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RESEARCH REPORT

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Health-care resource use among patients who use illicit opioids in England, 2010–20: A descriptive matched cohort study

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Abstract

Background and aims: People who use illicit opioids have higher mortality and morbidity than the general population. Limited quantitative research has investigated how this population engages with health-care, particularly regarding planned and primary care. We aimed to measure health-care use among patients with a history of illicit opioid use in England across five settings: general practice (GP), hospital outpatient care, emergency departments, emergency hospital admissions and elective hospital admissions.

Design: This was a matched cohort study using Clinical Practice Research Datalink and Hospital Episode Statistics.

Setting: Primary and secondary care practices in England took part in the study.

Participants: A total of 57 421 patients with a history of illicit opioid use were identified by GPs between 2010 and 2020, and 172 263 patients with no recorded history of illicit opioid use matched by age, sex and practice.

Measurements: We estimated the rate (events per unit of time) of attendance and used quasi-Poisson regression (unadjusted and adjusted) to estimate rate ratios between groups. We also compared rates of planned and unplanned hospital admissions for diagnoses and calculated excess admissions and rate ratios between groups.

Findings: A history of using illicit opioids was associated with higher rates of health-care use in all settings. Rate ratios for those with a history of using illicit opioids relative to those without were 2.38 [95% confidence interval (CI) = 2.36–2.41] for GP; 1.99 (95% CI = 1.94–2.03) for hospital outpatient visits; 2.80 (95% CI = 2.73–2.87) for emergency department visits; 4.98 (95% CI = 4.82–5.14) for emergency hospital admissions; and 1.76 (95% CI = 1.60–1.94) for elective hospital admissions. For emergency hospital admissions, diagnoses with the most excess admissions were drug-related and respiratory conditions, and those with the highest rate ratios were personality and behaviour (25.5, 95% CI = 23.5–27.6), drug-related (21.2, 95% CI = 20.1–21.6) and chronic obstructive pulmonary disease (19.4, 95% CI = 18.7–20.2).

Conclusions: Patients who use illicit opioids in England appear to access health services more often than people of the same age and sex who do not use illicit opioids among a wide range of health-care settings. The difference is especially large for emergency care, which probably reflects both episodic illness and decompensation of long-term conditions.

KEYWORDS
Crack cocaine, general practice, health-care use, heroin, secondary care, substance-related disorders

INTRODUCTION

Health outcomes for people with opioid dependence diagnoses are poor compared to the general population, including for long-term non-communicable diseases [1, 2]. A systematic review found that mortality rates in this population were 10 times higher than in people of the same age in the general population, and only one-third of deaths were directly related to drugs [3]. Although relative risks of viral infections and drug overdoses can be extremely high, non-communicable diseases may cause more excess deaths and illness [4–7].

Initiatives to improve health outcomes in this population have typically prioritized prevention of overdoses and transmission of hepatitis C and HIV [8]; however, there is a need to consider health-care in this population more holistically [3, 7]. The majority of long-term conditions, such as cancers and diabetes, are ideally diagnosed and managed by general practitioners (GPs) [9, 10]. However, studies have found that people who use illicit drugs have poor access to community health services such as GPs, which may be a barrier to early diagnosis and treatment of these chronic conditions. For example, studies that use interviews and focus groups have reported on the non-monetary barriers to health-care, including stigma among staff, diagnostic overshadowing in which symptoms are ascribed to drug use and competing priorities such as housing and managing drug withdrawal [11–13].

Despite this well-known poor access to health-care, limited quantitative research has investigated how people who use illicit drugs access health services. Some studies have shown high rates of hospital use but these studies were conducted mainly in North America and Australia, and few considered health-care settings other than inpatient admissions and emergency department (ED) visits [14].

We aimed to describe rates of health-care use among patients with a history of illicit opioids among five care settings: (a) GP, (b) hospital outpatient care, (c) hospital EDs, (d) emergency hospital admissions and (e) elective hospital admissions. We expected that patients who use illicit opioids would have higher rates of emergency health-care and lower rates of primary, elective and outpatient hospital care than those who do not use illicit opioids.

METHODS

We conducted a retrospective cohort study that compared rates of health-care episodes among primary care patients in England with and without a history of using illicit opioids.

Data source

Data were extracted from the Clinical Practice Research Datalink (CPRD) Aurum and linked hospital data in England [15]. CPRD Aurum is a database of anonymized GP health records, including approximately 13% of the England population. The CPRD Aurum database undergoes various levels of validation and quality assurance [16]. Linkage between primary care and hospital data is high due to the use of NHS numbers, which are unique 10-digit numbers allocated to each patient in England, either at birth or when care is accessed for the first time [17].

CPRD Aurum is broadly representative of the England population in terms of age and sex, but of a slightly higher socio-economic status, based on the Index of Multiple Deprivation (IMD) [16].

Participants

Participants joined the study at the first diagnostic code indicating illicit opioid use, which was identified using Systematized Nomenclature of Medicine Clinical Terms (SNOMED) codes. SNOMED codes are used to classify health-care interactions in a number of settings, including GP surgeries [18]. We identified patients who use illicit opioids using SNOMED codes that represent clinical observations (e.g. 'heroin dependence' or 'opioid drug dependence') and records of opioid agonist therapy (OAT) (i.e. methadone or buprenorphine). These observations are recorded by GPs either during a clinical consultation or following information shared with the GP from another health service. We previously published the full code list and showed that patients meeting these criteria have similar characteristics to other samples of people who use illicit opioids in the United Kingdom, including an increasing average age (currently in the early 40%), approximately 70% being male, and very high mortality rates [19]. We excluded participants with no recorded sex (0.002%). We also excluded participants younger than 18 or older than 65 years at cohort entry (4.2%) as illicit opioid use is low in these age groups [20, 21], and therefore our code list may have lower validity.

We aimed to study people who use illicit opioids in England, which principally means heroin. Participation is not defined by medical prescription of opioids such as codeine for pain relief. Other research suggests that people who use illicit opioids often use other drugs in addition, including prescription opioids, alcohol, cocaine and benzodiazepines [2, 22, 23], although we did not aim to estimate the prevalence of polydrug use in this cohort and these data were not analysed.

We limited follow-up to 10 years to focus upon contemporary health-care use. Therefore, cohort entry was defined as the latest of 31 March 2010, the first record of illicit opioid use, or the participants' entry date into the CPRD plus 12 months (a 'washout' period). A washout period was used to avoid the unusual period when patients join CPRD, which typically coincides with GP registration and may therefore be associated with the recording of pre-existing health problems [24]. Cohort exit was the earliest of 31 March 2020, death or the final date when GP data are available for the patient (known as the CPRD exit date). A graphical representation of different cases with respect to entry and exit dates is provided in the Supporting information, Figure S1.

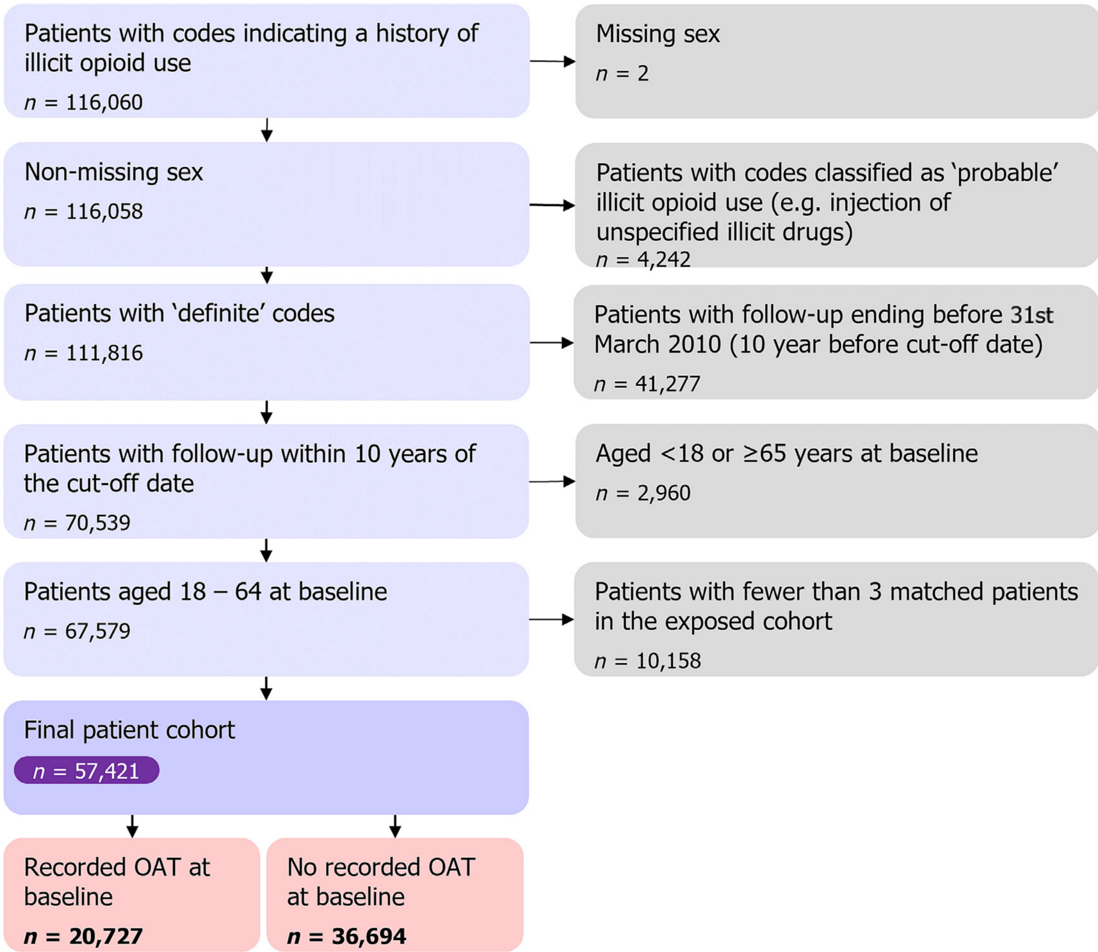

FIGURE 1 Derivation of patient cohort. OAT = opioid agonist therapy.

We then created a comparison group without a history of illicit opioid use. For each participant in the opioid group, we selected all patients of the same age (±3 years), sex and primary care practice who did not have any codes indicating illicit opioid use before the index date. From this group, we sampled three controls. Controls could be re-used between individuals in the opioid group but not within individuals (a process called exposure density sampling) [25]. We matched at a ratio of 1:3 to minimize the loss of individuals in the opioid group. Controls were assigned the same entry date as their matched counterpart. Controls who subsequently had illicit opioid use recorded were censored (*n* = 493, 0.29%). A flow-chart of study participants is shown in Figure 1.

Variables

The outcome was the count of visits among five health-care settings for the inclusive period between a participant's entry and exit date: GP, hospital outpatient care, hospital ED, elective hospital admissions and emergency hospital admissions.

We grouped hospital admissions (elective and emergency) by International Statistical Classification of Disease and Related Health Problems (ICD)-10 primary diagnosis. First, we identified admissions due to drug poisoning using the Office for National Statistics (ONS) definition for identifying drug-related deaths alongside ICD-10 codes T36–T50 (poisoning by adverse effect of and underdosing of drugs, medicaments and biological substances) [26]. We grouped the remaining hospital admissions using the categories included in two prior studies investigating cause of death and hospital admissions in a similar population [7, 27]. Additional categorization was included for diseases of the musculoskeletal system and the genitourinary system, given the high number of admissions. We did not analyse hospital outpatient and ED episodes by specific diagnosis, due to high levels of missing data (> 90%).

We defined comorbidity as the number of unique ICD-10 chapters recorded in hospital admissions during the 5 years prior to cohort entry. We used this time limit to ensure that comorbidity is measured over a standardized duration for all patients. We excluded ICD-10 chapters that cover transient conditions and may not be reflective of comorbidity (chapters 1, 15–16 and 18–21). We also excluded diagnoses of opioid-related disorders (F11), as this was the primary condition of interest in the exposed cohort. This method captures a greater distribution of morbidity than indices such as the Charlson Comorbidity Index (CCI), particularly when using administrative data, and is less susceptible to changes in treatment (for example, the CCI places high weighting on HIV due to its design prior to effective treatment) [28, 29].

For descriptive purposes, we analysed the following at cohort entry: age (years), sex (male, female), geographical region (East

Midlands, East of England, London, North East, North West, South East Coast, South West, Southern Central, West Midlands, Yorkshire and the Humber, Missing), ethnicity [White, Black (African, Caribbean or Other), Asian (Chinese, Indian, Bangladeshi, Pakistani and Other), Mixed and Other/Unknown [30]] and neighbourhood deprivation (quintiles). Patient ethnicity was derived from hospital episodes [31]. Where patients had varying ethnicity between episodes, the most frequently recorded value was used. If this was 'unknown', the second most frequently recorded ethnicity was used. In the case of no majority, the derived ethnicity was recorded as 'unknown'; patients with no hospital episodes in the study follow-up were recorded as 'missing'. Neighbourhood deprivation was calculated using a participant's registered address at cohort entry with the IMD [32]. Patients were categorized into five quintiles, with the lowest quintile (1) representing the least deprived. We also recorded history of receiving OAT prior to cohort entry [7].

Analysis

We described patient characteristics at cohort entry. Rates of resource use were calculated as the sum of all events divided by total follow-up time (patient-years). We used quasi-Poisson regression to estimate rate ratios for each health-care setting. The dependent variable was the count of episodes for each patient and the main independent variable was a binary indicator of a history of using illicit opioids. Follow-up was included as an offset parameter to account for differences in follow-up duration. We first adjusted for baseline age and sex only and then additionally adjusted for comorbidities in a mediation analysis. The groups were matched by age and sex, and the purpose of adjusting for these variables was to account for any association with follow-up duration. No additional adjustments were conducted, as the intention was to describe health-care use in a population using illicit opioids rather than estimate a causal effect [33]. We also reported the dispersion parameter from the regression model and the proportion of patients with at least one event as measures of concentration of events within patients. The dispersion parameter in a quasi-Poisson regression describes how the variance of the outcome compares to the mean, with a higher number reflecting more participants contributing to the outcome and a lower number reflecting fewer participants contributing to the outcome.

We then estimated expected and excess events in the opioid use group, whereby expected admissions were the age- and sex-specific rate of events in the comparison group multiplied by the follow-up duration of the opioid use group, and excess admissions were the difference between the observed and expected number of admissions in the opioid use group. For emergency and elective hospital admissions, we repeated these steps for each primary diagnosis associated with the admission. We also calculated incidence rate ratios (IRRs) adjusting for age, sex and comorbidity for each primary diagnosis ICD-10 chapter in emergency and elective hospital admissions comparing (a) rates of admission in the exposed versus matched cohort and (b) rates of emergency versus elective admissions within each cohort. We tested whether differences in health-care use were explained by prior OAT, in which consultations may relate to prescriptions, monitoring of methadone and buprenorphine and psychosocial input. We stratified the rates of resource use by records of OAT prior to cohort entry.

This analysis does not follow a published protocol, and therefore the results should be considered exploratory. All analyses were conducted in R (version 4.1.1) [34].

Approvals

The study was approved by the Medicines and Health-care products Regulatory Agency (UK) Independent Scientific Advisory Committee (number 19_142R, under Section 251; NHS Social Care Act 2006). This study is based in part on data from the CPRD, obtained under licence from the UK Medicines and Health-care products Regulatory Agency. The data were provided by patients and collected by the UK National Health Service as part of their care and support. Individual patient consent wass not required for this analysis.

RESULTS

A total of 57 421 patients had a history of illicit opioid use, with a median follow-up of 2.77 years [interquartile range (IQR) = 1.04–6.09]. We also included 172 263 matched patients without a history of illicit opioid use (the 'comparison group'), with a median follow-up of 4.29 years (IQR = 1.80–7.87). The majority of patients were male (68.4%) and the median age at cohort entry was 38.40 years (IQR = 32.19–45.53). Demographics at baseline are reported in Table 1.

Health-care use by setting

Health-care use was greater in the opioid use group than in the comparison group in all settings (Table 2). The relative difference was greatest for emergency hospital admissions, with a rate ratio of 4.98 [95% confidence interval (CI) = 4.82–5.14]. For the remaining health-care settings, the rate in the opioid use group was approximately double that of the comparison group.

Differences were partially explained by comorbidities. For example, the adjusted rate ratio for emergency hospital admissions reduced from 4.98 (95% CI = 4.82–5.14) to 2.81 (95% CI = 2.74–2.89) after adjusting for comorbidity. The rate ratios for GP, hospital outpatient visits and ED visits were also partially explained by comorbidities, but the rate remained significantly greater in the opioid group (Table 2). The higher rate of elective hospital admissions in the opioid use group appeared to be explained by comorbidities, reducing from 1.76 (95% CI = 1.60–1.94) to 0.94 (95% CI = 0.87–1.00) after adjustment.

TABLE 1 Patient demographics at baseline.

	History of illicit opioid use *n* (%)	Comparison group *n* (%)
Total	57 421 (100)	172 263 (100)
Sex (matched)		
Male	39 286 (68.4)	117 858 (68.4)
Female	18 135 (31.6)	54 405 (31.6)
Age (matched) (years)		
18–29	8027 (14.0)	24 757 (14.4)
30–39	22 140 (38.6)	65 421 (38.0)
40–49	18 222 (31.7)	54 670 (31.7)
50–64	9032 (15.7)	27 415 (15.9)
Median (IQR)	38.4 (32.2–45.5)	38.4 (32.2–45.6)
Ethnicity[a]		
White	49 794 (86.7)	114 431 (66.4)
Black	1413 (2.5)	6318 (3.7)
Asian	1468 (2.6)	8471 (4.9)
Mixed	867 (1.5)	1716 (1.0)
Other/unknown	3119 (5.4)	23 427 (13.6)
Missing	760 (1.3)	17 900 (10.4)
Region (matched)		
East Midlands	1061 (1.8)	3183 (1.8)
East of England	1849 (3.2)	5547 (3.2)
London	7668 (13.4)	23 004 (13.4)
North East	3690 (6.4)	11 070 (6.4)
North West	11 801 (20.6)	35 403 (20.6)
South East Coast	2485 (4.3)	7455 (4.3)
South West	10 804 (18.8)	32 412 (18.8)
Southern Central	5030 (8.8)	15 090 (8.8)
West Midlands	10 224 (17.8)	30 672 (17.8)
Yorkshire and the Humber	2789 (4.9)	8367 (4.9)
Missing	20 (0.0)	60 (0.0)
Comorbidity count		
0	24 625 (43.0%)	126 291 (73.3%)
1	6543 (11.4%)	17 809 (10.3%)
2	5495 (9.6%)	10 797 (6.3%)
3+	20 578 (35.9%)	17 366 (10.1%)
Median (IQR)	1 (0–4)	0 (0–1)
Index of Multiple Deprivation quintile		
1 (least deprived)	4110 (7.2)	23 095 (13.4)
2	6274 (10.9)	27 161 (15.8)
3	8691 (15.1)	30 200 (17.5)
4	14 192 (24.7)	39 993 (23.2)
5 (most deprived)	24 072 (41.9)	51 650 (30.0)
Missing	82 (0.1)	164 (0.1)

Abbreviations: IQR = interquartile range.

[a]Ethnicity is derived from hospital admissions data. The most commonly recorded value has been used, or if there was a tie, recorded as unknown. Patients with no secondary care episodes were recorded as missing; the opioid group has fewer missing data due to higher rates of secondary care use.

The greatest absolute rate of consultations was for primary care in both the opioid use group (26 838 visits per 1000 patient-years) and the comparison group (11 257 visits per 1000 patient-years).

Health-care use by opioid agonist treatment history

Within the opioid use group, 63.9% had prescriptions or clinical records indicating OAT prior to study entry. Both patients with and without a history of OAT had significantly higher rates of health-care use than in the comparison group among all settings (Table 3). However, rates for GP visits and elective hospital admissions were significantly higher for patients with a history of OAT compared to patients without, and emergency care (ED visits and emergency hospital admissions) was significantly lower.

Hospital admissions by primary diagnosis

We found evidence of excess admissions in the opioid group for 41 of 44 categories of emergency hospital admissions. The three causes that did not have significant evidence of a difference were all in the cancers category, which had low absolute rates of emergency hospital admission in both groups. The greatest number of excess emergency hospital admissions were for drug overdoses and drug-related problems (15.2%), injuries other than head injuries (5.9%); skin infections (5.8%); chronic obstructive pulmonary disease (COPD) (4.8%); and influenza and pneumonia (4.3%). The highest rate ratios were for personality and behavioural problems (24.38, 95% CI = 15.51–40.58); drug overdoses and drug-related problems (20.21, 95% CI = 18.06–22.69); COPD (18.55, 95% CI = 14.77–23.57); and viral hepatitis (13.40, 95% CI = 6.28–32.52).

We found evidence of excess admissions for 35 of 44 causes of elective hospital admissions. For four causes of hospital admission [breast cancer, other cancers, heart conditions other than ischaemic heart disease (IHD) and diseases of the ear], we found evidence of a lower rate of elective admission in the opioid group than in the comparison group. For the remaining five causes of elective hospital admission, no statistical evidence of a difference between groups was found. The greatest number of excess elective hospital admissions were for renal failure (29.4%); dorsopathies (i.e. back/spine pain) (6.8%); other musculoskeletal problems (6.6%); and diseases of the blood and blood-forming organs (4.9%). The large number of excess admissions for renal failure relates to a small number of patients (0.15%) having a high number of admissions. The highest rate ratios were for drug-related problems (180.35, 95% CI = 86.59–470.00); personality and behavioural problems (167.21, 95% CI = 46.44–1425.22); viral hepatitis (50.89, 95% CI = 28.51–102.03); and alcohol-related problems (26.21, 95% CI = 17.30–41.71).

The expected and excess admissions are summarized in Figure 2 and rate ratios are summarized in Figure 3. Full details are provided in Supporting information, Table S1.

TABLE 2 Health-care use by setting.

	GP	Hospital outpatient	ED visits	Elective hospital admissions	Emergency hospital admissions
Opioid group (*n* = 57 421)					
Events	5 792 916	615 607	154 890	49 065	62 490
Rate/1000 PY	26 838	2852	718	227	290
% ≥ 1 events	99.7%	57.7%	53.5%	25.0%	36.9%
Dispersion	93.5	50.7	26.4	87.1	9.8
Comparison group (*n* = 172 263)					
Events	8 831 808	1 126 435	201 365	101 288	45 647
Rate/1000 PY	11 257	1436	257	129	58
% ≥ 1 events	99.8%	56.2%	46.4%	23.1%	15.8%
Dispersion	72.3	44.8	9.8	76.4	6.2
Rate ratio, opioid group relative to comparison group (95% CI)					
Unadjusted	2.38 (2.36–2.41)	1.99 (1.94–2.03)	2.80 (2.73–2.87)	1.76 (1.60–1.94)	4.98 (4.82–5.14)
Adjusted	1.83 (1.81–1.85)	1.34 (1.32–1.37)	1.96 (1.92–2.00)	0.94 (0.87–1.00)	2.81 (2.74–2.89)
Excess events in the opioid group					
Unadjusted	3 363 256	305 721	99 494	21 200	49 932
Adjusted	2 627 774	156 442	75 747	−3363	40 278

Note: Dispersion reflects the dispersion parameter as reported in the quasi-Poisson regression, with a higher number reflecting a higher amount of dispersion. Variables adjusted for include age (years), sex (male, female) and comorbidity (count). *P*-values (adjusted) for each setting: < 0.001, < 0.001, < 0.001, 0.056 and < 0.001. *P*-values (unadjusted): < 0.001 for all settings.
Abbreviations: CI = confidence interval; ED = emergency department; GP = general practice; PY = person-years.

TABLE 3 Rates of health-care use by setting, stratified by opioid agonist therapy.

	Rate (episodes per person-year; 95% CI)		
Setting	**No prior OAT (*n* = 36 694)**	**Prior OAT (*n* = 20 727)**	**No history of illicit opioid use (*n* = 172 263)**
GP	23.16 (23.14–23.19)	31.03 (30.99–31.06)	11.26 (11.25–11.26)
Hospital outpatient	2.82 (2.81–2.83)	2.83 (2.82–2.84)	1.44 (1.43–1.44)
ED visits	0.78 (0.78–0.79)	0.62 (0.61–0.62)	0.26 (0.26–0.26)
Elective hospital admissions	0.21 (0.21–0.21)	0.24 (0.24–0.25)	0.13 (0.13–0.13)
Emergency hospital admissions	0.31 (0.30–0.31)	0.26 (0.26–0.26)	0.06 (0.06–0.06)

Abbreviations: CI = confidence interval; ED = emergency department; GP = general practice; OAT = opioid agonist therapy.

DISCUSSION

Key findings

Patients with a history of using illicit opioids have higher rates of health-care use throughout GP, ED, hospital outpatient, and hospital emergency and elective inpatient care and had more frequent hospital admissions for most diseases.

Contrary to our hypothesis, we found that patients with a history of using illicit opioids had substantially higher GP use: a surprising finding, as we expected illicit opioid use to be associated with poorer access to GPs. This may be because people with a history of using illicit opioids have greater health needs, or due to selection bias in which people who use illicit opioids were more likely to disclose their opioid use to their GP if they had good health-care access.

We also found that the high rate of GP visits in the opioid group was not explained by management of OAT, as patients with no prior OAT still showed significantly higher rates of GP visits than the comparison group. A history of OAT was associated with a higher rate of GP and outpatient visits and a lower rate of ED visits and emergency hospital admissions. This may reflect a beneficial effect of OAT care, helping patients to engage with planned management of long-term conditions [3, 35, 36].

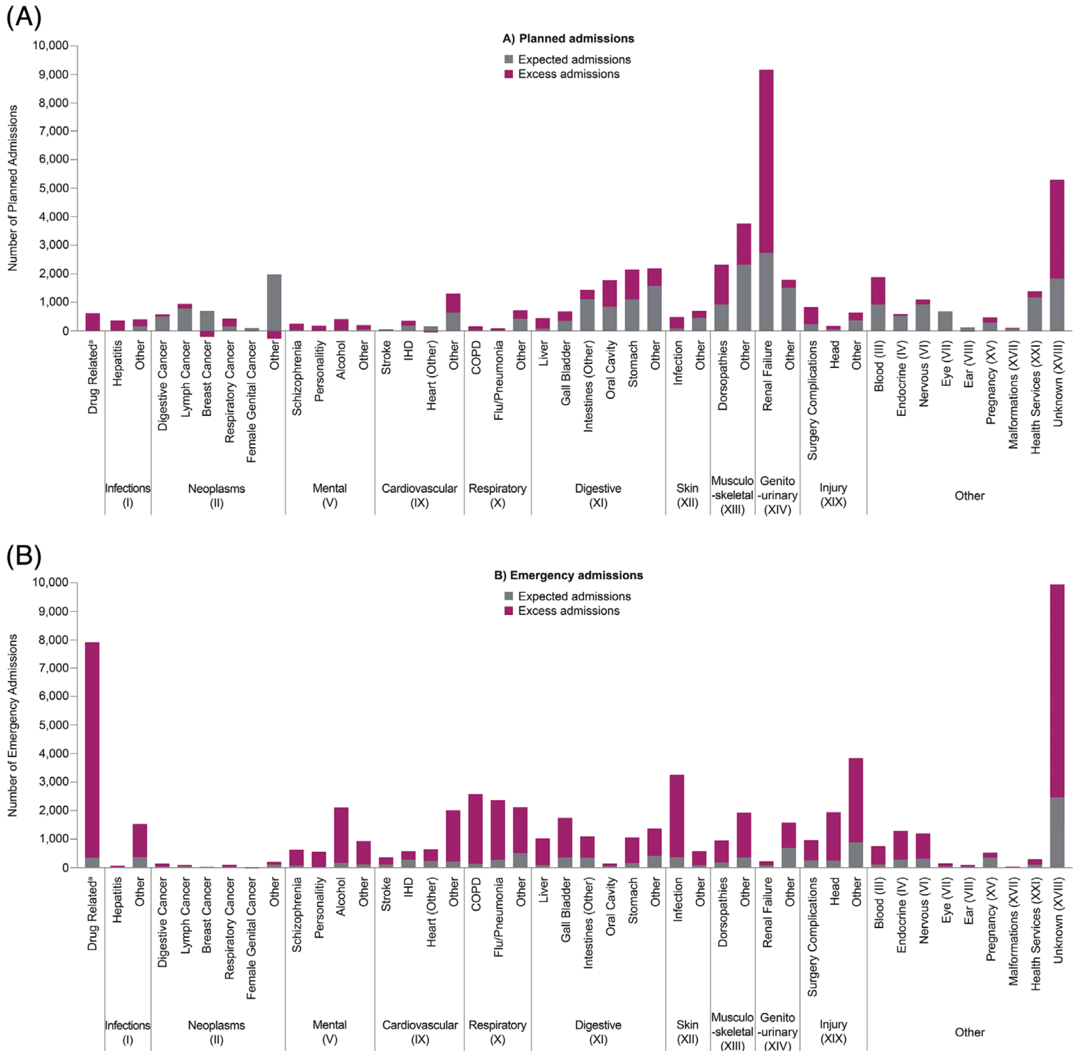

FIGURE 2 Expected and excess admissions for (a) elective and (b) emergency hospital admissions by diagnostic category. [a]Drug-related admissions are based on a published list of codes to identify drug-related deaths by the Office for National Statistics (ONS) [26] (F11–F16; F18–19, X40–X44, X60–X64, X85, Y10–Y14) in addition to ICD-10 codes T36–T50, poisoning by, adverse effect of and underdosing of drugs, medicaments and biological substances. COPD = chronic obstructive pulmonary disease; IHD = ischaemic heart disease.

Comparison with prior literature

Limited quantitative research has considered primary care utilization in this population. A study in Canada showed that patients with a substance use disorder had 4.2 times more primary care appointments than those without [37] and a study in Australia showed that, among heroin users, the rate of primary care utilization was higher than ED or inpatient admissions [38].

Consistent with previous studies, we found that patients with a history of illicit opioid use had substantially higher rates of hospital use, particularly for ED visits and emergency hospital care [14]. Our analysis of hospital admissions found high rates of admission throughout almost all diseases. While the highest rate ratios are for diseases often considered drug-related, such as drug overdoses and viral hepatitis, there were large numbers of excess admissions for many long-term conditions. Circulatory, respiratory, digestive and musculoskeletal conditions together accounted for a third (32.9%) of all emergency admissions in the opioid use group and a third (32.8%) of the excess emergency admissions. This is consistent with analyses of cause-specific death for patients who use illicit opioids, which have found elevated mortality rates across many infectious and non-communicable diseases [3, 27].

Health-care use in the opioid use group appears weighted towards emergency care, with higher rate ratios for emergency hospital admissions and ED than other settings. This may reflect higher rates of emergency and episodic illness (e.g. drug poisoning/overdose, injuries and interpersonal violence) associated with the use of criminalized and unregulated drugs; however, we found a skew towards emergency admissions over elective admissions for almost all diseases. This supports the findings of qualitative interview studies suggesting that open access settings are more accessible for this population and that poor health-care accessibility may

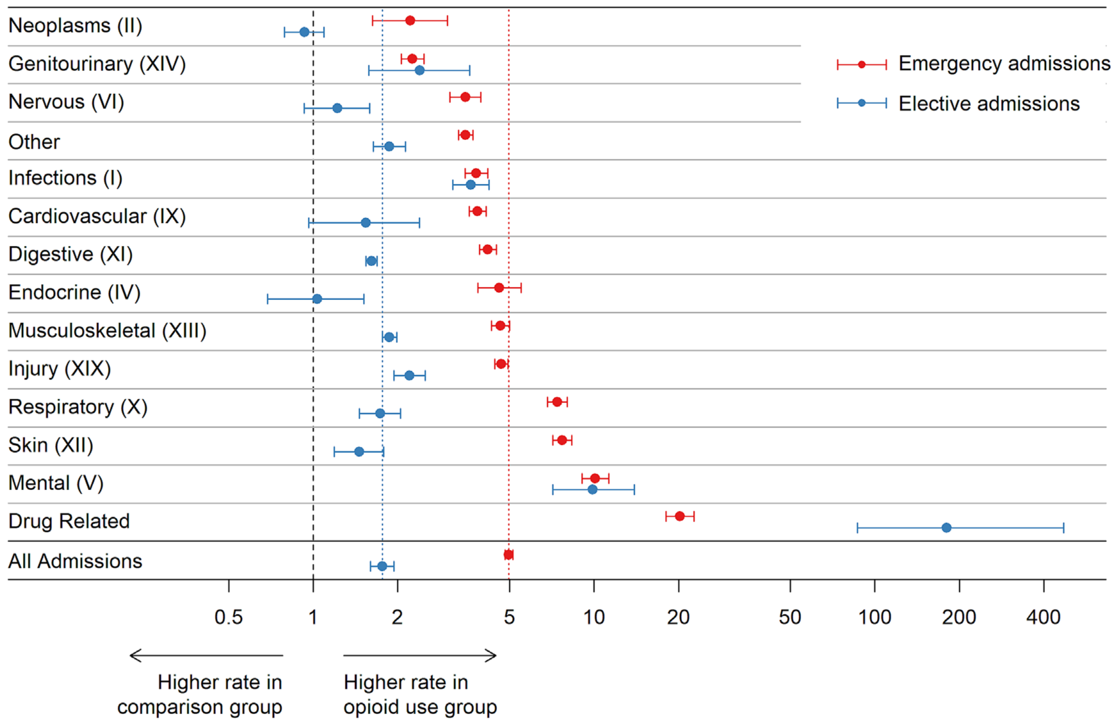

FIGURE 3 Incident rate ratios (IRRs) for hospital admissions by diagnostic category. Points represent the IRRs for patients in the opioid group relative to the comparison group, with 95% confidence intervals represented with error bars.

lead to emergency rather than proactive management of long-term conditions.

For most cancers, there was a lower rate of elective hospital admissions in the opioid use group than the comparison, with the exception of respiratory and digestive cancers (Figure 2), which aligns with the high prevalence of tobacco use, alcohol use and hepatitis viral infections in this population [22, 39]. The lower rates for other cancers is likely to reflect poor access to screening, late diagnosis and poor health-care access, as the rate of death due to cancers among people who use illicit opioids is double that of the general population [3, 27, 40, 41].

Implications for policy and practice

There are four key implications from this study. First, the high rates of emergency care suggest that the management of long-term conditions in this population can be improved. For example, we found high rates of emergency hospital admissions due to exacerbations of COPD. Management of conditions such as COPD may be improved by having clinics in open-access settings such as drug treatment services (a model that has been piloted in London, Liverpool and Sheffield, United Kingdom [40, 41]) or through outreach clinics for people not in drug treatment to improve service permeability.

Qualitative interviews have found that many health-care staff have insufficient knowledge of addiction treatment [11, 42]. This can lead to diagnostic overshadowing, where the clinician attributes symptoms to drug use and therefore carries out less thorough investigations, and stigmatizing attitudes such as that people who use illicit drugs are 'difficult' patients [43]. These challenges may be improved with training and policies for providing high-quality health-care to these patients.

Secondly, cause-specific rates of hospital admission indicate that the high rate of health-care among patients who use illicit opioids relates to a wide range of diseases, not limited to drug use and drug-related comorbidities. Services supporting this population typically focus upon treating drug and alcohol dependence, and ancillary health services usually focus upon diagnosing or preventing blood-borne viral infections. As the average age of people who use illicit opioids increases [44], long-term health conditions are becoming more important and there is a greater need for services that provide open-access holistic care.

Finally, there is a need for further research in the area of GP access by patients who use illicit opioids. There is substantial evidence from interviews suggesting that this population faces barriers to access [11–13]; however, the findings of this study suggest that there are high rates of GP visits, not limited only to visits related to OAT. This appears to be a contradiction; however, the true need may be even greater, or there may be subgroups with different barriers.

Limitations

This study included a large sample of patients who use illicit opioids, and by including patients with heroin dependence and other illicit opioid use documented by GPs, it is not limited to people in structured treatment [45, 46]. However, it is likely to have selection biases. By recruiting individuals who have disclosed opioid use, we may have disproportionately captured patients who are more dependent. We also would not have captured people who use illicit opioids but who do not interact with the health-care system. Further, no data were available on cessation of drug use or the degree of opioid dependence. These factors could result in an overestimate of the rates of health-care use.

Given the descriptive and exploratory nature of the study, the findings from this study can only be used to gain a clearer understanding of the health-care use in an illicit opioid use population, and causal interpretations cannot be made. The considered population is a complex patient group that faces a range of socio and economic adversities, which all probably contribute to elevated health-care use that cannot be attributed to a single drug class.

Diagnoses were only available for hospital admissions. A detailed analysis of the causes of GP visits and attendance history may help to explain the high rate of GP visits among participants with a history of opioid use. This research is challenging due to the nature of diagnostic information in GP records, which includes both clinical coding systems (such as SNOMED codes) and free text entries. Detailed studies might therefore focus upon specific areas where there are validated GP coding phenotypes. A recent study of patients diagnosed with COPD who use illicit opioids suggested that opioid use was not associated with lower uptake of treatments such as pulmonary rehabilitation and vaccination against respiratory infections [47]. This may further suggest that people who use illicit opioids do access GPs despite the barriers documented in interviews that some may experience.

Our measure of comorbidity relied upon diagnoses made during a hospital admission. Therefore, comorbidities that might be diagnosed in primary care are not included, which limits our mediation analysis of the role of comorbidity. Given the exclusion of diagnoses recorded in primary care, it is expected that the 'true' levels of comorbidity in both populations are underestimated; however, the extent to which this is the case is unknown. There is also a risk of introducing bias, as patients with higher rates of health-care use are more likely to have their comorbidities diagnosed. Resultantly, it is possible that the 'true' difference in comorbidity between the cohorts is less than that presented in this study, suggesting that a greater difference in comorbidity-adjusted health-care use is possible. As the intention of this study is to describe health-care use in the population of interest, rather than to estimate causal effects, the findings of the study are still considered salient.

CONCLUSIONS

Patients who use illicit opioids in England access health services more often than people of the same age and sex who do not use illicit opioids among all health-care settings. The difference is especially large for emergency care, which reflects both episodic illness and decompensation of long-term conditions. The high rate of emergency care among multiple disease groups suggests that management of long-term conditions can be improved in this population, and services that support this population need to extend beyond typical drug-related conditions.

AUTHOR CONTRIBUTIONS

Naomi Van hest: Conceptualization (lead); formal analysis (lead); investigation (equal); methodology (lead); project administration (lead); writing—original draft (lead); writing—review and editing (equal). **Thomas D Brothers:** Methodology (equal); writing—original draft (equal); writing—review and editing (equal). **Andrea Williamson:** Methodology (equal); validation (equal); writing—original draft (equal); writing—review and editing (equal). **Dan Lewer:** Conceptualization (equal); formal analysis (supporting); funding acquisition (lead); investigation (supporting); methodology (supporting); project administration (supporting); supervision (lead); writing—original draft (supporting); writing—review and editing (lead).

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DECLARATION OF INTERESTS

None.

DATA AVAILABILITY STATEMENT

This study used pseudonymized patient-level data from the CPRD. To protect patient confidentiality, we cannot publish patient-level data. Other researchers can use patient-level CPRD data in a secure environment by applying to the CPRD Independent Scientific Advisory Committee. Details of the application process and conditions of access are provided by the CPRD at https://www.cprd.com/Data-access. The code list used to select patients for our study is publicly available at https://wellcomeopenresearch.org/articles/5-282/v2.

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REFERENCES

1. Jan SA. Introduction: landscape of opioid dependence. J Manag Care Pharm. 2010;16:4–8.
2. Hay G, Rael dos Santos A, Reed H, Hope V. Estimates of the prevalence of opiate use and/or crack cocaine use, 2016/17: Sweep 13 report Liverpool, UK: John Moores University Public Health Institute; 2019.

3. Larney S, Tran LT, Leung J, Santo T Jr, Santomauro D, Hickman M, et al. All-cause and cause-specific mortality among people using extramedical opioids: a systematic review and meta-analysis. JAMA Psychiatry. 2020;77:493–502.
4. Aldridge RW, Story A, Hwang SW, Nordentoft M, Luchenski SA, Hartwell G, 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. Lancet. 2018;391:241–50.
5. Degenhardt L, Larney S, Randall D, Burns L, Hall W. Causes of death in a cohort treated for opioid dependence between 1985 and 2005. Addiction. 2014;109:90–9.
6. Degenhardt L, Bucello C, Mathers B, Briegleb C, Ali H, Hickman M, et al. Mortality among regular or dependent users of heroin and other opioids: a systematic review and meta-analysis of cohort studies. Addiction. 2011;106:32–51.
7. Lewer D, Tweed EJ, Aldridge RW, Morley KI. Causes of hospital admission and mortality among 6683 people who use heroin: a cohort study comparing relative and absolute risks. Drug Alcohol Depend. 2019;204:107525.
8. Park K, Otte A. Prevention of opioid abuse and treatment of opioid addiction: current status and future possibilities. Annu Rev Biomed Eng. 2019;21:61–84.
9. Hamilton W. Cancer diagnosis in primary care. Br J Gen Pract. 2010; 60:121–8.
10. National Institute for Health and Care Excellence (NICE). Type 2 diabetes in adults: management (NG28) London, UK: NICE; 2020.
11. Neale J, Tompkins C, Sheard L. Barriers to accessing generic health and social care services: a qualitative study of injecting drug users. Health Soc Care Community. 2008;16:147–54.
12. van Boekel L, Brouwers E, van Weeghel J, Garretsen H. Stigma among health professionals towards patients with substance use disorders and its consequences for health-care delivery: systematic review. Tijdschr Psychiatr. 2015;57:489–97.
13. Summers PJ, Hellman JL, MacLean MR, Rees VW, Wilkes MS. Negative experiences of pain and withdrawal create barriers to abscess care for people who inject heroin. A mixed methods analysis. Drug Alcohol Depend. 2018;190:200–8.
14. Lewer D, Freer J, King E, Larney S, Degenhardt L, Tweed EJ, et al. Frequency of health-care utilization by adults who use illicit drugs: a systematic review and meta-analysis. Addiction. 2020;115:1011–23.
15. Herrett E, Gallagher AM, Bhaskaran K, Forbes H, Mathur R, van Staa T, et al. Data resource profile: clinical practice research datalink (CPRD). Int J Epidemiol. 2015;44:827–36.
16. Wolf A, Dedman D, Campbell J, Booth H, Lunn D, Chapman J, et al. Data resource profile: clinical practice research datalink (CPRD) Aurum. Int J Epidemiol. 2019;48:1740–1740g.
17. Persson R, Vasilakis-Scaramozza C, Hagberg KW, Sponholtz T, Williams T, Myles P, et al. CPRD Aurum database: assessment of data quality and completeness of three important comorbidities. Pharmacoepidemiol Drug Saf. 2020;29:1456–64.
18. NHS Digital. SNOMED CT 2023. Available at: https://digital.nhs.uk/services/terminology-and-classifications/snomed-ct. Accessed 20 Feb 2023.
19. Lewer D, Padmanathan P, Qummer ul Arfeen M, Denaxas S, Forbes H, Gonzalez-Izquierdo A, et al. Health-care use by people who use illicit opioids (HUPIO): development of a cohort based on electronic primary care records in England [version 1; peer review: 1 approved]. Wellcome Open Res. 2020;5:282.
20. National Drug Treatment Monitoring System (NDTMS). Adult Substance Misuse Treatment Statistics 2020 to 2021: Report London, UK: Office for Health Improvement and Disparities; 2021.
21. UK Health Security Agency. Unlinked Anonymous Monitoring (UAM) Survey of HIV and Viral Hepatitis Among People Who Inject Drugs (PWID) 2022 Report London, UK: UK Health Security Agency; 2022.
22. Hassan AN, Le Foll B. Polydrug use disorders in individuals with opioid use disorder. Drug Alcohol Depend. 2019;198:28–33.
23. Jones JD, Mogali S, Comer SD. Polydrug abuse: a review of opioid and benzodiazepine combination use. Drug Alcohol Depend. 2012; 125:8–18.
24. Lewis JD, Bilker WB, Weinstein RB, Strom BL. The relationship between time since registration and measured incidence rates in the General Practice Research Database. Pharmacoepidemiol Drug Saf. 2005;14:443–51.
25. Ohneberg K, Beyersmann J, Schumacher M. Exposure density sampling: dynamic matching with respect to a time-dependent exposure. Stat Med. 2019;38:4390–403.
26. Office for National Statistics (ONS). Deaths Related to Drug Poisoning in England and Wales: 2019 Registrations Newport, UK: ONS; 2020.
27. Lewer D, Brothers TD, Van Hest N, Hickman M, Holland A, Padmanathan P, et al. Causes of death among people who used illicit opioids in England, 2001–18: a matched cohort study. Lancet Public Health. 2022;7:e126–35.
28. Li MH-G, Hutchinson A, Tacey M, Duke G. Reliability of comorbidity scores derived from administrative data in the tertiary hospital intensive care setting: a cross-sectional study. BMJ Health Care Informatics. 2019;26:e000016.
29. Kallogjeri D, Gaynor SM, Piccirillo ML, Jean RA, Spitznagel EL, Piccirillo JF. Comparison of comorbidity collection methods. J Am Coll Surg. 2014;219:245–55.
30. Office for National Statistics (ONS). Measuring equality: a guide for the collection and classification of ethnic group, national identity and religion data in the UK Newport, UK: ONS; 2016. Available at: https://www.ons.gov.uk/methodology/classificationsandstandards/measuringequality/ethnicgroupnationalidentityandreligion. Accessed 20 Feb 2023.
31. Dedman D. Hospital Episode Statistics (HES) admitted patient care and CPRD primary care data documentation (set 18). 2019. Available at: https://cprd.com/sites/default/files/2022-02/Documentation_HES_APC_set22.pdf. Accessed 25 Nov 2023.
32. McLennan D, Noble S, Noble M, Plunkett E, Wright G, Gutacker N. The English Indices of Deprivation 2019 London, UK: Ministry of Housing, Communities and Local Government; 2019.
33. Fox MP, Murray EJ, Lesko CR, Sealy-Jefferson S. On the need to revitalize descriptive epidemiology. Am J Epidemiol. 2022;191: 1174–9.
34. R Core Team. R: a Language and Environment for Statistical Computing Vienna, Austria: R Foundation for Statistical Computing; 2022.
35. Clay E, Khemiri A, Zah V, Aballéa S, Ruby J, Asche CV. Persistence and health-care utilization associated with the use of buprenorphine/-naloxone film and tablet formulation therapy in adults with opioid dependence. J Med Econ. 2014;17:626–36.
36. Lo-Ciganic WH, Gellad WF, Gordon AJ, Cochran G, Zemaitis MA, Cathers T, et al. Association between trajectories of buprenorphine treatment and emergency department and in-patient utilization. Addiction. 2016;111:892–902.
37. Graham K, Cheng J, Bernards S, Wells S, Rehm J, Kurdyak P. How much do mental health and substance use/addiction affect use of general medical services? Extent of use, reason for use, and associated costs. Can J Psychiatry. 2017;62:48–56.
38. Darke S, Marel C, Ross J, Mills KL, Slade T, Tessson M. Health service utilization among heroin users: 11-year follow-up of the Australian treatment outcome study cohort. Addict Disord Treat. 2015;14: 159–66.
39. Guydish J, Passalacqua E, Pagano A, Martínez C, Le T, Chun J, et al. An international systematic review of smoking prevalence in addiction treatment. Addiction. 2016;111:220–30.

40. Burhan H, Young R, Byrne T, Peat R, Furlong J, Renwick S, et al. Screening heroin smokers attending community drug services for COPD. Chest. 2019;155:279–87.
41. Furlong J, Peat R, Young R, Byrne T, Russell D, Elkin T, et al. Prevalence of COPD in heroin smokers screened at substance misuse clinics. Eur Respir J. 2016;48:PA4178.
42. Ross LE, Vigod S, Wishart J, Waese M, Spence JD, Oliver J, et al. Barriers and facilitators to primary care for people with mental health and/or substance use issues: a qualitative study. BMC Fam Pract. 2015;16:135.
43. Harris M. Normalised pain and severe health care delay among people who inject drugs in London: adapting cultural safety principles to promote care. Soc Sci Med. 2020;260:113183.
44. Lewer D, Croxford S, Desai M, Emanuel E, Hope VD, McAuley A, et al. The characteristics of people who inject drugs in the United Kingdom: changes in age, duration, and incidence of injecting, 1980–2019, using evidence from repeated cross-sectional surveys. Addiction. 2022;117:2471–80.
45. Cornish R, Macleod J, Strang J, Vickerman P, Hickman M. Risk of death during and after opiate substitution treatment in primary care: prospective observational study in UK General Practice Research Database. BMJ. 2010;341:c5475.
46. Hickman M, Steer C, Tilling K, Lim AG, Marsden J, Millar T, et al. The impact of buprenorphine and methadone on mortality: a primary care cohort study in the United Kingdom. Addiction. 2018;113:1461–76.
47. Lewer D, Cox S, Hurst JR, Padmanathan P, Petersen I, Quint JK. Burden and treatment of chronic obstructive pulmonary disease among people using illicit opioids: matched cohort study in England. BMJ Med. 2022;1:e000215.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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