Health policy 140 (2024) 104967

Contents lists available at ScienceDirect

Health policy

journal homepage: www.elsevier.com/locate/healthpol

Overseas general practitioners (GPs) and prescription behaviour in England

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ARTICLE INFO

JEL classification:
I1
C01
C55
C8

Keywords:
GPs
Immigration
Prescriptions
NHS England

ABSTRACT

The UK imports many doctors from abroad, where medical training and experience may differ. This study aims to understand how drug prescription behaviour varies in English GP practices with higher shares of foreign-trained GPs. Results indicate that in general prac- tices with a high proportion of GPs trained outside the UK, there are higher prescriptions for antibiotics, mental health medication, analgesics, antacids, and statins, while controlling for patient and practice characteristics. However, we found no significant impact on pa- tient satisfaction or unplanned hospitalisations, suggesting that this behaviour may be due to over-prescribing. Identifying differences in prescribing habits amongst GPs is crucial in deter- mining best policies for ensuring consistent services across GP practices and reducing health inequalities.

1. Introduction

A global workforce crisis in healthcare is looming. The WHO estimates that by 2030 there will be a global shortage of approximately 18 million health workers, corresponding to 20 % of the workforce needed to keep healthcare systems going [4]. The UK is no exception, being its health service heavily dependent on foreign clinical staff. Currently, the share of foreign-trained doctors is as high as 31 % in the UK, compared to 29 % in Sweden, 19 % in Finland and approximately 13 % in Germany and France. As the supply of physicians from British medical schools has been inadequate, over the past decades the UK has recruited physicians trained abroad both from European and non-European countries [21, 23]. This raises the issue of potential differences in the behaviour of UK-trained versus foreign-trained physicians operating in the UK. Specifically, we aim to undercover any prescription differences amongst UK-trained and foreign-trained general practitioners (GPs) working in English general practices. We focus on GPs as they serve as the initial point of contact for patients, and as such their attitude and prescription behaviour can profoundly influence population health outcomes. Furthermore, addressing the shortage of General Practitioners and the recruitment of foreign GPs has been identified as a top priority in the UK [3,19]. Understanding how GPs trained overseas operate within the English general practices is important to shape future policies (i) to identify the competencies that a foreign-trade GP needs to develop to match those of UK trained doctors, (ii) to guarantee a consistent prescribing behaviour across GPs, and (iii) to be able to attract more overseas GPs to the UK.

In this study, we investigate the prescription behaviour of UK-trained versus foreign-trained physicians in all English general practices in 2019, specifically examining their prescription ap- proach in relation to different drug categories, such as antibiotics, antacids, analgesics, statins, and mental-health drugs. Moreover, we explore the potential underlying mechanisms leading to these divergent patterns, and based on the evidence we offer targeted policy recommendations. In spite of the significance and relevance of this issue, the literature on the topic is scant. Few papers focus on the differences in practice patterns between physicians trained domestically and abroad. Descriptive evidence documents of non-UK qualified GPs working longer hours, and serv- ing a larger number of patients, mainly in more deprived areas [2,9,22]. Examining efficiency indicators in Norway, Sandvik et al. [20] finds minor differences in patient contacts per doctor, sickness certification and length of consultations amongst domestically trained versus foreign-trained GPs. Finally, some papers focus specifically on differences in antibiotics prescriptions amongst domestically trained versus foreign- trained GPs, with contrasting findings [5,12,16]. A comprehensive comparative study investigating drug prescribing patterns based

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https://doi.org/10.1016/j.healthpol.2023.104967
Received 8 June 2023; Received in revised form 27 November 2023; Accepted 11 December 2023
Available online 19 December 2023

on diagnosis is currently lacking. Furthermore, our research takes a step beyond by uncovering potential underlying mechanisms contributing to this observed phenomenon, allowing us to offer targeted policy recommendations.

The continued funding squeeze in the health sector, a fast ageing population, and the need to safeguard quality care have put increasing pressure on the UK health system [23]. Recruiting doctors of all levels has proven to be extremely difficult, resulting in many hospital specialties having to operate with incomplete rotas filled by covering trainees [25]. Due to Brexit, the shortage of GPs in recent years has worsened [6,8,19], leading to increased recruitment of overseas doctors by the UK's National Health Service (NHS). Currently, almost 40 % of GPs practising in the UK have trained abroad, compared to a third in the US, with India, Pakistan, and Nigeria being the largest providers [7]. However, the terms of the UK's exit from the European Union may affect the ability of European Economic Area (EEA) qualified doctors to work in the UK [13], while new visa requirements might have a significant impact on the inflow of non-EEA doctors [8]. As a consequence of the doctors shortage, and in order to facilitate the recruitment of doctors from overseas, the NHS has introduced in 2020 the NHS England's International GP Recruitment Programme [17].

After accounting for practice and patient characteristics, we find that GP practices with a higher proportion of physicians trained outside the UK exhibit a higher number of drug prescrip- tions across all drug categories analysed. In order to understand the potential underlying driving forces, we explore its impact on patients. Our findings indicate that the difference in prescription behaviour does not impact patient satisfaction or unplanned hospitalisations. Thus, we are able to rule out the hypothesis of an under-prescribing behaviour of domestically trained GPs as well as of a higher willingness of foreign-trained GPs to satisfy patients' requests to better integrate into the UK and the local community. Our findings seem to suggest that the different prescription patterns might be linked to an over-prescribing behaviour of foreign-trained GPs. This evidence points to the different training received and the training environment as possible important contributors. Although to become GPs in the UK it is necessary for the physicians to be registered internally and for their degrees to be recognised,[1] foreign-trained doctors are likely to retain their previous attitudes and behaviours in their prescription pattern [15]. When moving to the UK, these doctors encounter many cultural differences, in relation to training, the healthcare system and the doctor-patient relationship and training [5]. As such, foreign- trained GPs may continue to prescribe drugs in accordance with cultural expectations, in line with their country of training medical settings or epidemiological and demographic patterns [10].

Our investigation is therefore paramount to undercover potential differences in prescription behaviour between UK-trained and foreign-trained physicians and to shape future policies aimed at ensuring consistent prescribing behaviour across all GPs. Moreover, the study aims to identify the competencies that foreign-trained GPs need to develop to match those of UK-trained doctors and to attract more overseas GPs to the UK. Along these lines, the UK General Medical Council (GMC) is developing a methodology for comparing GP training and experiences in overseas countries, with the aim of identifying programs closer to those provided in the UK. The insights gained from this research could be used to inform future healthcare workforce planning and policies, which are crucial to address the global workforce crisis in healthcare

The rest of the paper is organised as follows. Section 2 describes the data and illustrates the methodology used for the estimation while Section 3 reports the findings. Section 4 concludes the paper with a discussion of potential mechanisms at play.

[1]ChatGPT According to European law, the training of General Practitioners (GPs) from countries within the European Economic Area (EEA) is recognised as equivalent to the training provided in the UK. Thus, EEA GPs who apply to practise in the UK are automatically registered as GPs by the UK's GMC. Non-EEA GPs who apply to join the UK GP register need to obtain a CEGPR. The CEGPR application process involves an initial assessment by the GMC, and the provision of substantial documentary evidence of the GPs' training, qualifications, and experience. This evidence is then assessed by the Royal College of General Practitioners (RCGP) before a final decision on eligibility is made by the GMC [10].

2. Methods

2.1. Data

Our study utilised data from various sources, with the primary data source being the National Health Applications and Infrastructure Services (NHAIS)/'Exeter' GP payment system. This computerised payment system is used by GPs in England and provides doctor-level data for all GPs who are employed. The data includes information on the GP's age and gender, the GP practice where they work, their full-time equivalent (FTE) status, their GP type (partner, trainee, salaried, or retainer), as well as their country of qualification. This data allowed us to analyse and compare the prescription behaviour of GPs trained in the UK with those trained outside of the UK.

Fig. 1 presents the percentages of GPs who received their medical training outside of the UK across different Clinical Commissioning Groups (CCGs). The data indicate that in 2019, more than one in five GPs in England were trained abroad. Specifically, out of the 209 CCGs, 14 had over 50 % of their GPs trained outside of the UK. In some regions, such as Barking and Dagenham in London, two-thirds of the GPs were trained outside of the UK. These areas were significantly impacted by immigration, experiencing a 205 % increase in non-UK born residents during the period 2001–2011 (See for instance: https://en.wikipedia.org/wiki/London_Borough_of_Barking_ and_Dagenham#cite_note-11)

We also have information on the total number of patients in each practice by gender and age. Unfortunately, the dataset does not provide information on patients' ethnicity. Therefore, we use data on the ethnic composition of the population at Lower Layer Super Output Areas (LSOAs) level from the 2011 Census. LSOAs are standard areas created by the Office for National Statistics for the reporting of small-area statistics. They are fairly homogeneous in terms of population size, allowing for comparisons over time and across areas. There are 32,844 LSOAs in England, with an average population of 1500 people or 650 households. By mapping GP practices and patients resident in each LSOA, we are able to estimate the number of patients by ethnicity at the GP practice level.

Similarly, we create the index of multiple deprivation (IMD) at the GP practice level. The IMD index, which is available at LSOA level, is a measure of relative deprivation for small areas based on 37 separate indicators grouped into seven domains, each of which reflects a different aspect of deprivation experienced by individuals living in an area. By mapping GP practices and patients resident in each LSOA, we estimate the index of multiple deprivation (IMD, 2019) at GP practice level.

From the Quality and Outcomes Framework (QOF) we extract data on disease prevalence at GP practice level. Finally, using the GP practice code, we include data from the English Prescribing dataset (EPD), which offers information on monthly drug prescriptions at the GP practice level. From this dataset, we extract information on the number of items, i.e., the number of times a specific drug has been prescribed within each GP practice. Fig. 2 reports the distributions of the number of prescriptions per patient for the different types of drugs considered (antibiotics, mental health, antacids, and analgesics). On average, patients were prescribed less than one antibiotic and antacid per month in 2019, but 1.4 analgesics and 2.4 mental health drugs.

To investigate possible mechanisms driving the main results, we included additional data sources in our analysis. Firstly, we extracted data on patients' satisfaction from the GP Pa- tient Survey. We selected various measures of overall patient satisfaction. Along with an overall

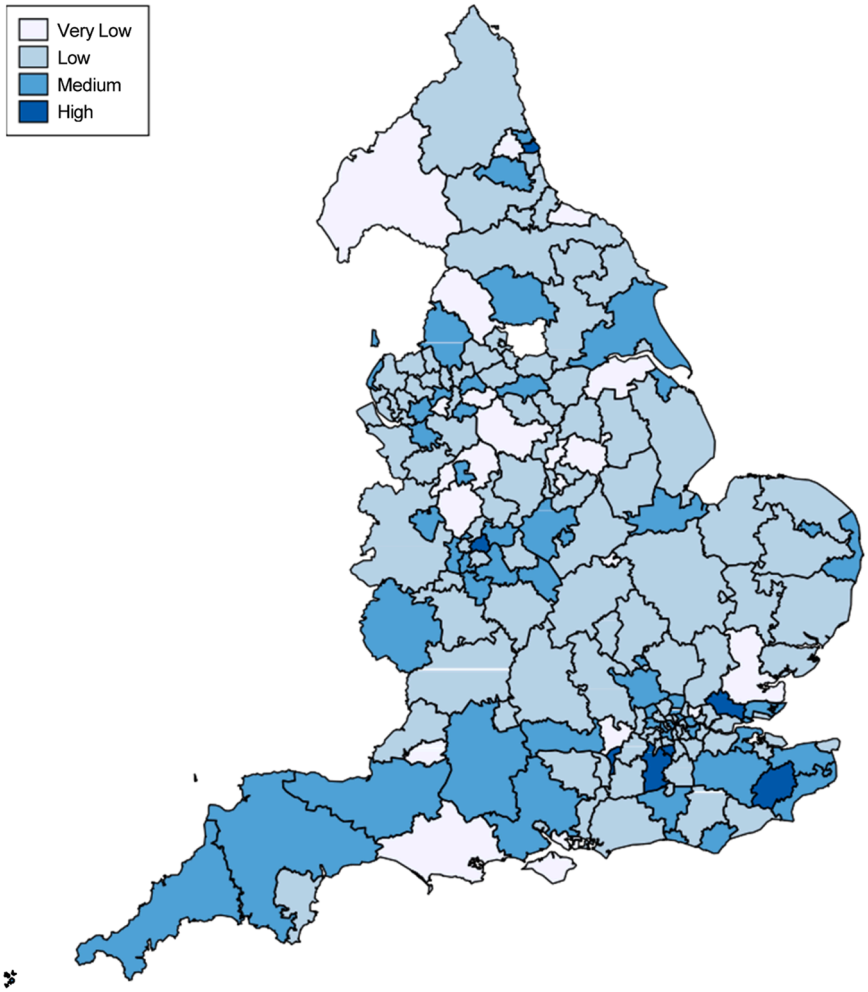

Fig. 1. Share of GPs trained abroad by CCGs in England in 2019. Very Low: 0–0.20; Low:0.20- 0.40; Medium: 0.40–0.60; High: 0.60–0.80; Very High: >0.80.

indicator for general satisfaction, we included GPs' understanding of patient mental health needs, involvement of patients in the GP's decision-making, satisfaction with making an appointment, description of the experience with the appointment received, whether the appointment met the patient's needs, and whether patients received support from the healthcare professionals in the practice.

Our second data source is the NHS Outcomes Framework Indicators available online, from which we select an indicator for unplanned hospitalisation at CCG level. This indicator measures the number of individuals with specific long-term conditions who, with appropriate treatment, could have avoided hospitalisation, but were still admitted to the hospital as an emergency. Examples of these conditions include diabetes, epilepsy, and high blood pressure. We normalise this indicator by dividing it by the CCG population, allowing us to assess the NHS's success in reducing emergency admissions for long-term conditions.

Finally, we employed data on emergency admissions at the practice level from NHS Digital, which is calculated from hospital reports. Our variable is constructed as the number of emergency admissions weighted by the total number of patients in a specific practice. Our final dataset is a panel consisting of 5937 GP practices in England, observed each month in 2019, for a total of 72,156 observations.

2.2. Empirical analysis

We examine the prescription behaviour of GPs with varying training backgrounds by utilizing the differing proportions of overseas-trained GPs across GP practices in England during 2019. We conduct a regression analysis, where the dependent variable is the average number of drug items prescribed per patient in each GP practice. To obtain this variable, we divide the total number of drug items prescribed in each GP practice by the total number of patients. We then regress this variable against the proportion of GPs in each practice who received their training overseas. We focus our analysis on five types of drug prescriptions that are commonly used by patients: antibiotics, antacids, analgesics, statins, and mental health drugs.

We control for several practice characteristics in our analysis, including the age and gender of GPs, the size of the practice, and the composition of patients by age, gender, and ethnicity. These demographic features may be associated with varying levels of disease exposure. We also control for disease prevalence and the index of deprivation at the GP practice level to account for the overall health of patients in the area, as individuals with lower socioeconomic status often have poorer health outcomes. Additionally, we include region-fixed effects to control for time-invariant characteristics specific to each geographic area, and month-fixed effects to take into account for unobservables that change over time but are constant over practices.

To understand whether a different prescription pattern may be associated with the presence of GPs trained in specific areas of the world, we also decompose the GP shares according to the broad geographical area where they received their degrees.

3. Results

Tables 1 and 2 report descriptive statistics for GPs and patients,

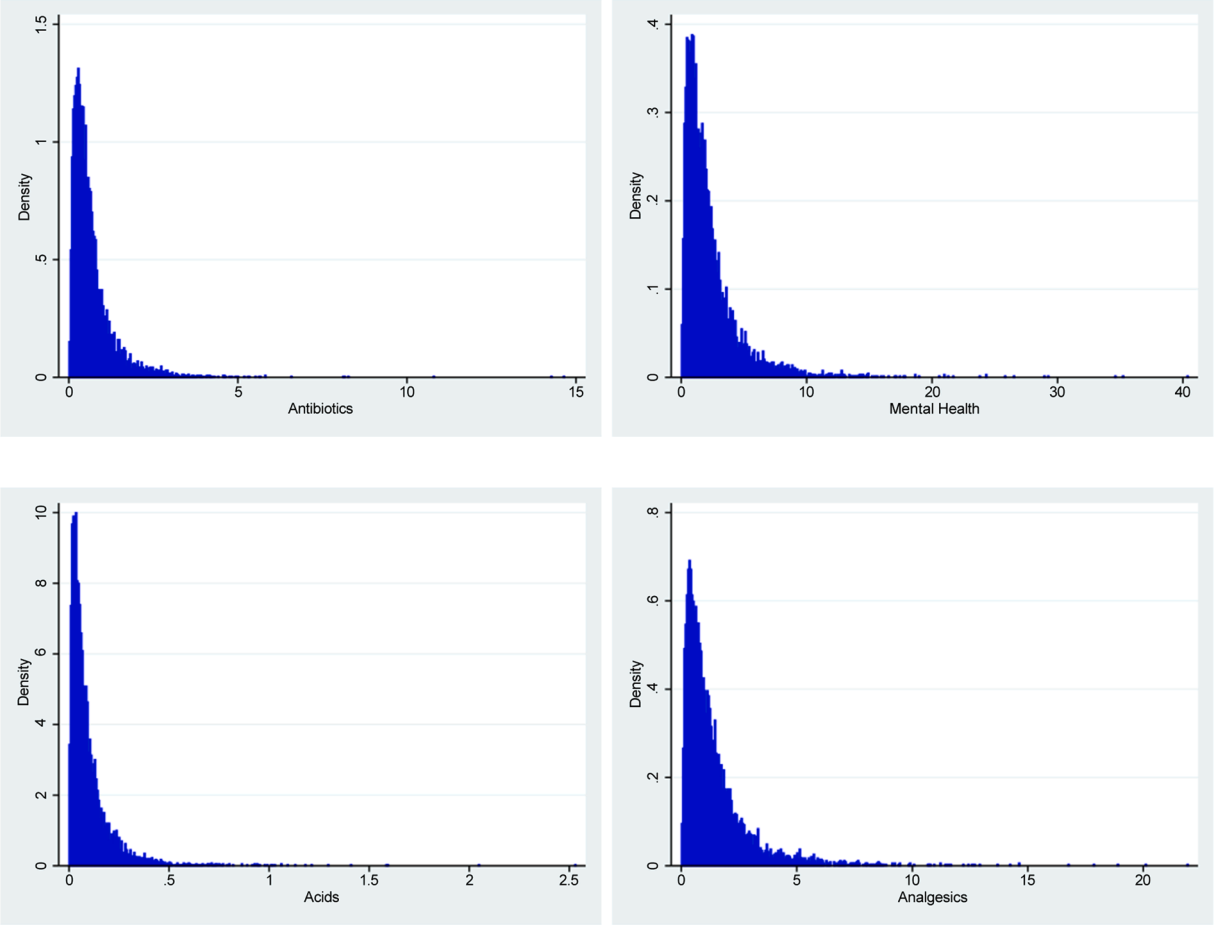

Fig. 2. Distribution of prescriptions per patient for different drugs.

Table 1
Summary statistics (GPs).

	Mean	Std. Dev.	Min	Max	Obs
Gender					
Female	.516	.239	0	1	72,156
Country of education					
Immigrant	.346	.312	0	1	72,156
EEA	.044	.113	0	1	72,156
Other EU	.007	.043	0	1	72,156
UK	.654	.312	0	1	72,156
Africa	.044	.124	0	1	72,156
Asia Other	.004	.037	0	1	72,156
Asia South	.155	.249	0	1	72,156
Australia/Pacific	.002	.02	0	.5	72,156
Central America	.004	.036	0	1	72,156
North America	0	.004	0	.167	72,156
South America	.001	.015	0	.5	72,156
Middle East	.011	.062	0	1	72,156
Age-category					
Under 30	.044	.09	0	1	72,156
30–34	.117	.146	0	1	72,156
35–39	.151	.17	0	1	72,156
40–44	.161	.183	0	1	72,156
45–49	.15	.191	0	1	72,156
50–54	.126	.17	0	1	72,156
55–59	.121	.178	0	1	72,156
60–64	.056	.131	0	1	72,156
65–69	.03	.11	0	1	72,156
>70	.033	.127	0	1	72,156
Deprivation Index					
IMD	23.247	11.554	3.382	68.834	72,156

Table 2
Summary statistics (Patients).

	Mean	Std. Dev.	Min	Max	Obs
Gender					
Female	.497	.025	.159	.686	72,156
Ethnicity					
White	.831	.198	.124	.995	72,156
Black	.04	.065	0	.437	72,156
Asian	.093	.134	.001	.782	72,156
Mixed	.024	.018	.001	.114	72,156
Age-category by gender					
Male 0–4	.027	.007	0	.081	72,156
Male 5–14	.061	.014	0	.147	72,156
Male 15–44	.2	.054	0	.642	72,156
Male 45–64	.133	.022	.001	.392	72,156
Male 65–74	.046	.017	0	.105	72,156
Male 75–84	.026	.012	0	.08	72,156
Male >85	.009	.005	0	.196	72,156
Female 0–4	.026	.007	0	.081	72,156
Female 5–14	.058	.013	0	.14	72,156
Female 15–44	.194	.047	0	.617	72,156
Female 45–64	.126	.025	0	.186	72,156
Female 65–74	.048	.019	0	.126	72,156
Female 75–84	.031	.013	0	.124	72,156
Female>85	.014	.01	0	.536	72,156

respectively. Table 1 provides information on the GP distribution by gender, age and country of education across English practices in each month of 2019. We observe that GPs are equally split between males and females, while in terms of age, the largest proportion is between 35 and 49 years old (46 %), 30 % between 50 and 64, 16 % below the age of 34,

and 6 % are older than 65 years old. Approximately 34.6 % of GPs have got their medical degree abroad: 15.5 % have a degree from South Asia, 4.4 % from Africa and 4.4 % from the European Union. Finally, we also report the deprivation index constructed at GP practice level.

Patients are split equally amongst gender; more than 80 % are white, approximately 9.3 % are Asian and the remaining are either black or have a mixed background (see Table 2). The distri- bution of age is similar by gender, with a slightly thicker right tale of the distribution for females. Table 3 shows descriptive statistics for the patients' satisfaction, unplanned hospitalisations, and emergency admissions variables, respectively. Regarding the question on the overall satisfac- tion with GP services, a relevant portion of the sample (about 47 %) declares to be very satisfied.

Moreover, about half of the individuals report that healthcare professionals recognised their mental health needs in a satisfactory way, and about 60 % of individuals declared to feel very involved in the decisions regarding care treatments. Data on unplanned hospitalisations are available only at the CCG level, thus our sample size is reduced to 191 observations. On average, the percentage of unplanned hospitalisations on the CCG population is about 0.4 %, ranging from a value of 0.1 % up to almost 0.2 %. Finally, on average, the percentage of emergency admissions (on total patients) is about 15 %.

Table 4, columns 1–5, presents the regression results using the number of prescriptions per patient for five different drug categories, namely antibiotics, mental health, antacids, statins, and analgesics as dependent variables. Our findings highlight a significant and positive relationship between the share of overseas GPs and the number of prescriptions per patient for all the categories of drugs considered. In GP practices with higher shares of GPs who have been trained abroad, the number of antibiotics, mental health drugs, antacids, statins, and analgesics prescribed per patient is significantly higher, compared to GP practices where the share of GP trained abroad is lower. Specifically, a 1 % increase in the share of GPs trained overseas is associated with a 0.18 % increase in antibiotics prescriptions over the mean of 0.68, a 0.19 % increase in mental health prescriptions over the mean of 2.36, a 0.1 % increase in antacids prescriptions over the mean of 0.1, a 0.16 % increase in analgesics prescriptions over the mean of 1.42, and a 0.15 % increase in statins prescriptions over the mean of 0.14. Our results show a significant effect of the age of the GPs, while no effect is detected in relation to their gender. In practices with a higher share of younger GPs (less than 45 years old), the number of prescriptions of the five drug types is smaller, in line with the findings of Wang et al. [24]. Demographic characteristics such as gender and age of patients represent other significant predictors: practices in which more than 50 % of the patients are females register lower rates of prescriptions compared to those in which the majority of patients are men, in line with the findings of Orzella et al. [18]. Similarly, higher shares of young patients (under 45) are associated with lower rates of prescriptions. Finally, we also find evidence of higher prescriptions in practices where the proportion of the white population is larger, in line with the findings of Gaskin et al. [11].

Table 3
Summary statistics: Patient Satisfaction, Emergency admissions & Unplanned Hospi- talisations.

	Mean	Std. Dev.	Min	Max	Obs
Overall Satisfaction	.468	.15	.066	.965	72,156
Mental Health Need	.544	.131	.121	.961	72,156
Involved in Decision	.604	.112	.228	.949	72,156
Satisfaction with appoint	.746	.113	.312	1	71,244
Experience with appoint	.312	.144	.021	.92	71,244
Meet needs	.632	.101	.25	.949	71,244
GP support	.423	.124	0	.84	71,244
Emergency admiss (on tot patients)	.153	.163	.003	3.725	71,244
Unplanned Hospitalisations	.004	.003	.001	.021	191

Not surprisingly and in line with the findings of Mooney et al. [14], we find that higher prescribing practices are located in more deprived areas. Results presented in Table 5 focus on the geographic area where GPs received their medical degrees. We observe a higher number of prescriptions for all drugs in practices with a higher share of GPs who studied in South Asia and Africa, while we do not find any significant effect amongst all other groups of immigrant GPs. This finding is relevant, indicating that the observed over-prescribing behaviour is associated with GPs trained in these specific regions and not in the others. Specifically, GPs trained in Africa prescribed an additional 0.17 antibiotics, 0.8 mental health drugs, and 0.4 analgesics per patient per month. GPs trained in South Asia prescribed an additional 0.17 antibiotics, 0.56 mental health drugs, 0.03 antacids, and 0.35 analgesics per patient per month. Potential explanations may lie in (i) a higher willingness to satisfy patients, (ii) different approaches in treating diseases, or (iii) differences in patient demand and expectations.

3.1. Potential mechanisms

To investigate the potential mechanisms driving the over-prescription behaviour of foreign-born GPs, we perform two tests. First, we examine the relationship between the share of foreign-born GPs (by country of training) and the dimensions of patient satisfaction described in Section 2. A positive correlation between these variables would suggest that the observed over-prescription behaviour may be driven by the willingness of overseas GPs to satisfy the requests of their patients or meet their expectations in terms of healthcare. We regress each of these dimensions on the share of foreign-born GPs trained in different countries, while controlling for the characteristics of the GP practices and their patients, as discussed earlier. A significant positive coefficient on the share of foreign-born GPs would provide evidence in support of the hypothesis that the over-prescription behaviour may be driven by the desire to satisfy patients.

Secondly, to investigate the possibility that the observed over-prescription behaviour is a signal of under-prescription behaviour by UK-trained GPs, we examine the relationship between the share of overseas GPs (by country of training) and unplanned hospitalisations at the CCG level. The indicator of unplanned hospitalisations measures the number of patients with specific long-term conditions that are admitted to the hospital in an emergency, which should not normally require hospitalization. We argue that the increase of such emergency admissions could be a signal of inadequate treatment in general practice, even after controlling for patients' characteristics and prevalence. This could push patients to seek care in A&E (Accident & Emergency), making them sicker. A negative correlation between the share of overseas GPs and unplanned hospitalisations would suggest potential under-prescribing behaviour by UK-trained GPs, who may not be providing their patients with the appropriate amount of drugs. As with the previous model, we include the same set of control variables as in the main specification.

Table 6 presents the results of our analysis of patients' satisfaction variables. Model 1 inves- tigates the association between the share of foreign-trained GPs and patient satisfaction, while Model 2 expands on this by including GP shares based on the geographical region where they received their degrees.

Our findings show that the share of immigrant GPs does not have a significant association with any of the patient satisfaction variables examined. We also found no significant effect on the indicator of unplanned hospitalisations as a dependent variable. These results were consistent across both the main variable of interest (the share of GP immigrants by GP practice) and the differentiation by the area of training.

The lack of a significant association between immigrant GPs and patient satisfaction may suggest that they do not prioritize meeting patients' requests or expectations in terms of health- care. Similarly, the lack of a significant effect on unplanned hospitalisations may indicate that UK-trained GPs are not under-prescribing drugs to their patients,

Table 4
OLS: Prescriptions per patient Antibiotics Mental health Antacids Analgesics Statins.

GP immigrant	0.119***	0.448***	0.020***	0.268***	0.028***
	(0.040)	(0.145)	(0.007)	(0.086)	(0.009)
Female GP	−0.052	−0.273	−0.008	−0.152	−0.020*
	(0.049)	(0.170)	(0.008)	(0.101)	(0.010)
GP age<45	−0.306*** (0.046)	−0.950*** (0.157)	−0.042*** (0.007)	−0.574*** (0.093)	−0.061*** (0.009)
Female Patients	−0.211*** (0.030)	−0.707*** (0.092)	−0.028*** (0.004)	−0.418*** (0.054)	−0.047*** (0.006)
White Patients	0.164* (0.096)	1.794*** (0.344)	−0.048** (0.019)	1.136*** (0.215)	0.031 (0.020)
Patient age<45	−1.319*	−5.516***	−0.240***	−3.480***	−0.304*
	(0.790)	(2.070)	(0.087)	(1.213)	(0.168)
Deprivation index	0.004**	0.012**	0.001***	0.008**	0.001**
	(0.002)	(0.006)	(0.000)	(0.003)	(0.000)
Other controls:					
Disease Prevalence	Yes	Yes	Yes	Yes	Yes
Geographical area	Yes	Yes	Yes	Yes	Yes
Month Fixed-Effects	Yes	Yes	Yes	Yes	Yes
N. Observations	72,156	72,156	72,156	72,156	72,156

Notes: The table shows the association between the share of overseas GPs and other practice characteristics, and per-patient prescriptions. The method of estimation is OLS. Robust standard errors are clustered at the practice level. All regression models account for geographical area fixed effects. Significance levels:.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Table 5
OLS: Prescriptions per patient by GP country of origin.

Antibiotics		Mental health	Antacids	Analgesics	Statins
GP: EEA	−0.052	−0.187	−0.006	−0.155	−0.013
	(0.091)	(0.301)	(0.014)	(0.175)	(0.019)
GP: Other EU	0.041	−0.012	0.088	0.332	−0.032
	(0.237)	(0.813)	(0.117)	(0.635)	(0.039)
GP: Africa	0.167*	0.753**	0.019	0.382*	0.048**
	(0.095)	(0.361)	(0.014)	(0.213)	(0.021)
GP: Asia	−0.040	0.053	−0.006	0.106	0.039
	(0.221)	(0.740)	(0.030)	(0.419)	(0.052)
GP: South Asia	0.171***	0.556***	0.032***	0.354***	0.038***
	(0.052)	(0.179)	(0.009)	(0.110)	(0.011)
GP: Australia	0.100	0.941	−0.008	0.614	0.020
(0.407)		(1.840)	(0.053)	(0.982)	(0.080)
GP: Centr. America	0.268	1.770	0.013	0.746	0.098
	(0.299)	(1.449)	(0.040)	(0.818)	(0.079)
GP: North America	−1.108	−5.648	−0.181	−3.771	−0.332
	(1.134)	(3.822)	(0.190)	(2.331)	(0.241)
GP: South America	−0.509	−1.511	−0.037	−0.776	−0.062
	(0.542)	(1.923)	(0.086)	(1.115)	(0.108)
GP: Middle East	−0.045	−0.435	−0.028	−0.212	0.004
	(0.158)	(0.650)	(0.022)	(0.360)	(0.039)
Female GP	−0.049	−0.253	−0.008	−0.145	−0.018*
	(0.049)	(0.175)	(0.008)	(0.104)	(0.010)
GP age<45	−0.305***	−0.961***	−0.042***	−0.577***	−0.061***
	(0.046)	(0.156)	(0.007)	(0.092)	(0.009)
Female Patients	−0.210***	−0.709***	−0.028***	−0.417***	−0.047***
	(0.030)	(0.091)	(0.004)	(0.053)	(0.006)
White Patients	0.167*	1.798***	−0.047**	1.145***	0.031
	(0.096)	(0.344)	(0.019)	(0.214)	(0.020)
Patients age<45	−1.311*	−5.510***	−0.236***	−3.466***	−0.304*
	(0.792)	(2.079)	(0.087)	(1.216)	(0.169)
Deprivation index	0.004**	0.012**	0.001***	0.008**	0.001**
	(0.002)	(0.006)	(0.000)	(0.003)	(0.000)
Other controls					
Disease Prevalence	Yes	Yes	Yes	Yes	Yes
Geographical area	Yes	Yes	Yes	Yes	Yes
Month Fixed-Effects	Yes	Yes	Yes	Yes	Yes
N. Observations	72,156	72,156	72,156	72,156	72,156

Notes: The table shows the association between the share of GPs by country of origin and other practice characteristics, and per- patient prescriptions. The method of estimation is OLS. Robust standard errors are clustered at the practice level. All regression models account for geographical area fixed effects. Significance levels:.
* $p < 0.1$.
** $P < 0.05$.
*** $p < 0.01$.

contrary to what we had hy- pothesized. In the same vein, our results suggest the absence of a significant relationship between the share of overseas GPs and the number of emergency admissions (Table 7) at the practice level, except when focusing on South-Asian GPs, where the association is significant and positive. However, these results could be driven by the fact that maybe patients located where there are more

Table 6
Robustness: Patients' Satisfaction***.

	Overall Satisfaction	Mental Health Needs	Involved in Decisions	Satisfaction with appoint	Experience with appoint	Meet needs	GP support
Model 1							
GP immigrant	0.000	0.006	−0.001	0.002	0.008	0.002	−0.007
	(0.006)	(0.006)	(0.004)	(0.005)	(0.006)	(0.004)	−0.005
Model 2							
GP country							
GP EEA	−0.002	0.006	−0.002	−0.005	−0.002	−0.004	−0.016
	(0.014)	(0.013)	(0.010)	(0.011)	(0.015)	(0.010)	(0.012)
GP: Other EU	−0.038	−0.053	−0.039	−0.041	0.006	−0.033	−0.063*
	(0.042)	(0.033)	(0.027)	(0.030)	(0.046)	(0.027)	(0.035)
GP: Africa	−0.005	0.005	−0.009	0.002	−0.005	−0.003	−0.024**
	(0.013)	(0.013)	(0.009)	(0.011)	(0.013)	(0.009)	(0.011)
GP: Asia	−0.049	−0.004	0.016	−0.052	−0.043	−0.016	−0.074**
	(0.034)	(0.037)	(0.024)	(0.034)	(0.044)	(0.026)	(0.034)
GP: South Asia	0.007	0.008	0.002	0.008	0.011	0.003	−0.003
	(0.008)	(0.007)	(0.006)	(0.006)	(0.008)	(0.005)	(0.006)
GP: Australia	0.019	0.069	−0.003	0.007	0.015	−0.052	0.047
	(0.078)	(0.082)	(0.052)	(0.063)	(0.077)	(0.048)	(0.073)
GP: Centr. America	−0.022	−0.079**	−0.055**	−0.012	−0.031	−0.032	−0.033
	(0.039)	(0.037)	(0.028)	(0.027)	(0.035)	(0.025)	(0.036)
GP: North America	−0.020	0.260	−0.381**	−0.081	−0.310	0.163	0.227
	(0.224)	(0.233)	(0.184)	(0.211)	(0.225)	(0.198)	(0.304)
GP: South America	−0.018	−0.042	0.002	0.040	0.089	−0.084	−0.021
	(0.092)	(0.144)	(0.095)	(0.085)	(0.093)	(0.076)	(0.089)
GP: Middle East	−0.003	0.028	0.012	0.018	0.014	0.000	0.025
	(0.030)	(0.025)	(0.021)	(0.023)	(0.028)	(0.020)	(0.024)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Disease Prevalence	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographical area	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Observations	71,244	71,244	71,244	71,244	71,244	71,244	71,244

Notes: The table shows the association between the share of overseas GPs, and the share of GPs by country of origin and a set of quality indicators.
The method of estimation is OLS. Robust standard errors are clustered at the practice level. In all regressions we control for a set of practice characteristics. Moreover, all regression models account for geographical area fixed effects. Significance levels:.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

South Asian GPs try to visit the emergency department more instead of seeing their general practitioner for preventive care. If patients are substituting away from primary care visits with foreign-trained GPs and relying more on emergency rooms, this could explain the results that we find here. Over- all, our results provide evidence to support the notion that over-prescribing behaviour by immigrant GPs may be driving the observed overuse of antibiotics and prescription drugs.

4. Discussion and conclusions

The shortage of GPs during the COVID-19 pandemic highlighted the need for policies to at- tract more overseas doctors to the UK. However, discrepancies in prescription patterns across GPs trained in different countries may increase health inequalities and jeopardise the efforts in achieving consistency in health service provision. Our study examines drug prescription behaviour in GP practices with high percentages of foreign-trained GPs compared to those with high per- centages of GPs trained in the UK. This represents a significant contribution to the literature, as it is the first study to perform a comparative and comprehensive analysis of the prescription patterns of UK-trained versus foreign-trained GPs. The scant existing literature either focuses on efficiency measures [20] or is limited to antibiotic prescriptions [5,12,16], providing contradictory results. We find that practices with high shares of South Asian GPs tend to prescribe more drugs across several different categories, even after controlling for other factors that could affect the number of prescriptions.

There are several possible explanations for this finding. Firstly, doctors trained in different countries with varying education systems may have developed different approaches to treating dis- eases, which could result in varying drug prescription guidelines. Secondly, doctors trained abroad may have a higher willingness to satisfy patients' requests in order to feel more integrated into the UK and the local community. Lastly, this finding could indicate potential under-prescribing behaviour amongst GPs trained in the UK.

We provide evidence against the latter two mechanisms, leaving the possibility of over-prescribing behaviour amongst foreign-trained GPs, particularly from South Asia, which may be linked to differing disease treatment approaches. Some evidence in the literature suggests that medical education systems in these countries are diverse, with traditional, teacher-centred and hospital-based training and little or no educational innovations and experiments as seen in other parts of the world [1]. These findings support policymakers in designing better policies for the integration of GPs trained abroad within the UK system to ensure a more consistent drug prescription be- haviour. Our findings suggest that differences in medical training and healthcare contexts across countries may contribute to varying prescription behaviors between UK and foreign-trained GPs. This has important policy implications.

First, screening and selection procedures for foreign GPs could be tailored to identify candidates whose prescribing aligned more closely with UK norms. Pre-registration exams or supervised practice periods could then be used to reinforce UK prescribing guidelines before full registration is granted.

Second, the General Medical Council and Royal College of General Practitioners may consider reciprocal agreements regarding GP training with select countries that have comparable programs to the UK. This could expedite the registration process for doctors from these white-listed nations. Third, educational outreach visits and audits could

Table 7
Robustness: emergency admission (practice level), and unplanned hospitalisations (CCG level)**.

	Emergency Admissions	Unplanned Hospitalisations
Model 1		
GP immigrant	0.025	0.001
	(0.009)	(0.002)
Model 2		
GP country		
GP EEA	−0.022	−0.006
	(0.019)	(0.010)
GP: Other EU	−0.006	0.020
	(0.049)	(0.024)
GP: Africa	0.024	−0.001
	(0.021)	(0.008)
GP: Asia	0.008	−0.017
	(0.044)	(0.035)
GP: South Asia	0.043***	−0.001
	(0.013)	(0.003)
GP: Australia	0.036	−0.082*
	(0.108)	(0.046)
GP: Centr. America	0.059	0.024
	(0.073)	(0.037)
GP: North America	−0.368	0.006
	(0.261)	(0.183)
GP: South America	−0.144	0.092
	(0.114)	(0.060)
GP: Middle East	−0.040	−0.009
	(0.033)	(0.019)
Other controls	Yes	Yes
Disease Prevalence	Yes	Yes
Geographical area	Yes	Yes
Month Fixed Effects	Yes	Yes
N. Observations	71,244	191

Notes: The table shows the association between the share of overseas GPs, and the share of GPs by country of origin, and emergency admissions and unplanned hospitalisations indicators.
The method of estimation is OLS. Robust standard errors are clustered at the practice level. In all regressions we control for a set of practice characteristics. Moreover, when we look at emergency admissions, we account for geographical area fixed effects. Significance levels:.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

provide continuing medical education to foreign GPs on prescription best practices after they enter the NHS workforce. Practice quality committees could target training to foreign GPs as needed based on prescription data monitoring. Finally, feedback from patient surveys and community organizations could help identify any misalignment between community healthcare needs and foreign GPs' prescribing patterns. Cultural training and community integration programs for foreign doctors may be warranted in some areas. Overall, a multi-pronged approach is needed to align overseas doctors' prescribing with UK norms. Pre-arrival selection and training, reciprocal agreements with select nations, ongoing pre- scription audits/education, and community feedback are key policy levers to ensure consistent and appropriate prescribing across all GPs in the NHS. Our findings elucidate specific prescription differences that can inform these workforce integration policies.

Our study has some intrinsic limitations. First, foreign GPs may opt to settle in areas with a higher concentration of immigrants from their region or country, or in locations with similar cultural and language characteristics. While this choice can facilitate their integration and interactions with the local community, the non-random sorting of foreign GPs may introduce a selection bias that impacts our results. On one hand, immigrant communities may have specific healthcare needs or face unique health challenges that lead to different prescription rates. On the other hand, patients often feel more comfortable and trusting of healthcare providers who share their cultural background or migration experiences. While we control for various patient demographics and needs, there may be unobserved factors influencing where foreign GPs decide to practice. Unfortunately this non-random sorting issue is difficult to fully address empirically. However, being transparent about this limitation provides helpful context when interpreting the results. Future research could survey foreign GPs about their settlement decisions to better understand this potential bias.

Given that half of doctors in the UK are trained abroad, and this percentage is set to increase further in the near future, additional research on this topic is necessary to guide policy interven- tions. As highlighted at the beginning of the paper, understanding how GPs trained abroad operate within English general practices is crucial for shaping future policies. This includes (i) identifying the competencies that foreign-trained GPs need to develop to match those of UK-trained doctors, (ii) ensuring a consistent prescribing behaviour across all GPs, and (iii) attracting more overseas GPs to the UK.

Research funding

Nicodemo receives funding from Horizon Europe [grant number ES/T008415/1] and from the National Institute for Health Research Applied Research Collaboration Oxford and Thames Valley at Oxford Health NHS Foundation Trust. Consortium iNEST (Interconnected North-Est Innovation Ecosystem) funded by the European Union Next-GenerationEU (Piano Nazionale di Ripresa e Resilienza (PNRR) – Missione 4 Componente 2, Investimento 1.5 – D.D. 1058 23-06-2022, ECS-00000043).

CRediT authorship contribution statement

Catia Nicodemo: Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing. **Cristina E. Orso:** . **Cristina Tealdi:** Conceptualization, Data curation, Methodology, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

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