brief Symptom Inventory; CA, California; CA, Canada; CC, Consumer Choice; CD4, cluster of differentiation 4; CF, community functioning; CHATT, Chattanooga; CHHP, Chicago housing for health partnership; CHI, Chicago; CICH, Collaborative Initiative to End Chronic Homelessness; CIS, Community Integration Scale; CJOP, Canadian Journal of Psychiatry; CO; Colorado; COC,

Continuum of Care model; COLS, Columbus; CONG, congregate housing; CR, community residence; CSI, Colorado Symptom Index; DAD, Drug and Alcohol Dependence; DAFBC, Drug and Alcohol Follow-Back Calendar; DAR, Drug and Alcohol Review; DEN, Denver; DSU, Daily Substance Use; ECBI, Eyberg Child Behaviour Inventory; ED, emergency department; EHR, electronic health record; ER-ICM, Ethno Racial-Intensive Case Management; FEDU, frequent emergency department user; FL, Florida; FQHC, Federally qualified health centres; FTL, Fort Lauderdale; GAD-7, Generalised Anxiety Disorder-7; GAIN-SPS, Global Appraisal of Individual Needs–Substance Problem Scale; GAIN-SS, Global Assessment of Individual Need – Short Screener; HADS, Hospital Anxiety and Depression Scale; HF, Housing First; HIV, human immunodeficiency virus; HN, high needs; HoNOSCA, Health of the Nation Outcome Scale for Children and Adolescents; HOU, Houston; HR-QoL, health-related quality of life; HSJSU, Health, Social, and Justice Service Use Inventory; IADL, Instrumental Activities of Daily Living; ICM, intensive case management; IJSP, International Journal of Social Psychiatry; JDD, Journal of Dual Diagnosis; JGIM, Journal of General Internal Medicine; JE-BSW, Journal of Evidence-Based Social Work; JSDH, Journal of Social Distress and the Homeless; KADL, Katz Activities of Daily Living; LA, Los Angeles; LICM, low-intensity case management; MA, Massachusetts; MAP, Maudsley Addiction Profile; MCAS, Multnomah Community Ability Scale; MCS, mental component summary; MCSI, Modified Colorado Symptom Index; MH, mental health; MINI 6.0, Mini International Neuropsychiatric Interview 6.0; MN, moderate needs; MON, Montreal; MONC, Moncton; MTZ, Martinez; NFEDU, non-frequent emergency department user; NSW, New South Wales; NY, New York; OH, Ohio; OR, Oregon; PA, Pennsylvania; PCS, physical component summary; PD, parenting difficulties, PDHS, Parenting Daily Hassles Scale; PDX, Portland; PH, physical health; PHL, Philadelphia; PLWH, people living with HIV; PS, psychiatric services; PSH, permanent, supportive housing; PSx, psychiatric symptoms, PTSD, Post-traumatic stress disorder; PWID, people who inject drugs; QoLEQ-5D, European Quality of Life-5D; QoLI-20, Quality of Life Interview-20; QoLR, Quality of Life Research; Quant, quantitative; Quasi, quasi-experimental; QQM, qualitative and quantitative methods; RS, residential stability; RTLFB, Residential Time-Line Follow-Back Inventory; SA, substance abuse; SAMHSA-HSS, Substance Abuse and Mental Health Services Administration - Housing Satisfaction Scale; SF, San Francisco; SF-12, Short Form-12 Health Survey; SF-36 Short Form-36 Health Survey; SF-36v2 Short Form Version 2 Health Survey; SH, supported housing, SIS, Social Integration Scale, SLTB, Suicide and Life-Threatening Behaviour; SS, social services; SU, substance use; SUD, substance use disorder; TAU, treatment as usual; TEX, Texas; TOR, Toronto; TSI, Treatment Services Inventory; UK, United Kingdom; USA, United States of America, VAN, Vancouver; WASH, Washington; WPG, Winnipeg

Table 5

Overview of Types of Housing (Intervention Models and Support Services) Identified in the 24 Included Studies

Type of Housing / Intervention (Model)	Authors / Year of Study	Description of Housing Model & Service Interventions
Permanent supportive housing		
Pathways/Housing First (HF)	Tsemberis et al. (2004) Collins et al. (2016) Driscoll et al. (2018)	HF was developed by Pathways to Housing in New York City in response to the needs of "chronically" homeless people with mental health and substance use problems. Traditionally known as Treatment First (TF) or Continuum of Care (COC), individuals are required to remain sober, abstain from substance use, and participate in mental health treatment to display "housing readiness". Residency is dependent on sobriety and treatment compliance. Contemporary HF models provide homeless people with immediate access to subsidised housing with access to support services regardless of past housing history or co-occurring behavioural health issues. Support services include a combination of rent supplements that cover individuals' housing costs, assertive community treatment (ACT): a community-based, multidisciplinary team that is always available for help, or intensive case management (ICM) that includes one-on-one support.
At Home/Chez Soi (AHCS)	Kirst et al. (2014) Stergiopoulos et al. (2014) Kirst et al. (2015) Aubry et al. (2015) Somers et al. (2015) Aubry et al. (2016) O'Campo et al. (2016) Aquin et al. (2017) Urbanoski et al. (2018) Kerman et al. (2020)	The AHCS project was initiated by the Mental Health Commission of Canada in 2009 across five cities (Moncton, Montreal, Toronto, Winnipeg, and Vancouver) to assess the effectiveness of HF in the Canadian context (Goering et al., 2011). Homeless Adults diagnosed with mental health disorders were recruited by local agencies and randomised into HF (n = 1265) (ACT/ICM) and treatment as usual (TAU) (n = 990) groups. HF participants were provided with a private housing unit and case management support services were obtained. The TAU participants maintained access to existing community supports (Goering et al., 2011).
Chicago Housing for Health Partnership (CHHP)	Buchanan et al. (2009)	CHHP was developed to meet the need for housing people with chronic illnesses who were being discharged from a hospital. As part of this model, eight non-profit organisations with a CHHP case manager were hired to provide housing referrals to intervention participants and to provide ICM to help participants live more stable and productive lives.

New York/New York III (NY III)	Hall et al. (2019)	NY III was initiated by New York City and New York State to provide single- and scatter-site assisted living for chronically homeless HIV-positive individuals with concurrent serious mental illness (SMI) or substance use disorder (SUD). NY III participants had leases with obligations and rights of general tenancy. Participants paid no more than 30% of their income for rent and utilities. Housing agencies were expected to assess participants' connections to HIV care in each case through in-person case management so that they could receive government benefits and access to SUD, mental health and primary care services primary.
Collaborative Initiative to Help End Chronic Homelessness (CIHC)	Tsai et al. (2019)	CIHC was a demonstration programme implemented by the US Interagency Council on Homelessness from 2004 to 2009. Eleven sites participated in CICH, providing permanent housing, primary health care and mental health services for chronically homeless adults.
Federally Qualified Health Centres (FQHC) collaborative care model	Schick et al. (2019)	FQHC is a permanent housing and on-site integrated care team programme, that includes clinical case managers, community health workers or on-site registered nurses who assess and coordinate immediate health care needs.
Affordable housing	Brown et al. (2015) Spector et al. (2020)	Fixed- or scattered- sites of affordable housing with housing assistance programmes that include rental assistance, housing subsidies, and ICM.
Supported housing	Collard et al. (2014)	Various rental apartments in the city of Atlanta where participants pay rent based on their household income each month.
Transitional housing		
Overnight shelters	Buchanan et al. (2009) Collard et al. (2014)	Participants in intervention groups reside in transitional housing during the study period and are provided with a case manager who supports them towards permanent supportive housing.
Boarding houses & Hostels	Tsemberis et al. (2004) Karim et al. (2006) Whittaker et al. (2015)	
Respite care centre	Buchanan et al. (2009)	
Social housing	Sharpley et al. (2019)	Includes short or long-term rental housing operated by Homes North; a non-government organisation in the New England Region of New South Wales (NSW), Australia.
Community housing	Siegal et al. (2006) Collard et al. (2014)	Includes single or shared rooms, or studios with shared dining, meeting, and service spaces designed to serve participants with mental illness and SUD. The method of one study (Siegal et al., 2006) resembled the COC model under which residents were assigned a case manager and required to attend an ongoing

rehabilitation programme. Sobriety was closely monitored, and the loss of sobriety resulted in mandatory treatment or expulsion from the community residence.

ONLINE SUPPLEMENTARY FILES

1. PRISMA-P 2015 Checklist

2. Table 1 PICOS Criteria Used in this Systematic Review

3. Search Strategy

4. List of Excluded Articles with Reasons for Exclusion

5. Table 2 Key Characteristics and Main Findings from the Three Systematic Reviews Included in this Review

6. Table 4 Summary of Key Characteristics of the 24 Studies Included in this Review

7. Figure 2 Risk of Bias Assessment Summary (RoB2)

8. Risk of Bias Assessment Summary (RoB2))

9. Risk of Bias Assessment Summary (ROBINS-I)

10. Table 6 Health Measurement Tools and the Frequency of their Use in the 24 Studies Included in this Review

FIGURE CAPTIONS LIST

Figure 1 *PRISMA Flow Diagram Outlining the Systematic Review Search, Screening, and Selection Process.* Adapted from Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., & The PRISMA Group. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine, 6(7),* e1000097. https://doi.org/10.1371/journal.pmed.1000097

Figure 2 Risk of Bias Assessment Summary (RoB2). McGuinness, L. A., & Higgins, J. P.T. (2020). Risk-of-bias VISualization (robvis): An R package and Shiny web app for visualizing risk-of-bias assessments. *Research Synthesis Methods,* 1- 7. https://doi.org/10.1002/jrsm.1411

Figure 3 Risk of Bias Assessment Summary (RoB2). McGuinness, L. A., & Higgins, J. P.T. (2020). Risk-of-bias VISualization (robvis): An R package and Shiny web app for visualizing risk-of-bias assessments. *Research Synthesis Methods,* 1- 7. https://doi.org/10.1002/jrsm.1411

Figure 4 Risk of Bias Assessment Summary (ROBINS-I). McGuinness, L. A., & Higgins, J. P.T. (2020). Risk-of-bias VISualization (robvis): An R package and Shiny web app for visualizing risk-of-bias assessments. *Research Synthesis Methods,* 1- 7. https://doi.org/10.1002/jrsm.1411