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ORIGINAL ARTICLE

# Determinants of long-term opioid prescribing in an urban population: A cross-sectional study

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**Background:** Opioid prescribing has more than doubled in the UK between 1998 and 2016. Potential adverse health implications include dependency, falls and increased health expenditure.

**Aim:** To describe the predictors of long-term opioid prescribing (LTOP) (≥3 opioid prescriptions in a 90-day period).

**Design and setting:** A retrospective cross-sectional study in 41 general practices in South London.

**Method:** Multi-level multivariable logistic regression to investigate the determinants of LTOP.

**Results:** Out of 320 639 registered patients ≥18 years, 2679 (0.8%) were identified as having LTOP. Patients were most likely to have LTOP if they had ≥5 long-term conditions (LTCs) (adjusted odds ratio [AOR] 36.5, 95% confidence interval [CI] 30.4-43.8) or 2-4 LTCs (AOR 13.8, CI 11.9-16.1) in comparison to no LTCs, were ≥75 years compared to 18-24 years (AOR 12.31, CI 7.1-21.5), were smokers compared to nonsmokers (AOR 2.2, CI 2.0-2.5), were female rather than male (AOR 1.9, CI 1.7-2.0) and in the most deprived deprivation quintile (AOR 1.6, CI 1.4-1.8) compared to the least deprived. In a separate model examining individual LTCs, the strongest associations for LTOP were noted for sickle cell disease (SCD) (AOR 18.4, CI 12.8-26.4), osteoarthritis (AOR 3.0, CI 2.8-3.3), rheumatoid arthritis (AOR 2.8, CI 2.2-3.4), depression (AOR 2.6, CI 2.3-2.8) and multiple sclerosis (OR 2.5, CI 1.4-4.4).

**Conclusion:** LTOP was significantly higher in those aged ≥75 years, with multimorbidity or specific LTCs: SCD, osteoarthritis, rheumatoid arthritis, depression and multiple sclerosis. These characteristics may enable the design of targeted interventions to reduce LTOP.

KEYWORDS
analgesic, chronic disease, inappropriate prescribing, multimorbidity, opioid, primary health care, risk factors

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## 1 | INTRODUCTION

In the UK opioid prescribing has more than doubled in the past 20 years,[1–4] with prescriptions peaking in 2016 and then subsequently beginning to decline.[1] A larger proportion of opioids being prescribed are strong opioids,[5] with the majority prescribed for noncancer pain.[6] A growing number of patients are prescribed opioids in primary care for musculoskeletal conditions and are more likely to remain on them long term.[7,8]

Higher levels of opioid prescribing are associated with social deprivation, rurality and larger practice size.[1,3,7] Polypharmacy, multimorbidity, increasing number of GP consultations and referral to specialist pain services are also associated with strong opioid prescribing.[9–11] In addition, variation in opioid prescribing between practices and clinicians has also been observed,[12] with practices on the 75th centile of opioid prescribing, prescribing twice as much opioid as those on the 25$^{th}$.[13]

While opioids are effective in acute musculoskeletal and cancer pain,[14] they are of limited effectiveness for chronic pain, with no benefits seen with higher doses and an increasing likelihood of adverse effects.[15–18] Long-term opioid prescribing (LTOP; >12 weeks) has been associated with increased major trauma, overdose, addiction, functional gastrointestinal disorders and all-cause mortality.[19–21] Both the Scottish intercollegiate guidelines network (SIGN) and the Faculty of Pain Medicine (FoPM) guidelines state there is a lack of benefit and evidence of harm, for LTOP in noncancer pain.[9,22] Draft NICE guidance states opioids should not be prescribed for pain that persists or recurs for more than 3 months due to lack of efficacy and long-term harms.[23]

Given the evidence of the ineffectiveness and harms of LTOP for noncancer pain and new recommendations on treatment duration, we aimed to characterise the prevalence and determinants of LTOP.

### What is already known about this subject

- Opioid prescribing has significantly increased in recent years. Long-term opioid prescribing (LTOP) is associated with increased morbidity and health expenditure, and may be inappropriate. The recent Draft National Institute for Health and Care Excellence (NICE) guidance on the management of chronic pain has highlighted the lack of efficacy and harms of treatment of pain with opioids for greater than 3 months.

### What this study adds

- Our study shows that multimorbidity and having certain long-term conditions are important determinants of LTOP. We found higher levels of LTOP in those with multimorbidity, older adults (aged over 75 years) and in those with long-term conditions such as sickle cell disease, depression, rheumatoid arthritis, osteoarthritis and alcohol dependence. These findings can be used to target deprescribing initiatives at the most at-risk groups.

## 2 | METHODS

### 2.1 | Study design

We conducted a cross-sectional study using anonymised coded primary care data extracted from electronic health records (EHRs) reported according to the RECORD-PE checklist.[24]

### 2.2 | Study setting

The study used a routinely collected pseudonymised database Lambeth DataNet (LDN) containing data from all 41 GP practices in Lambeth, South London.

### 2.3 | Study population

We included all patients 18 years or older registered with a GP in Lambeth, n = 323 980 (1/9/19). The study period was from 3 June to 1 November 2019. The number of opioid prescriptions was assessed in the period 3 June to 1 September 2019, with the two subsequent months used to assess new cancer diagnoses following opioid prescription. Patients with a cancer diagnosis (up to 5 years prior to or 2 months after 1 September 2019) were removed to ensure patients suffering from possible cancer pain were excluded. All patients prescribed opioid substitution therapy in the study period were also excluded (see Figure 1).

### 2.4 | Variables

#### 2.4.1 | Outcome

We defined LTOP as ≥3 opioid prescriptions in a 90-day period, 3 June to 1 September 2019. This is in line with previous studies demonstrating harm, as well as the Scottish Intercollegiate Guidelines Network (SIGN) and the Faculty of Pain Medicine (FoPM) guidelines.[7,9,19,22,25,26]

We included all opioid medications in the British National Formulary (BNF) chapters 4.7.1 and 4.7.2. All formulations and potencies were included. Dosage, duration and indication were not examined; defined daily dosage and indication of the prescription were not available within the database used.

#### 2.4.2 | Covariates

Demographic data consisted of gender, age, ethnicity and deprivation (Index of Multiple Deprivation 2019, IMD).[27] We used local

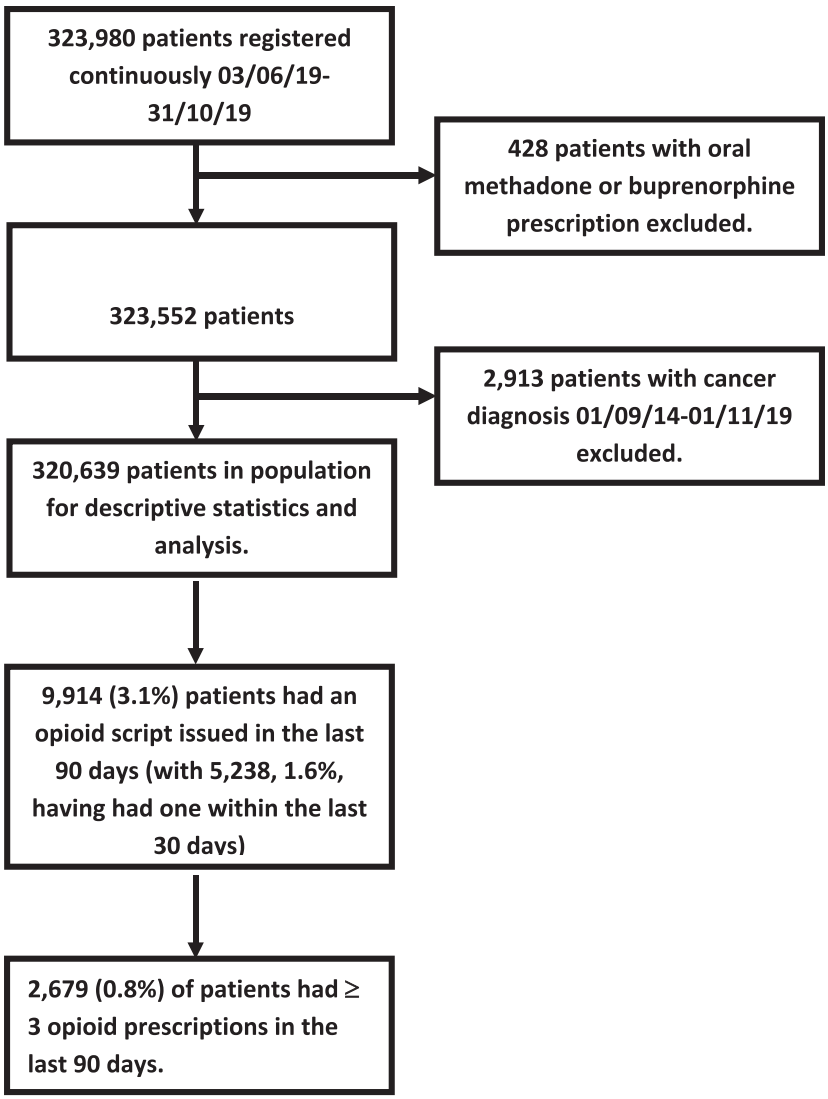


**FIGURE 1** Study selection flow-chart

deprivation quintiles in place of national deprivation quintiles, as mean deprivation levels are high in Lambeth (34th most deprived local authority in England).[28]

We used a definition of multimorbidity which included 32 long-term conditions (LTCs).[29,30] The 32 LTCs (Supporting Information Appendix S1) include all those forming part of the Quality and Outcomes Framework (QOF)[31] or included on the basis of local relevance as part of a wider study of multimorbidity. Multimorbidity can be considered to be two or more LTCs.[32,33] LTCs were grouped as 0, 1, 2-4 and ≥ 5; previous literature has used ≥5 LTCs as a clinically relevant cut point.[34–36]

## 2.5 | Data analysis

We used Stata V.16 for all analyses. We undertook a descriptive analysis of the population-reported demographic details, smoking, deprivation quintile, number of LTCs and the proportion experiencing the primary outcome. Analysis of missingness and association between variables, using Pearson's chi-squared test, was carried out.

We carried out partially (age and gender) and fully adjusted multilevel multivariable logistic regression models to estimate the association between the primary outcome and age, gender, deprivation, smoking, ethnicity and number of LTCs. In these models, individual patients are nested within GP practices, giving rise to a (two-level) multilevel model. Multilevel modelling adjusts for variation observed at practice level due to different prescribing behaviours between practices. Model checks were carried out assessing residual intraclass correlation to examine practice variation and model sensitivity. Multiple imputation by chained equations[37] was used to account for missing data after initial exploration.

A second multilevel multivariable logistic regression model was fitted to estimate the association of the individual LTCs (see Supporting Information Table S1) with LTOP. The individual LTCs were analysed using logistic regression in a stepwise model. Those which had a significant association ($P < .05$) with LTOP were included in the model. The model was adjusted for age, sex, deprivation, smoking and ethnicity (Table 3 and Supporting Information Table S1).

Assessment of interactions of the terms (with age and gender) and collinearity for the model was carried out. A Receiving operator characteristic (ROC) curve was plotted and a Hosmer-Lemeshow test was carried out post-test to check the model goodness of fit.

## 3 | RESULTS

### 3.1 | Descriptive

The population studied is ethnically diverse, with less than a third being White British or Irish (see Table 1). The majority of the population were nonsmokers, below 45 years of age and without comorbidities. Figure 1 shows how the LTOP study population was selected.

### 3.2 | Missing data

There were 18 182 (5.6%) missing smoking values and 3155 (1.0%) missing values for deprivation quintile. The level of missing data for deprivation was higher in the non-LTOP group (1.0%) compared to the LTOP group (0.6% ($P = .04$). The level of missing data for smoking was higher in the non-LTOP group (5.7%) compared to the LTOP group (0.3%) ($P < .001$.

### 3.3 | Outcome

In total, 3.1% (n = 9914) of patients received at least one opioid prescription in the previous 90 days (Figure 1); 0.8% (n = 2679) received ≥3 opioid prescriptions in a 90-day period (the primary outcome). The relative frequency of LTOP was higher in females (1.1%) compared to males (0.6%) ($P < .001$), smokers (1.3%) compared to nonsmokers (0.6%) ($P < .001$), those in the most deprived areas (1.2%) compared with the least deprived areas (0.6%) ($P < .001$) and those with an increasing number of LTCs (3.7% 2-4 LTCs, 13.5% ≥ 5 LTCs) ($P < .001$), and was more frequent with increasing age (0.1% 18-24 years, 5.6% ≥ 75 years). The relative frequency of LTOP was highest in the White British or Irish (1.2%) and Caribbean populations (1.2%) compared to all other ethnicities ($P < .001$) (Table 1).

The LTCs with the highest proportion of patients with LTOP were chronic obstructive pulmonary disease (COPD) (9.1%), sickle cell disease (SCD) (8.5%) and dementia (8.0%) (Supporting Information Table S1).

### 3.4 | Analysis

When partially adjusted for age and sex, individuals aged ≥75 years compared to those 18-24 years (OR 106.1, CI 63.6-177.1) and with ≥5 LTCs in comparison to those with none (OR 43.8, CI 36.6-52.3) showed the largest associations with LTOP (Table 2).

**TABLE 1** Population descriptive statistics

| | Number of patients (percentage of population, %) | Number of patients with LTOP (relative frequency, %) |
|---|---|---|
| Total population | 320 639 (100) | 2679 (0.8) |
| Sex | | |
| Male | 162 996 (50.8) | 958 (0.6) |
| Female | 157 643(49.2) | 1721 (1.1) |
| Age (years) | | |
| 18-24 | 29 138 (9.1) | 15 (0.1) |
| 25-44 | 175 882 (54.9) | 323 (0.2) |
| 45-64 | 86 435 (27.0) | 1195 (1.4) |
| 65-74 | 16 862 (5.3) | 497 (2.9) |
| 75+ | 11 673 (3.6) | 649 (5.6) |
| Smoking status | | |
| Nonsmoker | 178 778 (55.8) | 1045 (0.6) |
| Exsmoker | 64 201 (20.0) | 880 (1.4) |
| Current smoker | 59 478 (18.6) | 747 (1.3) |
| Missing data | 18 182 (5.7) | 7 (<0.1) |
| IMD (2019) quintile of deprivation | | |
| 1 (least deprived) | 64 891 (20.2) | 376 (0.6) |
| 2 | 63 149 (19.7) | 472 (0.7) |
| 3 | 64 824 (20.2) | 476 (0.7) |
| 4 | 63 362 (19.8) | 630 (1.0) |
| 5 (most deprived) | 61 258 (19.8) | 709 (1.2) |
| Missing data | 3155 (1.0) | 16 (0.5) |
| Number of LTCs | | |
| 0 | 205 333 (64.0) | 111 (0.1) |
| 1 | 68 654 (21.4) | 329 (0.5) |
| 2-4 | 41 244 (3.7) | 1507 (3.7) |
| 5+ | 5408 (1.7) | 732 (13.5) |
| Ethnicity | | |
| White British or Irish | 103 096 (32.2) | 1193 (1.2) |
| Other White | 72 628 (22.7) | 357 (0.5) |
| Caribbean | 24 485 (7.6) | 307 (1.2) |
| African | 32 501 (10.1) | 296 (0.9) |
| Black other | 8688 (2.7) | 86 (1.0) |
| Indian/Pakistani/Bangladeshi | 9472 (3.0) | 94 (1.0) |
| Chinese and other Asian | 14 810 (4.6) | 77 (0.5) |
| Other or unknown | 54 959 (17.1) | 269 (0.5) |

*Note*: Descriptive statistics undertaken after exclusion of cancer diagnosis (01/09/14-01/11/19) and those with oral buprenorphine or methadone prescription in prior 3 months. Percentages rounded to one decimal place. Abbreviations: IMD, Index of Multiple Deprivation; LTC, long-term condition; LTOP, long-term opioid prescribing.

#### 3.4.1 | Model 1 (Table 2)

In the fully adjusted logistic regression model, the factors associated with significantly increased odds of LTOP were increasing number of

**TABLE 2** Associations with LTOP. Partially adjusted logistic regression (by age and sex) and fully adjusted multilevel logistic regression (adjusted for variation between practices, number of LTCs, age, deprivation, smoking status, sex and ethnicity)

| | Odds ratio (partially adjusted) | 95% confidence interval (partially adjusted) | Odds ratio (fully adjusted) | 95% confidence interval (fully adjusted) | *P* value (fully adjusted model) |
|---|---|---|---|---|---|
| Sex | | | | | |
| Male | Ref | | Ref | | |
| Female | 1.84 | 1.70-1.99 | 1.87 | 1.72-2.04 | <0.001 |
| Age (years) | | | | | |
| 18-24 | | | | | |
| 25-44 | 3.66 | 2.18-6.15 | 2.74 | 1.57-4.78 | <0.001 |
| 45-64 | 28.61 | 17.19-47.61 | 8.85 | 5.10-15.34 | <0.001 |
| 65-74 | 60.14 | 35.97-100.56 | 9.76 | 5.59-17.05 | <0.001 |
| 75+ | 106.07 | 63.55-177.06 | 12.31 | 7.05-21.50 | <0.001 |
| Smoking status[a] | | | | | |
| Nonsmoker | Ref | | Ref | | |
| Exsmoker | 1.89 | 1.73-2.08 | 1.47 | 1.34-1.63 | <0.001 |
| Smoker | 2.85 | 2.58-3.14 | 2.24 | 2.02-2.48 | <0.001 |
| IMD (2019) quintile of deprivation[a] | | | | | |
| 1 (least deprived) | Ref | | Ref | | |
| 2 | 1.44 | 1.26-1.65 | 1.24 | 1.08-1.43 | 0.003 |
| 3 | 1.45 | 1.26-1.66 | 1.28 | 1.11-1.48 | 0.001 |
| 4 | 1.84 | 1.61-2.09 | 1.49 | 1.30-1.71 | <0.001 |
| 5 (most deprived) | 2.05 | 1.81-2.33 | 1.60 | 1.39-1.83 | <0.001 |
| Number of LTCs | | | | | |
| 0 | Ref | | Ref | | |
| 1 | 4.36 | 3.72-5.12 | 3.96 | 3.36-4.65 | <0.001 |
| 2-4 | 15.81 | 13.59-18.38 | 13.82 | 11.86-16.11 | <0.001 |
| 5+ | 43.76 | 36.60-52.32 | 36.49 | 30.41-43.79 | <0.001 |
| Ethnicity | | | | | |
| White British or Irish | Ref | | Ref | | |
| Other White | 0.56 | 0.49-0.63 | 0.69 | 0.61-0.79 | <0.001 |
| Caribbean | 0.71 | 0.62-0.81 | 0.57 | 0.50-0.65 | <0.001 |
| African | 0.70 | 0.62-0.80 | 0.74 | 0.64-0.85 | <0.001 |
| Black other | 0.92 | 0.74-1.15 | 0.82 | 0.65-1.03 | 0.084 |
| Indian/Pakistani/Bangladeshi | 0.77 | 0.62-0.95 | 0.83 | 0.67-1.04 | 0.105 |
| Chinese and other Asian | 0.48 | 0.38-0.60 | 0.62 | 0.49-0.79 | <0.001 |
| Other or unknown | 0.56 | 0.49-0.64 | 0.83 | 0.72-0.95 | 0.008 |

Table 2: Partially and fully adjusted Logistic regression (model 1) examining determinants of LTOP.
Abbreviations: IMD, Index of Multiple Deprivation; LTC, long-term condition.
Associations with LTOP. Partially adjusted logistic regression (by age and sex) and fully adjusted multilevel logistic regression (adjusted for variation between practices, number of LTCs, age, deprivation, smoking status, sex and ethnicity).
[a]Missing values smoking = 18 182, deprivation quintile = 3155 (299 504 patients included in complete case analysis).

LTCs compared to those with none (2-4 LTCs AOR 13.8, CI 11.9-16.1, ≥ 5 LTCs AOR 36.5, CI 30.4-43.8), increasing age in comparison to the 18-24 years group (≥75 years AOR 12.3, CI 7.1-21.5), current smoker compared to nonsmokers (AOR 2.9, CI 2.0-2.5), female sex (AOR 1.9, CI 1.7-2.0) and being in the most deprived quintile compared to the least deprived quintile (AOR 1.6, CI 1.4-1.8). We found the following ethnic groups had lower odds of LTOP, compared to White British or Irish: Caribbean (AOR 0.6, CI 0.5-0.7), Chinese and other Asian (AOR 0.62, 0.49-0.79), African (AOR 0.74, CI 0.64-0.85), other White (AOR 0.7, CI 0.6-0.8) and other (AOR 0.8, CI 0.7-1.0).

### 3.4.2 | Model 2 (Table 3)

A second fully adjusted logistic regression model was used to explore the association between LTOP and individual LTCs adjusted for age, sex, deprivation and ethnicity (see Table 3). The comorbidities most strongly associated with LTOP were SCD (AOR 18.4, CI 12.8-26.4), osteoarthritis (AOR 3.0, CI 2.8-3.3), rheumatoid arthritis (AOR 2.8, CI 2.2-3.4), depression (AOR 2.6, CI 2.3-2.8) and multiple sclerosis (AOR 2.5, CI 1.4-4.4). Other comorbidities significantly associated with LTOP were epilepsy, alcohol dependence, morbid obesity, COPD, asthma, serious mental illness, hypertension, diabetes mellitus, dementia and anxiety.

The residual class correlation of both models was significant ($P < .05$), suggesting significant practice variation and the appropriateness of a multilevel model. Multiple imputations using chained equations[37] were carried out to check the sensitivity of the models, which resulted in similar findings. Therefore, a complete case analysis was retained.

## 4 | DISCUSSION

We found that the prevalence of LTOP in the Lambeth population was 0.8% and 3.1% of the population had received an opioid prescription within the last 90 days. We found LTOP was more likely with multimorbidity, age 75 years or more, being a smoker, being female, living in a more deprived area or being White British or Irish.

When individual LTCs were assessed in a separate model, we found the associations with age, gender and deprivation remained. SCD was the LTC most strongly associated with LTOP. Long-term mental health conditions were associated with LTOP: anxiety, depression, severe mental illness and those with alcohol dependence. Rheumatological (rheumatoid arthritis and osteoarthritis), neurological (dementia, multiple sclerosis and epilepsy), respiratory (COPD and asthma) and metabolic conditions (type 2 diabetes and obesity) all showed association with LTOP, as did diagnosed hypertension.

### 4.1 | Strengths and limitations

The large amount of data and its relative completeness is a strength of the study, as well as the ability to link prescriptions to individual patients and their clinical, demographic, smoking status and area details is a strength of the study. Increasing LTOP with age and increasing number of LTCs seems plausible and congruent with what has previously been observed.[38]

However, the findings are subject to possible bias in the quality of coding in primary care records. For example, the accuracy of the LTC definitions is reliant on the detection of the conditions and coding in the patient notes. Some LTCs such as hypertension are known to be underdiagnosed.[29] In addition, prescription data does not include prescriptions issued elsewhere (eg, private prescriptions, secondary care), nor does it account for patient medication adherence, and an individual patient's level of deprivation may not correspond to that of their lower super output area (LSOA, IMD 2019).

The FoPM guidelines also state that a small proportion of chronic pain patients may derive benefit from LTOP,[9] therefore a proportion of the prescribing described may be appropriate. Our study did not take into account contraindications to alternative medicines, such as anti-inflammatories or paracetamol. Furthermore, the database did not allow us to identify patients at the end of life or under palliative care, where prescribing of ongoing opioid therapy may have been warranted. We did not include mortality as an outcome. We did not assess response to opioid therapy, as our database did not include any quality-of-life measures or functional assessments.

There is a risk of bias from the missing data, as the missing data was disproportionately from the non-LTOP group. This may be due to a group of patients who are not accessing healthcare, therefore not having their smoking status or postcode recorded and who are not likely to be prescribed opioids; the findings of association between smoking status or deprivation and LTOP should be interpreted with caution. We were unable to assess the duration of our prescriptions; it is possible that some patients with recurrent short-term opioid use were included. Guidance within Lambeth states that opioids should be issued as acute rather than repeat or long-duration prescriptions.[39] However, if patients have been issued <3 prescriptions but with a duration of opioid therapy >90 days, they will have been missed by our analysis. As we used a primary care database, we were unable to account for prescriptions in secondary care.

The cross-sectional analysis does not allow us to infer the temporality of the relationship or to attribute causality. In particular, the association with SCD may be due to opioids given to treat painful crises. There are also a number of potentially associated factors that were not analysed, including the number of patient medications, the number of GP consultations and whether or not patients had been referred to a pain clinic. Additionally, as in most EHR studies, we were unable to account for unmeasured confounders (eg, lifestyle factors).

Finally, the generalisability of the findings is impacted by the Lambeth population being on average younger, more ethnically diverse and significantly more deprived than the UK average.

### 4.2 | Comparison with literature

A US primary care study showed 1.1% of patients were receiving opioid prescriptions for 3 months or longer.[40] A recent national database study in the UK estimated that 2.7% of the UK population had been on continuous opioid prescriptions for 12 months or more.[41] This is higher than we observed. However, opioid prescribing in Lambeth is lower than the UK average.[3,42]

In agreement with our findings, previous studies have reported the increased likelihood of opioid prescribing in women and older age groups.[7,19,43–45] The elderly are at greater risk of cardiovascular disease,[46] renal impairment,[47] gastrointestinal bleeds[48] and hepatic disease,[49] which may make alternative analgesia such as anti-inflammatories and paracetamol less appropriate. However, we noted

**TABLE 3** LTCs associated with LTOP. Multilevel fully adjusted logistic regression (adjusted for age, sex, deprivation, ethnicity, other significant LTCs and practice-practice prescribing variation)

| | Odds ratio | 95% confidence interval | *P* value |
|---|---|---|---|
| Individual LTCs | | | |
| Sickle cell disease | 18.41 | 12.82-26.41 | <0.001 |
| Osteoarthritis | 3.04 | 2.76-3.34 | <0.001 |
| Rheumatoid arthritis | 2.77 | 2.22-3.44 | <0.001 |
| Depression | 2.55 | 2.31-2.82 | <0.001 |
| Multiple sclerosis | 2.50 | 1.41-4.41 | 0.002 |
| Epilepsy | 2.43 | 1.84-3.20 | <0.001 |
| Alcohol dependence | 2.20 | 1.91-2.53 | <0.001 |
| Morbid obesity | 1.96 | 1.72-2.24 | <0.001 |
| COPD | 1.77 | 1.53-2.04 | <0.001 |
| Asthma | 1.77 | 1.57-1.98 | <0.001 |
| Severe mental illness | 1.70 | 1.41-2.03 | <0.001 |
| Hypertension | 1.70 | 1.55-1.88 | <0.001 |
| Diabetes mellitus | 1.49 | 1.35-1.65 | <0.001 |
| Dementia | 1.42 | 1.13-1.79 | 0.003 |
| Anxiety | 1.41 | 1.28-1.56 | <0.001 |
| Sex | | | |
| Male | Ref | Ref | |
| Female | 1.54 | 1.42-1.69 | <0.001 |
| Age (years) | | | |
| 18-24 | Ref | Ref | |
| 25-44 | 2.85 | 1.63-4.97 | <0.001 |
| 45-64 | 11.29 | 6.52-19.57 | <0.001 |
| 65-74 | 14.12 | 8.07-24.69 | <0.001 |
| 75+ | 22.29 | 12.72-39.06 | <0.001 |
| Smoking status* | | | |
| Nonsmoker | Ref | Ref | |
| Exsmoker | 1.47 | 1.33-1.62 | <0.001 |
| Smoker | 2.05 | 1.84-2.29 | <0.001 |
| IMD (2019) quintile of deprivation* | | | |
| 1 (least deprived) | Ref | Ref | |
| 2 | 1.21 | 1.05-1.40 | 0.009 |
| 3 | 1.23 | 1.07-1.43 | 0.004 |
| 4 | 1.43 | 1.25-1.65 | <0.001 |
| 5 (most deprived) | 1.59 | 1.32-1.75 | <0.001 |
| Ethic group | | | |
| White British or Irish | Ref | Ref | |
| Other White | 0.69 | 0.61-0.78 | <0.001 |
| Caribbean | 0.59 | 0.51-0.67 | <0.001 |
| African | 0.81 | 0.70-0.94 | 0.004 |
| Black other | 0.83 | 0.66-1.06 | 0.136 |
| Indian/Pakistani/Bangladeshi | 0.91 | 0.72-1.14 | 0.389 |
| Chinese and other Asian | 0.68 | 0.53-0.86 | 0.002 |
| Other or unknown | 0.83 | 0.72-0.95 | 0.008 |

*Missing values smoking = 18 182, deprivation quintile = 3155 (299 504 patients included in complete case analysis).
Abbreviations: IMD, Index of Multiple Deprivation; LTC, long-term condition; LTOP, long-term opioid prescribing.

that chronic kidney disease, liver disease, heart failure and coronary artery disease were not associated with long-term opioid prescribing in our analysis.

Opioid use disorder is more common in the elderly than other age groups, but is under-recognised.[50] A proportion of these patients have developed opioid use disorder from taking prescription opioids.[51] The elderly have a higher rate of medical complications from this drug use. In the UK and Canada guidelines have been developed to target opioid use disorder in this age group.[50,51]

A US study looking at opioid prescribing of greater than 3 months found that opioid prescribing was higher in the Black or African American population,[40] in contrast to our study. However, the US study used a different ethnic classification and did not adjust for LTCs.

Our study confirms the finding that patients with depression and anxiety diagnoses are associated with opioid initiation and prescribing of opioids for noncancer pain.[38,52,53] Other studies have found an association between LTOP and a diagnosis of arthritis in older adults or rheumatoid arthritis.[54–56]

The associations we have shown may be explained by the differences in how specific groups experience pain; the elderly,[57,58] females,[59] the depressed[60] and those with SCD[61] have all previously been shown to have lower pain thresholds or tolerance. Therefore, analgesia requests may be more likely in these groups. Chronic pain is associated with developing alcohol dependence[62]; there may be confounding in our observed relationship between alcohol dependence and opioids.

### 4.3 | Implications for research and practice

We have confirmed the roles of multimorbidity, age, gender, ethnicity and deprivation in LTOP in a deprived multi-ethnic urban population. We have also identified that LTCs such as SCD have the highest odds of LTOP.

Higher doses and more frequent use of opioids in SCD patients have been associated with chronic pain and decreased health-related quality of life.[63] Daily use of opioids in sickle cell patients has been associated with increased somatic symptoms burden and decreased mental and physical quality of life.[64] The association between LTOP and respiratory conditions such as asthma and COPD is of particular concern. A previous study in Ontario has shown higher use of opioids in COPD populations with increase in usage associated with exacerbations.[65] Opioid use to palliate dyspnoea in end-stage COPD may be considered appropriate,[66] but this is likely to reflect a very small number of cases. Conversely, there is a wide range of evidence that opioid use in COPD is related to worse health outcomes, including increased hospital admission, and respiratory and all-cause mortality.[67–69] Similarly, in alcohol-dependent patients LTOP increases the risks associated with opioid prescribing and is known to be associated with poorer health outcomes and an increased risk of alcohol-related deaths.[70,71]

Further work needs to be done to characterise the association of multimorbidity and LTCs with LTOP. Longitudinal studies would help to characterise the temporality of the relationship.

Some of the LTCs identified are patient groups with significant risk of harm from opioids, such as COPD, asthma and patients with alcohol dependence. These groups may benefit from targeted interventions to reduce LTOP. Increased mortality in LTOP was recently highlighted by NICE[23]; more research needs to be done to examine which groups with LTOP are most at risk.

Public health and clinical policies should be targeted at the vulnerable groups identified in this study to reduce inappropriate LTOP. Interventions could be designed to address previously identified barriers to safe opioid prescribing, addressing gaps in knowledge, reducing time pressure, introducing prescription monitoring programmes and improving access to pain management services.[72,73]

## 5 | CONCLUSION

Increasing levels of opioid prescribing in recent years has public health implications, with greater population exposure to their potential harms. We have shown that some of the groups most vulnerable to harm, the elderly and those with multiple LTCs, respiratory conditions, depression and alcohol dependence, are more likely to be prescribed potentially inappropriate long-term opioids. Future research and policy interventions should be focussed on reducing prescribing in these most vulnerable groups.

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### CONFLICT OF INTEREST

M.N. is GP Academic Clinical Fellow working at a practice within the Lambeth Lambeth Clinical Commissioning Group.

### CONTRIBUTORS

M.N.: conception, design, analysis and paper writing; P.R.: design, supervision, statistical support, editing of paper; S.D.: data extraction and manipulation; M.A.: data extraction, paper editing; M.M.: design, supervision, analysis, editing and final draft of paper.

### DATA AVAILABILITY STATEMENT

Due to the nature of this research the participants did not agree for their data to be shared publicly, so supporting data is not available.

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