BMJ Public Health

Holistic health and social care outreach for people experiencing homelessness with recent non-fatal overdose in Glasgow, Scotland: the Pharmacist and third sector Homeless charity worker Outreach Engagement Non-medical Independent prescriber Rx (PHOENIx) pilot randomised controlled trial

Richard Lowrie ,[1] Andrew McPherson ,[2] Frances S Mair,[3] Kate Stock,[2] Donogh Maguire,[4] Vibhu Paudyal ,[5] Clare Duncan,[6] Rebecca Blair,[2] Cian Lombard,[2] Steven Ross,[7] Fiona Hughes,[2] Jane Moir,[2] Ailsa Scott,[7] Frank Reilly,[7] Laura Sills,[8] Jennifer Hislop,[9] Stephen Wishart,[10] David Brannan,[11] James Roy Robertson,[12,13] Rebekah Ramage,[2] Alison Boyle,[2] Nicola Greenlaw,[14] Andrea E Williamson [15]

To cite: Lowrie R, McPherson A, Mair FS, *et al*. Holistic health and social care outreach for people experiencing homelessness with recent non-fatal overdose in Glasgow, Scotland: the Pharmacist and third sector Homeless charity worker Outreach Engagement Non-medical Independent prescriber Rx (PHOENIx) pilot randomised controlled trial. *BMJ Public Health* 2024;**2**:e000219. doi:10.1136/bmjph-2023-000219

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/bmjph-2023-000219).

Received 11 May 2023
Accepted 16 February 2024

For numbered affiliations see end of article.

Correspondence to
Dr Richard Lowrie;
Richard.lowrie@ed.ac.uk

ABSTRACT

Objectives To examine randomised controlled trial (RCT) progression criteria including emergency department (ED) attendance and non-fatal overdose, from a holistic, integrated health and social care outreach intervention (PHOENIx), for people experiencing homelessness with recent non-fatal street drug overdose.

Design Pilot RCT. 1:1 randomisation to PHOENIx plus usual care (UC) or UC.

Setting Glasgow, Scotland.

Participants 128 adults experiencing homelessness with at least one non-fatal street drug overdose in the preceding 6 months.

Interventions Pharmacists from the National Health Service and third sector homelessness workers offered weekly outreach. PHOENIx teams develop therapeutic relationships to address health (physical health, mental health and problem drug use) and social care (housing, welfare benefits and social prescribing) in addition to UC. UC comprised building-based primary and secondary health, social and third sector services.

Outcomes Primary: progression criteria: recruitment (≥100 participants in 4 months); ≥80% of participants with data collected at baseline, 6 and 9 months; ≥60% of participants retained in the trial at each follow-up period (6 and 9 months); ≥60% of participants receiving the intervention weekly; any reduction in the rate of presentation to ED and overdoses, at 6- or 9-month follow-up. Secondary: participants with, and time to: hospitalisations; health-related quality of life (QoL); treatment uptake for physical and mental health conditions, and problematic drug use.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The increasing public health epidemic of drug deaths disproportionately impacts people experiencing homelessness. There are no primary care–based complex health and social/third sector care interventions known to prevent fatal or non-fatal overdoses.

WHAT THIS STUDY ADDS

⇒ People experiencing homelessness with a recent non-fatal overdose can be recruited, retained, and receive a novel complex health and third sector holistic outreach intervention called PHOENIx, over 7 months, in a pilot randomised controlled trial (RCT). There were signs of delayed time to overdose, emergency department visits and hospitalisations in the intervention versus usual care arm, which merits further investigation in a definitive RCT.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study has shown that it is possible to explore the utility of complex interventions in a high-risk subset of people experiencing homelessness using robust randomised clinical trial methodologies. Future research funding should be directed towards supporting testing of such interventions in particularly high-risk populations.

Results Progression criteria were exceeded. In PHOENIx compared with UC, there appeared to be a delay in the median time to ED visit, overdose and hospitalisation but no improvement in number of participants with ED visits, overdoses or hospitalisations. QoL and treatment uptake appeared to be higher in PHOENIx versus UC at 6 and 9 months.

Conclusions A definitive RCT is merited, to assess the impact of PHOENIx on people with multiple, severe disadvantages.

Trial registration number ISRCTN10585019.

INTRODUCTION

Worldwide, homelessness, drug overdose rates and drug overdose deaths are increasing.[1–5]

In Scotland, the rate of drug-related deaths is the highest in the United Kingdom (UK), broader Europe,[2 3] and when compared with the USA.[6] Homelessness affects 0.5% of the Scottish population although homelessness can be hidden and numbers are poorly enumerated.[2] Non-violent and violent household disputes remain the most common reasons why people become homeless.[2] Most people experiencing homelessness who present to local authorities in the UK are offered temporary accommodation, for example, congregate hostels, however some people refuse or are not offered temporary accommodation. Rough sleeping and the proportion of people becoming homeless from private rented tenancies has increased.[2]

Reports of the average age at death of people experiencing homelessness range from 41 to 44 years.[7] Half of all homeless deaths are caused by polydrug overdose.[3 8 9] High levels of anxiety and depression, destitution, problem substance use and living in congregate homeless accommodation increase the risk of death.[10 11] People experiencing homelessness live with extensive, complex multimorbidity and unmet health and social care needs.[12 13] One-third report health states worse than death.[14] Institutionalisation, trauma, care fragmentation and mistrust in authority are common among people experiencing homelessness, who live in circumstances of multiple, intersecting health and social disadvantage.[15]

Low levels of engagement with mainstream primary healthcare results in low uptake of medicines for treatable conditions.[12–14 16–18] Against a backdrop of declining numbers of general practitioners (GPs) in the UK and increasing GP workload,[19 20] new, approaches to providing first contact, comprehensive and continuous care are needed to guide overdose prevention efforts. Pharmacists in the UK, and in other countries including the USA and Canada, can legally prescribe any medicine.[21–23] Feasibility studies suggest pharmacists collaborating with third sector homelessness workers offering outreach to address a wide range of problems may help to address health and social care needs among people experiencing homelessness in Glasgow, Scotland.[16–18] This is a mobile, accessible model of outreach care, called PHOENIx (Pharmacist and third sector Homeless charity worker Outreach Engagement Non-medical Independent prescriber Rx). PHOENIx provides a 'whole patient oriented' approach[24] that includes offers of housing, health and social care support.

To date, no study has recruited people experiencing homelessness in the community following a recent overdose.[14 25] To our knowledge, there are no published trials of interventions aiming to offer holistic wrap-around health and social care support on outreach, to reduce the risk of overdose.[25–27] The PHOENIx intervention is a novel, holistic intersectional response by UK National Health Service (NHS) Pharmacist independent prescribers collaborating with third sector homelessness charity workers.[16–18 28] PHOENIx aims to support self-care and address multimorbidity and wider determinants of health. PHOENIx ask the person facing homelessness with recent non-fatal overdose, to identify their own priorities, and PHOENIx help to address these through long consultations, weekly, on assertive outreach visits.[29 30]

We report the findings from a pilot randomised controlled trial (RCT) which aims to examine recruitment, retention, data collection, intervention adherence and preliminary effects of PHOENIx.

METHODS

Study design and setting

We conducted a pilot RCT in 20 venues in Glasgow, which is Scotland's largest city (circa 600 000 inhabitants). Venues included different locations where people experiencing homelessness live, for example, hostels, or visit, for example, third sector homelessness charity drop-in centres or congregate, for example, begging pitches. In Scotland, the NHS provides free healthcare including prescriptions. We followed the Consolidated Standards of Reporting Trials guidelines[31] and the trial was preregistered. A detailed protocol has been previously published.[28]

Participants

Inclusion criteria were as follows[14 28]:

Homeless (living in temporary homeless accommodation, no fixed abode or rough sleeping);

and

Aged 18 years or over;

and

At least one self-reported, non-prescribed drug overdose (blackout/lack of response and slow/irregular breathing that was thought to progress to complete cessation of respiratory effort unless treated) in the past 6 months confirmed by:

- A witness; or
- An ambulance call out; or
- An emergency department (ED) visit; or
- An administration of naloxone.

Exclusion criteria were as follows: living in a residential or community-based rehabilitation facility which had direct access to in-house medical and nursing care; or unable to give written informed consent. If necessary, researchers confirmed overdose occurrence(s) by

contacting witnesses. Witnesses were usually known to the participant, for example, workers in the temporary accommodation, or other residents in the temporary accommodation. Researchers also checked different records for confirmation of overdose(s): accommodation workers' records (a diary, kept at the accommodation); social care or addictions team records; secondary care records.

In recruitment venues, researchers collected a wide range of information including demographics, diagnoses, prescribing, street drug use, laboratory tests, subjective and objective health measures, validated questionnaires and healthcare utilisation data. These data were collected during in-person consultations or from clinical records after the in-person consultation (online supplemental web appendix 1).[28] Participants received a £10 shopping voucher (redeemable at a shop not selling tobacco or alcohol) on completion of baseline, 6- and 9-month data collection.

Randomisation and blinding

After baseline data collection, researchers phoned a study administrator on a dedicated randomisation number. On receiving the call, the administrator randomly picked a concealed, sealed envelope from a bundle. The concealed, sealed envelopes were produced in advance of recruitment, by an independent member of the research team who had no other study involvement. The administrator opened the envelope (while the researcher remained on the phone line) and divulged the participant's allocation (PHOENIx plus usual care (UC) or UC). Due to the nature of the intervention, blinding of participants and staff to allocation was not possible. Outcome assessments and analysis were conducted by blinded researchers.

Researchers aimed to locate participants and collect follow-up data at 6 and 9 months postrandomisation. Reasons, why follow-up assessments could not be conducted, included participant dead; participant lacking the mental capacity to make decisions (confirmed in writing in the participant's medical case records); participant withdrawn consent; participant under the influence of alcohol and/or street drugs and unable to complete the assessment; or could not be located by researchers. For all participants (except those who had died, lost capacity or had consent withdrawn), researchers accessed health and social care records at 6- and 9-month follow-ups to extract service utilisation data and outcomes. Details of parallel economic and qualitative evaluations will be reported elsewhere.

Intervention

The PHOENIx intervention has been described previously[14 16–18 28] and full details are given in online supplemental web appendix 2. Briefly, generalist pharmacists with an independent prescribing qualification paired with third sector homelessness outreach workers and visited participants weekly for approximately 7 months. During visits, PHOENIx collaborated with primary health, social care and third sector teams to assess and address a wide range of health and social care problems prioritised by the participant.

Outcomes

The coprimary outcomes of interest were the following progression criteria[28]:

1. Recruitment: at least 100 participants within 4 months of trial start date;
2. Data collection: at least 80% of participants with data collected (baseline, 6- and 9-month follow-ups);
3. Intervention adherence: at least 60% of participants in the PHOENIx group receiving the intervention;
4. Retention: at least 60% of participants remaining in the study (receiving in-person or telephone follow-up assessment at 6 and 9 months postrandomisation); and
   - any improvement in the rate of presentation to EDs, and overdoses, at 6- or 9-month follow-up.

Secondary outcomes included the number of participants with, and time to first: overdose; hospitalisation. Also, the number of participants receiving prescribed treatment for physical or mental health and problem drug use; number of treatments per participant; health-related quality of life (QoL) (Euro Qol-Visual Analogue Scale which forms part of the self-rated EuroQol 5 Dimension-3 Level (EQ5D5L). Participants were asked to measure their own health from 0 (worst health state imaginable) to 100 (best health state imaginable).[32] Other measures included: Patient Experience with Treatment and Self-management measure (PETS: a measure of the work and impact of self-management on functioning and well-being)[33] (the research team worked with the developer (Dr David Eton) to adapt PETS version 2.0. The PETS including adapted versions are protected by copyright, ©2020 Mayo Foundation for Medical Education and Research. All rights reserved. Permission to use the PETS from Dr Eton.) number of primary healthcare contacts; number of missed and attended outpatient appointments; a measure of frailty (Fried's adapted frailty phenotype)[34]; anxiety/ depression score (Patient Health Questionnaire 4 (PHQ4)[35]; modified Medical Research Council breathlessness scale[36]; peak flow rate; participant reported injecting drug use; attempted suicide and self-harm. Welfare entitlements, social prescribing and tenancy type were also collected. Adverse events were not formally assessed although events such as overdoses and ED attendances were collected by researchers and recorded onto data collection forms at 6- and 9-month follow-ups (online supplemental web appendix 1). PHOENIx provided care in accordance with established local and national clinical guidance.

Procedures

Baseline characteristics for each participant were documented at inclusion. Primary and secondary outcomes were assessed as close as possible to the planned 6 and 9 months after randomisation. Independent researchers collected outcome data during in-person/phone

interviews and from participants' health and social care records. Overdose occurrences at follow-up were collected from primary and secondary care clinical records.

Participants who died or lost capacity were excluded from numerators and denominators of calculations of retention in the trial at 6 and 9 months.

Sample size and statistical methods

We aimed to recruit at least 100 participants to inform the sample size of a subsequent definitive RCT[28 37] and based on an earlier feasibility study,[18] we invited 160 to account for loss to follow-up. No interim analyses or stopping guidelines were planned.[28]

Participant characteristics are summarised using counts and percentages for categorical data, means and SD, or medians (IQR) 25th and 75th percentiles for continuous data depending on the distribution. Primary and secondary outcome measures are reported using the same summaries as noted above at each of the planned 6- and 9-month follow-ups. Number and percentage of participants experiencing outcomes of interest, as well as the mean and SD/median (IQR) for the number of events per participant are reported as required.

This approach was used for exploring the pilot data because this is a hypothesis-generating study, the sample size was small, outcomes were anticipated to have low prevalence and the study was not powered to detect differences between groups.[28 37] As noted previously,[28] we followed recommended advice for the analysis of pilot RCTs by reporting descriptive statistics rather than reporting formal tests of significance.[37] The aim of a pilot trial is not to assess effectiveness (or efficacy) and it will usually be underpowered to do this.[31] Formal hypothesis testing for effectiveness (or efficacy) is not recommended.[31 37] Our aims were to assess participant recruitment, retention, data collection and intervention delivery, with exploration of any signal of effect in clinical outcomes, for example, ED attendance or overdose occurrence. The information gathered will inform the design of a planned, future full-scale RCT. All summaries were conducted using MINITAB 21.[38]

Patient and public involvement

People experiencing homelessness were involved at each stage of the study including identifying the need for the study, recruitment and providing feedback on the proposed intervention. This was done independently by Johnsen and colleagues.[39] Participants (n=7) and people with lived experience of homelessness and street drug use provided comments on the research materials (consent form, participant information and baseline assessments) when they were consulted during protocol development. People (n=4) with lived experience from participating third sector homelessness organisations were part of the trial management group, which met monthly throughout the trial, and contributed to the final manuscript.

Process and economic evaluation

Semistructured interviews will explore future implementation of the PHOENIx intervention. Participants' reasons for overdose and protective factors are described.[40] An economic evaluation will assess the feasibility of conducting a cost-effectiveness analysis in a subsequent definitive trial.[28]

Results (primary outcome)

Recruitment

Glasgow has over 30 venues accommodating or providing support to people experiencing homelessness, most of which are located in the city centre. The research team started recruiting in city centre venues for convenience and then travelled to three outlying congregate dwelling places for people experiencing homelessness. Target recruitment was reached after visiting the 20th venue. Researchers visited homeless venues and passed study information to staff. Staff then approached eligible participants, explaining the nature of the study, and passed eligible participants the study information leaflet. Participants who were interested in participating made themselves known to the researchers. A median of 3.5 participants were recruited from each venue (IQR 2–9). 130 eligible people experiencing homelessness with a non-fatal overdose in the preceding 6 months were approached over 2.9 months (65 working days) between May and September 2021 (figure 1). Two participants declined and 128 (98%) provided informed consent thereby satisfying the first progression criterion.

Data collection (baseline)

Baseline interviews were conducted by researchers asking participants a mixture of open and closed questions (online supplemental appendix 1). Researchers were not viewed as being part of social welfare and they did not describe themselves as such to participants. They did not affect care directly. Instead, they obtained informed, written consent and collected baseline data (tables 1 and 2) before randomisation. Participants' responses were written directly onto the paper data collection form, by the researcher during the interview. Following in-person assessments, researchers accessed participants' health (primary care and secondary care), social care and third sector records to confirm relevant variables, for example, overdose, diagnoses and prescribed medicines.

Tables 1 and 2 give participant characteristics at baseline prior to randomisation. None of the characteristics at baseline relate to services given or received after baseline. The tables describe summary characteristics by randomised group. There were few missing data; where these did occur, they are quantified in table footnotes. One exception was the collection of data from participants, on duration of homelessness, where 36 intervention and 44 UC participants had missing data. The reason for this was that the question on duration of homelessness was omitted in error from earlier versions of the data

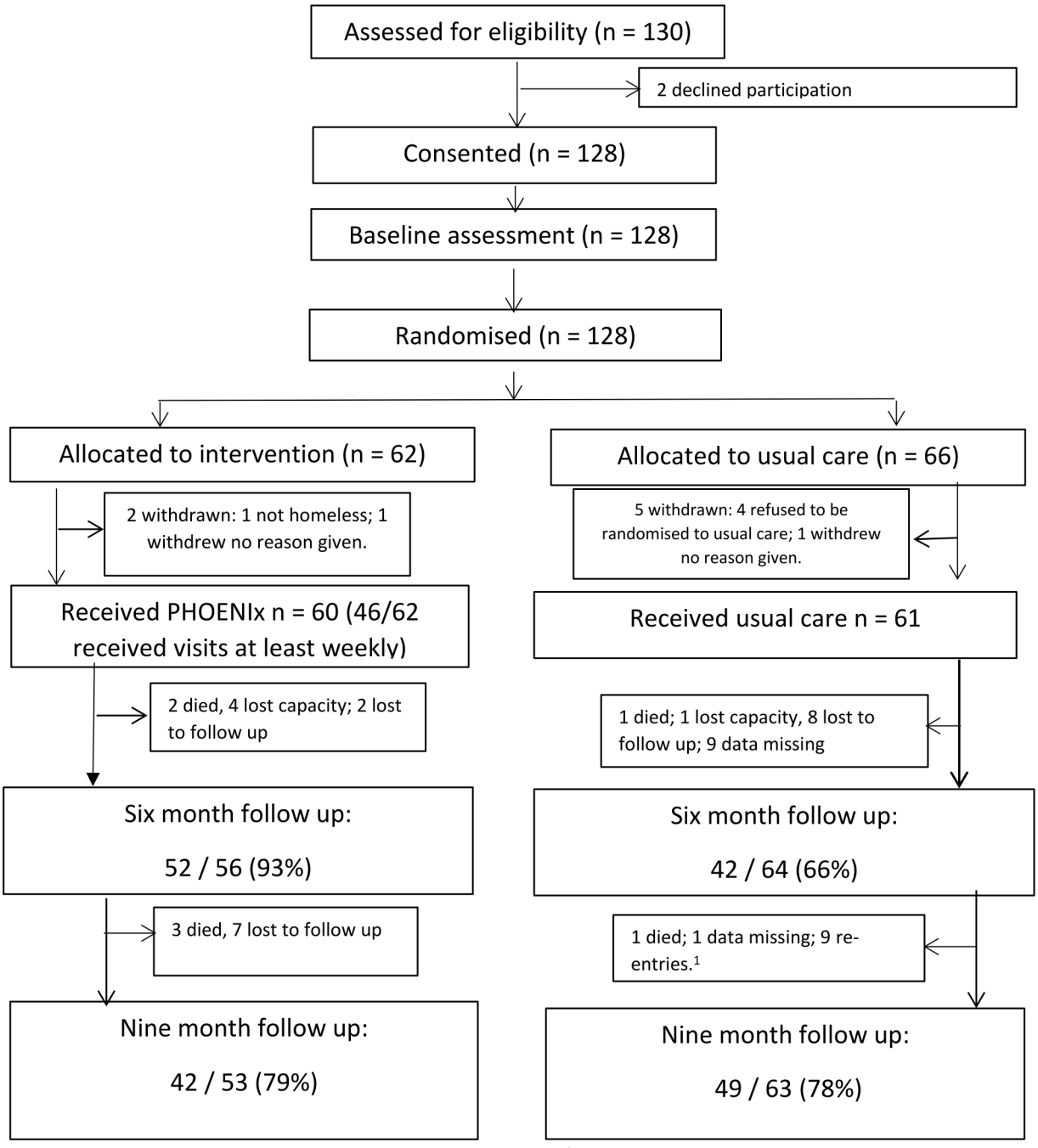

Figure 1 Consolidated Standards of Reporting Trials flow diagram. [1]n=9 participants reappeared at 9 months follow up, who had not received follow up at 6 months.

collection form. While we have a lot of missing data for this measure, we have no reason to believe the findings would be different if all participants had provided data in relation to this.

Baseline data were collected on all recruited participants, satisfying the second part of the progression criteria, as reported previously.[14]

Approximately 25% of participants were not registered with a GP.[14] Of those who were registered, contacts were infrequent (one-third of participants contacted their GP in the previous 6 months). 90% of participants were registered with Alcohol and Drug Recovery Services (ADRS: the health and social care service with responsibility for managing alcohol and problem substance use), of whom, 60% had at least one contact in the past 6 months. One-third of participants were registered with specialist mental health services although 75% had not had any contact in the past 6 months.

Randomisation achieved comparable characteristics for most variables, with some exceptions including patterns of street drug use: 45 (73%) in the PHOENIx arm used heroin compared with 32 (48%) in the UC arm; 41 (66%) in the PHOENIx arm used cocaine versus 35 (53%) in UC and 32 (76%) used cannabis compared

Table 1 Baseline demographic and clinical characteristics by randomised group (n (%) or mean (SD) or median (IQR))

Characteristic	PHOENIx (n=62)	Usual care (n=66)
Age (years)	42.4 (10.1)	42.0 (6.8)
Sex (male)	43 (69%)	48 (73%)
Ethnicity (white)	62 (100%)	65 (98%)
Number of years experienced homelessness*	23 (9–34)	24 (17–29.5)
Tobacco smoker	55 (88%)	58 (88%)
Temporary homeless accommodation		
Emergency (hostel, bed and breakfast) accommodation	57 (92%)	61 (92%)
Temporary furnished flat	1 (2%)	2 (3%)
Rough sleeping/no fixed abode	4 (6%)	3 (4%)
Primary healthcare registration		
GP registration (on the list of a family physician)	45 (73%)	50 (76%)
Receiving alcohol and drug services†	60 (97%)	57 (88%)
Receiving mental health team services†	19 (31%)	24 (36%)
Health conditions		
Physical health conditions/ patient‡	5.8 (2.6)	5.0 (2.3)
Any prescribed medicine for physical health	33 (53%)	33 (50%)
Number of medicines for physical health	1.1 (1.3)	1.2 (1.5)
Mental health conditions/ patient‡	2.1 (1.2)	2.3 (1.4)
Any prescribed medicine for mental health	30 (48%)	37 (56%)
Number of medicines for mental health	0.7 (0.8)	1.0 (1.0)
Psychological distress§ (PHQ4 (Patient Health Questionnaire 4) ≥3; 9–12 score severe)	9.1 (3.7)	10.0 (3.4)
Number of long-term health conditions		
0–1	0 (0)	0 (0)
2–4	5 (8%)	6 (9%)
5–8	31 (50%)	28 (42%)
9–16	26 (42%)	32 (48%)
Overdose		
Overdoses in past 6 months¶	3.2 (3.2)	3.2 (3.2)
Polydrug use**	3 (2–4)	3 (2–3.3)
Heroin	45 (73%)	32 (48%)
Cocaine	41 (66%)	35 (53%)
Street benzodiazepines††	54 (87%)	58 (88%)
Spice	5 (8%)	3 (5%)
Gabapentinoids‡‡	4 (6%)	9 (16%)
Cannabis	32 (76%)	21 (65%)
Main cause of overdose (self-report)§§		
Unable to recall	25 (40%)	21 (31%)
Street benzodiazepines	20 (32%)	26 (39%)
Street benzodiazepines+other drugs	7 (11%)	12 (18%)
Cocaine	2 (3%)	3 (4%)
Heroin	4 (6%)	2 (3%)
Suboxone	2 (3%)	1 (2%)
Alcohol (in addition to polydrug use)	1 (2%)	1 (2%)
Injecting drugs	35 (53%)	31 (47%)
Possesses naloxone¶¶	37 (65%)	43 (72%)
Prescribed opiate substitution treatment Buprenorphine injection/oral	58 (94%) 6 (10%)	57 (86%) 13 (20%)
Prescribed diazepam	5 (9%)	8 (12%)

Missing data:
*n=80 (intervention n=36; usual care n=44).
†n = 1 (intervention).
‡Ever diagnosed (from self-report or medical records).
§PHQ4; ≥ 3 indicating caseness; n =1 (intervention).
¶n=2 (usual care).
**In past 6 months.
††Novel psychiatric substance-type benzodiazepines (synthetic benzodiazepine analogues).
‡‡n=10 (intervention n=6; usual care n=4).
§§n=1 (intervention).
¶¶n=11 (intervention n=4; usual care n=7).
GP, general practitioner.

with 21 (65%) in UC. Four (6%) used gabapentinoids in PHOENIx group compared with 9 (16%) in UC. There appeared to be fewer PHOENIx group participants prescribed diazepam maintenance by ADRS: as part of a wider harm reduction intervention (5 (9%) PHOENIx versus 8 (12%) UC.

In table 1, diazepam means 'prescribed diazepam'. In Scotland, because of the extent of the street benzodiazepine problem,[41] diazepam is prescribed by ADRS staff, as a substitute (although unlicensed) for some people who have problem street benzodiazepine use.

All participants had severe and multiple disadvantages. Quality-of-life scores were low, and experience of burden of treatment scores was high (indicating more difficulty for participants) in both groups at baseline. There appeared to be fewer participants in the PHOENIx arm with hospitalisations and ED visits in the previous 6 months and contacts with ADRS prescribers (medical, nursing and pharmacy staff all prescribed; medical staff given as an example in table 2). Approximately one-third of participants in each arm received at least one contact from a GP in the previous 6 months, and 11%–20% had received care from a practice nurse.

Table 2 Baseline frailty, quality of life, treatment experience and healthcare contacts (n (%) or mean (SD) or median (IQR))

Characteristic	PHOENIx (n=62)	Usual care (n=66)
Frail*	28 (65%)	22 (92%)
Prefrail†	14 (33%)	2 (8%)
Quality-of-Life (EQ5D5L) Visual Analogue Scale‡	36 (25.7)	33 (22.2)
EQ5D5L Index Score – crosswalk method to UK Value Set	0.3 (0.3)	0.2 (0.4)
Patient experience with treatment and self-management§		
Workload summary score	47	42
Impact summary score	72	67
Modified Medical Research Council Breathlessness Scale¶	2 (1-3)	2 (1-3)
Secondary care utilisation in previous 6 months		
Hospitalisations per participant	1.6 (1.9)	1.8 (1.6)
Hospitalisations	40 (64%)	53 (80%)
Duration of hospitalisations	12.7 (2.7)	8.5 (10.3)
Emergency department visits/participant	3.4 (3.8)	3.6 (3.2)
Emergency department attendances	46 (74%)	59 (89%)
Missed outpatient appointments/participant	1.0 (1.9)	1.0 (1.6)
Primary care utilisation in previous 6 months		
Mental health nurse	15 (24%)	17 (26%)
GP	18 (29%)	22 (33%)
Practice nurse	7 (11%)	13 (20%)
Alcohol and Drug Recovery Service (ADRS) nurse**	39 (59%)	41 (46%)
ADRS medical officer	6 (10%)	13 (20%)
ADRS social care**	42 (68%)	37 (57%)

*Fried's frailty phenotype (adapted): ≥3 criteria indicating caseness. 1 or 2 criteria = intermediate or prefrail.
†Missing data: n=57 (Intervention(Ix) n=19; UC n=38).
‡EQ5D5L(EuroQol 5 Dimension 3 Level) Visual Analogue Scores 0= worst health imaginable; 100=best health imaginable.
§ Ix n=6; UC n= 1.
¶n=13; Options 0 (breathless only on hard exercise to 4 (too breathless to leave accommodation).
**ADRS nurse or ADRS social care worker may have provided care management in addition to respective professional roles; contacts for both roles included in totals.
GP, general practitioner; UC, usual care.

Data collection (6- and 9-month follow-ups) and participant retention

Figure 1 shows losses and exclusions after randomisation with reasons, by treatment allocation. No safety concerns were raised by trial staff, participants or the Trial Management Group at any point during the study. The mean duration of 6 months in-person follow-up was 5.8 (SD 1.6) months: PHOENIx 5.5 months (SD 1.6) and UC 6.0 months (SD 1.5). Due to delays in locating and interviewing five participants (two in the intervention arm and three in the UC arm) who were in prison at 6 months, the mean duration of planned 9-month (in-person) follow-up was 10.3 months (SD 1.5): 10.5 (SD 1.5) months in the intervention group and 10.2 (SD 1.6) months in UC. Figure 1 shows data collected at baseline (128/128; 100%), 6 (94/120; 78%) and 9 (91/116; 78%) months give 86% combined, while satisfying the minimum threshold of 60% for proportions retained in the study at 6- and 9-month follow-ups. At both follow-up time points and in both study arms, all participants other than those who had died, lost capacity or were withdrawn, had secondary outcome data collected from health and social care records.

PHOENIx intervention adherence

It was planned that at least 60% of participants would receive the PHOENIx intervention at least weekly. 60 (97%) of PHOENIx participants received at least one visit or phone call from the PHOENIx team. Every weekly visit/phone call counted as part of intervention delivery was a consultation rather than an attempt at outreach. One participant moved into permanent accommodation on the day of recruitment and another voluntarily withdrew (giving no reason). Figure 1 shows the PHOENIx intervention was offered to 60 participants from the date of the first participant being randomised, until 3 March 2022 (the end of funded intervention time). 46 (74%) received at least weekly visits (or phone calls) from the PHOENIx team until study close, death, loss of capacity or withdrawal of consent. Table 3 (PHOENIx consultations and interventions) summarises the types of contact, and health and social care actions taken by the PHOENIx team. On average, participants received 14.9 in-person consultations, 13.8 phone consultations and 2.5 text messages (combined average of 28 contacts per participant) over a mean period of 201.8 (SD 58.2) days (28.8 weeks; 7.2 months). The minimum number of consultations per patient was 2 and the maximum was 86. The minimum duration of PHOENIx support was 39 days and the maximum was 290 days (10.4 months). Eight out of 10 attempted consultations resulted in face-to-face or phone consultations. Participants received almost 20 hours of in-person or phone support from the PHOENIx team over an average of 7.2 months (approximately 40 min/week). Those participants who received the intervention for shorter periods had either died during the trial, were lost to follow-up, or lost mental capacity to continue in the study. At the end of the study intervention period, the PHOENIx team stopped seeing participants. They stepped back and UC (without the PHOENIx intervention) resumed. If there were any outstanding actions for

participant care, these were recorded in medical and social care records to ensure continuity of care. The intervention was individualised to each participant. This was necessary because participants had a large range of different, longstanding health and social care problems as described in tables 1 and 2. The wide range of support (duration of intervention and range of problems addressed) did not come as a surprise to the staff delivering the intervention, or the research team, because we had conducted extensive feasibility testing prior to the pilot RCT.[16–18]

Many participants had not had any previous therapeutic relationships with health or other workers and were wary of entering into any kind of alliance–outcome relationship due to past traumas. This meant that some time was needed to build trust before beginning to tackle the participants' problems. When the team addressed health and social care problems, these took some time because there were normally multiple problems. For example, the participant may have prioritised their dental pain, necessitating the team to take the participant to a dentist for registration and booking serial appointments for assessment and treatment. Following this, or while waiting for the next dental appointment, the participant may have asked for help with their leg ulcer, or respiratory problems, or help to apply for welfare benefits. All of these actions took time and persistent follow-up on outreach.

Changes to care resulting directly from PHOENIx

49 (82%) participants received at least one physical health medicine prescription from the pharmacist. Online supplemental web appendix 3 describes the range of medicine groups prescribed for physical health problems including pain/epilepsy; anaemia and nutritional problems; chronic obstructive pulmonary disease and wound care dressings. Medicines prescribed for mental health conditions included antidepressants and in a minority of instances, antipsychotics which were prescribed for people with established, relevant diagnoses who had recently discontinued due to difficulty obtaining prescriptions. Approximately half (32/60 (53%)) received at least one prescription for an untreated mental health problem. A PHOENIx Pharmacist-initiated prescription to treat problem drug use was rare (3% of participants) because PHOENIx Pharmacists worked under Homeless Health Service GP Service governance, which did not include governance to prescribe medication-assisted treatment for problem drug use. Instead, patients were prescribed treatments for problem drug use, by specialists in the ADRS. Requests for help with problem diazepam use constituted most PHOENIx team referrals to ADRS. These occurred after several consultations, the team having built trust to the point where participants began to think about addressing their problem street benzodiazepine use, then accepted the offer of specialist assessment.

At baseline, participants had a range of conditions, some of which were treated and others untreated (table 1). PHOENIx Pharmacists prescribed medicines for conditions whether they were treated or not. For treated conditions, the pharmacists tended to stop existing treatments (because they were not achieving the desired effect, for example, antidepressant without any evidence of benefit) and start a new type of medicine for the same condition, or change the dose of an existing medicine, for example, increase the dose of a steroid inhaler for chronic obstructive pulmonary disease. Pharmacists made the new diagnoses described in table 3.

In all cases when medicines were prescribed, or participants received treatment or referral, PHOENIx teams followed up at the next contact, to confirm the patient was responding as planned.

Third sector homelessness worker interventions received by most participants: advice and social support, and accompanied appointment attendance, for example, to job centres and outpatient appointments, were common. Half of participants received items to help with daily living, for example, kettles and televisions, for use in emergency accommodation. Social workers do not tend to support people experiencing homelessness in this way. Usual social support does not include working with people experiencing homelessness (or the wider population in recovery from drug use) to encourage participation in work training programmes, voluntary or paid work. Through social prescribing networks established by third sector organisations, half of participants began participation in purposeful activities, for example, fixing bicycles or other voluntary work. These types of activities were welcomed by participants and viewed as a step towards recovery and re-integration into mainstream society.

Rate of presentation to ED at 6- and 9-month follow-up

Three measures of ED attendance were collected at follow-up: ED attendances per participant; participants with at least one ED attendance; the number of days between randomisation and first overdose after randomisation.

PHOENIx supported some participants to attend ED (table 3). Table 4 shows what appears to be more participants with at least one ED visit but delayed time to first ED visit. From Table 4, there appeared to be a delay in the time to first overdose in the intervention group compared with UC. Similarly, there appeared to be more intervention group participants with at least one hospitalisation compared with UC but delayed time to hospitalisation.

Participants in the PHOENIx arm received increases in the prescribing of medicines for physical and mental health and problem opiate use and more ADRS contacts at follow-up. Baseline differences in diazepam (fewer in the intervention arm) prescribing persisted. Quality-of-life scores (on the EQ5D5L Visual Analogue Scale) in PHOENIx appeared to be higher at follow-up but any apparent difference waned at 9 months. Of note is the improvement in EQ5D5L scores in both groups from baseline (table 1) to follow-up (table 4).

Table 3 PHOENIx consultations and interventions (from PHOENIx intervention records) (n (%) or mean (SD) or median (IQR))

Characteristics of consultations/ interventions	PHOENIx (n = 60)
Engagement (visit/phone call/text)	
Attempts per participant	
Consultations per participant	28.8 (17.8)
Participants with at least one consultation	60 (100%)
Participants with in-person consultations	893 (52%)
In-person consultations per participant	14.9 (9.9)
Participants with phone consultations	771 (45%)
Phone consultations per participant	13.8 (9.8)
Participants sent text messages	65 (4%)
Text contacts per participant	2.5 (2.2)
Cumulative duration of consultations per participant (hours)	19.4 (13.8)
Timespan of PHOENIx intervention per participant (days)	201.8 (58.2)
Prescriptions by PHOENIx pharmacist (n (%) participants prescribed medicines)	
Physical health	49 (81%)
Mental health	32 (53%)
Problem drug use 1	2 (3%)
Prescriptions by PHOENIx pharmacist for untreated conditions (medicines/participant)	
Physical health	3.4 (2.3)
Mental health	1.3 (0.6)
Problem drug use*	1 (0)
Prescription for treated conditions	
Physical health	
Medicines prescribed/participant	17.0 (18.4)
Mental health	
Medicines prescribed/participant	2.6 (4.1)
Problem drug use	
Medicines prescribed/participant	0 (0.2)
New physical health diagnoses	
New diagnoses/participant	1.3 (1.6)
Participants with new diagnoses	35 (58%)
New mental health diagnoses/participant	
New diagnoses/participant	0.2 (0.6)
Participants with new diagnoses	6 (10%)
Other interventions by pharmacist	
Naloxone/injection equipment/dry blood spot	47 (78%)
Wounds dressed	26 (43%)
Clinical examination	50 (83%)
Referrals to other services	
General practitioner (GP)	42 (70%)
GP treatment room nurse (eg, wound dressings)	19 (32%)
Emergency department	16 (27%)
Specialist clinic (acute care outpatients)	29 (48%)
Dentist	18 (30%)
Optician	19 (32%)
Blood-borne virus team	10 (17%)
Other health service, for example, physiotherapy	32 (53%)
Alcohol and Drug Recovery Service (ADRS) referrals	
Request for new/restart opiate substitution treatment	16 (27%)
Request for review consultation, for example, diazepam start†	51 (85%)
Advice	38 (63%)
Social care support	
Advice/information, for example, casework for change of accommodation	58 (97%)
Food parcels	26 (43%)
Clothing/toiletries	22 (37%)
Household item, for example, microwave	29 (48%)
Social prescribing	29 (48%)
Benefits support	30 (50%)
Accompanied appointment attendance	47 (78%)

*ADRS medical staff agreed it was more appropriate and convenient that PHOENIx prescribed opiate substitution treatment in these cases, as exceptions to rule.
†Some participants who have problem street benzodiazepine use, are prescribed diazepam by specialist ADRSs, to minimise or eliminate the need to purchase street benzodiazepines and thereby reduce harm.

Online supplemental web appendix 4 shows reduction in treatment burden workload and impact of self-management in PHOENIx participants was more pronounced at 6 months (while the intervention was being delivered) than at 9 months. Online supplemental web appendix 4 also shows eight (15%) PHOENIx group participants lived in temporary furnished flats at 6 months, signalling a step up in terms of independence, as compared with supported or unsupported emergency accommodation. Seven (16%) PHOENIx group lived in their own tenancies at 9 months compared with UC (4(9%)) and increases in welfare benefits appeared higher in participants receiving PHOENIx support. High levels of psychological distress persisted throughout the study for most participants (online supplemental appendix 4).

Table 4 Outcomes (n (%) or mean (SD)/median (IQR))

	6 months after randomisation		6–9 months after randomisation	
	Intervention	Usual care	Intervention	Usual care
Primary				
Emergency department (ED)				
ED visits/participant	3.0 (2.9)	2.6 (3.4)		
Participants with at least one ED visit	46 (85%)	41 (70%)		
Days to first ED visit	34 (12–77)	26 (6–52)	0.9 (1.5)	0.5 (1.1)
Non-fatal overdose				
Overdoses/participant	2.3 (3.8)	2.8 (4.6)	0.8 (2.6)	0.8 (2.3)
Participants with at least one overdose	32 (59%)	32 (54%)		
Days to first overdose	61 (22–113)	36 (12–70)		
Secondary				
Hospitalisation				
Hospitalisation/participant	1.4 (1.8)	1.3 (1.8)	0.4 (0.9)	0.3 (0.7)
Participants with at least one hospitalisation	33 (61%)	30 (51%)		
Days to first hospitalisation	122 (62–156)	109 (74–164)		
Duration of hospitalisation	7.6 (18.4)	4.1 (7.7)		
Prescribed (Rx) treatments				
Physical health Rx/participant	3 (1-5)	1 (0–4)	4 (2-5)	2 (1-4)
Participants with ≥1 physical health Rx	48 (88%)	32 (54%)	45 (88%)	33 (57%)
Mental health Rx/participant	1 (0–1)	0 (0–1)	1 (0–2)	1 (1-1)
Participants with ≥1 mental health Rx	35 (65%)	30 (51%)	30 (59%)	30 (52%)
Participants Rx opiate substitution therapy	50 (93%)	49 (83%)	47 (92%)	43 (74%)
Buprenorphine oral/ injection	8 (15%)	15 (25%)	9 (18%)	7 (12%)
Days missed methadone	5 (10.7)	4 (9.3)	2.9 (7.8)	1.3 (4.3)
Diazepam Rx	5 (9%)	11 (19%)	4 (8%)	12 (21%)
Health-related quality of life (QALYs)				
EQ5D5L (EuroQol 5 dimension 3 Level) Visual Analogue Scale	50.5 (24.5)*	42.2 (25.0)*	51.9 (25.5)†	48.0 (24.0)†
Index QALYs	8.6‡	6.2‡	14.6§	11.7§

*Missing data: UC n=21; Intervention (Ix) n=10.
†UC and Ix n=19 each.
‡Ix n=2; UC n=17.
§Ix n=8; UC n=14.

DISCUSSION

There are calls for innovative, longer duration wraparound health and social care interventions and a growing worldwide public health crisis of drug-related deaths, particularly among people experiencing homelessness.[3 14 42] People experiencing homelessness with recent non-fatal overdose, who are at high risk of drug-related death, can be recruited and retained in a RCT. The PHOENIx intervention was delivered as planned.

Almost all eligible participants identified at the 20 venues and invited to participate during the study period were successfully enrolled in the study. We note that Beaudoin *et al* recruited participants within 30 days of presenting to ED with overdose.[43] We also considered recruiting participants from EDs. However, in the design phase of our trial, patients told us that delays in receiving opiate substitution treatment in hospital led them to self-discharge against medical advice. We suspected this would make recruitment from ED more difficult. We therefore opted for primary care/community recruitment instead. We are also mindful that changing health behaviours during or immediately following overdose and hospitalisation may be difficult due to variable levels of receptivity to advice.[43] In Scotland, on leaving hospital after several days, patients may find their temporary room in homeless accommodation has been passed onto another person. This means that on discharge from hospital, while they are recovering from a near-death experience and vulnerable, they may require to re-present to authorities to secure new accommodation. On this basis, we felt

that the priority of any patient with recent overdose in hospital would be to secure a safe place to stay, rather than discuss trial recruitment.

Our data collection methods were successful and results show the intervention was delivered as planned, leading to prescribing of a range of medicines, referrals to social care, social prescribing and housing. Therapeutic relationships between PHOENIx and allocated participants were developed over time. Many of these relationships outlived the trial timelines and participants continued to seek PHOENIx support.

The characteristics of participants lost to follow-up were similar to those remaining in the study, suggesting good external validity (online supplemental web appendix 5). As far as we are aware from the worldwide literature, there is only one other published pilot RCT (Savage *et al*, involving nine participants)[44] targeting people experiencing homelessness, offering an intervention to improve health outcomes.[25] Other published RCTs in homelessness are definitive trials without previous pilot work, lacking information about recruitment procedures. This limits understanding of successful recruitment strategies and may contribute to under-recruitment.[45]

Most previous studies describing longitudinal characteristics and outcomes of inclusion health and homeless populations have relied on data linkage methods.[46 47] While data linkage methods are advantageous in terms of enabling larger sample sizes, the resulting data lack the breadth and granularity that can be obtained through in-person assessments and lookup of individual-level clinical records. Obtaining data directly from primary care clinical and administrative records for people experiencing homelessness may enable more comprehensive information,[48–50] but data may be limited because of poor engagement in primary care.[12] We therefore sought to collect a wide range of detailed information using all available sources: in-person assessments and directly from clinical and social care records. We did this to better understand unmet health and social care needs and inform the choice of outcome in a subsequent definitive RCT. Findings reinforce intersectionality and multiple exclusion homelessness, underscoring the urgent need to move policy and practice through testing new interventions.[51] Three findings, in particular, merit attention as markers of lack of progress in the provision of effective healthcare services for people experiencing homelessness. First, half of the recruited participants' physical and mental health problems were untreated. The uptake of evidence-based treatment therefore lags 20 years behind levels observed in the mainstream population.[52] Second, overdoses continued despite near maximal engagement with ADRS, and availability of heroin-assisted treatment, confirming the urgent need for additional complementary approaches. Lastly, people at the highest risk of fatal overdose are continuing to live in unsupported temporary accommodation which further increases the risk of fatal overdose.[53] Additional, new findings that may be expected to perpetuate risk included maximum levels of frailty, high levels of treatment burden and low QoL.

Participant retention rates of 83% at 6 and 9 months are on a par with retention rates in other definitive RCTs in homelessness[14 25 26] and pilot RCTs in mainstream populations.[54]

The intervention was delivered as planned suggesting participants accept longer contacts which are conducive to enabling multiple, entrenched health and social care problems to be discussed.[42] Dedicated, generalist, outreach health input has been noted to be lacking in Housing First intervention studies.[55] Our findings suggest PHOENIx may be delivered to people experiencing homelessness moving into more settled accommodation. Given the therapeutic alliance formed between participants and PHOENIx (with GP backing), a subsequent definitive study of a strengthened PHOENIx intervention, including direct referral to permanent housing for those who wish to receive it, may be appropriate.

The number of deaths in the trial (seven participants: five in PHOENIx and two in UC) was notable. Reasons for the difference between groups are uncertain but may relate to the excess in street heroin and cocaine use in the PHOENIx group at baseline, and lower prescribing of medication-assisted treatment, for example, buprenorphine or diazepam. Participants were noted to be frail or prefrail, conditions known to be associated with mortality.[56] In a larger trial, formal recording of cause of in-trial death will be required. The average age of death of seven participants within the trial was 45.3 (SD 7.6) years, approximately 5 years younger than the median age of death in the most recent (record linkage) study of people experiencing homelessness in England.[47] More prospective studies recruiting and interviewing consented participants are urgently needed to inform our understanding of contemporary health and social care factors protecting against risk of overdose and drug-related death in people experiencing homelessness with recent overdose.

The EQ5D5L measure enabled capture of QoL across different domains; the median score was 50 which is lower than in people experiencing homelessness in England[57] and Germany.[58] The intervention may have decreased treatment burden and increased QoL through the strong alliance–outcome relationship formed between PHOENIx and participants who lacked supportive relationships.[14] However, comparative inferences are not possible due to insufficient sample size. Quality-of-life improvements of similar magnitude have been described previously in an RCT testing a GP-led intervention in England.[59]

By achieving a priori progression criteria, our pilot RCT provides sufficient evidence that a definitive RCT (a scaled-up version of the pilot, powered to detect clinically and statistically significant differences in outcomes) can be successfully delivered. If the definitive RCT shows PHOENIx recipients have statistically and clinically significantly better outcomes, information on the costs and impact of scaling up the intervention

will be required. The definitive RCT will have a parallel economic evaluation to answer the question: is PHOENIx cost-effective, in assisting people experiencing homelessness from: a health and social care perspective, under the UK National Institute of Clinical Effectiveness reference case criteria; and a social return on capital perspective additionally accounting for third sector, criminal justice and welfare payments?

Strengths and limitations

As far as we know, our approach involving collaboration between health and third sector workers is novel.[25] Third sector and voluntary organisations exist across the world, aiming to support people experiencing homelessness. In addition to the UK, pharmacists can legally prescribe medicines in Canada, New Zealand, Nigeria, Argentina, Israel and the USA.[21–23] Our intervention, if shown to be effective in a subsequent RCT, may be generalisable worldwide to other healthcare settings where clinical pharmacists and third sector homeless teams work collaboratively with GPs/family physicians. However, in healthcare systems other than the UK National Health Service, transferability of the pharmacist intervention may be limited by other impediments faced by people experiencing homelessness, for example, a lack of health insurance which complicates access to medicines. It is possible that the intervention could be delivered by independent prescriber nurses or other healthcare professionals, alongside third sector homelessness workers. Adherence with the intervention was comparable to rates in other studies targeting homeless participants.[14 25] We included a diverse range of outcomes that are important to patients including, for the first time, a measure of treatment burden (PETS) and explored the possibility of time to overdose being a primary outcome in subsequent work.

Nonetheless, the study has several limitations. Pilot studies are not designed to detect intervention effectiveness. The study setting and availability of other services may have impacted outcomes. For example, uptake of PHOENIx interventions may have been conditional on a relative lack of alternative health and social care outreach or, for example, tailored mental health services such as cognitive–behavioural therapy—trauma-focused care. Generalist pharmacists worked closely with specialist homelessness/inclusion health GPs, obtaining advice on outreach when needed. Specialist homelessness GP services exist because of the unique needs of this group of patients, and the evidence of effectiveness for people experiencing homelessness.[60] The UK also has mainstream (regular) GP practices catering for people who are not homeless. People are free to register with one or the other. The specialist homelessness GP service offered psychologically informed unconditional care to people experiencing homelessness. The PHOENIx Pharmacists, acting as the outreach arm of the specialist homeless GP practice, also provided trauma-informed care. Continuity of care was offered through repeated outreach visits, even if the participant moved from one temporary accommodation to another. The specialist homelessness GPs and pharmacists never 'closed' participants to their services and did not move people who were registered with the homelessness GP service onto a mainstream GP practice, until they were ready.[60]

The extent of access to permanent supported housing and rehabilitation in Glasgow also has a bearing on the PHOENIx intervention and outcomes. Other weaknesses include some baseline imbalances between groups which may have arisen following 1:1 randomisation without stratification, for example, baseline diazepam prescribing.

CONCLUSION

People experiencing homelessness with recent non-fatal overdose remain exposed to multiple known risk factors for fatal overdose, including unmet long-term health needs. People experiencing homelessness are accessible, willing to receive sustained support on outreach. The majority can be recruited into and remain in a trial for up to 10 months.

Intersectional, unmet health and social care needs may be met, in part, by the PHOENIx intervention over 7 months. A definitive trial is needed to assess effectiveness, cost-effectiveness and any implementation and contextual factors facilitating or inhibiting delivery and achievement of intended outcomes.

PHOENIx in Glasgow offers a recognised, accepted and integrated process of care, and if effective at delaying overdose in the context of a definitive RCT, the intervention could be rolled out to other cities worldwide.

Author affiliations
[1]Centre for Homelessness and Inclusion Health, The University of Edinburgh School of Health in Social Science, Edinburgh, UK
[2]Pharmacy and Prescribing Support, NHS Greater Glasgow and Clyde, Glasgow, UK
[3]Primary Care, University of Glasgow, Glasgow, UK
[4]Emergency Medicine Department, Glasgow Royal Infirmary, Glasgow, UK
[5]Florence Nightingale Faculty of Nursing, Midwifery & Palliative Care, King's College, London, England
[6]Addictions Psychiatry, Crosshouse Hospital, Kilmarnock, UK
[7]Simon Community Scotland, Glasgow, UK
[8]NHS Greater Glasgow and Clyde Homelessness Health Services, Glasgow, UK
[9]Healthcare Improvement Scotland Glasgow, Glasgow, UK
[10]Shelter Scotland, Glasgow, UK
[11]The Marie Trust, Glasgow, UK
[12]Muirhouse Medical Group, Edinburgh, UK
[13]University of Edinburgh, Usher Institute, Edinburgh, UK
[14]Robertson Centre for Biostatistics, University of Glasgow, Glasgow, UK
[15]General Practice and Primary Care, School of Medicine, College of MVLS, University of Glasgow, Glasgow, UK

Acknowledgements We acknowledge the efforts of every patient and member of staff who willingly gave their time to enable recruitment and study pharmacists (KS, CL, RB, RR and AB), Simon Community (AS and SR) and Marie Trust staff (DB and Frances McKinlay).

Contributors Each author (RL, AM, FSM, KS, DM, VP, CD, CL, SR, FH, JM, AS, FR, LS, JH, SW, DB, JRR, RR, NG, AB and AEW) helped write and draft the manuscript and gave final approval before submission for publication. Planning, conduct and reporting were undertaken by RL, AM, FSM, DM, VP, FH, JH and AEW. The study was conceived by RL. Design input from RL, FSM and AEW. Acquisition of data by AM, JM, FH, AS, SR, DB, CL, RR, AB and RL. Analysis by AM and FH. Interpretation by RL,

AM, FSM, DM, VP, BB, DB, JM, FH, CD, KS, RR, CL, SR, NG, AS, LS, JH, FR and AEW. RL accepts full responsibility for the work and the conduct of the study, had access to the data, and controlled the decision to publish.

Funding This work was supported by NHS Greater Glasgow and Clyde and the Scottish Government's Drug Deaths Task Force grant number DDTF 06. The study design, data collection, analysis, interpretation and governance are independent from commercial sponsorship of any kind.

Disclaimer The study sponsor (NHS Greater Glasgow and Clyde) had no role in the conception, conduct or reporting of the study.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by NHS South East Scotland Research Ethics Committee 01. REC reference 21/SS/0004. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Selected anonymised quantitative data and related documents including data dictionaries will be made available on reasonable request to the principal investigator, for 5 years from the date of publication.

ORCID iDs
Richard Lowrie http://orcid.org/0000-0002-6440-9089
Andrew McPherson http://orcid.org/0000-0001-9961-2338
Vibhu Paudyal http://orcid.org/0000-0002-4173-6490
Andrea E Williamson http://orcid.org/0000-0002-8981-9068

REFERENCES

1 De Sousa T, Andrichik A, Cuellar M, *et al*. The 2022 annual homelessness assessment report (AHAR) to Congress: part 1 point-in-time estimates of homelessness. 2022. Available: https://www.huduser.gov/portal/sites/default/files/pdf/2022-AHAR-Part-1.pdf
2 Scottish Government. Homelessness in Scotland: update to 30 September 2022. n.d. Available: https://www.gov.scot/publications/homelessness-in-scotland-update-to-30-september-2022/documents/
3 National Records for Scotland. Homeless deaths. 2021. Available: https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/deaths/homeless-deaths/2021
4 CDC. National center for health Statistics mortality data on CDC WONDER. 2023. Available: https://wonder.cdc.gov/mcd.html
5 Jalal H, Buchanich JM, Roberts MS, *et al*. Changing Dynamics of the drug overdose epidemic in the United States from 1979 through 2016. *Science* 2018;361:eaau1184.
6 Anon. The economist. 2019. Available: https://www.economist.com/britain/2019/07/18/scotland-overtakes-america-as-the-worlds-drug-overdose-capital
7 Morrison DS. Homelessness as an independent risk factor for mortality: results from a retrospective cohort study. *Int J Epidemiol* 2009;38:877–83.
8 Hanzlick R, Lazarchick J. Health care history and utilization for Atlantans who died homeless. *J Med Assoc Ga* 1989;78:205–8.
9 O'Driscoll PT, McGough J, Hagan H, *et al*. Predictors of accidental fatal drug overdose among a cohort of injection drug users. *Am J Public Health* 2001;91:984–7.
10 Carver H, Ring N, Miler J, *et al*. What constitutes effective problematic substance use treatment from the perspective of people who are homeless? A systematic review and meta-Ethnography. *Harm Reduct J* 2020;17:10.
11 McGovern L. The relative contribution of multiple determinants to health. *Health Affairs Health Policy Brief* 2014.
12 Queen AB, Lowrie R, Richardson J, *et al*. Multimorbidity, disadvantage, and patient engagement within a specialist homeless health service in the UK: an in-depth study of general practice data. *BJGP Open* 2017;1:bjgpopen17X100941.
13 Reilly J, Hassanally K, Budd J, *et al*. Accident and emergency Department attendance rates of people experiencing homelessness by GP registration: a retrospective analysis. *BJGP Open* 2020;4:bjgpopen20X101089.
14 Lowrie R, McPherson A, Mair FS, *et al*. Baseline characteristics of people experiencing homelessness with a recent drug overdose in the phoenix pilot randomised controlled trial. *Harm Reduct J* 2023;20:46.
15 Bramley G, Fitzpatrick S, Wood J, *et al*. *Hard edges Scotland: new conversations about severe and multiple disadvantage*. Edinburgh: Heriot-Watt University, I-SPHERE, Lankelly Chase, The Robertson Trust, 2019.
16 Lowrie R, Williamson AE, Spencer R. Collaborative engagement for long term conditions by clinical pharmacists for people who are homeless in Glasgow, Scotland. *FEANTSA* 2017. Available: https://www.feantsa.org/en/newsletter/2017/03/31/march-2017-health-and-homelses?bcParent=27
17 Lowrie F, Gibson L, Towle I, *et al*. A descriptive study of a novel pharmacist led health outreach service for those experiencing homelessness. *Int J Pharm Pract* 2019;27:355–61.
18 Lowrie R, Stock K, Lucey S, *et al*. Pharmacist led homeless outreach engagement and non-medical independent prescribing (Rx) (Phoenix) intervention for people experiencing homelessness: a Non-randomised feasibility study. *Int J Equity Health* 2021;20:19.
19 NHS. NHS workforce: summary of staff in the NHS: results from September 2012 census, the information centre for health and social care. 2013. Available: http://content.digital.nhs.uk/catalogue/PUB10392/nhs-staf-2002-2012-over-rep.pdf
20 Marchand C, Peckham S. Addressing the crisis of GP recruitment and retention: a systematic review. *Br J Gen Pract* 2017;67:e227–37.
21 Emmerton L, Marriott J, Bessell T, *et al*. Pharmacists and prescribing rights: review of international developments. *J Pharm Pharm Sci* 2005;8:217–25.
22 Auta A, Strickland-Hodge B, Maz J, *et al*. Stakeholders' views on granting prescribing authority to pharmacists in Nigeria: a qualitative study. *Int J Clin Pharm* 2016;38:960–7.
23 Hammond RW, Schwartz AH, Campbell MJ, *et al*. American college of clinical pharmacy. collaborative drug therapy management by pharmacists 2003. *Pharmacotherapy* 2003;23:1210–25.
24 Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q* 2005;83:457–502.
25 Hanlon P, Yeoman L, Gibson L, *et al*. A systematic review of interventions by healthcare professionals to improve management of non-communicable diseases and communicable diseases requiring long-term care in adults who are homeless. *BMJ Open* 2018;8:e020161.
26 Fornaro M, Dragioti E, De Prisco M, *et al*. Homelessness and health-related outcomes: an umbrella review of observational studies and randomized controlled trials. *BMC Med* 2022;20:224.
27 van Draanen J, Tsang C, Mitra S, *et al*. Socioeconomic marginalization and opioid-related overdose: a systematic review. *Drug Alcohol Depend* 2020;214:108127.
28 Lowrie R, McPherson A, Mair F, *et al*. Pharmacist and homeless outreach engagement and non-medical independent prescribing Rx (Phoenix): a study protocol for a pilot randomised controlled trial. *BMJ Open* 2022;12:e064792.
29 Scottish Government. Chief medical officer's annual report 2016-17: practicing realistic medicine [Edinburgh Crown Copyright]. 2018. Available: https://www.gov.scot/publications/practising-realistic-medicine/documents/
30 Ostrom E. *Toward a Behavioral Theory Lining Trust, Reciprocity and Reputation*. New York, NY: Russell Sage Foundation 2003:19-79,
31 Schulz KF, Altman DG, Moher D, *et al*. CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. *International Journal of Surgery* October 2010.
32 EuroQOL Research Foundation. EQ-5D-5L user guide: basic information on how to use the EQ-5D-5L instrument. 2015. Available: https://euroqol.org/docs/EQ-5D-5L-User-Guide.pdf

33 Eton DT, Yost KJ, Lai JS, *et al*. Development and validation of the patient experience with treatment and self-management (PETS): a patient-reported measure of treatment burden. *Qual Life Res* 2017;26:489–503.
34 Fried LP, Tangen CM, Walston J, *et al*. Frailty in older adults: evidence for a phenotype. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences* 2001;56:M146–57.
35 Stanhope J. Patient health questionnaire-4. *OCCMED* 2016;66:760–1.
36 Stenton C. The MRC breathlessness scale. *Occupational Medicine* 2008;58:226–7.
37 Lancaster GA, Dodd S, Williamson PR. Design and analysis of pilot studies: recommendations for good practice. *J Eval Clin Pract* 2004;10:307–12.
38 MINITAB LLC. MINITAB statistical software (version 21).
39 Johnsen S, Cuthill F, Blenkinsopp J. Outreach-based clinical pharmacist prescribing input into the healthcare of people experiencing homelessness: a qualitative investigation. *BMC Health Serv Res* 2021;21:7.
40 Farmer N, McPherson A, Thomson J, *et al*. There's no hope for any kind of decent life': a qualitative study to explore the perspectives of people who are homeless and have experienced a recent non-fatal overdose in Scotland during COVID-19. *The British Journal of Social Work* 2023.
41 McAuley A, Matheson C, Robertson JR. From the clinic to street: the changing role of benzodiazepines in the Scottish overdose epidemic. *Int J Drug Policy* 2022;100:103512.
42 NICE. *Integrated health and social care for people experiencing homelessness NICE guideline [NG214]*. 2022.
43 Beaudoin FL, Jacka BP, Li Y, *et al*. Effect of a peer-led behavioral intervention for emergency department patients at high risk of fatal opioid overdose: a randomized clinical trial JAMA. *JAMA Netw Open* 2022;5:e2225582.
44 Savage C, Xu Y, Richmond MM, *et al*. A pilot study: retention of adults experiencing homelessness and feasibility of a CDSM diabetes program. *J Community Health Nurs* 2014;31:238–48.
45 Walters SJ, Bonacho dos Anjos Henriques-Cadby I, Bortolami O, *et al*. Recruitment and retention of participants in randomised controlled trials: a review of trials funded and published by the United Kingdom health technology assessment programme. *BMJ Open* 2017;7:e015276.
46 Aldridge RW, Story A, Hwang SW, *et al*. Morbidity and mortality in homeless individuals, prisoners, sex workers, and individuals with substance use disorders in high-income countries: a systematic review and meta-analysis. *The Lancet* 2018;391:241–50.
47 Aldridge RW, Menezes D, Lewer D, *et al*. Causes of death among homeless people: a population-based cross-sectional study of linked hospitalisation and mortality data in England. [version 1; peer review: 2 approved]. *Wellcome Open Res* 2019;4:49.
48 Himsworth C, Paudyal P, Sargeant C. Risk factors for unplanned hospital admission in a specialist homeless general practice population: case-control study to investigate the relationship with tri-morbidity. *Br J Gen Pract* 2020;70:e406–11.
49 Vickery KD, Winkelman TNA, Ford BR, *et al*. Trends in Trimorbidity among adults experiencing homelessness in Minnesota, 2000-2018. *Med Care* 2021;59:S220–7.
50 Zeitler M, Williamson AE, Budd J, *et al*. Comparing the impact of primary care practice design in two inner city UK homelessness services. *J Prim Care Community Health* 2020;11:215013272091056.
51 Fitzpatrick S, Bramley G, Johnsen S. Pathways into multiple exclusion homelessness in seven UK cities. *Urban Studies* 2013;50:148–68.
52 Lowrie R, McConnachie A, Williamson AE, *et al*. Incentivised chronic disease management and the inverse equity hypothesis: findings from a longitudinal analysis of Scottish primary care practice level data. *BMC Med* 2017;15:77.
53 Tomko C, Schneider KE, Rouhani S, *et al*. Identifying pathways to recent non-fatal overdose among people who use opioids non medically: how do psychological pain and unmet mental health need contribute to overdose risk *Addictive Behaviors* 2022;127:107215.
54 Biddle GJH, Sanders JP, Gokal K, *et al*. A Christmas Themed physical activity intervention to increase participation in physical activity during advent: pilot randomised controlled trial. *BMJ* 2022;379:e072807.
55 Johnsen S, Blenkinsopp J, Rayment M. Gaining and preserving pioneer status: key lessons from the housing first pathfinder programme in Scotland. *Eur J Homelessness* 2023;17:73–97.
56 Hanlon P, Nicholl BI, Jani BD, *et al*. Frailty and pre-frailty in middle-aged and older adults and its association with multimorbidity and mortality: a prospective analysis of 493 737 UK Biobank participants. *Lancet Public Health* 2018;3:e323–32.
57 Lewer D, Aldridge RW, Menezes D, *et al*. Menezes D, et al health-related quality of life and prevalence of six chronic diseases in homeless and housed people: a cross-sectional study in London and Birmingham. *BMJ Open* 2019;9:e025192.
58 van Rüth V, König H-H, Bertram F, *et al*. Determinants of health-related quality of life among homeless individuals during the COVID-19 pandemic. *Public Health* 2021;194:60–6.
59 Hewett N, Buchman P, Musariri J, *et al*. Randomised controlled trial of GP-led in-hospital management of homeless people ('pathway. *Clin Med (Lond)* 2016;16:223–9.
60 Crane M, Joly L, Daly BJ, *et al*. n.d. Integration, effectiveness and costs of different models of primary health care provision for people who are homeless: an evaluation study. *Health Soc Care Deliv Res*:1–217.