Title: Proposing a typology to examine the health impact of Housing First: a systematic review and meta-analysis

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ABSTRACT

This is the most inclusive systematic review and meta-analysis to understand the health impact of Housing First. Sixty articles relating to HF programmes in America, Australia and Canada were included. Evidence was reviewed using a novel biopsychosocial typology. Collectively, findings suggest that Housing First could play a wider role in customer's health by moving people toward restoring normality in their social roles and on the development of positive subjective experiences. The proposed typology could serve as a theoretical framework to improve understanding of HF's impact on health, and allow generalisation of HF outcomes in other countries, where HF's principles are less revolutionary.

Keywords: Homelessness, Housing First, Treatment as Usual, typology, health.

Background

Homelessness is one of the most extreme forms of health inequality, with devastating health consequences for those experiencing it (Srebnik, Connor, & Sylla, 2013). Even among the general homeless population, a minority group of recurrent homeless people (Gilmer et al. 2013; Pleace & Quilgars, 2013) is disproportionately affected (Wood et al. 2019). Firstly, as a result of serious and complex needs, such as mental, physical and substances abuse (Bean, Shafer & Glennon, 2013) and secondly as 'collateral damage' of the inverse care law effect that usually accompanies the traditional housing support services; where those most in need have the poorest access to services (Pleace & Quilgars, 2013). Inevitably, they are caught in a 'revolving door' situation, where repeated inclusion and exclusion from support services is the norm. This is mainly due to people with complex needs non-fully complying with the various demands and restrictions of services that are related to their step-by-step processes towards being 'housing ready' (e.g., full abstinence from drugs and/or alcohol (Bretherton & Pleace 2015)).

Housing First (HF) was developed as an alternative solution (Padgett et al. 2011) for those unable or unwilling to follow (Greenwood, Stefancic & Tsemberis, 2013) traditional linear approaches (Pleace, 2018) and who have been left behind (Matejkowski & Draine, 2009; Larimer et al. 2009; Stefancic et al. 2013). In contrast to traditional staircase homeless support services (Tsemberis et al. 2004), HF recognises housing as an unconditional human right (Padgett, 2007), rather than a reward at the end of a long rehabilitation process (Kertesz et al. 2009). Being part of permanent supportive housing (PSH) programs (Henwood et al., 2019), Housing First is an intensive support model, which is customer-driven (Tsemberis, Gulcur, Nakae, 2004). Shared core principles with other PSH approaches are the immediate,

permanent, provision of housing to single homeless adults with complex needs, with strong links to support services (Raven, Niedzwiecki & Kushel, 2020). Specific to Housing First is the non-judgmental respect of customer choice in relation to where they live (if possible), whether or not to engage in harm reduction services (Hawk & Davis, 2012) or their sobriety/abstinence at the stage of referral (Pleace, 2016; Raven, Niedzwiecki & Kushel, 2020).

Housing First appears in the literature as an evidence-based model (Byrne & Henwood, 2018; Polvere, Macnaughton & Piat, 2013) capable of ending recurrent homelessness of people with complex needs (Bretherton & Pleace 2015). However, many have questioned whether the apparent effectiveness of HF extends beyond housing sustainment outcomes and includes health (Pleace and Quilgars 2013; Kertesz & Weiner, 2009; Urbanoski et al. 2018). In other words, there is uncertainty about whether offering to homeless people with complex needs the choice of whether, where and when to participate in the available health, social and other support services (Greenwood, Stefancic & Tsemberis, 2013) can lead to better health outcomes (Baxter et al. 2019) or reduce health risk behaviours (Pleace & Bretherton, 2013), or whether this non-coercive recovery process leads to harmful health effects (Kertesz & Weiner, 2009; Collins et al. 2012).

Other concerns are methodological. Several researchers have suggested that evidence of improvements in addiction (Collins et al. 2012), mental health (Polvere, Macnaughton & Piat, 2013), and social integration (Breatherton & Pleace, 2015), is generally derived from observational studies, but not replicated in stronger study designs (Somers, Moniruzzaman, & Palepu, 2015; Quilgars, & Pleace, 2016). There are also concerns about population heterogeneity and implications for making generalisations about positive health-related outcomes based on HF studies of people

with alcohol and drug problems. It is argued that such results may be susceptible to misclassification bias due to the possible large heterogeneity of HF customers regarding their level of addiction (Kertesz et al. 2009).

Previous reviews of health-related outcomes in HF have verified such heterogeneity (Woodhall & Dunn, 2016; Quilgars & Pleace, 2016). Only one of these reviews attempted to systematically review and meta-analysed evidence, but was limited to randomized controlled trials (RCTs) (Baxter et al. 2019).

The present review aimed, not only to contribute to this evidence base through taking an inclusive and holistic approach (including evidence from both RCTs and observational studies), but also to employ an existing typology of 'unhealth' to explore the effects of HF on various types of health-related outcome. Specifically, Marinker's (1975) typology provided a holistic framework that could accommodate the range of health outcomes that are relevant to HF. The original typology was derived to explain the "relationship-based" healing process between doctor and patient. This has parallels with the recovery process of HF, which has been described as the "ultimate relationship-based approach to change" (Blood, et al. 2018, p.4), whereby the relationship between HF and the customers is considered a principal mediator (Poremski et al. 2016) in their recovery to "regain a healthy sense of self" (Polvere, Macnaughton, & Piat, 2013, p.110).

We have adapted the three modes of unhealth from Marinker (1975) and Boyd (2000) to HF health-related outcomes, which are summarised with examples (*Figure 1: Adaptation of Marinker's typology to health-related outcomes reported in Housing First studies*)

- *Disease* – presence of objectively measured physical or mental health problems, which includes alcohol and drug addiction.
- *Illness* -subjective experience and/or personal feelings of (un)health, which includes health related quality of life, the health-risk behaviours changes (e.g., drug and alcohol usage) and compliance with treatment.
- *Sickness* - indicators of the 'negotiated social role' and status, whereby a 'sick' person has a level of need that excludes them from usual levels of social function, and a reliance on others to help them become well. This includes levels of health care use, contact with the criminal justice system, and the rapidity of ending homelessness and social integration (e.g., community participation and the establishment of trusting, healthy relationships)

Through conducting an inclusive review of the Housing First and health literature and with novel application of Marinker's typology to the HF context, the present review aimed to: i) examine the health impact of the HF model in controlled and observational studies; ii) investigate the variability of health-related results in the published literature; iii) apply a typology that could serve as a theoretical framework to better understand HF's health impact, without jeopardizing the rigor of evidence.

Methods

This systematic review followed a registered protocol (PROSPERO CRD42020210711) and the Cochrane collaboration methodology (Higgins & Green, 2009).

Inclusion criteria and types of outcomes

Both randomized and non-randomized study designs were eligible for inclusion if they examined the provision of homeless support interventions based on the core principles and philosophy of HF for single homeless adults (aged ≥18 years) with complex needs. Outcomes reported in HF interventions were aligned with the typology of modes of unhealth (*disease*, *illness*, and *sickness*).

Search Strategy

Various combinations of terms and keywords suggested in the HF Literature were trialed to reach an optimal list of search terms. The search strategy (*Supplementary file 1. Housing First search strategy*) was undertaken in five electronic databases (MEDLINE, CINHAL, PsycINFO, PubMed, Cochrane) followed by a snowball method using the reference lists of included articles. Since HF was introduced in literature in 1990s searches were limited to articles published between 1990 and Mar.2020. Only studies published in English language could be considered.

Data collection and analysis

One author (KS) conducted the preliminary screening of titles and abstracts, and data extraction from the final included studies. The second author (CG) acted as a second reviewer through the whole process. Any discrepancies were discussed until consensus was reached.

Data extraction and management

Data extraction was performed using the Cochrane collaboration data collection form. Important study characteristics (designs, settings, eligible population, sociodemographic characteristic etc.) were extracted alongside with evidence of recruitment process, duration of intervention, baseline imbalances, follow-up period, types of measurement, outcome effects and reported results.

The internal validity of each study was examined using one of two tools appropriate to the study design. Randomized control trials were examined with the Cochrane's Risk of Bias (ROB 2) tool, while non-randomized studies were assessed via ROBINS-I tool. GRADE methodology (Guyatt et al. 2011), was used to evaluate the quality of the combined health related outcomes addressed by the proposed typology. Once again (CG) acted as a second reviewer verifying the quality of screening and data extraction process implemented by (KS). (NE) resolved any discrepancies between (CG) and (KS).

There was caution when dealing with multiple studies that presented data from the same intervention and samples. To avoid double counting, two parameters were

applied to determine which study to include in the meta-analysis: i) which study gave the best possible representation of a given outcome (in terms of details provided for specific outcome and/or sample size); ii) whether these permitted the calculation of a pooled effect estimate. Narrative synthesis was provided for all outcomes, including those where meta-analyses were not possible, to highlight potential variability within a single or across HF interventions.

Data synthesis

All evidence is considered according to the unhealth typology.

Meta-analyses used a fixed effect method to examine pooled effect estimates. This was appropriate given the need to identify the best estimate of the intervention effect in relation to a specific health-related outcome within the proposed typology, and because information was derived from a small number of studies with few events (where random-effects deliver poor estimates regarding the width of the distribution of intervention effects) (Higgins & Green, 2009).

All meta-analyses were performed on outcomes from at least two studies using RevMan 5.3 (Higgins & Green, 2009). As a general rule, we first tried to calculate summary statistics directly from data extracted from each one of the studies' intervention and control groups, especially when examining trade-offs, like benefits or harm, of HF intervention. Otherwise, when only effect estimates were reported or estimated, generic inverse variance method was implemented. Pooled effect estimates from meta-analyses results were presented with 95% confidence intervals and heterogeneity estimates.

When necessary, transformations were used to generate pooled effect estimates. Specifically, odds ratios (OR) were chosen for dichotomous outcomes. As such, switch events to non-events via (1/x) reciprocal equation or transforming standardized mean differences (SMD) to OR (either when combining dichotomous and continuous outcomes or as necessary step for calculation the pool effect of change scores and final values) produced consistent comparisons of effect estimates with minor consequences on OR. For continuous outcomes, the assumption of normal distribution in each intervention arm in each study was examined. When data skew violated the normality assumption, meta-analyses were performed on log-transformed data. Heterogeneity was examined via Chi^2 test for heterogeneity and I^2 statistics cut-points (substantial heterogeneity, 50%-90%; considerable heterogeneity, 90%-100%) (Higgins & Green, 2009).

Results

After the exclusion of duplicates, the search strategy identified 1289 articles (*Supplementary file 2. Flow diagram of screening process*) as potentially eligible for inclusion, of which 120 were subject to full text examination. Of those, 55 articles were eligible; with a further five identified through searching the reference lists of included studies. This resulted in 60 eligible articles that referred to 20 interventions or projects implemented in three countries *(Supplementary file 3. Study characteristics).* Most were in USA (15 interventions), with three in Australia and two in Canada.

Four out of 20 interventions were designed and implemented as randomized control trials (RCT) - Birmingham Alabama, Chicago Housing for Health Partnership (CHHP), New York Pathways to Housing (NY-PTH) and Chez Soi At Home. These were reported in 34 articles. The remaining 16 interventions were non-randomized trials; six used a comparative study design (Ottava project, New York/New York III (NY/NY III), Seattle-Begin at Home (Seattle BAH), 1811 Eastlake HF, 11-site Collaborative Initiative to Help End Chronic Homelessness CICH, New York City (NY-CITY). Finally, 10 applied a Before-After within subjects study design (Project H3, Los Angeles Permanent Supportive Housing (L.A. PSH), Philadelphia Permanent Supportive Housing (Philadelphia PSH), Elizabeth Street Common Ground **(**ESCG), 50 lives 50 Homes (50L50H), Platform 70 & Common Ground, Washington DC-Pathways to Housing (WC-DC PTH), Philadelphia P.A., Housing First Indianapolis (HF-Indianapolis) and Open Door-Pittsburgh). All comparative studies examined the differential health effects of the HF model as their treatment intervention versus treatment as usual (TAU) or waiting list as the control.

Risk of Bias

Risk of bias was examined at study and intervention level though no significant differences were found among studies derived from the same intervention, (*Supplementary file 4. Risk of bias by study and intervention*). Studies relating to all but two interventions (Pathways to Housing and Chez Soi) were found to have high risk of bias. This was mainly due to the lack of randomization and allocation concealment processes in Before–After study designs, and uncontrolled confounders resulting from the limited number of participants and convenience sampling (Srebnik et al. 2013; Bean et al. 2013; Henwood et al. 2014; Holmes et al. 2017; Wood et al. 2019; Tsemberis et al. 2012; Hawk & Davis, 2012; Whittaker et al. 2016), or due to the lack of adjustment for potential confounders in analysis (Bean et al. 2013; Golembiewski et al. 2017).

Effects of Interventions

Disease

Three objectively measured physical and mental health outcomes and addiction were examined under the *disease* mode (*Supplementary file 5. Modes of unhealth - Disease*). There were no direct measures of addiction in included studies. Rather, two surrogates (alcohol problems and problems with drugs) were used to examine HF impact on addiction.

Physical health

Eight interventions (Chez Soi, Ottawa project, Open Door Pittsburgh, NY/NY III, 11-site CICH, Philadelphia PSH, CHHP, Project H3) reported across 13 studies, provided evidence on physical health.

Meta-analytic evidence from two Before-After within study design projects from Philadelphia PSH (Henwood et al. 2019) and 11-site CICH (Tsai, 2012) suggested

that HF significantly increased the odds of positive changes in the physical health of its customers (OR=1.71 95%CI: 1.31, 2.24, I^2=76%) (*Supplementary file 6. Forest plots of pooled outcome effects for Disease mode of unhealth - Figure 6a*). This was supported further by evidence from two other single studies-interventions, namely the Project H3 (Bean et al. 2013) and CHHP (Buchanan et al. 2009) that also found significant physical health improvements for their HF participants (M=3.51 SD=0.65 t=-2.96 p=0.008) and (RR=1.63 95% 1.01, 2.61 p=0.04) respectively.

Comparative pooled effect from two studies (Buchanan et al, 2009 & Hall et al. 2019) from equivalent projects (CHHP and NY/NY III) found marginal non-significant difference between HF and TAU in reduction of HIV viral loads in customers (RR=1.09 95%CI: 0.85, 1.39, I^2=67%) (*Supplementary file 6. Forest plots of pooled outcome effects for Disease mode of unhealth - Figure 6b*). There was a similar, marginal non-significant difference between HF and TAU groups (SMD=0.44 95% CI: -0.99, 1.87, I^2=0%) from the meta-analysis of two studies (Cherner et al. 2017; Stergiopoulos et al. 2015b) regarding the general improvement in physical health (*Supplementary file 6. Forest plots of pooled outcome effects for Disease mode of unhealth - Figure 6c*).

This meta-analytic evidence is aligned with the remaining studies derived from the RCT of Chez Soi At Home, where no significant between-group differences were found for health status (Stergiopoulos et al. 2015; 2016), BMI (Woodhall-Melnik et al. 2015) or self-reported health (Aubry et al. 2019).

Mental health

Mental health outcomes were reported in 24 studies across eight interventions (NY-PTH, Chez Soi At Home, Ottawa project, 1811 Eastlake, Project H3, Washington D.C.-PTH, Philadelphia PSH and 11-site CICH). Four meta-analyses were possible, two for RCTs and two for Before-After studies. The first meta-analysis of 1811 Eastlake (Collins, 2016) and WC-DC PTH (Tsemberis et al. 2012), indicated a significant reduction in psychiatric symptoms of HF participants (SMD=-1.24 95%CI: -1.47, -1.01, I^2=60%) (*Supplementary file 6. Forest plots of pooled outcome effects for Disease mode of unhealth - Figure 6d*). Greenwood et al. (2005) further supported this evidence showing choice as a mediator of HF's mental health benefits (t=-2.87, p<.004).

A meta-analysis of Before-After studies (Bean et al, 2013) and (Tsai et al. 2012) also showed a small but significant an improvement in mental health (SMD=0.31 95%CI:0.14, 0.49, I^2=0%) (*Supplementary file 6. Forest plots of pooled outcome effects for Disease mode of unhealth - Figure 6e*).

Various single Before-After studies also showed improvements in HF customers in terms of their mental health recovery and their overall mental health (ASMD=0.39 95%CI=0.05-0.74 ; ASMD=0.76 95%CI: 0.63, 0.90; Aubry et al. 2019), that followed by evidence of strong resilience (MD=0.51 SD=0.11 p<.001) and adjustment to stress (MD=3.6 95%CI: 17.9, 19.4; Durbin et al. 2019) alongside with decrease in suicidal thoughts (estimate=-.57, SE=.05, p<.001; Aquin et al. 2007) as well as suicidal rates (OR=0.31 95%CI: 0.21, 0.46, p<.001; Noël et al. 2016 . Stergiopoulos et al. (2014) also showed a close interrelation between early independent housing and improvements in mental health (mean change from baseline: -2.56 to 6m: 6.26, p=0.043) while Chung et al. (2018) showed greater improvements in the mental health

symptom severity in older customers compared with younger participants (MD=-3.39, 95%CI: -6.24 to -0.54, p=.02).

Sequentially, another meta-analytic evidence from two other interventions WC-DC PTH (Tsemberis et al. 2012) and Chez Soi (Stergiopoulos et al. 2015) also found that HF does significantly better affected participants' mental-health recovery in relation to TAU counterparts (MD=-0.97 95%CI: -1.54, -0.40, I^2=47%) (*Supplementary file 6. Forest plots of pooled outcome effects for Disease mode of unhealth - Figure 6f*) that further supported form the pooled effect on overall mental health from a meta-analysis of three RCTs (Aubry et al. 2016; Cherner et al. 2017; Tsemberis et al. 2004) from the corresponding Chez Soi At Home, Ottawa project, and N.Y.-PTH interventions, favoured HF over TAU[(SMD=0.10; 95%CI=-0.00, 0.20 I^2=83%); Grade: Low (-1 level: risk of bias); (-1 inconsistency)] (*Supplementary file 6. Forest plots of pooled outcome effects for Disease mode of unhealth - Figure 6g*).

Considerable heterogeneity obtained from comparative meta-analysis raises question of whether this meta-analytic outcome indicates the single best intervention effect or one among a distribution of intervention of effects (Higgins & Green, 2009). Evidence from studies not included in the meta-analysis, mostly from Chez Soi At Home, supports this explanation, showing no significant difference between HF and TAU groups [Stergiopoulos et al. 2015 MD=0.57 95%CI=−0.88, 2.01, p=.44, Stergiopoulos et al. 2015b MD=-0.49 05% CI -3.18, 2.19, p=.72; Stergiopoulos et al. 2016 MD=0.04 (95%CI=-3.39, 3.46, p=.98)].

Finally, subgroup analysis in four studies indicated that older age (Chung et al. 2018) and the provision of 'assertive community treatment' (Campo et al. 2016) were also associated with improved mental health outcomes (compared with TAU), while

whether participants lived in scattered or congregated HF sites did not (Somers, et al 2017; Whittaker et al. 2007).

Addiction

Four interventions (Chez Soi At Home, Ottawa project, Washington D.C.–PTH, 1811 Eastlake) represented by five studies, examined alcohol problems. Two Before-After studies found that HF effectively reduced the number of days that participant experienced alcohol related problems, with a 48% reduction after two years (M=3.6 SD=5.2, t=3.8 df=29 p<.05) (Tsemberis et al. 2012), and with lower frequency of alcohol-related problems for every three months participation in HF (Model coefficient -0.26 SE=0.10 95%CI=-0.46, -0.05 z-score=-2.48, p=.013) (Collins et al. 2012).

However, a meta-analysis of two studies comparing HF and TAU (Cherner et al. 2017; Kirst et al. 2015) found a non-significant difference in effectiveness to reduce health problems related with alcohol abuse (OR=0.63 95%CI: 0.39,1.01, I^2=0%) (*Supplementary file 6. Forest plots of pooled outcome effects for Disease mode of unhealth - Figure 6i*). This evidence is further supported from other comparative studies that also found no difference between HF and TAU regarding the duration (days) of alcohol problems [(RR=0.35 95%CI=0.12, 1.02 p=0.54) (Stergiopoulos et al. 2016) and (MD =3.44 95%CI=0.57, 7.54 P=.09))].

Problems with drugs were examined in three studies from two interventions, Chez Soi At Home and Ottawa project of which two studies could be included in a meta-analysis (Stergiopoulos et al. 2015 and Cherner et al. 2017). Pooled effect for the days that participants experienced problems with drugs was marginally non-significant

(RR=0.90 95%CI=0.78, 1.03 I^2=32%) (*Supplementary file 6. Forest plots of pooled outcome effects for Disease mode of unhealth - Figure 6j*).

This was in accordance with the remaining studies that found non-significant differences between HF and TAU in customer's drug problems in the past 30 days showing (IRR=0.66 95%CI=0.23, 0.90 p>0.5 (Kirst et al. 2015)) and (RR=0.58 95%CI=0.24, 1.42 p=.23 (Stergiopoulos et al. 2016)).

Illness

The subjective mode of unhealth includes three types of health outcome: such as quality of life, adherence to treatment and health risk behaviour change (*Supplementary file 7. Modes of unhealth - Illness*). Since health risk behaviour change could not be examined directly, the surrogate outcomes of alcohol, drug and overall substance usage were used.

Quality of life (QoL)

Five interventions (Chez Soi At Home, Ottawa project,11-site CICH, Philadelphia PA and Platform 70 & Common Ground) examined QoL and, overall, did not find an intervention effect of HF. This was observed for the Before -After study by Henwood et al. (2014) (T1=4.63(1.54), T2=4.94(1.46), t=-1.688 df(79) p=0.095), and a meta-analysis of two studies showing no difference between HF and TAU (SMD=0.05 95%CI=-0.08, 0.18 I^2=0%) (*Supplementary file 8. Forest plots of pooled outcome effects for Illness mode of unhealth - Figure 8a*), and all single study outcomes from the Chez Soi At Home.

Sub-group analyses have revealed some effects on QoL. Patterson et al. (2013) found that QoL improved significantly more in HF residents with higher need compared

with TAU, but not for those with moderate needs. Similarly, when Edens et al. (2011) examined QoL in their own stratified group based on their relation to substance use, they found that high frequency users had significantly poorer QoL compared with those abstaining from substances. However, comparisons between HF customers on the basis of scattered or congregated housing, revealed not differences in QoL (Whittaker et al. 2017).

Adherence to treatment

Treatment adherence e was examined by three studies, all relating to Chez Soi At Home (high risk of duplicate data precluded meta-analysis). Two studies of medication possession ratio (a measure of medication adherence) had mixed findings: Parpouchi et al. (2018) found no statistical difference between HF and TAU (M=0.54, SD=0.39, p=0.870), whereas Rezansoff et al. (2017) found a significant intervention effect that favoured HF relative to TAU but only with scattered housing, not congregated (RD=0.24 95%CI=0.10, 0.37, p<0.001). A third study reported no difference between the HF and TAU in adherence to safe sex guidance (OR =0.93 95%CI=0.71, 14.3 p =.982) (Parpuchi et al. 2016).

Health Risk Behaviour change

Substance use overall, alcohol and drug use were, reported by 11 studies representing four interventions (Chez Soi At Home, Project H3, Birmingham Alabama). A meta-analysis of two studies found no evidence of a difference between HF and TAU in terms of customers' change in substances use overall (OR=0.86 95%CI: 0.60, 1.21 I^2=0%); Grade: Moderate (-1 level: risk of bias)] (*Supplementary file 8.*

Forest plots of pooled outcome effects for Illness mode of unhealth - Figure 8b). However, there was inconsistency among studies not meta-analysed. Stergiopoulos et al. (2015, 2015b, 2016) (RR=0.91 95%CI=0.65, 1.28, p=.583; RR=0.94 95%CI=0.79, 1.12 p=.50; RR=1.00 95%CI=0.61, 1.64, p>.99, respectively) and Somers et al. (2015, 2017) showed no statistical significance in substance use difference at 24 months whereas all other studies reported a significant reduction in substance use in the HF group, ranging from 20 to 45% (Kirst et al. 2015; Aubry et al. 2016, 2019; Bean et al. 2013; Henwood et al. 2014) and Padgett et al. (2011), that TAU participants were 3.4 times more likely to use drugs than their HF counterparts (OR=3.41 95%CI: 1.12, 10.35, p=0.03).

Drug use was examined in eight studies representing four interventions (Philadelphia PSH, L.A. PSH, NY-NY III, 11-site CICH, NY PTH, Ottawa project), with mixed results. Although the pooled effect of three studies that were eligible for meta-analysis (Cherner et al. 2017, Davidson et al. 2014 and Padgett et al. 2011) showed no significant difference between the HF and TAU (OR=0.59 95%CI=0.15, 2.31 I^2=71%, (*Supplementary file 8. Forest plots of pooled outcome effects for Illness mode of unhealth - Figure 8c*), some studies that could not be meta-analysed disagreed. Three studies showed significantly decreases in drug use among HF customers (Tsai et al. 2012; Rhoades et al. 2018; Padgett et al. 2006), although two of these indicated that such benefits were not maintained long-term (e.g., 12-months) (Rhoades et al. 2018; Padgett et al. 2006).

Finally, alcohol use was examined by six studies from five interventions (Ottawa HF, 1811 Eastlake, NY-PTH, 11-site CICH, LA. PSH). Results were mixed ranging from unchanged individual levels of binge drinking at three- and six-month follow up (15% and 17%; Rhoades et al. 2018), to a significant decrease in daily drinking of 2% per

month after participants were housed (RR=0.98 95%CI=0.96, 0.99) at 12 months follow up (Larimer et al. 2009), and significant decrease in alcohol usage from the baseline (F= $(_{2,1,20})$ 5.30, p<.01 η^2_p=.02; Tsai et al (2012). Others have found a significant decrease in alcohol usage for HF participants, but which did not differ from TAU (Cherner et al. 2017; Tsemberis et al. 2004).

Sickness

The social mode of unhealth was examined through four main outcomes (*Supplementary file 9. Modes of unhealth - Sickness*): rapidity of ending homelessness, social integration, health care usage, and contact with the criminal justice system.

Health care usage

Several outcomes related to this construct. Seven studies out of five interventions (Seattle BAH, NY-PTH, Chez Soi At Home and 50 lives 50 Homes, Project H3) reported the number of days in hospital. Meta-analysis of three studies (Gulcur et al. 203, Pakzad et al. 2017 and Srebnik et al 2013) showed that a trend favouring HF over TAU with a marginal pooled effect [(SMD=-0.30 95%CI=-0.71, 0.11 I^2=0%); Grade: Moderate (-1 level: imprecision)] (*Supplementary file 10. Forest plots of pooled outcome effects for Sickness mode of unhealth - Figure 10a*).

A meta-analysis of two Before-After studies confirmed that HF participants significantly reduced their hospitalization days relative to pre-intervention levels (MD=-1.52 95%CI=-2.08, -0.97, I^2=82%) (Bean et al. 2013; Wood et al. 2019) (*Supplementary file 10. Forest plots of pooled outcome effects for Sickness mode of unhealth - Figure 10b*). Conversely, two studies not meta-analysed did not find such statistical differences between HF and TAU at three months (Kerman et al. (2018) or 24 months ((Stergiopoulos et al. 2016).

Seven interventions (Philadelphia PA,11-site CICH, Chez Soi At Home, NY-PTH and 50 lives 50 Homes) reported in 12 studies examined contact with hospital emergency departments, from which, two groups of studies from equivalent interventions could be meta-analysed. The first group of three Before-After studies of Project H3, 1811 Eastlake and 50 Lives 50 Homes, verified a significant reduction in emergency department days in HF customers, either at six or at 24 months (MD=-0.67 95%CI=-1.10, -0.23, I^2=0%) (*Supplementary file 10. Forest plots of pooled outcome effects for Sickness mode of unhealth - Figure 10c*). However, no significant difference between groups (MD=-0.15 95%CI=-0.56, 0.26 I^2=63%) was found by the meta-analytic evidence from two comparative studies (Pakzad et. 2017 and Srebnik et al. 2013) (*Supplementary file 10. Forest plots of pooled outcome effects for Sickness mode of unhealth - Figure 10d*). Other comparative studies, mainly from Chez Soi At Home, confirmed this null finding (Stergiopoulos et al. (2105, 2015b, 2016); Aubry et al. 2016) with (RR=0.74 95%CI: 0.41,1.34, p=.320; RR=0.76, 95%CI: 0.49, 10.7, p=.11; MD=0.67 95%CI: 0.28,1.58, p=.36; IRR=.80 95%CI: .06, 1.00, p=.05) respectively. Other factors were identified as possible determinants of ED contacts that might complicate potential HF effects, including housing stability (in HF or TAU customers) (ASMD=0.21 95%CI: 0.13, 0.28 p<.001; Kerman et al. 2018) and previous substance use treatment (RR=0.91 95%CI: 0.80, 1.02; Hal et al. 2018).

Use of sobering centres or rehabilitation units were examined by five interventions (BAH, 11-site CICH, 1811 Eastlake, N.Y.-PTH and NY/NY III), reported in seven studies. The pooled effect estimate derived from a meta-analysis of three studies (Larimer et al. 2009; Padgett et al. 2011; Srebnik et al. 2013) suggested that use of such centres by TAU participants was double that of HF participants [(OR=2.16 95%CI=1.11, 4.19, I^2=60%); Grade: High (+1 level: imprecision)] (*Supplementary file*

10. Forest plots of pooled outcome effects for Sickness mode of unhealth - Figure 10e). This supported findings from the two remaining studies that similarly found a between-group difference favouring HF (Padgett et al. 2006 and Tsemberis et al. 2004). Subgroup analysis in Before-After studies exploring differential changes in HF customers based on frequency of substance use have given mixed results (Edens et al. 2001, Hall et al. 2018).

Seven studies from equivalent interventions (BAH, ESCG, 50Lives 50 Homes, Platform 70 & Common Ground, 11-site CICH, NY/NY III, Chez Soi At Home) measured inpatient admissions. Meta-analytic evidence of findings from Before-After studies (Holmes et al. 2017; Wood et al. 2019) showed a significant intervention effect and decrease in inpatient admission (MD = -0.71 95%CI=-1.09, -0.34 I^2=0%) (*Supplementary file 10. Forest plots of pooled outcome effects for Sickness mode of unhealth - Figure 10f*). This evidence was supported by the comparative study by Srebnik et al. (2013) that found HF participants had fewer inpatient admissions than TAU participants (HF M=0.62 SD=1.05 vs TAU M=0.84 SD=1.07).

Subgroup analysis confirms the complexity of identifying potential HF effects, whereby housing stability might increase the potential use of outpatient services (Kerner et al. 2018, the use of substances does not exhibit consistent effects. Indicatively, high frequency users linked with higher inpatient attendance by Edens et al. 2011, but not by Hall et al. 2018).

Use of mental health care services was reported by seven studies from five different interventions (ESCG, Philadelphia PA., 11-site CICH, Chez Soi At Home and N.Y.-PTH) and showed mixed results. In a Before-After study, Holmes et al. (2017) reported that the mean number of contacts with mental health clinicians before, during

or 24-months after HF did not differ significantly (M=197, SD=232; m=224, SD=226; M=196, SD=203, respectively, p=0.84). Additional evidence from subgroup analysis in studies that stratified HF customers by substance use did not show consistent differences in mental health care use by substance use status (Henwood et al. 2015b; Edens et al. 2018).

In the contrary, four RCT studies (all from Chez Soi At Home) found that TAU were significantly higher users of mental health services. Specifically Padgett et al. (2006) found significant difference at 48 months (p=.003), Pakzad et al. (2017) showed a small but significant difference intervention effect favouring HF (Cohen d=0.20), and O' Campo et al. (2016) found that HF participants who received Assertive Community Treatment spend fewer days in psychiatric hospitals than their TAU counterparts (RR=0.4 95%CI: 0.2, 0.8, p=0.01); while Kerner et al. (2018) showed that housing stability decreasing significantly the mental healthcare usage (ASMD=0.23 95%CI: 0.12, 0.33, p<.001).

Finally, primary care usage was examined only by Bean et al. (2013) for Project H3, where a large increase observed from baseline to six months (16 to 57%, p=.07) was observed in a small sample of customers (n=20).

Rapidity of ending homelessness

Five studies from three interventions (Chez Soi At Home, NY – PTH, Ottawa project) examined how quickly HF customers were housed. Three studies provided eligible data for a meta-analysis, which showed a medium intervention effect favouring HF [(SMD=0.44 95%CI=0.17, 0.71, I^2=0%) Grade: High], (*Supplementary file 10. Forest plots of pooled outcome effects for Sickness mode of unhealth - Figure 10g*).

This was further supported by studies from NY-PTH and Chez Soi At Home that were not included in the meta-analysis.

Social integration

Social integration through HF was examined under two parameters: community participation and the level of the establishment of trusting, healthy relationships.

There was no evidence to support HF benefits for comunity participation from 10 studies from five interventions (Chez Soi At Home, Ottawa project, 11-site CICH, NY-CITY, Platform 70 & Common Ground) that measured it. A meta-analysis of two studies (Cherner et al. 2017; Stergiopoulos et al. 2015b) showed a marginal non-significant improvement in HF participants at 24 months, relative to TAU [(SMD=0.94 95%CI=-0.05, 1.93, I^2=0%); Grade: Moderate (-1level: imprecision)] *(Supplementary file 10. Forest plots of pooled outcome effects for Sickness mode of unhealth - Figure 10h),* which accords with evidence from the other five studies from Chez Soi. The only exception was a study from 11-site CICH (Tsai et al. 2012) who found small but significant increase in HF participants community participation ($F_{(2,1,098)}$=9.71 P<0.001, η^2_p=.02).

Two studies examining changes in social relationships indicated that HF participants obtained significant improvement (M=.362 SD=0.87, t=-2.13, p=.05) (Bean et al. 2013); (t=2.87, p<.01) (Henwood et al. 2015); even showing increased social contacts (%change= +215%) when social networks diminish (%change= -29.6%) (Golembiewski, 2017).

Contact with criminal justice system

Contact with criminal justice system was examined through two surrogate parameters, jail bookings and arrests. A meta-analysis of two studies (from two interventions -BAH, 1811 Eastlake) that examined days in prison produced a pooled effect of no significant intervention effect (MD=0.33, 95%CI=-0.70, 1.37, I^2=90%) (*Supplementary file 10. Forest plots of pooled outcome effects for Sickness mode of unhealth - Figure 10i*), but with considerable heterogeneity.

Before-After studies found mixed results. For example, Henwood et al, (2015) found no effect in HF customers with alcohol dependence. Those using subgroup analysis also highlighted the potential importance of other factors, such as abstinence from substance use (Edens et al. 2011) and engagement with support services for substance use (Hall et al. (2018) in reducing days in jail. Whereas Kerman identified a three-way interaction effect between intervention, time, and housing stability, which indicated that sustained housing (in)stability was the critical factor, regardless of the intervention.

Arrests were investigated by seven studies from three interventions (Chez Soi At Home, Project H3, Platform 70 & Common Ground), again, with mixed results. The small Before-After study by Bean et al. (2013) showed a significant decrease in HF participants arrests after 12 months (baseline M=2.05, SD=1.04 vs 12m M=0.50, SD=1.24, t=3.24, p<0.1), whereas Stergiopoulos et al. (2015b, 2016) found no effect when comparing HF with TAU. In contrast, Campo et al. (2016) and Somers et al. (2013) showed that HF participants supported by Active Community Treatment (RR=0.36 95%CI=0.14, 0.97, p=.043) and Scattered HF (IRR=0.29 95%CI: 0.12, 0.72, p<.01) respectively had greater reductions in arrests than those receiving TAU. Subgroup analysis by Whittaker et al (2016) also suggested that Scattered HF

accommodation provision was associated with greater reductions in arrest than Congregated (AOR=-3.95 95%CI: 1.01, -0.1).

Discussion

Summary of main results

We present findings from the most inclusive systematic review and meta-analysis to date of the health effects of HF. The evidence base, regarding the contribution of HF to health revealed considerable heterogeneity among studies, in terms of design, population, outcomes, measurement and findings. To overcome the variable approaches and rigour, the present review tried to provide a meaningful analysis through novel application of Marinker's typology to RCTs and observational studies exploring health impacts of HF. Adapting the health-related outcomes to Marinker's typology, distinctively different constructs were grouped within the most appropriate typology mode. Specifically: physical health, mental health, and addiction were grouped within *disease*; quality of life, health risk behaviour change and adherence to treatment were aligned with *illness*; healthcare usage, ending homelessness, social integration and contact with the criminal justice system were grouped within the *sickness* mode.

Our review did not find any evidence that HF was associated with worsening health outcomes, or be inferior to TAU when they were compared. Rather, for numerous outcomes in each mode, HF was associated with significant improvements, and for several outcomes, these effects were greater than those observed with TAU.

The most marked health-related benefits of HF even when compared to TAU, were observed for the *sickness* mode. Specifically, HF effectively reduced the usage of

most measured health services, most notably reducing hospitalizations, inpatient admissions, and use of sobering centres. Relatedly, there was also strong evidence supporting significant improvement of HF participants' mental health (*disease).* And all these were accompanied by the notable HF's achievement of the rapidity with which HF ends homelessness (*sickness* mode).

This evidence together suggests that health related contribution of HF on the biopsychosocial spectrum of Marinker's typology of unhealth is its effectiveness to support a heterogeneous population of the chronically homelessness to (re)negotiate their social role and status, helping to redress the societal inequity whereby those in most vulnerable positions are often the least supported by services (Marinker, 1975). In the homelessness literature, stigma and marginalization seems to be the norm, rather than exception, presenting barriers to chronically homeless people receiving the necessary support (Quilgars & Pleace, 2016).

The contribution to the HF-health area of applying Marinker's typology, is that is has helped to identify how HF can restore equity through improving customers outcomes aligned with *sickness*. For chronic homelessness, this can mean rapid accommodation and continuous support until the reinstatement of their personhood (Polvere, Macnaughton, & Piat, 2013), or what Padgett et al. (2007) referred as "ontological security"; the having a "home" where constancy, control, daily routine, and privacy" (p.1929) are secured.

Non-significant differences and grey areas between HF and TAU were observed for some health outcomes. Sometimes non-significant differences were marginal and showed a trend favouring HF, as in the case of physical health and problems with drugs, reduction of HIV viral loads, general improvement of health (*disease*), and community

participation (*sickness*). For other outcomes, like reduction of health problems related with alcohol abuse (*disease*), quality of life and overall substance usage (*illness*) there was no intervention effect. Finally, mixed results were found for, the adherence and alcohol and drug usage (*illness*) as well as for the mental health's healthcare usage and contact with criminal justice system (*sickness*).

Overall completeness and applicability of evidence

A key message emerging from our analyses, which should be of interest to researchers and policymakers, is that the overall estimation of the health impact of HF might be an issue of perspective. When examining the evidence at the level of the typology mode (or macro level), HF's beneficial properties were observed. This was true for all modes of unhealth (*disease, illness, sickness*) and at times HF appeared to have greater heath impact than traditional approaches, especially for outcomes most relevant to (re) negotiate the chronic homelessness social role and status, namely the *sickness* mode of unhealth. Nevertheless, even when no differences were observed between HF and TAU, benefits were observed in HF customers. This review supports the view that housing acts as a healthcare intervention by preventing further deterioration in health associated with homelessness (Wood et al. 2019) and support health improvement (Polver, Macnaughton & Piat, 2009). At the meso level, where higher order constructs (e.g., health risk behavioural change, addiction etc.) incorporate within them other specific types of health-related outcome (e.g., substance abuse; drug and alcohol usage; and/or drug and alcohol problems), the potential for HF to improve customers' health was apparent within each mode of unhealth. However, such impacts started to become blurred or even disappear when examined at the individual level (micro), producing the known variability effect.

Therefore, as one goes deeper, focusing on specific health outcomes, and using controlled research designs applied in different contexts and specific populations, greater inconsistencies arise. We do not interpret this as a reason to reject studies that use controlled, robust methods; it is important to understand if HF can improve health in specific populations and contexts. Rather, our findings should provide some confidence that HF can benefit health in its broadest sense, acknowledging the complexity and myriad of potential confounders that might affect HF-health effects (as some subgroup analyses suggested).

Moreover, our review poses serious concerns on whether relying on the medical model's abstinence-contingent methodology, can lead to ecologically effective housing support services for people with complex needs (Collins et al. 2012). Specifically, this review and previous reviews (Baxter et al. 2019) indicate that typical study follow-up periods of six to 24 months are insufficient to capture health changes in people who have been chronically homeless (Legander et al. 2006). Recuperation and behavioural changes are likely to be complex processes and take time, with periods of relapse as individuals' progress towards a healthier life (Hipolito et al. 2011; Henwood et al, 2012; Henwood et al. 2013; Padgett et al. 2016;). This has led to calls for longer time periods to evaluate HF health impact effects, from researchers (Legander et al. 2006; Baxter et al. 2019) and those trying to influence policy (Centre for Social Justice, 2021).

Strengths and limitations

This review has a number of strengths. A predefined protocol specified all steps of the evaluation process. KS led the review by screening, extracting data and processing the risk of bias assessment while CG checked a sample of abstracts and full texts during the screening process, and reviewed data extraction tables. The review was inclusive and considered RCTs and Before-After observational studies. Furthermore, Marinker's

typology provided the scientific rigour for the evaluation and taxonomy of the findings, and allowed grouping health-related outcomes for meaningful exploration of their occurrence and interrelations.

Limitations are also recognised. First, most HF interventions have been implemented in USA and Canada, which limits generalisability of evidence, especially to European countries where the HF philosophy is perhaps less 'revolutionary' (Johnsen & Teixeira, 2012). Second, heterogeneity in study methodologies and results limited the number of studies that could be included in meta-analyses. Surrogates were used to deal with heterogeneity in outcomes, which facilitated a more inclusive approach and identified some important health benefits of HF, reduced the strength/quality of evidence (generally low to moderate). Third, although only English language articles could be included, none were excluded on basis of language.

Agreements and disagreements with other studies or reviews

Five reviews (Pleace & Bretherton 2013; Quilgars & Pleace 2016; Woodhall-Melnik & Dunn, 2016; Leclair et al. 2018; Aubry, Nelson and Tsemberis, 2015) and one meta-analysis (Baxter et al. 2019) have explored HF and health, although none included the breadth of evidence considered here. The present review identified positive impacts of HF on health at all levels and all modes of the proposed unhealth typology, which concur with several outcomes presented by earlier reviews.

The most consistent evidence across reviews, relates to outcomes within the *sickness* mode, and specifically with the speed with which HF ends homelessness (Aubry, Nelson, Tsemberis, 2015). Moreover, health risk behaviour modification for behaviours, such as alcohol and drugs use, featured in a relatively large number of studies (unsurprising given the close links with homelessness). The difference between

HF and TAU services for drug use, and the mixed results for alcohol use were also reported in previous reviews (Please & Quilgars, 2013; Woodhall-Melnik & Dunn, 2016; Baxter et al. 2019). In contrast to other reviews that reported small but statistically significant differences favouring HF for QoL (*illness* mode) (Baxter at al.2019; Quilgars & Pleace 2016; Aubry, Nelson, Tsemberis, 2015), we found no such effects within the time limits of 12–24-month follow-ups.

Within the *sickness* mode, our results on social integration partially support previous reviews that showed mixed results (Pleace & Quilgars, 2013; Quilgars &Please, 2016; Woodhall-Melnik & Dunn, 2016). We found that psychological social integration produced mixed results, while community participation was marginally non-significant between HF and TAU. For healthcare use, we observed a marginal positive effect of favouring HF on hospitalization, and a strong positive one on ED contacts, which is consistent with Baxter et al. (2019). Unlike previous reviews, however, we examined meta-analytic evidence on inpatient admissions and sobering centres usage, where significant differences favouring HF were also observed. Our results regarding with the contacts with criminal justice system partially support the evidence of prior reviews. Non-significant reductions for jail bookings concurred with Leclair et al. (2019), and our mixed results for arrests were more consistent Woodhall-Melnik & Dunn (2016).

Finally, in the *disease* mode, our findings agree with those of a meta-analysis that found no difference between HF and TAU for physical health, but small improvements in mental health favouring HF Baxter et al. (2019).

Conclusion

The present review examined evidence from a biopsychosocial perspective proposing Marinker's typology oof unhealth to systematically review and meta-analyse evidence from RCTs and observational studies exploring the health impact of HF (compared with TAU). Findings highlight that HF significantly benefits both soft and hard health-related outcomes, within each modes of the unhealth typology but with strongest evidence for outcomes in the *sickness* mode, which relates the social role and status of chronic homeless population (and associated reliance on others for support). Particularly, the strong supportive evidence toward the rapidity with which HF can end homelessness alongside the reductions at various healthcare settings like sobering centre, hospitalizations, and inpatient admissions evidence this. There was also evidence of benefits for HF customers' mental health (*disease*). Overall, the findings suggest that HF benefits outcomes that extend beyond those directly related to the tenancy helping to address concerns that HF 'delivers only housing' (Kertesz et al. 2009). This suggests that HF could play a wider role in moving people toward the restatement of normality in social roles (via tackling *sickness*) and in developing improvements in mental health (*disease*).

Declaration of interest

All authors declare that they have no competing interests.

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