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Article

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Prevalence of frailty and associated socioeconomic factors in people experiencing homelessness in England: cross-sectional secondary analysis of health needs survey data

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Summary

Background Frailty is a complex health state affecting multiple body systems, resulting in increased vulnerability to health stressors. People experiencing homelessness (PEH) have poorer health, including higher prevalence of frailty, than the general population. This study aimed to calculate prevalence of frailty in PEH in England and explore associated sociodemographic characteristics.

Methods This cross-sectional, secondary analysis study of health needs data collected from PEH in England created a frailty index by seeking expert input using a modified Delphi method and following published guidance for frailty index construction. Data were collected by Homeless Link in primarily urban areas through in-person, interviewer-administered surveys between 2012 and 2021 in three waves. Participants with data for at least 80% of frailty index variables were included. Descriptive statistics summarised the population. Among participants with sufficient frailty index data, the prevalence of frailty (frailty index scores of 0·25 or more) and pre-frailty (scores between 0·08 and 0·25) was calculated. Associations between frailty and sociodemographic characteristics were explored using multinomial logistic regression (adjusted for age; gender; accommodation at time of survey; engagement in employment, volunteering, and education; and immigration status).

Findings The study sample included 2288 PEH (2156 [94·2%] aged 18–59 years). Frailty was prevalent in 949 (41·5%) of the study population and pre-frailty in 1001 (43·8%). Frailty was identified in 210 of 789 (26·6%) PEH aged 18–29 years. PEH aged 50–59 years had over eight times higher risk of frailty compared with PEH aged 18–29 years (adjusted risk ratio 8·30, 95% CI 4·86–14·16). Women experiencing homelessness (2·30, 1·57–3·37), and PEH who were not engaged in employment, volunteering, and education (3·05, 1·97–4·71) also had higher risk of frailty than men experiencing homelessness and PEH who were engaged in these activities, respectively. PEH who were not UK nationals had lower risk of frailty than those who were UK nationals (0·20, 0·12–0·33). Sleeping outside conferred a lower likelihood of frailty compared with people who were previously homeless but now housed (0·36, 0·17–0·76). Similar patterns were observed with pre-frailty.

Interpretation To our knowledge, this is the largest study of frailty in PEH, offering valuable insights into the high levels of non-geriatric frailty in this vulnerable group, and can act as a starting point to guide service development and policy for this population.

Funding National Institute for Health and Care Research.

Introduction

Frailty is a complex health-related condition, comprising of diminished reserve and function, decreasing adaptive capacity, and increasing vulnerability to stressors, potentially causing adverse outcomes.[1] Homelessness is a global problem associated with poor health and premature mortality.[2] Homelessness and frailty can synergistically heighten vulnerability, with homelessness further exacerbating frailty-related risks due to unstable living conditions and limited access to health care.

Homelessness does not have one single definition. People experiencing homelessness (PEH) can simply be defined by absence of shelter. Alternatively, a more inclusive definition exists of being without shelter that meets basic requirements for health and social development. Homelessness has been categorised using the European Typology of Homelessness and Housing Exclusion (ETHOS) as rooflessness (without a shelter of any kind or sleeping rough), houselessness (with a place to sleep but temporary, or in institutions or shelters), living in insecure housing (in longer-term support due to homelessness, insecure tenancies, or threatened with eviction, or domestic violence), or living in inadequate housing (in caravans on illegal campsites, in unfit housing, in extreme overcrowding).[3] According to this guidance, homelessness has increased in many European countries and the USA since

Research in context

Evidence before this study

We conducted a search of PubMed and Scopus from inception to March 31, 2025 combining the terms "frailty" with other terms related to the outcome of interest (eg, multimorbidity, multiple long-term conditions, or geriatric syndrome) AND "homeless" with other terms related to the population (eg, rough sleep*, hostel, shelter, temporary accommodation, or housing insecurity). There were no language restrictions. Two review studies of frailty in people experiencing homelessness (PEH) described a wide range of estimates of prevalence of frailty (16–70%) and pre-frailty (18–60%), with frailty presenting in PEH at a younger age than in the general population. However, studies had small sample sizes (31–250 participants), high heterogeneity, and used different screening tools to detect frailty. Pooled prevalence estimates range between 31 and 53% depending on the frailty identification tool. The evidence preceding our study suggested that frailty in PEH occurs at concerning rates. However, the current picture is unclear, highlighting the need for more methodologically robust research to address the sampling limitations identified in previous work.

Added value of this study

To our knowledge, our study is the largest of its kind to date. Using secondary analysis of cross-sectional health needs audit data collected from PEH in England, we created a frailty index to identify frailty and analysed its relationship with sociodemographic characteristics of the population. Women experiencing homelessness had approximately double the relative risk of frailty compared with homeless men. Not being engaged in employment, education, or volunteering conferred a three-times greater relative risk of frailty. PEH who declared their immigration status as non-UK national carried a reduced relative risk of frailty compared with those who declared their status as UK national. Similar associations were observed for pre-frailty as for frailty.

Implications of all the available evidence

The prevalence of frailty in PEH is high, and its onset occurs at a far younger age than observed in the general population. Our finding that PEH younger than 30 years showed high levels of frailty and pre-frailty justifies the exploration of targeted interventions to prevent or reverse frailty in younger homeless people. Although there could be some element of reverse causality with frailty predisposing people to homelessness, it is likely that homelessness and associated living conditions lead to premature frailty. This study adds further justification to the need to prevent homelessness and to support people out of homelessness. The poor health of PEH remains an important issue. Development and testing of strategies to identify, prevent, and manage frailty in this population should be prioritised.

the COVID-19 pandemic,[4] and an estimated 1·6 billion people worldwide are without shelter or adequate housing.[5]

Core homelessness describes the most severe forms of homelessness, including those sleeping on the street and living in hostels, shelters, or temporarily with family or friends.[6] The number of people estimated to be core homeless in England was approximately 242 000 in 2022, an increase of 18 000 people compared with 2018, before the pandemic.[6] However, this figure could be underestimated, omitting those who are part of the hidden homeless population.[7]

PEH are known to have poorer health than the general population, with cohort studies showing a mortality risk that is three to six times greater, high levels of chronic illness, and mental health problems.[2,8] Before the 2020 pandemic, the UK Office for National Statistics reported that the mean age of death among PEH in England and Wales was 45·9 years for men and 43·4 years for women, which is more than 30 years less than the mean age of death in the general population (76·1 years for men and 80·9 years for women).[9]

Defining frailty is challenging.[1] Whether it is considered as a phenotypic model constituting components of unintended weight loss, weakness, low energy, slowness, and low physical activity levels,[10] or a cumulation of multiple deficits[11] from a variety of health, social, and functional domains, there is no definitive consensus.[1] Although commonly regarded as a health state related to ageing,[12,13] this view is increasingly challenged, with recognition that frailty can be identified in younger populations (aged ≤60 years).[14] Frailty can be assessed and measured in many ways, including rules-based instruments, impairment lists, and algorithms derived from clinical judgement,[15] with no single measure considered a gold standard. People affected by some components of a frailty measure, but not enough to meet the defined frailty cutoff, could be considered at risk of frailty or pre-frail.[1]

A systematic review and meta-analysis published in 2025 further illuminates the uncertainty surrounding the prevalence of frailty in PEH, suggesting a wide variance in estimates between 16% and 70%, with frailty presenting in PEH at a young age (≤60 years).[16] The authors identified 11 studies, noting high heterogeneity between them, relatively small sample sizes (31–250 participants), and variations in location (the UK, the USA, Germany, and Ireland) and in how frailty was quantified (Fried Frailty Phenotype; Edmonton Frail Scale; Clinical Frailty Scale; Tilburg Frailty Indicator, Survey of Health, Ageing and Retirement in Europe–Frailty Instrument) and frailty indices (eg, the electronic Frailty Index).[16] Selection bias could have affected prevalence estimates, because cohort characteristics might have been specific to study settings (ie, hostels, day services, or hospital), therefore influencing the prevalence of frailty identified. To address the limitations of previous studies, secondary data analysis of existing health survey information collected from PEH provides an opportunity for understanding frailty in a much larger sample size, without the need for new data collection.

The aim of this cross-sectional study was to use existing health needs data collected from PEH in England to calculate the prevalence of frailty among PEH and explore the relationship of frailty with sociodemographic characteristics. This study addresses two questions. First, what is the prevalence of frailty and pre-frailty among PEH in England? Second, which sociodemographic factors are associated with frailty or pre-frailty among PEH in England?

Methods

Study design

This study used secondary data analysis of cross-sectional homeless health needs audit (HHNA)[17] data collected by Homeless Link, a membership charity for organisations working with PEH in England. The study protocol is available online.[18] Ethical approval was provided by the Research Ethics Committee at University College London (UCL; London, UK; project identification number 25071/001) on June 7, 2023.

Patient and public involvement and engagement (PPIE)

Six PPIE group meetings with PEH and clinicians or support staff working in homelessness shaped this research, from the funding application through to data analysis and dissemination. All meetings were designed to best reach the people we wished to engage, including one online and five in-person group meetings with six to eight clinicians, support staff, or PEH (for the purposes of the PPIE, PEH were defined as people who were currently experiencing or had past experience of homelessness). Additionally, to reach PEH who were thought to be frail, we carried out one day of outreach PPIE one-to-one meetings with three PEH living in hostels. Food and travel expenses were covered during in-person meetings, and supermarket vouchers were provided as compensation for participants' time. PPIE meetings informed the refinement of research questions, exploration of variables generated by the HHNA, prioritisation of topics for exploration (see protocol paper),[18] and dissemination strategy.

Participants

Participant recruitment and data collection were overseen by Homeless Link. Participants were recruited and surveyed between 2012 and 2021 in three waves (2012–14, 2015–17, and 2018–2021) after providing written, informed consent. Data collectors were local partners (eg, support workers, local authority staff working in the homelessness sector, or voluntary organisation staff) who were trained by Homeless Link to administer the survey tool and were familiar with the local homelessness context. Data collectors were briefed to maximise reach by working with as many local homeless services as possible, including efforts to access people who were hidden from local authority housing registers (eg, people who were sofa surfing or not engaged with formal services). Homeless Link's inclusion criteria for participating in the survey were: being an individual experiencing homelessness at the time of survey; or, previously homeless (recently accommodated) and still accessing homeless support services; and, presenting within the geographical area in which data collection was underway. The three waves of data collection ran continuously, with no break between each wave. Recruitment was consistent across waves, seeking to reach people attending services frequented by PEH, for example homeless accommodation, day centres, night shelters, and support services. Data collection site selection was purposive (ie, sites where PEH could be found) but recruitment of participants was random, to include anyone who was homeless in that geographical area. Across the three waves, data collectors would attend data collection sites, advertise that HHNA data collection was underway, and invite all people meeting inclusion criteria to participate. Data were collected using an in-person, interviewer-administered survey in primarily urban areas, over different geographical locations throughout England. The strategy of site selection and participant recruitment remained consistent throughout. Each wave involved some survey tool alterations in response to feedback from data collectors. Data collectors read survey questions to the participants and entered their responses into LimeSurvey,[19] an online survey tool. Surveys took 30–40 min to complete. No form of sample size calculation was conducted, as the objective was to analyse all data made available by Homeless Link to UCL for secondary analysis.

For the **study protocol** see https://doi.org/10.3310/nihropenres.13545.1

For **LimeSurvey** see https://www.limesurvey.org/

Procedures

The HHNA was generated by Homeless Link. HHNA data comprise extensive anonymised health information (ie, sociodemographic variables, physical health, mental health, drug and alcohol use, health service usage, wellbeing, and preventive health care). Data pertaining to gender were generated from a pre-set categorical response to the question "What is your gender?" (male, female, transgender male, transgender female, non-binary, other, or no answer). Data collected before 2018 included information on gender as sex (male or female). When extraction of gender data was conducted by Homeless Link, a single gender variable was provided to the UCL team. Data pertaining to race and ethnicity were also generated based on pre-set categories (White; mixed ethnic background or multiple ethnic groups; Asian or Asian British; Black or Black British; or other). HHNA survey questions included primarily closed questions, generating categorical data, with some open questions allowing people to provide more information (appendix p 2). Where changes were made to the survey tool across waves, the Homeless Link research manager reviewed the data and ensured only consistent and similar variables were shared with the UCL team. For the purposes of this study, only sociodemographic variables (age; gender; race and ethnicity; work, education or volunteering at time of survey; immigration status;

See **Online** for appendix

recourse to public funds; accommodation; and disability) and those variables included in the frailty index were extracted by the UCL team and included in this analysis. Although the HHNA survey was administered by trained local personnel coordinated by Homeless Link, the 25 variables used to construct the frailty index (appendix p 2) were subsequently extracted and cleaned by the research team at UCL with the Homeless Link's research manager acting in an advisory capacity. This dataset is a unique and useful resource for understanding health among PEH, because identification of PEH can be challenging within more commonly used national health survey datasets.

Data were transferred to a UCL secure server following a data sharing agreement. Homeless Link ensured that the shared data could not be used to deduce the identity of individuals. Data were imported to Stata, version 17, for subsequent data management and analysis.

Variables were checked against the most recent iteration of the survey tool to identify any discrepancies between the expected and received variables. Any anomalies were discussed and clarified with Homeless Link. When survey questions included an "Other" option with free-text responses, these responses were manually reviewed and coded in line with existing categories and were cross checked within the UCL research team.

Once the dataset was cleaned and basic summaries were completed, volumes and patterns of missing data were assessed for probable explanation for their missingness, including liaison with Homeless Link's research manager. Most missing data were considered as likely to be missing completely at random (MCAR; defined as missingness unrelated to both observed and unobserved data [eg, people being interrupted during the interview]), although some variables such as sexual orientation or substance use could be missing not at random due to perceived associated stigma. Efforts to minimise potential response biases around perceived stigma were mitigated by interviewers using neutral language and surveys being carried out in areas to maximise privacy. Furthermore, selection bias was minimised by ensuring interviews were carried out across mornings, afternoons, and evenings, on both weekdays and weekends, throughout the calendar months (2012–21).

Statistical analysis

To identify levels of frailty and pre-frailty among participants, a frailty index was constructed using a four-stage process: (1) reviewing the survey tool to identify all discrete variables generated; (2) reaching expert consensus on variable inclusion using a modified Delphi[19] process (outlined in the study protocol);[18] (3) constructing the frailty index in line with published guidance;[20,21] and (4) comparing the proposed frailty index for the HHNA dataset with existing published frailty indices (figure 1). A total of 25 variables from the HHNA dataset were deemed appropriate for inclusion in the frailty index (appendix pp 2–3). Reflecting guidance that a frailty index score should not be calculated for individuals missing more than 20% of the frailty index items,[20] participants with complete data in 20 or more of the 25 frailty index variables were included in the analysis.[20] We reviewed the literature and adopted cutoff scores of frailty index of 0·08 or less for non-frail, 0·25 or more for frail, and values between 0·08 and 0·25 for pre-frail categories.[22] Details of the decision-making process for adopting these cutoff scores are provided in the study protocol.[18]

Calculation of frailty prevalence was conducted. Descriptive statistics were used to report univariate analyses of proportions overall and by sociodemographic characteristics. Differences within each variable were examined using Pearson's Chi-squared test, Fisher's exact test, or Spearman's correlation coefficient (to account for the ranking of frailty). Unadjusted and adjusted multinomial logistic regression models with robust standard errors were used to assess the relationships between pre-frailty or frailty and sociodemographic characteristics (age; gender; accommodation at time of survey; engagement in employment, volunteering, and education; and immigration status) among participants who provided sufficient data in frailty index variables and complete data for sociodemographic variables included in the regression model (age; gender; accommodation at time of survey; engagement in employment, volunteering or education; and immigration status). Robust standard errors are preferable compared with normal standard errors when unequal variances across observations are detected.[23] Common examples include unequal variances across observations, using a Poisson distribution instead of a binomial distribution, and clustered data.

Decisions about which variables to adjust for in the multivariable analysis were decided a priori, based on a review of the literature. Sexual orientation was identified by PPIE groups and Homeless Link as probably under-reported due to perceived stigma, so it was not considered in the multivariable analysis. Ethnicity and recourse to public funds were also not considered for adjustment due to concerns for multicollinearity with immigration status. A p value of less than 0·05 was considered statistically significant. Statistical analysis was conducted using Stata version 17.

Sensitivity analysis was done in two ways. First, to assess whether data were likely to be missing at random (MAR; defined as missingness related to observed data only) or MCAR, we conducted a comparison between individuals included in the complete case analysis (n=2288) and those excluded due to missing data on frailty index variables (n=391). Differences between these groups were examined using Pearson's Chi-squared test or Fisher's exact test. Second, a multiple imputation with chained equations was used to generate ten imputed datasets and assess the risk of pre-frailty and frailty for all study participants who consented to be part of the

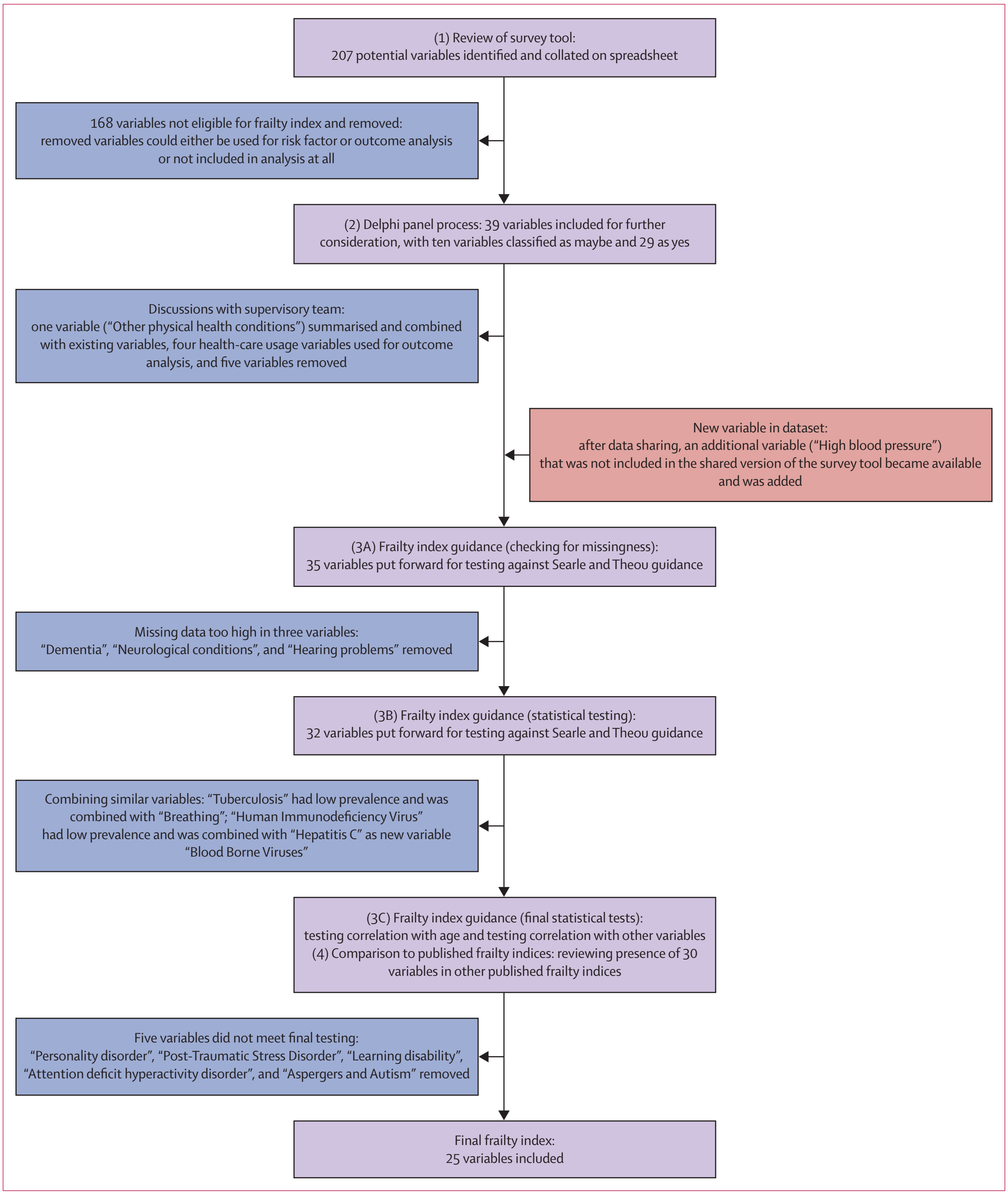

Figure 1: **Outline of four-stage process for selection of variables for inclusion in frailty index. Frailty index development was informed by the work of Theou and Searle[20,21]**

study. The multivariable associations between socio-demographic characteristics and frailty in the imputed datasets were compared with the results from the complete case analysis to assess the robustness of findings (appendix pp 4–5).

Role of the funding source

The funder did not have any role in the study design; in the collection, analysis, or interpretation of data; in the writing of the report; or in the decision to submit this paper for publication.

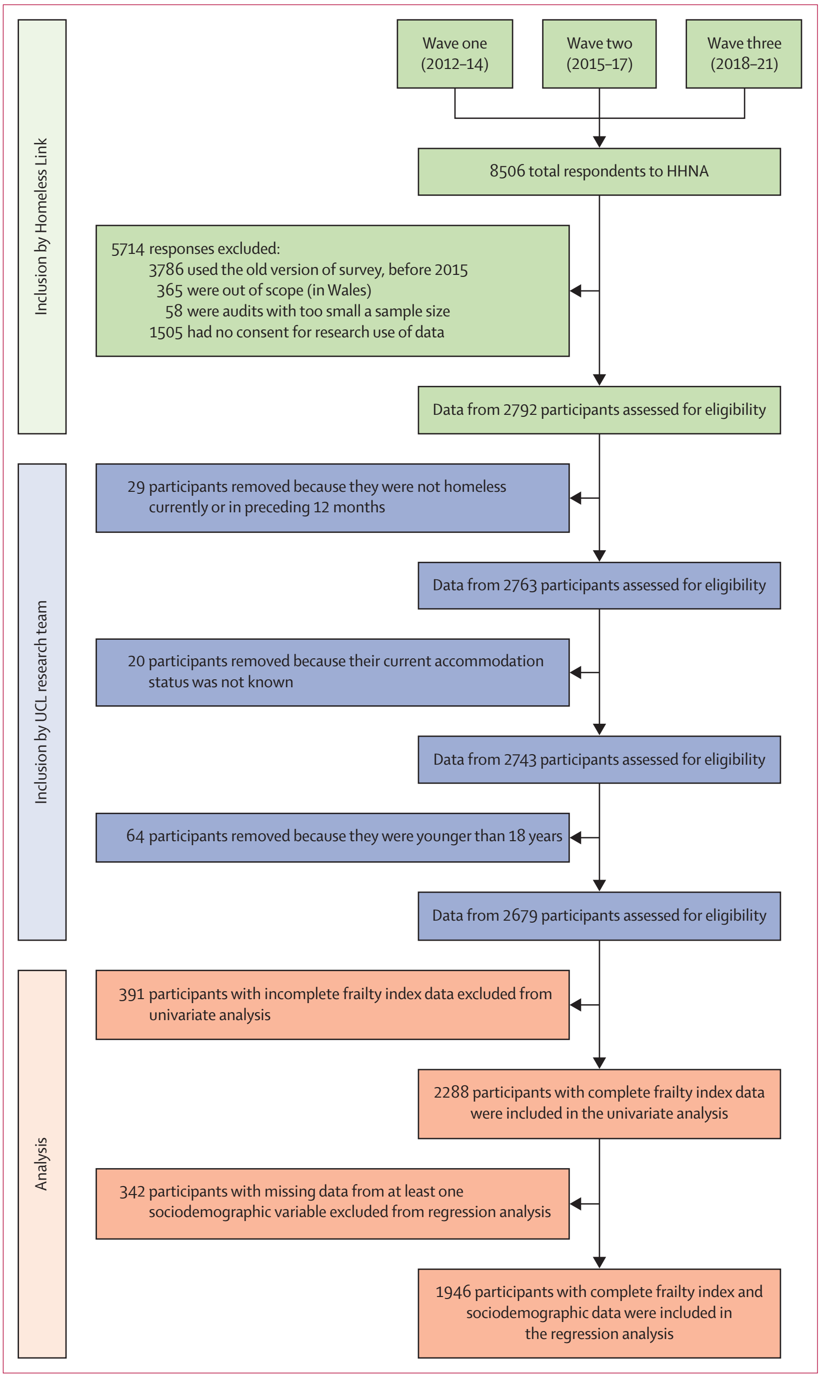

Figure 2: **Summary of participant inclusion**
HHNA=homeless health needs audit. UCL=University College London.

Results

2288 (84·8%) of 2679 total participants surveyed provided sufficient data to calculate their frailty index score (ie, they provided data for 20 or more frailty index variables; figure 2). Sensitivity analyses showed that participants with missing data (391 [14·6%] of 2679) were broadly similar to those without missing data (appendix pp 4–5). Therefore, we assumed that data were likely to be MAR, although some small but significant differences in age; gender; accommodation; engagement in employment, volunteering, or education; and recourse to public funds between groups were noted (appendix p 4). Further to that, the regression estimates of the sensitivity analysis were similar to the estimates of the complete case analysis (appendix p 5).

Among participants with sufficient data, when considering the ETHOS categories of homelessness,[3] 64·9% of the participants studied were houseless, 17·2% of participants were roofless, 8·1% were living in insecure or inadequate accommodation, and 9·3% were housed but homeless in the preceding 12 months. Among PEH with sufficient data, 41·5% were frail, 43·8% were pre-frail, and 14·8% were not frail (table 1).

Univariate analysis showed a significant association of frailty with age ($p<0·001$), with prevalence of frailty increasing as age increased. This increase was less pronounced in people who were 60 years or older (figure 3), which was possibly explained by this group being smaller than the other age groups. A high prevalence of frailty (26·6%) was detected in participants aged 18–29 years.

In other univariate analyses, among participants with sufficient data, frailty was significantly higher in participants who were non-heterosexual (including people identifying as gay, lesbian, bisexual, pansexual, and other) than in those who were heterosexual (50·0% *vs* 41·7%; $p=0·0010$). Frailty was significantly higher in those not engaged in employment, volunteering, or education than in those engaged in these activities (45·7% *vs* 23·6%; $p<0·0001$). Frailty was also significantly higher among participants who described themselves as UK nationals than among those who were non-UK nationals (44·1% *vs* 24·3%; $p<0·0001$). However, frailty was significantly lower in participants who were not White than in those who were White (22·9% *vs* 44·4%; $p<0·0001$). Participants who were not White included individuals identifying as being from a mixed ethnic background or those who were Asian or Asian British, Black or Black British, or from another ethnic background (eg, Arab). Frailty was also significantly lower in participants with no recourse to public funds than in those who had recourse to public funds (26·2% *vs* 44·5%; $p<0·0001$). The univariate associations between frailty and gender or housing status were non-significant (table 1).

Adjusted multinomial logistic regression models carried out with 1946 participants who provided complete data for frailty index and sociodemographic variables included in modelling showed that older age was associated with higher risk of frailty across all age bands, with PEH aged 50–59 years having over eight times higher risk of frailty compared with PEH aged 18–29 years (adjusted risk ratio 8·30, 95% CI 4·86–14·16). Women were twice as likely as men to be frail (2·30, 1·57–3·37), and those who were roofless were less likely to be frail than those who

	Total	Not frail	Pre-frail	Frail	p value
All participants	2288	338/2288 (14·8%)	1001/2288 (43·8%)	949/2288 (41·5%)	
Age, years					
18–29	789/2288 (34·5%)	183/789 (23·2%)	396/789 (50·1%)	210/789 (26·6)	<0·0001*
30–39	510/2288 (22·3%)	69/510 (13·5%)	218/510 (42·7%)	223/510 (43·7)	
40–49	496/2288 (21·7%)	46/496 (9·3%)	198/496 (40·0%)	252/496 (50·8)	
50–59	361/2288 (15·8%)	28/361 (7·8%)	137/361 (38·0%)	196/361 (54·3)	
≥60	102/2288 (4·5%)	8/102 (7·8%)	38/102 (37·2%)	56/102 (54·9)	
Missing	30/2288 (1·3%)	4/30 (13·3%)	14/30 (46·7%)	12/30 (40·0%)	
Gender					
Male	1664/2288 (72·7%)	265/1664 (15·9%)	713/1664 (42·8%)	686/1664 (41·2%)	0·11†
Female	603/2288 (26·4%)	70/603 (11·6%)	279/603 (46·3%)	254/603 (42·1%)	
Other	8/2288 (0·4%)	1/8 (12·5%)	4/8 (50·0%)	3/8 (37·5%)	
Missing	13/2288 (0·6%)	2/13 (15·4%)	5/8 (38·5%)	6/8 (46·2%)	
Sexual orientation					
Heterosexual	1864/2288 (81·5%)	274/1864 (14·7)	813/1864 (43·6)	777/1864 (41·7)	0·0010†
Non-heterosexual	174/2288 (7·6%)	10/174 (5·7)	77/174 (44·3)	87/174 (50·0)	
Missing	250/2288 (10·9%)	54/220 (21·6)	111/220 (44·4)	85/220 (34·0)	
Accommodation at time of survey					
Roofless	394/2288 (17·2%)	80/394 (20·3%)	157/394 (39·8%)	157/394 (39·8%)	0·20†
Houseless	1486/2288 (64·9%)	202/1486 (13·6%)	661/1486 (44·5%)	623/1486 (41·9%)	
Insecure or inadequate	185/2288 (8·1%)	26/185 (14·1%)	85/185 (45·9%)	74/185 (40·0%)	
Housed	213/2288 (9·3%)	29/213 (13·6%)	95/213 (44·6%)	89/213 (41·8%)	
Missing	10/2288 (0·4%)	1/10 (10·0%)	3/10 (30·0%)	6/10 (60·0%)	
Engagement in employment, volunteering, or education					
Yes	276/2288 (12·1%)	63/276 (22·8%)	148/276 (53·6%)	65/276 (23·6%)	<0·0001‡
No	1686/2288 (73·7%)	211/1686 (12·5%)	705/1686 (41·8%)	770/1686 (45·7%)	
Other	55/2288 (2·4%)	9/55 (16·4%)	31/55 (56·4%)	15/55 (27·3%)	
Missing	271/2288 (11·8%)	55/271 (20·3%)	117/271 (43·2%)	99/271 (36·5%)	
Race and ethnicity					
White	1971/2288 (86·1%)	234/1971 (11·9%)	862/1971 (43·7%)	875/1971 (44·4%)	<0·0001‡
Non-White	293/2288 (12·8%)	96/293 (32·8%)	130/293 (44·4%)	67/293 (22·9%)	
Missing	24/2288 (1·0%)	8/24 (33·3%)	9/24 (37·5%)	7/24 (29·2%)	
Immigration status					
UK national	1915/2288 (83·7%)	235/1915 (12·3%)	836/1915 (43·7%)	844/1915 (44·1%)	<0·0001‡
Non-UK national	148/2288 (6·5%)	44/148 (29·7%)	68/148 (45·9%)	36/148 (24·3%)	
Missing	225/2288 (9·8%)	59/225 (26·2%)	97/225 (43·1%)	69/225 (30·7%)	
Recourse to public funds					
Yes	1781/2288 (77·8%)	218/1781 (12·2%)	771/1781 (43·3%)	792/1781 (44·5%)	<0·0001‡
No	214/2288 (9·4%)	59/214 (27·6%)	99/214 (46·3%)	56/214 (26·2%)	
Missing	293/2288 (12·8%)	61/293 (20·8%)	131/293 (44·7%)	101/293 (34·5%)	

Data are n/N (%), unless otherwise specified. Missing categories were not included in significance testing. p values show the difference in frailty prevalence across the study participants' sociodemographic characteristics. PEH=people experiencing homelessness. The p values were obtained using either Spearman's rank correlation coefficient, Fisher's exact test, or Pearson's Chi-squared test. *Spearman's rank correlation coefficient. †Fisher's exact test. ‡Pearson's Chi-squared test.

Table 1: **Difference in prevalence of frailty among PEH and sociodemographic characteristics**

were housed but homeless in the previous 12 months (0·36, 0·17–0·76). Not engaging in employment, education, or volunteering was associated with a three times greater likelihood of being frail compared with those who were engaged in these activities (3·05, 1·97–4·71). Furthermore, being a non-UK national was associated with a lower risk of frailty compared with being a UK national (0·20, 0·12–0·33; table 2). Similar associations were observed for pre-frailty as for frailty (tables 1, 2).

Discussion

To our knowledge, this is the largest study to date estimating the prevalence of frailty in PEH. 1950 of 2288 participants with sufficient data were pre-frail or frail. 949 (41·5%) of 2288 PEH were frail, a prevalence that falls midway within the range reported in previous studies (16–70%).[16] 1001 (43·8%) PEH were pre-frail, meaning only 338 (14·8%) were considered to be in good health (ie, not frail). Notably, 2156 (94·2%) of 2288 participants were aged

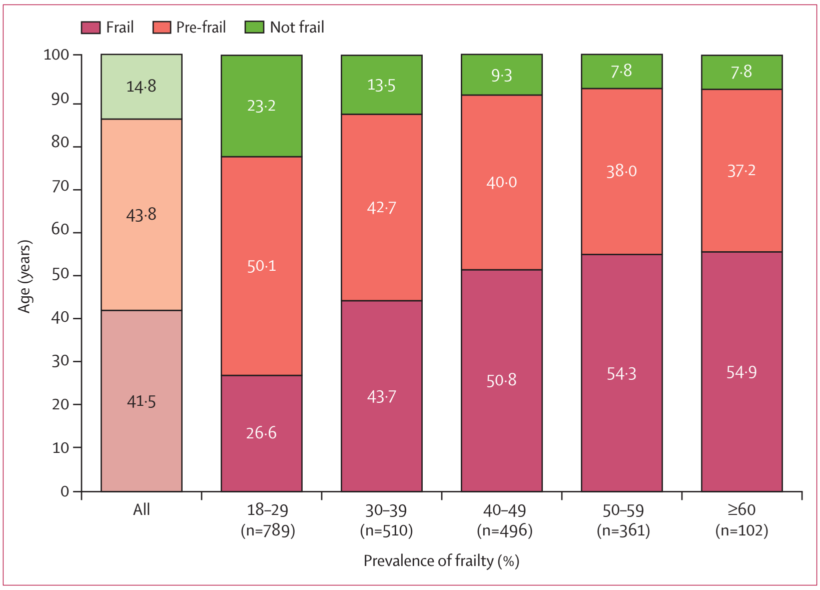

Figure 3: **Frailty prevalence by age groups in PEH**
PEH=people experiencing homelessness.

18–59 years (representative of PEH in England[24]), highlighting high proportions of frailty and pre-frailty in a relatively young population. By comparison, a UK study reported a 10·0% prevalence of frailty among individuals in the general population who were younger than 65 years.[25]

A substantial proportion of PEH aged 18–29 years were frail (26·6%) or pre-frail (50·1%). By comparison, a study of Canadian National Population Health Survey data found a frailty prevalence of 2·4% in their general population aged 15–39 years.[26] This finding supports the argument that frailty is not purely related to age and presents in younger populations. Our findings add to the understanding of premature ageing—defined as the early onset of frailty and geriatric syndromes typically observed in older adults—and highlight the presence of geriatric conditions in PEH[27] who are generally younger than 65 years.

After adjusting for age and sociodemographic risk factors, women were twice as likely to be frail or pre-frail compared with men. In the general population, women tend to live longer than men but also have higher levels of frailty, probably due to a combination of physiological, epigenic, psychosocial, and lifestyle factors.[28] Although our study cannot establish why women experiencing homelessness are at greater risk of frailty than men, they are thought to be more vulnerable due to the higher prevalence of disability and discrimination that they experience compared with men.[29]

Those defined as housed at the time of survey were more likely to be frail than those defined as roofless. One explanation for this finding is that frail individuals could be prioritised for housing. Similarly, a degree of robustness might be required to survive life on the street. However, the cross-sectional nature of the dataset means inferences about the direction of the relationship between frailty and accommodation are not possible. Moreover, many PEH frequently change accommodation, so accommodation at the time of survey might not represent individuals' wider accommodation picture. Those engaged in employment, education, or volunteering were less likely to be frail than those not engaged in these activities. Although these activities can be good for health, being frail or pre-fail probably makes it more difficult to engage in them.

This study suggests that among PEH, people who were not UK nationals were less likely to be frail than those who were UK nationals. This finding could seem counterintuitive, because many migrants experiencing homelessness do not have recourse to public funds and therefore cannot access health services. However, research highlights the so-called healthy immigrant effect, suggesting that immigrants exhibit better health than domestic-born populations.[30] Risk factors predisposing to homelessness and frailty, such as adverse childhood experiences, substance use, and imprisonment, might be more common in PEH who were UK nationals.

Although data about sexual orientation were captured in this research, PPIE groups and stakeholders were vocal about perceived stigma of non-heterosexuality among PEH. Consequently, a relatively high level of missing data was seen for this characteristic and there is likely to be further under-reporting, so it was not included in regression analysis. Associations between sexual orientation, homelessness, and frailty warrant further research.

A strength of this study was its large sample size, which maximised opportunities to reach a wide range of PEH, including those defined as hidden homeless.[7] We adopted a thorough programme of PPIE, facilitating the prioritisation of research questions and dissemination strategies. Robust, evidence-based processes were followed in creating the frailty index, allowing confidence in identifying frailty in this population.[20,21] The application of unadjusted and adjusted multinomial logistic regression models, with a priori adjustments informed by literature review, strengthened the validity of associations between frailty and key sociodemographic variables while addressing potential confounders. The exclusion of some variables such as sexual orientation due to under-reporting concerns and ethnicity due to multicollinearity with immigration status reflects careful consideration of data limitations and biases. Sensitivity analyses add robustness by assessing potential biases due to missing data. The use of multiple imputation with chained equations ensures consistent estimates across the imputed datasets, enhancing the reliability of study conclusions.

Limitations of the study must be acknowledged. Despite substantial efforts to include core homeless (those sleeping on streets or living in hostels) and hidden homeless (those who are not easily found) individuals, when comparing the proportions to national homelessness data,[6] our primarily convenience sample considerably represents rooflessness

	Pre-frailty				Frailty			
	Unadjusted relative RR (95% CI)	p value	Adjusted relative RR (95% CI)	p value	Unadjusted relative RR (95% CI)	p value	Adjusted relative RR (95% CI)	p value
Age, years								
18–29	Ref		Ref		Ref		Ref	
30–39	1·77 (1·23–2·55)	0·002	2·04 (1·39–2·98)	<0·0001	3·35 (2·30–4·88)	<0·0001	3·85 (2·59–5·73)	<0·0001
40–49	2·07 (1·38–3·10)	<0·0001	2·29 (1·51–3·47)	<0·0001	5·00 (3·29–7·47)	<0·0001	5·55 (3·63–8·49)	<0·0001
50–59	2·97 (1·77–4·99)	<0·0001	3·24 (1·90–5·52)	<0·0001	7·71 (4·58–12·96)	<0·0001	8·30 (4·86–14·16)	<0·0001
≥60	1·95 (0·88–4·31)	0·10	1·89 (0·82–4·67)	0·13	5·37 (2·47–11·65)	<0·0001	6·61 (2·79–15·62)	<0·0001
Gender								
Men	Ref		Ref		Ref		Ref	
Women	1·77 (1·24–2·52)	0·0020	1·89 (1·31–2·74)	0·0010	1·90 (1·26–2·57)	0·001	2·30 (1·57–3·37)	<0·0001
Other	1·42 (0·16–12·79)	0·75	0·99 (0·08–11·74)	1·00	1·11 (0·11–10·70)	0·93	0·63 (0·44–9·02)	0·73
Accommodation at time of survey								
Housed	Ref		Ref		Ref		Ref	
Roofless	0·26 (0·13–0·53)	<0·0001	0·31 (0·15–0·66)	0·0020	0·29 (0·14–0·60)	0·0010	0·36 (0·17–0·76)	0·0080
Houseless	0·45 (0·23–0·89)	0·0230	0·49 (0·24–1·00)	0·050	0·45 (0·23–0·89)	0·0210	0·50 (0·25–1·02)	0·057
Insecure or inadequate	0·40 (0·18–0·88)	0·0240	0·48 (0·21–1·10)	0·083	0·36 (0·22–0·81)	0·13	0·49 (0·21–1·15)	0·10
Engagement in employment, volunteering, or education								
Yes	Ref		Ref		Ref		Ref	
No	1·34 (0·94–1·89)	0·10	1·38 (0·96–2·00)	0·084	3·22 (2·18–4·77)	<0·0001	3·05 (1·97–4·71)	<0·0001
Other	1·28 (0·57–2·88)	0·55	1·18 (0·49–2·83)	0·72	1·26 (0·50–3·18)	0·62	0·91 (0·34–2·45)	0·85
Immigration status								
UK national	Ref		Ref		Ref		Ref	
Non-UK national	0·42 (0·27–0·64)	<0·0001	0·41 (0·27–0·64)	<0·0001	0·22 (0·13–0·35)	<0·0001	0·20 (0·12–0·33)	<0·0001

RR=risk ratio. All p values were derived using univariable and multivariable multinomial logistic regression, with robust standard errors.

Table 2: **The relative RRs (adjusted and unadjusted) of frailty compared with sociodemographic factors in 1946 PEH in England, where not being frail is the base comparison**

and houselessness. However, national data would suggest many people accepted as statutorily homeless in England are living in temporary accommodation and our research captured fewer people living in inadequate or insecure settings.[31] Therefore, this study is not fully representative of all forms of homelessness. This study used cross-sectional data, so direction of associations cannot be established. The HHNA survey tool was created before this study, and not with frailty in mind, limiting the variables available for the frailty index. The survey tool included no physical measures of function or strength, which are commonly present in clinical assessment tools to assess frailty.[10,15] Moreover, we cannot know whether our frailty index would underestimate or overestimate frailty in this population compared with clinical assessment tools. Despite this limitation, our frailty index covered broad health domains and systems within the 25 variables included, although this was slightly below the suggested and optimal number of at least 30 variables.[20] The literature debates cutoff points of frailty scores. We reflected the Fried Phenotypic model classifications of non-frail, pre-frail, and frail[10] and mirrored the work that proposed frailty index scores of 0·08 or less as non-frail, 0·25 or more as frail, and scores in between as pre-frail.[22] Furthermore, we note that the data collection phase included the COVID-19 pandemic, but date of interview was not shared with the UCL research team and therefore we were unable to adjust for the impact of the pandemic.

Our study supports the findings of previous, smaller-scale studies: that the prevalence of frailty in PEH is high and that onset occurs at a younger age than in the general population. This picture of poor health in PEH emphasises the central importance of preventing and minimising the duration of homelessness. It is also recognised that if frailty is addressed early, it can be reversable. Anecdotally, across the UK, many clinical or residential services that provide care for people who are frail include a referral criterion of being aged at least 65 years. Therefore, the majority of PEH identified as frail or pre-frail in this study would be ineligible for these. Our findings indicate that PEH younger than 30 years have a high prevalence of frailty and pre-frailty. Thus, there is a justification to either expand existing frailty services to enable younger people to access them, or to design and test targeted interventions that aim to prevent or reverse frailty in younger homeless people.

Existing literature suggests that exercise plus nutritional supplementation or exercise alone are likely the most effective interventions to reduce frailty.[32] Nutritional status in PEH is recognised as poor,[33] so this should be a focus of future research. Physical activity interventions have been shown to benefit the health of PEH,[34] so further work is required to better understand how nutrition and exercise interventions can be adapted to address frailty in PEH. Because women experiencing homelessness appear to be at greater risk of frailty than men and commonly face greater barriers to exercise (eg, body image concerns, childcare, or worries about safety issues and physical environment), gender specific interventions should be considered.

Because most of the PEH in this study are of working age, the relationship between frailty and employment, education, and volunteering warrants closer scrutiny. It is possible that if robust measures are put in place to prevent and address frailty among PEH, this could situate them to better move on from homelessness and improve their chances of engaging in these activities. Although the prevalence of frailty was lower in those engaged in employment, volunteering, or education, substantial numbers of people who were engaged in these activities were frail, meaning that frailty services for PEH need to be flexible to their clients' other commitments.

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Future research is needed to better understand the direction and contexts of the relationship between frailty and homelessness. Within this dataset, future exploration of whether specific variables within the frailty index were particularly common could reveal which aspects of frailty or its manifestation might be more pronounced in this population of PEH and in PEH more generally to allow for better identification and targeting of care. Furthermore, future use of large datasets, where frailty can be identified in both PEH and individuals with secure housing, would allow for direct comparisons to be made, enabling better understanding specifically of how homelessness itself is a risk factor for frailty. Longitudinal research could generate further understanding of the trajectory of frailty in PEH. Qualitative studies could help to understand drivers and life events which contribute to frailty, thus directing how preventive strategies should be targeted. Most importantly, research to develop and test interventions to prevent and manage frailty in this population is urgently needed.

Contributors

All authors contributed to the conceptualisation of this research and reviewing of the manuscript. Data curation and verification was undertaken by DH and JD. Formal data analysis was undertaken by JD and EB. JD primarily led funding acquisition, but this was supported by KW, AH, and RF. The methodology of this research was developed by JD, AH, KW, EB, and RF. The project was administered by JD. DH provided the study materials, participants, and data collection tools. Computing software and analysis tools were overseen by JD and EB. Supervision was provided by AH, KW, RF, AB, and EB. Data validation and visualisation were undertaken by JD and EB. Writing of the original draft was undertaken by JD and all authors contributed to reviewing and editing the manuscript. All authors had full access to all the data in the study and had final responsibility for the decision to submit for publication. JD and EB accessed and verified the data.

Declaration of interests

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Data sharing

This study used third party data made available under a licence that the authors do not have permission to share. Requests to access the data should be directed to Homeless Link, via their website or by email (research@homelesslink.org.uk).

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