Socioeconomic status and HRT prescribing: a study of practice-level data in England.

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Abstract

Background

Concerns have been raised that women from deprived backgrounds are less likely to be receiving hormone replacement therapy (HRT) treatment and its benefits, although evidence in support of this is lacking.

Aim

To investigate general practice HRT prescription trends and their association with markers of socioeconomic deprivation.

Design

Cross-sectional study of primary care prescribing data in England in 2018.

Method

Practice-level prescribing rate was defined as the number of items of HRT prescribed per 1000 registered female patients over the age of 40 years. The association between Index of Multiple Deprivation (IMD) score and HRT prescribing rate was tested using multivariate Poisson regression, adjusting for practice proportions of obesity, smoking, hypertension, diabetes, coronary heart disease and cerebrovascular disease and practice list size.

Results

The overall prescribing rate of HRT was 29% lower in practices from the most deprived quintile compared with the most affluent (incidence rate ratio [IRR] 0.71, 95% CI 0.68-0.73). After adjusting for all cardiovascular disease outcomes and risk factors, the prescribing rate in the most deprived quintile was still 18% lower than in the least deprived quintile (adjusted IRR 0.82, 95% CI 0.77-0.86). In more deprived practices, there was a significantly higher tendency to prescribe oral HRT than transdermal preparations ($p < 0.001$).

Conclusion

This study has highlighted inequalities associated with HRT prescription. This may reflect a large unmet need in terms of menopause care in areas of deprivation. Further research is needed to identify the factors from patient and GP perspectives that may explain this.

How this fits in

Little is known about the relationship between hormone replacement therapy (HRT) prescribing rates and socioeconomic deprivation. Our analysis shows that there is an **18%** lower HRT prescribing rate in primary care practices in the most deprived areas compared with the least deprived after adjusting for all cardiovascular disease outcomes and risk factors. In addition, women in more deprived areas who are prescribed HRT are relatively more likely to receive oral rather than transdermal therapy compared with women in the least deprived areas. More research is needed to confirm these findings, to establish the reasons for this difference and to identify how we can understand how inequalities in menopause support associated with socio-economic deprivation can be addressed.

Introduction

Socioeconomic deprivation may be associated with prescribing rates in primary care. Recent research has looked at opiate, benzodiazepine and antibiotic prescribing, all of which have higher rates of prescribing in areas of greater socioeconomic deprivation[1-3].

Hormone replacement therapy (HRT) is a medication that has been subject to wide fluctuations in prescribing rates over recent decades. Following its introduction in the 1960s, prescribing rates rose and by the 1990s thirty percent of UK women aged 50-64 years were current users and fifty percent were ever users[4].

Evidence presented by the Women's Health Initiative (WHI) programme (between 1996-2000) showed that deprivation was associated with HRT prevalence. In the least deprived areas thirty four percent of women were receiving HRT compared to thirty percent in the most deprived. However, they also found that HRT prescribing was influenced considerably more strongly by a woman's medical and surgical background than by deprivation[5]. Other studies in the 1990s showed a reduced prescribing rate in lower socio economic groups[6,7].

Prescribing rates of HRT changed dramatically with the premature closure of the UK WHI study in 2002[8]. The findings, which showed an increased risk of breast cancer in HRT users, triggered a worldwide review of practice. The prevalence of menopause-related consultations fell, as did the incidence and prevalence of HRT prescribing[4]. Although more reassuring results were published they received relatively little media attention and so both women consulting for menopause and prescribing of HRT continued to fall[9]. More recent primary care prescribing data suggest that the prescribing of drugs in the British National Formulary section *Female Sex Hormones and their Modulators*, which includes oestrogen-containing HRT as well as progesterone, sildenafil and ulipristal, has gradually increased over the previous five years from ~218,000 items in November 2014 to ~345,000 items in October 2019 (data from OpenPrescribing.net[10])

HRT is prescribed for the treatment of menopausal or perimenopausal symptoms such as vasomotor instability or vaginal atrophy. HRT can also improve a plethora of symptoms as captured by the Greene climacteric score[11]. The menopause can have a negative effect on mood as well as physical symptoms. Many women find that their work and home life are negatively affected and consult their GP during this time.

Social deprivation is associated with a range of morbidities many of which may affect a clinician's decision to prescribe HRT. Bone fractures and osteoporosis are more prevalent in areas of socio-economic deprivation[12], and deprivation is associated with a younger age of the

menopause[13] both of which are positive influences to prescribe. Cardiovascular disease and diabetes are more prevalent in more deprived areas. HRT does not increase cardiovascular risk when prescribed to women under 60 years of age and is cardiovascular protective (when prescribed as oestrogen alone). However cardiovascular risk factors and the presence of known cardiovascular comorbidity may dissuade a clinician from prescribing if over the age of 60 years[14]. A difference in prescribing levels may also not be attributed solely to the decision-making behaviour of the clinician but to the consulting behaviour of the woman.

There is no recent evidence regarding whether the rates of HRT prescribing are linked to socioeconomic deprivation. In a climate where we are increasingly concerned about prescribing costs and there is still a reluctance from both women and clinicians to use HRT in the post-WHI era, we hypothesise that it is the women from the most deprived backgrounds that are least likely to receive HRT. In addition to exploring this hypothesis in relation to all oestrogen-containing HRT, we also look at the types of HRT prescribed (oral versus transdermal), the effect of cardiovascular risk factors and the relationship to socioeconomic deprivation.

Methods

Data Sources

This is a cross-sectional study of monthly prescribing data for primary care practices in England in 2018, downloaded from NHS Digital (https://digital.nhs.uk)[15]. The dataset gives information for each primary care practice and their Clinical Commissioning Group, and the number of prescription items prescribed that month for each drug preparation. Private prescriptions are not recorded in these datasets. Information on GP practice list sizes (in January 2018), including stratification by sex and 5-year age bands, was also retrieved from NHS Digital[16], as were British National Formulary (BNF) drug codes[17].

Data on practice-level and CCG-level socioeconomic status were obtained from Public Health England's National General Practice Profiles[18]. Socioeconomic status was quantified using the Index of Multiple Deprivation (IMD) score from 2015. The IMD score combines information from seven domains to produce an overall relative measure of socioeconomic status (SES). The domains are combined using the following weights[19]: income deprivation (22.5%); employment deprivation (22.5%); education, skills and training deprivation (13.5%); health deprivation and disability (13.5%); crime (9.3%); barriers to housing and services (9.3%); and living environment deprivation (9.3%).

Data Processing

Primary care prescribing data for each month in 2018 were filtered for all oestrogen-containing HRT preparations and aggregated by BNF drug code to give the total number of items prescribed under each BNF code per practice over a year. All oral, transdermal, intranasal and implant preparations were included, but progesterone-only preparations – such as utrogestan and levonorgestrel-releasing intrauterine devices – were excluded so as not to "double count" HRT prescriptions (The BNF drug codes used in this analysis are given in *Supplementary Table 1*.). The total number of prescribed items were then aggregated by practice, irrespective of the initial preparation. Practices with small numbers of patients (fewer than 500 females) or prescribing fewer than 50 HRT items in 2018 were then excluded, in order to help remove prescribing from units other than general practices (such as walk-in centres). Information on the following were added to the aggregated prescribing dataset: practice-level IMD score; the total number of females over the age of 40 years on the practice list (calculated from the age/sex-stratified practice list size dataset); and the practice prevalence risk factors or clinical conditions that may influence the prescribing of HRT (specifically, smoking, obesity, diabetes,

hypertension, coronary heart disease (CHD) and stroke or transient ischaemia attack (TIA)). Disease and risk factor prevalence estimates were taken from Quality Outcomes Framework returns from 2017/18[20].

Prescribing in each practice was calculated as number of HRT items per 1000 female patients over the age of 40 years. Practice-level prescribing was then categorised by IMD decile, showing the mean and 95% confidence interval (CI), where decile ten represents the practices with the highest IMD score (lowest socioeconomic status).

Statistical Analysis

The association between practice-level IMD score quintiles and HRT prescribing rate was initially testing using simple (univariate) Poisson regression. Robust standard errors were calculated to control for any violations in the assumption of variability equalling the mean. To test whether practice-level IMD was independently associated with the rate of HRT prescribing, multivariable stepwise Poisson regression was conducted considering factors which may influence decision-making when prescribing HRT, specifically: practice prevalence of smoking, obesity, diabetes, hypertension, CHD and stroke or TIA, as well as the practice list size of females over the age of 40 years. All independent variables were stratified by quintile, with the lowest values in magnitude assigned to quintile 1. Multicollinearity was tested using the variance inflation factor. The final model chosen was that most parsimonious, as judged using Akaike Information Criterion (AIC). In addition to exploring the association between deprivation and prescribing rate of all HRT items prescribed, the analysis was repeated for: oral preparations alone; and transdermal preparations alone, in order to ascertain whether or not the pattern seen across all HRT prescribing was consistent among different HRT preparations (implant or intranasal oestrogen was not analysed separately due to far fewer prescriptions).

The results of Poisson regression analyses are presented as unadjusted or adjusted incident rate ratios (IRRs or aIRRs), with the lowest quintile for each variable used as the reference comparator. A p value < 0.05 was considered statistically significant. All data were analysed, and all plots generated, using the software R (v3.5.3)[21]. As all the data used were publicly available, no ethical approval was required.

Results

Association between socioeconomic status and all hormone replacement therapy prescribing

Of 7099 practices in the dataset, with 14,637,950 women over the age of 40 years, 621 (8.7%) practices did not meet the eligibility thresholds, thereby excluding 345,961 (2.4%) women. The final dataset included 6478 practices with 14,291,989 women over the age of 40 years, and 2,677,613 prescriptions for oestrogen-containing HRT at a cost of £38,583,509. Overall, 53% more items of oral HRT were prescribed than transdermal HRT.

The association between HRT prescribing rates and practice IMD score decile was examined (*Figure 1*). This shows that the prescribing rate was 39% higher in decile 1 (the decile with the lowest IMD scores) compared to decile 10. There was a step-wise decrease in prescribing rates from deciles 1 to 9 (*Supplementary Table 2*).

On univariate analysis, there was a significant association between practice IMD score quintile and prescribing rate (IRR 0.71, 95% CI 0.68-0.73, for quintile 5 *vs.* quintile 1), with a significant reduction in prescribing rate with each quintile of practice IMD score (*Table 1*). Before running the multivariable analysis, we confirmed that there was no evidence of multicollinearity. The most parsimonious model on stepwise regression was found to be that which had all included variables. After adjusting for the practice prevalence of smoking, obesity, hypertension, diabetes, CHD and stroke or TIA, practice IMD score quintile remained an independent predictor of prescribing rates, with a 18% lower prescribing rate of HRT in the most deprived practices compared to the least deprived practices (aIRR 0.82, 95% CI 0.77-0.86, quintile 5 *vs.* quintile 1, *Table 1*).

A summary of the regression results of all variables included in the multivariable model can be found in *Supplementary Table 3*. Interestingly, of all the independent variables in the model, the practice prevalence of diabetes was most strongly associated with prescribing rates, with 34% less prescribing in practices with the highest prevalence of diabetes compared to those with the lowest prevalence (aIRR 0.66, 95% CI 0.63-0.69, quintile 5 vs. quintile 1).

Association between socioeconomic status and oral or transdermal preparation prescribing

Similar relationships were found when examining only oral, or only transdermal, preparations alone, with both exhibiting a clear reduction in prescribing rate in practices with higher IMD scores on univariate analysis (oral IRR 0.83, 95% CI 0.81-0.86; transdermal IRR 0.68, 95% CI 0.65-0.71, both for quintile 5 *vs.* quintile 1, **Supplementary Tables 4 and 5**). However, the difference in prescribing rates between the least and most deprived practices was more pronounced for transdermal preparations (45% higher in decile 1 *vs.* decile 10) compared to oral preparations (15% higher in decile 1 *vs.* decile 10). In the adjusted regression model, IMD score was an independent predictor of prescribing rates for oral preparations (aIRR 0.81, 95% CI 0.76-0.86, quintile 5 *vs.* quintile 1) but not for transdermal preparations (aIRR 0.97, 95% CI 0.90-1.04, quintile 5 *vs.* quintile 1).

The ratio of oral-to-transdermal prescribing varied by deprivation quintile, with a trend towards more oral prescribing in more deprived practices (oral-to-transdermal prescribing ratios by IMD score quintile: 1.40 (quintile [Q] 1), 1.55 (Q2), 1.67 (Q3). 1.69 (Q4), 1.62 (Q5); $p < 0.001$). Specifically, practices in IMD quintiles 2 to 5 prescribed a greater proportion of oral items than practices in IMD quintile 1 (the least deprived, adjusted $p < 0.001$ for all).

Discussion

Summary

This study has identified a stark association between prescribing rates for HRT at a practice level and socioeconomic deprivation. The overall rate of HRT prescriptions (per 1000 women aged 40 years and above) was 29% lower in practices from the most deprived quintile compared with the least deprived. After adjusting further for risk factors of cardiovascular health (obesity, smoking, practice prevalence of hypertension, diabetes, coronary heart disease and stroke/TIA), there was still an 18% lower prescribing rate in the most deprived practices compared with the least deprived.

When preparation type was divided into transdermal and oral the trend remained (more prescribing in affluent areas); however, proportionately more oral HRT is prescribed than transdermal in practices with higher levels of deprivation. This trend is interesting as cardiovascular risk (as occurs in areas of higher deprivation) is an indicator that might lead to a higher ratio of transdermal HRT prescriptions (which has no increased risk of thromboembolism or stroke[14]) compared to oral HRT preparations. It may also reflect patient choice and a request for more oral HRT in more deprived areas.

It appears that practices with a higher prevalence of diabetes prescribed less HRT, and it is possible that diabetes may influence clinical decision-making in this setting. HRT should not be prescribed for the prevention of diabetes; however, it has been shown to improve glycaemic control, particularly when prescribed as oral oestrogen[22] and can be prescribed after taking other cardiovascular risk factors into account[23]. This may go some way in explaining the higher oral HRT prescribing in deprived areas but as we did not analyse individual patient data we cannot say with certainty if diabetes directly affected doctor's decision making to either prescribe HRT or give an oral preparation.

The prescription costs of HRT to women may also account for reduced prescribing in more deprived areas.

Strengths and limitations

This work provides an analysis of prescribing of HRT in England at the practice level compared to the overall level of socioeconomic deprivation of individuals registered at each practice. All NHS primary care prescribing is captured by NHS Digital, providing a robust and unbiased method for reviewing prescribing trends in England.

However, prescription rates and deprivation were analysed at the aggregated practice level. Hence, it cannot be determined from this data the extent to which there may be intra-practice variation in prescribing HRT associated with the socioeconomic status of the individual patient. Research using individual patient-level data is needed to explore this further. Secondly, IMD scores represent, but are not a direct measure of, socioeconomic deprivation. Finally, the data we used in this analysis precluded any meaningful health economic analysis beyond perhaps the extra cost required to abolish the inequality in prescribing rates across deciles of deprivation. Further work is required to estimate the health economic benefits of appropriate and equitable prescribing of HRT, to include consideration of savings on diagnostic tests and other medications (such as antidepressants or analgesics), and of benefits to the economy and wider society that may be associated with HRT prescribing (such as an increased ability to work).

Comparison existing literature

Previous literature has shown decreased levels of prescribing HRT for women living in areas of more deprivation[5,6]. However there have not been any recent studies (post WHI publication) investigating the association between HRT prescription rates and socioeconomic deprivation. This article also looks at practice prevalence of cardiovascular risk as a possible explanation of decreased prescribing rates.

Implication for research

Further research is needed to explore the facilitators and barriers to prescribing HRT from a patient, clinician and health economic perspective, and our findings needs to be confirmed using individual-level primary care data. Further research also needs to be done into the HRT preparation types prescribed, and the reasons for prescribing more or less transdermal HRT. The recent HRT shortages have added a further barrier to acquiring HRT to both the patient and prescriber, the impact of which we are yet to establish[24].

It is likely that this analysis uncovers a larger unmet need in terms of the menopause care and support that is provided and utilised in areas of deprivation. The barriers to accessing support in and around the time of the menopause for women in areas of social deprivation needs to be further explored before recommendations to change practice can be made.

Additional Information

Ethical approval

This study used publicly available data only, so no ethical approval was required.

Competing Interests

The authors declare no competing interests

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Figure 1. Oestrogen-containing hormone replacement therapy prescription rates per 1000 registered females over the age of 40, by practice Index of Multiple Deprivation score deciles in England (2018).

For Index of Multiple Deprivation (IMD) deciles, decile 1 includes practices with the lowest IMD scores (least deprived). Bars and whiskers show the mean and 95% confidence interval for each decile.

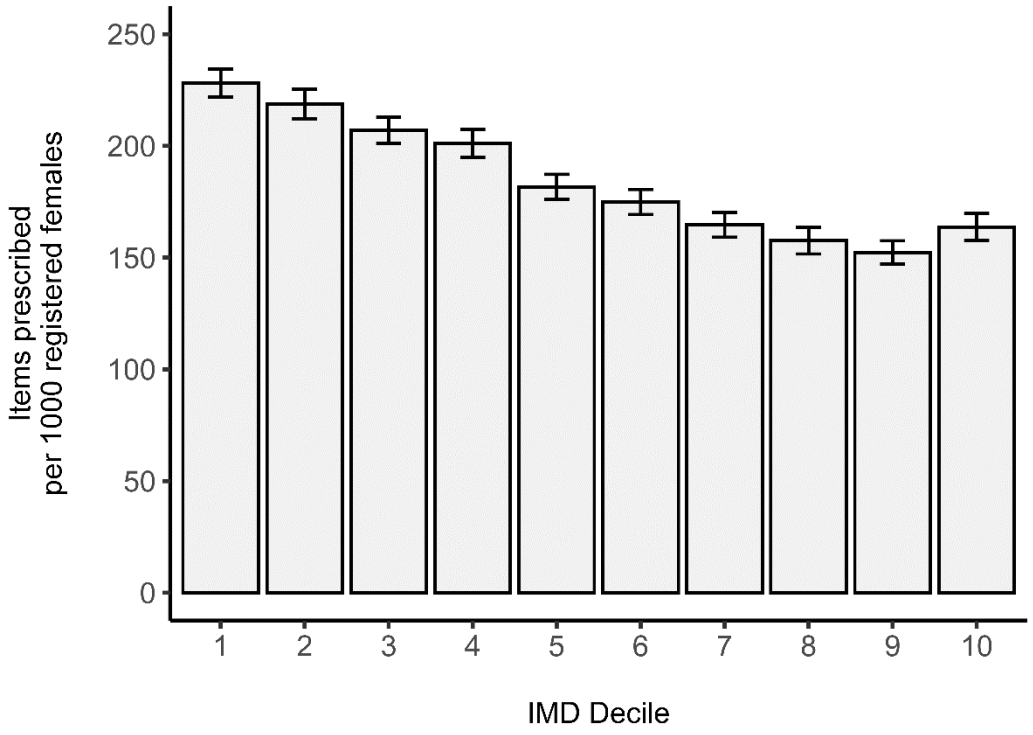

Table 1. Summary of regression analysis results for all oestrogen-containing hormone replacement therapy.

Results from unadjusted and adjusted Poisson regression analyses showing the association between HRT prescribing rate IMD score. The multivariable model adjusted for the practice list size of females over the age of 40 years, and the practice prevalence of smoking, obesity, hypertension, diabetes, coronary heart disease and stroke/transient ischaemic attack. Quintile 1 – the lowest quintile – is the reference for all variables. (IRR = incidence rate ratio; aIRR = adjusted incidence rate ratio; CI = confidence interval; HRT = hormone replacement therapy; IMD = Index of Multiple Deprivation)

				Unadjusted		Adjusted	
				IRR (95% CI)		aIRR (95% CI)	
Index of Multiple Deprivation score	Quintile	1	*Reference*	1		1	
		2		0.91	(0.89 - 0.94)	0.97	(0.94 - 1.00)
		3		0.80	(0.77 - 0.82)	0.89	(0.85 - 0.92)
		4		0.72	(0.70 - 0.74)	0.82	(0.79 - 0.86)
		5		0.71	(0.68 - 0.73)	0.82	(0.77 - 0.86)

Supplementary Material

Supplementary Table 1. List of British National Formulary codes used for all oestrogen-containing hormone replacement therapy preparations.

0604011ADAAAAAA	0604011G0BIABAU	0604011L0AAAKAK	0604011L0BTACBG
0604011ADBBAAAA	0604011G0BJAABH	0604011L0AAARAR	0604011L0BUAABH
0604011D0AAAAAA	0604011G0BJABBL	0604011L0AAAXAX	0604011L0BVAABI
0604011D0AAACAC	0604011G0BJACBR	0604011L0AABABA	0604011L0BWAABJ
0604011D0AAAEAE	0604011G0BKAABM	0604011L0AABDBD	0604011L0BXAAAK
0604011D0AAALAL	0604011G0BKABBQ	0604011L0AABEBE	0604011L0BYAAAF
0604011D0AAARAR	0604011G0BKACBP	0604011L0AABFBF	0604011L0BZAABK
0604011D0AAAWAW	0604011G0BLAABM	0604011L0AABGBG	0604011L0CBAAA0
0604011D0AABDBD	0604011G0BLABBP	0604011L0AABKBK	0604011M0BBABAB
0604011D0AABEBE	0604011G0BMAABD	0604011L0BBAABB	0604011N0BBAAAA
0604011G0AAAAAA	0604011G0BMABAI	0604011L0BBABBC	0604011P0AAABAB
0604011G0AAABAB	0604011G0BMACBE	0604011L0BCAAAB	0604011P0AAACAC
0604011G0AAACAC	0604011G0BMADBG	0604011L0BCABAC	0604011P0AAADAD
0604011G0AAAIAI	0604011G0BNAABA	0604011L0BEAAAF	0604011P0AAAFAF
0604011G0AAAUAU	0604011G0BNABBL	0604011L0BEABAZ	0604011P0BBAAAB
0604011G0AABABA	0604011G0BNACBN	0604011L0BEACAK	0604011P0BBABAC
0604011G0AABDBD	0604011G0BNAEBL	0604011L0BFAAAG	0604011P0BBACAD
0604011G0AABIBI	0604011G0BNAFBR	0604011L0BGAAAH	0604011P0BBAGAF
0604011G0AABJBJ	0604011G0BPAABI	0604011L0BGABAI	0604011Q0AAACAC
0604011G0AABLBL	0604011G0BPABBJ	0604011L0BHAAAJ	0604011Q0AAADAD
0604011G0AABNBN	0604011G0BRAAAI	0604011L0BHABAX	0604011Q0AAAEAE
0604011G0AABQBQ	0604011G0BSAABS	0604011L0BHACAY	0604011Q0AAAHAH
0604011G0AABRBR	0604011G0BUAABR	0604011L0BIAAAK	0604011Q0BBACAC
0604011G0AABSBS	0604011G0BUABBN	0604011L0BJAAAL	0604011Q0BBADAD
0604011G0BCAABL	0604011G0BUACBA	0604011L0BKAAAM	0604011Q0BCACAG
0604011G0BCABBA	0604011G0BUADBH	0604011L0BKABAN	0604011Q0BCADAE
0604011G0BCACBN	0604011G0BUAEBL	0604011L0BKACAP	0604011Q0BCAEAH
0604011G0BCADBA	0604011G0BVAAAI	0604011L0BKADBD	0604011R0AAAAAA
0604011G0BCAEBL	0604011H0BBAAAA	0604011L0BKAEBL	0604011R0BBAAAA

0604011G0BCAFBN
0604011G0BCAGBR
0604011G0BEAAAI
0604011G0BEABBD
0604011G0BFAABL
0604011G0BFABBA
0604011G0BFACBR
0604011G0BFADBN
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0604011L0BSAAAI
0604011L0BTAABE
0604011L0BTABBF
0604011Y0AAAAAA
0604011Y0AAABAB
0604011Y0BBAAAA

Supplementary Table 2. Average prescribing rates (and 95% confidence intervals [CIs]) of oestrogen-containing hormone replacement therapy per 1000 registered females over the age of 40 years, for practices in each deprivation decile, as defined by the Index of Multiple Deprivation (IMD) score. Figures are given for 2018 in England.

IMD Decile	Items per 1000 (95% CI)
1	228 (222, 234)
2	219 (212, 225)
3	207 (201, 213)
4	201 (195, 207)
5	182 (176, 187)
6	175 (169, 181)
7	165 (159, 170)
8	158 (152, 164)
9	152 (147, 158)
10	164 (158, 170)

Supplementary Table 3. Summary of unadjusted and adjusted regression analyses for the rate of prescribing of all oestrogen-containing hormone replacement therapy. The results for all variables included in the multivariable model are given. Quintile 1 – the lowest quintile – is the reference for all variables. (IRR = incidence rate ratio; aIRR = adjusted incidence rate ratio; CI = confidence interval; HRT = hormone replacement therapy; IMD = Index of Multiple Deprivation).

				Unadjusted		Adjusted	
				IRR (95% CI)		aIRR (95% CI)	
Index of Multiple Deprivation score	Quintile	1	*Reference*	1		1	
		2		0.91	(0.89 - 0.94)	0.97	(0.94 - 1.00)
		3		0.80	(0.77 - 0.82)	0.89	(0.85 - 0.92)
		4		0.72	(0.70 - 0.74)	0.82	(0.79 - 0.86)
		5		0.71	(0.68 - 0.73)	0.82	(0.77 - 0.86)
Practice list size of female aged 40 years and above	Quintile	1	*Reference*	1		1	
		2		0.98	(0.94 - 1.01)	0.94	(0.91 - 0.97)
		3		1.01	(0.97 - 1.05)	0.93	(0.90 - 0.96)
		4		1.03	(1.00 - 1.07)	0.92	(0.88 - 0.95)
		5		1.05	(1.01 - 1.08)	0.90	(0.87 - 0.93)
Practice prevalence of smoking	Quintile	1	*Reference*	1		1	
		2		0.92	(0.89 - 0.95)	1.02	(0.99 - 1.06)
		3		0.82	(0.79 - 0.85)	1.01	(0.97 - 1.05)
		4		0.76	(0.73 - 0.78)	1.02	(0.98 - 1.07)
		5		0.78	(0.76 - 0.81)	1.10	(1.04 - 1.15)
Practice prevalence of obesity	Quintile	1	*Reference*	1		1	
		2		0.90	(0.87 - 0.93)	0.96	(0.93 - 0.99)
		3		0.89	(0.86 - 0.92)	0.97	(0.94 - 1.00)
		4		0.86	(0.83 - 0.89)	0.98	(0.95 - 1.02)
		5		0.81	(0.79 - 0.84)	0.97	(0.94 - 1.01)

Practice prevalence of hypertension	Quintile	1	*Reference*	1		1	
		2		0.99	(0.96 - 1.03)	0.96	(0.93 - 1.00)
		3		1.05	(1.02 - 1.09)	0.99	(0.95 - 1.04)
		4		1.05	(1.01 - 1.08)	1.00	(0.95 - 1.05)
		5		1.06	(1.03 - 1.10)	1.06	(1.01 - 1.12)
Practice prevalence of diabetes	Quintile	1	*Reference*	1		1	
		2		0.9	(0.87 - 0.93)	0.85	(0.82 - 0.88)
		3		0.85	(0.82 - 0.87)	0.80	(0.78 - 0.83)
		4		0.79	(0.76 - 0.81)	0.76	(0.73 - 0.79)
		5		0.66	(0.64 - 0.68)	0.66	(0.63 - 0.69)
Practice prevalence of coronary heart disease	Quintile	1	*Reference*	1		1	
		2		1.09	(1.06 - 1.13)	1.05	(1.01 - 1.10)
		3		1.11	(1.07 - 1.15)	1.07	(1.02 - 1.12)
		4		1.12	(1.08 - 1.15)	1.11	(1.05 - 1.17)
		5		1.05	(1.02 - 1.09)	1.08	(1.02 - 1.15)
Practice prevalence of stroke or transient ischaemic attack	Quintile	1	*Reference*	1		1	
		2		1.16	(1.12 - 1.20)	1.15	(1.11 - 1.20)
		3		1.18	(1.14 - 1.22)	1.17	(1.11 - 1.22)
		4		1.19	(1.15 - 1.24)	1.19	(1.13 - 1.25)
		5		1.18	(1.14 - 1.22)	1.18	(1.12 - 1.25)

Supplementary Table 4. Summary of unadjusted and adjusted regression analyses for the rate of prescribing of oral oestrogen-containing hormone replacement therapy. The results for all variables included in the multivariable model are given. Quintile 1 – the lowest quintile – is the reference for all variables. (IRR = incidence rate ratio; aIRR = adjusted incidence rate ratio; CI = confidence interval; HRT = hormone replacement therapy; IMD = Index of Multiple Deprivation).

				Unadjusted		Adjusted	
				IRR (95% CI)		aIRR (95% CI)	
Index of Multiple Deprivation score	Quintile	1	*Reference*	1		1	
		2		0.99	(0.96 - 1.02)	0.99	(0.96 - 1.03)
		3		0.88	(0.85 - 0.91)	0.89	(0.85 - 0.92)
		4		0.85	(0.82 - 0.88)	0.85	(0.81 - 0.89)
		5		0.83	(0.81 - 0.86)	0.81	(0.76 - 0.86)
Practice list size of female aged 40 years and above	Quintile	1	*Reference*	1		1	
		2		0.86	(0.83 - 0.89)	0.84	(0.81 - 0.87)
		3		0.86	(0.84 - 0.90)	0.82	(0.79 - 0.85)
		4		0.88	(0.85 - 0.91)	0.82	(0.79 - 0.85)
		5		0.90	(0.87 - 0.93)	0.81	(0.78 - 0.84)
Practice prevalence of smoking	Quintile	1	*Reference*	1		1	
		2		0.99	(0.96 - 1.02)	1.06	(1.02 - 1.10)
		3		0.92	(0.89 - 0.95)	1.08	(1.03 - 1.12)
		4		0.88	(0.85 - 0.91)	1.10	(1.05 - 1.15)
		5		0.92	(0.89 - 0.95)	1.17	(1.11 - 1.24)
Practice prevalence of obesity	Quintile	1	*Reference*	1		1	
		2		0.97	(0.93 - 1.00)	0.99	(0.96 - 1.03)
		3		0.98	(0.95 - 1.02)	1.02	(0.99 - 1.06)
		4		0.96	(0.92 - 0.99)	1.01	(0.98 - 1.05)
		5		0.93	(0.90 - 0.97)	1.02	(0.98 - 1.06)

Practice prevalence of hypertension	Quintile	1	*Reference*	1		1	
		2		1.03	(0.99 - 1.07)	0.99	(0.95 - 1.03)
		3		1.08	(1.04- 1.12)	1.01	(0.96 - 1.05)
		4		1.07	(1.03 -1.11)	1.01	(0.96 - 1.06)
		5		1.05	(1.02 - 1.09)	1.02	(0.96 - 1.08)
Practice prevalence of diabetes	Quintile	1	*Reference*	1		1	
		2		0.97	(0.94 - 1.00)	0.90	(0.87 - 0.93)
		3		0.94	(0.91 - 0.97)	0.87	(0.84 - 0.90)
		4		0.90	(0.87 - 0.93)	0.83	(0.80 - 0.87)
		5		0.80	(0.78 - 0.83)	0.75	(0.72 - 0.79)
Practice prevalence of coronary heart disease	Quintile	1	*Reference*	1		1	
		2		1.11	(1.07 - 1.15)	1.06	(1.01 - 1.11)
		3		1.12	(1.08 - 1.16)	1.09	(1.03 - 1.16)
		4		1.13	(1.09 - 1.17)	1.13	(1.06 - 1.20)
		5		1.06	(1.02 - 1.09)	1.09	(1.02 - 1.17)
Practice prevalence of stroke or transient ischaemic attack	Quintile	1	*Reference*	1		1	
		2		1.15	(1.10 - 1.19)	1.13	(1.09 - 1.19)
		3		1.16	(1.11 - 1.20)	1.14	(1.08 - 1.21)
		4		1.13	(1.09 - 1.17)	1.12	(1.06 - 1.19)
		5		1.12	(1.08 - 1.16)	1.14	(1.07 - 1.22)

Supplementary Table 5. Summary of unadjusted and adjusted regression analyses for the rate of prescribing of transdermal oestrogen-containing hormone replacement therapy. The results for all variables included in the multivariable model are given. Quintile 1 – the lowest quintile – is the reference for all variables. (IRR = incidence rate ratio; aIRR = adjusted incidence rate ratio; CI = confidence interval; HRT = hormone replacement therapy; IMD = Index of Multiple Deprivation).

				Unadjusted		Adjusted	
				IRR (95% CI)		aIRR (95% CI)	
Index of Multiple Deprivation score	Quintile	1	*Reference*	1		1	
		2		0.86	(0.82 - 0.90)	0.97	(0.93 - 1.02)
		3		0.76	(0.72 - 0.79)	0.95	(0.90 - 1.01)
		4		0.70	(0.67 - 0.73)	0.95	(0.89 - 1.01)
		5		0.68	(0.65 - 0.71)	0.97	(0.90 - 1.04)
Practice list size of female aged 40 years and above	Quintile	1	*Reference*	1		1	
		2		0.84	(0.80 - 0.88)	0.84	(0.81 - 0.88)
		3		0.82	(0.78 - 0.86)	0.81	(0.78 - 0.85)
		4		0.78	(0.74 - 0.81)	0.76	(0.72 - 0.79)
		5		0.80	(0.76 - 0.83)	0.77	(0.73 - 0.80)
Practice prevalence of smoking	Quintile	1	*Reference*	1		1	
		2		0.86	(0.82 - 0.90)	0.94	(0.89 - 0.98)
		3		0.74	(0.71 - 0.78)	0.86	(0.82 - 0.91)
		4		0.66	(0.63 - 0.70)	0.80	(0.76 - 0.85)
		5		0.66	(0.63 - 0.69)	0.79	(0.74 - 0.84)
Practice prevalence of obesity	Quintile	1	*Reference*	1		1	
		2		0.83	(0.79 - 0.87)	0.95	(0.91 - 0.99)
		3		0.76	(0.73 - 0.80)	0.92	(0.88 - 0.97)
		4		0.74	(0.71 - 0.77)	0.94	(0.89 - 0.99)
		5		0.67	(0.64 - 0.70)	0.90	(0.85 - 0.95)

Practice prevalence of hypertension	Quintile	1	*Reference*	1		1	
		2		0.86	(0.82 - 0.90)	0.98	(0.94 - 1.03)
		3		0.87	(0.83 - 0.91)	1.02	(0.97 - 1.08)
		4		0.85	(0.82 - 0.89)	1.03	(0.97 - 1.10)
		5		0.89	(0.85 - 0.94)	1.14	(1.06 - 1.22)
Practice prevalence of diabetes	Quintile	1	*Reference*	1		1	
		2		0.81	(0.77 - 0.84)	0.85	(0.81 - 0.89)
		3		0.71	(0.68 - 0.75)	0.79	(0.75 - 0.84)
		4		0.67	(0.64 - 0.70)	0.77	(0.73 - 0.82)
		5		0.61	(0.58 - 0.63)	0.70	(0.66 - 0.74)
Practice prevalence of coronary heart disease	Quintile	1	*Reference*	1		1	
		2		0.96	(0.91 - 1.00)	1.00	(0.95 - 1.06)
		3		0.88	(0.84 - 0.92)	0.95	(0.88 - 1.02)
		4		0.87	(0.83 - 0.91)	0.96	(0.89 - 1.03)
		5		0.80	(0.77 - 0.84)	0.88	(0.81 - 0.96)
Practice prevalence of stroke or transient ischaemic attack	Quintile	1	*Reference*	1		1	
		2		0.98	(0.94 - 1.03)	1.08	(1.03 - 1.14)
		3		0.89	(0.85 - 0.93)	1.05	(0.99 - 1.12)
		4		0.92	(0.88 - 0.97)	1.11	(1.03 - 1.19)
		5		0.90	(0.86 - 0.94)	1.08	(1.00 - 1.17)