Influences on the use of antidepressants in primary care: All England general practice-level analysis of demographic, practice-level and prescriber factors

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Abstract
Introduction: General practice (GP) antidepressants (ADs) prescribing in England has almost doubled in the past decade: how does location, GP characteristics, and prescribing selection influence antidepressant prescribing rate (ADPR) and growth.

Methods: Stepwise multivariate regression analysis was applied to national public relevant data for each general practice to establish associations between these factors and ADPR. The regression coefficient was applied to the actual change in the number of different ADs and costs/dose to extrapolate the impact of these on growth.

Results: In 2017–2018, 2.1 billion doses of antidepressant were prescribed into a population of 52 million people in 6,146 larger practices. In the model, location demographics accounted for 62% of the variation in ADPR: including practice size and health raised this to 71%, and local prescribing behaviour to 80%. Practices using more different drugs and lower-cost/dose had higher ADPR. Extrapolation showed that 40% of growth in ADPR could be attributed to the historic changes in these factors.

Conclusions: While practice location factors do impact on AD prescription rates, local long-term physical health condition prevalence and prescribing behaviours are almost as important. We hope that our findings can provide insights that are helpful to local clinical behaviour and medicines management.

KEYWORDS
antidepressant, cost, prescribing, primary care

1 INTRODUCTION

The number of prescriptions for antidepressants (ADs) in England has almost doubled in the past decade. Data from NHS Digital show that 70.9 million prescriptions for ADs were given out in 2018, compared with 36 million in 2008 (Iacobucci, 2019).

Evidence suggests that medication prescribing for many chronic health conditions, particularly in older persons is often inappropriate (Spinewine et al., 2007) with associated increases in morbidity and economic burden (Simonson & Feinberg, 2005).

In 2017, one in six adults in England was prescribed ADs. The United Kingdom figures, covering the NHS as a whole, saw a total of 7.3 million people given at least one AD prescription in 2017. This included more than 70,000 people under the age of 18 years. Those aged over 60 were twice as likely as those in their twenties to be on ADs. One in five people in towns such as Blackpool and Great...
Yarmouth was prescribed ADs in 2017, while in London the figure was less than 1 in 10 (www.pulsetoday.co.uk).

We have previously applied multivariate regression analysis on publicly available NHS data at the general practice level to identify how general practice factors relate to outcome in terms of glycosylated haemoglobin (HbA1c) (Heald et al., 2017, 2018). This approach can be generalised to other areas of medicine, including prescribing in psychiatry and has proved informative in terms of appreciating the drivers of prescribing year-on-year in several long-term conditions.

This exploratory study using national-level data aimed to look at how a range of quantifiable and nationally audited factors at a general practice (family doctor practice) relate to general the practice variation in antidepressant prescribing rate (ADPR) across England.

2 | METHODS

We collected the England national public published population demographic, practice characteristics and AD prescribing behaviour in each general practice and year and used multivariate regression analysis to establish their link to the practice ADPR. Only general practices with more than 2,000 registered patients (i.e. requiring ≥ one full-time general practitioner) were included in the analysis.

Defined Daily Dose levels (DDD) as published by the Anatomical Therapeutic Chemical Classification System with World Health Organisation Anatomical Therapeutical Chemical (WHO/ATC) (Defined Daily Dose [DDD]) were applied to convert the General Practice Prescribing data (GP Practice Prescribing Presentation-level Data. NHS Digital, 2019) into doses of AD.

The population demographic, general practice processes and prescribing behaviour in each practice and year were analysed.

We examined three different classes of possible factors that could influence the ADPR.

1. Location and demographics
   - Population age distribution and gender
   - Social deprivation
   - Ethnicity % black and minority ethnicity (BME)
   - Latitude (Northerliness)
   - Population density (urban/rural)
2. Practice characteristics
   - List size
   - Practice-level comorbidities (depression, diabetes, chronic obstructive pulmonary disease [COPD])
   - Patient experience (as evidenced by the National Patient Survey [National patient survey ref])
   - General practitioner workforce (age, gender, country of qualification [COQ])
3. Practice MH prescribing behaviour
   - Use of antipsychotic DDD/pop
   - Use anxiolytic and hypnotic DDD/pop
   - Number of different types of antidepressant (AD) (Chem/Dose/Method)
   - AD doses/prescription
   - AD average cost/dose
   - Mix of different ADs—%Tricyclic ADs % other ADs (agents rarely prescribed)

2.1 | Statistical analysis

Stepwise multivariate regression analysis was used to establish the link between these factors to the ADPR at a general practice level. Only factors that had a p-value < .05 were retained within the analysis. As many factors are not independent of each other, this analysis was carried out both for each class (location, characteristics and prescribing behaviour) and across all classes and factors.

The impact over the last 4 years of the change in the number of different ADs and their average cost/dose was evaluated by applying the regression coefficients taken from the model associated with these factors to the difference in the annual average value of costs/dose and number of different AD to quantify how much of the overall increase in ADPR could be linked to these changes. The relationship between change as measured by 2017/2018 value as % of 2014/2015 in both costs/dose and Quantity for each different AD was also considered.

2.2 | Ethical approval

As we used publicly available general practice-level data, with no individual patient data, it was not considered necessary to seek Ethics Approval for this study.
ADPR was measured in defined daily doses of AD/head of population/day. The number of AD prescriptions steadily increased year-on-year, with 64.7 million given out in 2016 and 67.5 million prescribed. In the 3 years from 2014–2015 to 2017–2018 in general practices in England, there was a 37% rise in the number of people being recorded on the depression register and 22% rise in total doses of ADs.

**FIGURE 2** Cross-sectional analysis of the link between practice-level factors and AD prescribing. AD, antidepressant
Total costs of ADs fell 15%, a reduction in the unit cost of 35%. The total number of different unique ADs at different dose levels increased from 94 to 107 in 2017–2018, with 2.1 billion doses of AD being prescribed into a total population of 52 million people. Average ADPR, Defined Daily Doses of AD/head population/day, was 0.096 and 80% of practices lay between 50 and 150% of this value. This highlights the wide variation in the use of antidepressants by local practices (Figure 1).

3.1 Multiple regression analysis

Location and demographics including age, gender, ethnicity, social deprivation, population density and latitude accounted for 62% of the variation (Figure 2). The results for each of the factors that were included in the final model are shown in Table S1.

Practice characteristics on their own including levels of comorbidities including depression could account for 62% of the variation. It is worth noting that the univariate analysis for % of patients on the depression register accounted for 30% of the variation in overall ADPR.

The prescribing behaviours accounted for 51% of prescribing variation. The remaining explained variation came from practice prescribing behaviour including the number and mix and costs of different ADs being prescribed. Practices with higher cost/dose had lower ADPR, those using a higher number of different ADs had higher ADPR.

As many factors were codependent, that is, age, social disadvantage and BME ethnicity could impact on comorbidities and prescribing behaviour so when all the factors were included, the model could account for 81% of the variation in GP practice ADPR.

Factors cross-sectionally linked with relatively more AD prescribing at general practice level included:

- Higher proportion of people with COPD and diabetes as major comorbidities
- Greater social deprivation of the practice population
- More northerly latitude
- A higher proportion of women on the general practice list
- Higher ratings for on the National Patient Survey for the question “In the last 12 months have you had enough support from local services or organisations to help you manage your condition or conditions?”
- Higher DDD of antidepressants prescribed and higher prescribing of tricyclic antidepressants and antidepressants rarely prescribed.

Factors cross-sectionally linked with relatively less AD prescribing at general practice level included:

- Higher proportion of BAME patients at the practice
- Higher proportion of older general practitioners (GPs) (>56 years old) and of GPs not United Kingdom trained
- The general practice being in a more densely populated area

![Figure 3](image-url)
• Proportionately higher rating for the practice for the question "How confident are you that you can manage any issues arising from your condition or conditions?"
• A higher proportion of people aged 60 or more on the practice list
• Larger general practice list size
• Higher cost of each DDD of AD

There was no relation of prescribing to general practice % of adolescents on the general practice list.

3.2 Cost and AD prescribing rate

The multivariate regression highlighted that practices with higher cost/dose had lower ADPR. Also, those using a higher number of different ADs had higher ADPR, and there was a significant reduction in costs of antidepressant and growth in the use of different ADs in each practice over the last 3 years. Applying the regression coefficient for both these factors to the change in unit cost and number of different ADs over the previous 36 months showed that 49% of the increase in ADPR could be linked to the increasing use of lower-cost agents and increasing variety of ADs prescribed (Figure 3).

Linking the particulars of ADs change in costs/dose to their relative growth is shown in Figure 3. Where the larger circle associates with a higher volume of prescribing. The dashed inner circle is the 2014/2015 prescribing volume versus the outer circle displaying 2017/2018 prescribing volume.

When examining relative change in prescribing amount in the last 3 years, the strongest growth was in those agents that had reduced costs.

4 DISCUSSION

ADs may be being prescribed more often as they are a lower-cost option. However demographic influences, socioeconomic deprivation, population density and location of the general practice are also important factors associated with increasing prescriptions at the general practice level.

This analysis highlights the opportunity to review the ADPR in each general practice reducing variation by optimising their prescribing range. This has implications for local clinical behaviour and medicines management across a locality in the United Kingdom or elsewhere.

The escalating prescription rate for ADs in the United Kingdom is cause for much debate in the public domain and among health care professionals. Our analysis is the first study to look at the determinants of prescribing at a general practice level. The increase in prescribing of Sertraline between 2014/2015 and 18 May 2017 well relate to the influence of earlier metanalyses on acceptability versus efficacy of antidepressant medication (https://cks.nice.org.uk/).

The association of comorbidities—COPD and diabetes with increased AD prescribing highlights the importance of holistically addressing long-term health concerning the impact of long-term physical conditions on mental health. The influence of GP practice size and location on AD prescribing has not been reported before. The finding that a higher overall social disadvantage level is associated with greater prescribing of ADs is not surprising. Conversely, the link between higher proportion BAME ethnicity in the GP practice and lower AD prescribing may be a marker for profound cultural influences on the way that individuals perceive symptoms of depression and the implications of those symptoms.

We have recently described using national GP practice-level data how the empowerment of individuals in managing long-term conditions, has the potential to reduce GP practice level prescribing of ADs (Heald et al., 2020). Practices more effective in empowering their patients as assessed by "How confident are you that you can manage any issues arising from your condition (or conditions)?", was non-linear with less antidepressants prescribed for both high and low responses. The difference between the lowest and highest decile of prescribing for this response was over 10% and potentially modified by changing practice approach. Therefore measures that facilitate patient empowerment can potentially decrease the level of antidepressant prescribing.

We have shown that demographic factors, socioeconomic deprivation, population density and location are also important factors associated with increasing prescriptions. Further research is needed to examine whether prescriptions are being effectively prescribed and whether areas of lower prescribing have lower rates of depression, higher unmet need or better use of non-pharmacological strategies. We nevertheless accept that we are applying at an individual level, conclusions drawn from general practice-level analysis.

The limitations of our analysis are that it does not look at individual patient data and only includes data that is recorded on national registries. However, the data covers all GP surgeries in England and is, therefore, representative of the determinants of antidepressant prescribing across these nations.

5 CONCLUSION

The results represent a benchmark against which general practices can establish their baseline ADPR, incorporating their local demographic and practice profile—and then consider mix and relevance of the various ADs to enhance the patient benefit of their prescribing protocols.

We hope that our findings can inform local clinical behaviour, medicines management recommendations and provide insight that is helpful to general practices.

AUTHOR CONTRIBUTIONS

Adrian H. Heald and Mike Stedman conceived the study. Adrian H. Heald, Mike Stedman and Mark Davies conducted the data analysis. Adrian H. Heald, Mike Stedman, Mark Davies, Sanam Farman, David Taylor, Rachel Upthegrove and Roger Gadsby all contributed to the writing of the manuscript. David Taylor, Rachel Upthegrove and...
Roger Gadsby provided an overview of the manuscript before submission.

**DATA AVAILABILITY STATEMENT**
Any requests for data extracts will be considered by Dr Adrian H. Heald as the corresponding author.

**ETHICS STATEMENT**
As we used publicly available and GP level data, with no individual patient data, it was not necessary to seek Ethics Approval for this study.

**CONFLICT OF INTEREST**
The authors declare no conflicts of interest.

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**SUPPORTING INFORMATION**
Additional supporting information may be found online in the Supporting Information section at the end of this article.

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