

## Factors associated with consultation rates in general practice in England, 2013–2014:

a cross-sectional study

### Abstract

#### Background

Workload in general practice has risen during the last decade, but the factors associated with this increase are unclear.

#### Aim

To examine factors associated with consultation rates in general practice.

#### Design and setting

A cross-sectional study examining a sample of 304 937 patients registered at 316 English practices between 2013 and 2014, drawn from the Clinical Practice Research Datalink.

#### Method

Age, sex, ethnicity, smoking status, and deprivation measures were linked with practice-level data on staffing, rurality, training practice status, and Quality and Outcomes Framework performance. Multilevel analyses of patient consultation rates were conducted.

#### Results

Consultations were grouped into three types: all (GP or nurse), GP, and nurse. Non-smokers consulted less than current smokers [all: rate ratio [RR] = 0.88, 95% CI = 0.87 to 0.89; GP: RR = 0.88, 95% CI = 0.87 to 0.89; nurse: RR = 0.91, 95% CI = 0.90 to 0.92]. Consultation rates were higher for those in the most deprived quintile compared with the least deprived quintile [all: RR = 1.18, 95% CI = 1.16 to 1.19; GP: RR = 1.17, 95% CI = 1.15 to 1.19; nurse: RR = 1.13, 95% CI = 1.11 to 1.15]. For all three consultation types, consultation rates increased with age and female sex, and varied by ethnicity. Rates in practices with >8 and ≤19 full-time equivalent (FTE) GPs were higher compared with those with ≤2 FTE GPs [all: RR = 1.26, 95% CI = 1.06 to 1.49; GP: RR = 1.36, 95% CI = 1.19 to 1.56].

#### Conclusion

The analyses show consistent trends in factors related to consultation rates in general practice across three types of consultation. These data can be used to inform the development of more sophisticated staffing models, and resource allocation formulae.

#### Keywords

consultation rates; general practice; health services; workload.

### INTRODUCTION

Recent studies on trends in patient consultation rates in general practice in England provide evidence of an increase in patient-facing clinical workload.<sup>1,2</sup> Between 2007 and 2013, the crude annual consultation rate per patient increased by 10.5%.<sup>2</sup> Despite concerns that general practice is under unsustainable pressure, with particular difficulties in the recruitment and retention of GPs, there has been surprisingly little research into the factors associated with consultation rates during the past two decades.

The last major studies about consultation rates conducted in the UK analysed data collected more than 25 years ago,<sup>3–5</sup> or examined the effect of a limited number of characteristics on consultation rates.<sup>6</sup> Other research relates to consultations for specific conditions, such as anxiety and/or depressive disorders,<sup>7,8</sup> or the association between consultation rates and specific factors, such as socioeconomic status<sup>9</sup> or psychosocial problems,<sup>10</sup> or factors relating to consultation rates in specific population groups, for example, children<sup>11</sup> and older people.<sup>12</sup>

Internationally, data on factors related to consultation rates in general practice are sparse. Studies focus on specific conditions,<sup>13,14</sup> conditions within specific populations,<sup>15</sup> the effect of particular

factors,<sup>16,17</sup> or particular factors within specific populations.<sup>18</sup>

Empirical data on the factors associated with consultation rates in primary care are urgently needed to inform practice planning by primary care practice managers, and workforce planning by health service providers. The aim of this study was to examine factors associated with consultation rates in general practice.

### METHOD

#### Data sources

Data were obtained from the Clinical Practice Research Datalink (CPRD) on consultations with non-temporary patients registered for at least 1 day at an English general practice between April 2013 and March 2014. From each age–sex stratum of eligible patients, a random 10% sample was selected; this sample included data for 304 937 patients, drawn from 316 practices. Patient-level variables available in the CPRD included age, sex, ethnicity, and smoking status. The CPRD provided patient-level deprivation status based on scores from the English Index of Multiple Deprivation (IMD).<sup>19</sup> These data were linked to practice-level data on staffing,<sup>20</sup> rurality,<sup>21</sup> training status, and Quality and Outcomes Framework (QOF) performance,<sup>22</sup> from NHS Digital (formerly known as the Health and Social Care Information Centre).

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## How this fits in

Recent research on the volume of consultations in general practice in England shows an increase in consultation rates between 2007 and 2013, but there is little understanding of why this increase occurred. There are few international or UK data on the factors associated with consultation rates in general practice, and this is the first study to examine a comprehensive range of patient-level and practice-level characteristics. In previous research, NHS England used the estimated consultation duration as a proxy for workload. In this study, the authors use an alternative measure, the per patient consultation rate, and analyses show robust trends in patient-level and practice-level factors associated with workload across three different types of consultation. These findings can be used to develop new resource allocation formulae, and staffing models, which consider the effect of both patient-level and practice-level factors associated with workload.

**Table 1. Characteristics of patients in study (N= 304 937)**

Characteristic	n	%
<b>Sex</b>		
Male	150 081	49.2
Female	154 856	50.8
<b>Ethnicity</b>		
White	147 205	48.3
Asian	7541	2.5
Chinese	688	0.2
Black	5140	1.7
Other/mixed	5814	1.9
Unknown	138 549	45.4
<b>Age</b>		
<5	19 388	6.4
5–14	34 356	11.3
15–24	36 874	12.1
25–44	85 075	27.9
45–64	76 500	25.1
65–74	27 676	9.1
>74	25 068	8.2
<b>IMD</b>		
Lowest quintile	65 582	21.5
2nd quintile	65 758	21.6
3rd quintile	58 879	19.3
4th quintile	59 333	19.5
5th quintile	48 976	16.1
Unknown	6409	2.1
<b>Smoking status</b>		
Non-smoker	111 584	36.6
Current smoker	50 276	16.5
Ex-smoker	49 323	16.2
Unknown	93 754	30.8

IMD = Index of Multiple Deprivation.

Practice-level data were downloaded from the NHS Digital website, and were grouped or deciled before being linked to CPRD data by NHS Digital. The categorisation of practice-level variables was a requirement of ethical approval from the Independent Scientific Advisory Committee to the CPRD. Although data on staffing, rurality, training status, and QOF performance are publicly available, providing these data for each practice increased the possibility of the unintentional deductive disclosure of the identity of individual practices. Thus, these data were grouped or deciled to protect practices from being identified.

## Consultation types

Consultations in CPRD data represent events in which a patient's electronic health record is opened by a staff member of the practice. Codes for face-to-face, telephone, and visit consultations were selected from the consultation type variable, as were codes for GP and nurse consultations from the staff role variable. In line with the authors' previous research on consultation rates,<sup>2</sup> consultations with GPs or nurses that were conducted in the practice, over the telephone, or at home, were included in the study, whereas other types of entries in the consultation record, such as administrative entries, were excluded. Separate variables were created for GP consultations, nurse consultations, and all consultations (GP or nurse consultations

combined); and separate analyses were conducted for all three consultation types. Missing data were included in unknown categories for variables in the models.

## Statistical analyses

Multilevel negative binomial models were used to model consultation rate for each of the three consultation type variables with patient-level (age, sex, ethnicity, IMD score, and smoking status) and practice-level (number of full-time equivalent [FTE] GPs, number of FTE nurses, QOF achievement score, training status, and rurality) covariates. As expected, the variables number of FTE GPs and practice list size were correlated. Both variables could not be included in each multivariate model because of collinearity, therefore, practice list size was omitted from further analyses.

The dependent variable was number of consultations (GP, nurse, or all), and the offset for each model was log of person-years, which is used so that the dependent variable can be modelled as a rate. The random effect parameter for all models was an anonymised practice identifier, and significance was measured at the 5% level.

Univariate analyses were conducted, and likelihood ratio tests were used to test the overall significance of categorical variables. All significant variables were entered into a multivariate model. Non-significant variables were manually removed from the multivariate model using stepwise regression until a parsimonious model was derived. Each variable that was not significant in the univariate analyses was then re-entered into the model, individually, to see if it became so when grouped with other significant variables. Models for each consultation type are presented that include only those factors that had a significant effect on patient consultation rates. Data were analysed using the statistical package Stata (version 14.1).

## RESULTS

### Patient characteristics

Table 1 outlines the characteristics of patients in the study. Of the 304 937 patients in the study, 49.2% were male and 50.8% were female. Most patients were white (48.3%), although findings on ethnicity should be viewed with some caution because data for this variable were missing in 45.4% of CPRD patient records. In terms of age, 29.8% of patients were aged <25 years, and 8.2% of patients were aged >74 years. More than one-third of the sample (35.6%) had an IMD score in the fourth or fifth quintile (with the fifth quintile containing scores for the

**Table 2. Characteristics of practices in study (N= 316)**

Characteristic	n	%
<b>FTE nurses</b>		
≤2	188	59.5
>2 and ≤4	65	20.6
>4 and ≤6	20	6.3
>6 and ≤8	6	1.9
>8 and ≤19	4	1.3
Unknown	33	10.4
<b>FTE GPs</b>		
≤2	44	13.9
>2 and ≤4	74	23.4
>4 and ≤6	101	32.0
>6 and ≤8	55	17.4
>8 and ≤19	40	12.7
Unknown	2	0.6
<b>QOF achievement score</b>		
1st quintile	50	15.8
2nd quintile	49	15.5
3rd quintile	59	18.7
4th quintile	82	26.0
5th quintile	73	23.1
Unknown	3	1.0
<b>Training practice</b>		
No	188	59.5
Yes	126	39.9
Unknown	2	0.6
<b>Rurality</b>		
Urban >10k to less sparse	267	84.5
Hamlet, village, town, & fringe	49	15.5

FTE = full-time equivalent. QOF = Quality and Outcomes Framework.

most deprived patients). Just under one-third of the sample were either ex-smokers (16.2%), or current smokers (16.5%).

### Practice characteristics

Patient data were drawn from a total of 316 linked CPRD practices. Of these practices, 84.5% were located in urban areas; 59.5% had ≤2 FTE nurses; 13.9% had ≤2 FTE GPs; 39.9% were training practices; and 49.1% had QOF achievement scores in the fourth or fifth quintile (the highest achievement scores) (Table 2).

### All consultations

**Univariate analyses.** There was a significant association ( $P<0.05$ ) between the all consultation rate and the following covariates: sex, ethnicity, age, number of FTE GPs, number of FTE nurses, IMD score, smoking status, QOF achievement score, and practice training status. There was no significant association between the all consultation rate and practice rurality status (Table 3). For the covariate QOF

achievement score, the association was only significant for the unknown (missing) level of the variable.

**Multivariate analyses.** Multivariate analyses showed that consultation rate for females (rate ratio [RR] = 1.21, 95% CI = 1.20 to 1.22) was 21% higher than for males (Table 3). Asian patients consulted more (RR = 1.14, 95% CI = 1.11 to 1.16), and Chinese patients less (RR = 0.82, 95% CI = 0.77 to 0.89), than white patients.

Older patients consulted more, with the oldest age group (aged >74 years) consulting almost four more times as often (RR = 3.97, 95% CI = 3.90 to 4.05) as those in the reference group (aged 5–14 years).

The all consultation rate was also associated with a greater number of FTE GPs at a practice; compared with surgeries that had ≤2 FTE GPs, the consultation rate for surgeries that had >8 and ≤19 GPs was 26% higher (RR = 1.26, 95% CI = 1.06 to 1.49).

Compared with patients with IMD scores in the least deprived quintile (quintile 1), consultation rate was 11% higher (RR = 1.11, 95% CI = 1.10 to 1.13) for those with scores in the fourth quintile, and 18% higher (RR = 1.18, 95% CI = 1.16 to 1.19) for those with scores in the fifth quintile.

Finally, compared with current smokers, non-smokers had a 12% lower (RR = 0.88, 95% CI = 0.87 to 0.89), and ex-smokers a 2% lower (RR = 0.98, 95% CI = 0.97 to 0.99), consultation rate than smokers.

### GP consultations

**Univariate analyses.** As with univariate analyses for all consultations, univariate analyses for GP consultations showed a significant association ( $P<0.05$ ) between consultation rate and the variables sex, ethnicity, age, number of FTE GPs, number of FTE nurses, IMD score, smoking status, QOF achievement score (only for the unknown level of the variable), and practice training status (Table 4). There was no association between consultation rate and practice rurality status.

**Multivariate analyses.** Multivariate analyses for GP consultation rate showed similar trends to those for all consultations. GP consultation rate was significantly associated with sex, ethnicity, age, number of FTE GPs, IMD score, and smoking status. Females consulted more than males (Table 4). Compared with white patients, Asian patients consulted more, and Chinese patients less. Consultation rate was positively associated with a patient's age. Consultation rate was also associated

**Table 3. Multilevel, univariate, and multivariate analyses of all consultations, 2013–2014<sup>a</sup>**

	Univariate			Multivariate <sup>b</sup>		
	Rate ratio	95% CI	P-value	Rate ratio	95% CI	P-value
<b>Sex</b>						
Male	1			1		
Female	1.20	1.19 to 1.21	<0.01	1.21	1.20 to 1.22	<0.01
<b>Ethnicity</b>						
White	1			1		
Asian	0.99	0.97 to 1.02	0.67	1.14	1.11 to 1.16	<0.01
Chinese	0.73	0.68 to 0.79	<0.01	0.82	0.77 to 0.89	<0.01
Black	0.86	0.83 to 0.88	<0.01	0.97	0.94 to 1.00	0.02
Other/mixed	0.87	0.84 to 0.89	<0.01	1.01	0.98 to 1.03	0.55
Unknown	0.63	0.63 to 0.64	<0.01	0.71	0.70 to 0.71	<0.01
<b>Age</b>						
<5	2.09	2.05 to 2.12	<0.01	1.88	1.84 to 1.91	<0.01
5–14	1			1		
15–24	1.45	1.42 to 1.47	<0.01	1.65	1.62 to 1.68	<0.01
25–44	1.73	1.70 to 1.75	<0.01	1.88	1.85 to 1.91	<0.01
45–64	1.96	1.94 to 1.99	<0.01	2.22	2.18 to 2.26	<0.01
65–74	2.60	2.56 to 2.65	<0.01	2.89	2.84 to 2.95	<0.01
>74	3.75	3.69 to 3.81	<0.01	3.97	3.90 to 4.05	<0.01
<b>FTE nurses</b>						
≤2	1			1		
>2 and ≤4	1.11	1.01 to 1.23	0.04	1.04	0.94 to 1.16	0.42
>4 and ≤6	1.18	1.00 to 1.38	0.05	1.08	0.90 to 1.28	0.41
>6 and ≤8	1.45	1.09 to 1.93	0.01	1.30	0.97 to 1.72	0.08
>8 and ≤19	1.51	1.06 to 2.13	0.02	1.39	1.00 to 1.93	0.05
Unknown	1.03	0.90 to 1.17	0.66	0.92	0.81 to 1.04	0.18
<b>FTE GPs</b>						
≤2	1			1		
>2 and ≤4	1.15	1.01 to 1.31	0.03	1.14	1.01 to 1.29	0.03
>4 and ≤6	1.24	1.10 to 1.40	<0.01	1.22	1.09 to 1.38	<0.01
>6 and ≤8	1.21	1.06 to 1.39	0.01	1.20	1.05 to 1.38	0.01
>8 and ≤19	1.37	1.18 to 1.58	<0.01	1.26	1.06 to 1.49	0.01
Unknown	4.05	2.42 to 6.77	<0.01	3.72	2.25 to 6.15	<0.01
<b>IMD</b>						
1st quintile	1			1		
2nd quintile	1.05	1.03 to 1.06	<0.01	1.03	1.02 to 1.04	<0.01
3rd quintile	1.05	1.04 to 1.07	<0.01	1.06	1.04 to 1.07	<0.01
4th quintile	1.09	1.07 to 1.10	<0.01	1.11	1.10 to 1.13	<0.01
5th quintile	1.15	1.13 to 1.16	<0.01	1.18	1.16 to 1.19	<0.01
Unknown	1.02	0.99 to 1.06	0.20	1.29	1.25 to 1.33	<0.01
<b>Smoking status</b>						
Current smoker	1			1		
Non-smoker	0.89	0.88 to 0.90	<0.01	0.88	0.87 to 0.89	<0.01
Ex-smoker	1.14	1.12 to 1.15	<0.01	0.98	0.97 to 0.99	<0.01
Unknown	0.81	0.80 to 0.82	<0.01	1.10	1.08 to 1.11	<0.01
<b>QOF achievement score</b>						
1st quintile	1					
2nd quintile	1.00	0.87 to 1.16	0.97			
3rd quintile	1.05	0.92 to 1.20	0.47			
4th quintile	1.01	0.89 to 1.15	0.82			
5th quintile	1.06	0.94 to 1.21	0.35			
Unknown	2.10	1.36 to 3.23	<0.01			
<b>Training practice</b>						
No	1					
Yes	1.10	1.01 to 1.19	0.02			
Unknown	3.52	2.10 to 5.90	<0.01			
<b>Rurality</b>						
Urban >10 000 to less sparse	1					
Hamlet, village, town, & fringe	1.10	0.99 to 1.23	0.09			

<sup>a</sup>The random effect parameter for each analysis is practice. <sup>b</sup>The multivariate columns only include data for those covariates that had a significant effect on consultation rate. FTE = full-time equivalent. IMD = Index of Multiple Deprivation. QOF = Quality and Outcomes Framework.

with an increase in the number of GPs in a practice; compared with surgeries with ≤2 FTE GPs, patients who were registered with surgeries with >8 and ≤19 FTE GPs consulted 36% more often (RR = 1.36, 95% CI = 1.19 to 1.56).

As with the analyses for all consultations, consultation rate with GPs was positively associated with level of deprivation, with patients with IMD scores in the most deprived quintile consulting 17% more often (RR = 1.17, 95% CI = 1.15 to 1.19) than those with scores in the least deprived quintile.

Finally, non-smokers had a consultation rate that was 12% lower (RR = 0.88, 95% CI = 0.87 to 0.89) than that for smokers, and ex-smokers had a consultation rate 4% lower (RR = 0.96, 95% CI = 0.95 to 0.97) than that for smokers.

### Nurse consultations

**Univariate analyses.** There was a significant association between consultation rate for nurses ( $P < 0.05$ ) and the variables sex, ethnicity, age, number of FTE GPs, number of FTE nurses, IMD score, smoking status, QOF achievement score, and practice training status. For the covariates number of FTE GPs, QOF achievement score, and practice training status, the association was only significant for the unknown level of each variable (Table 5). In addition, there was no significant univariate association between consultation rate and rurality.

**Multivariate analyses.** Consultation rate with nurses was significantly associated with ethnicity, age, number of FTE GPs (but only for the unknown level), number of FTE nurses, IMD score, and smoking status.

Multivariate analyses showed findings that mirrored trends on age, ethnicity, deprivation, and smoking status in the all consultation and GP consultation models.

Consultation rate was positively associated with number of FTE nurses; compared with surgeries with ≤2 practice nurses, those surgeries that had >4 and ≤6 FTE nurses had a higher consultation rate by a factor of 1.30 (RR = 1.30, 95% CI = 1.07 to 1.59). Counts for practices with >6 FTE nurses were low (Table 2).

## DISCUSSION

### Summary

Multivariate analyses were performed with three types of consultations: all (GP or nurse), GP, and nurse consultations. Analyses for all three consultation types showed similar, robust trends in factors associated with consultation rates in general practice.

**Table 4. Multilevel, univariate, and multivariate analyses of GP consultations, 2013–2014<sup>a</sup>**

	Univariate			Multivariate <sup>b</sup>		
	Rate ratio	95% CI	P-value	Rate ratio	95% CI	P-value
<b>Sex</b>						
Male	1			1		
Female	1.22	1.21 to 1.22	<0.01	1.20	1.19 to 1.21	<0.01
<b>Ethnicity</b>						
White	1			1		
Asian	1.00	0.98 to 1.02	0.98	1.13	1.10 to 1.15	<0.01
Chinese	0.74	0.68 to 0.80	<0.01	0.82	0.76 to 0.89	<0.01
Black	0.85	0.83 to 0.88	<0.01	0.95	0.92 to 0.98	<0.01
Other/mixed	0.88	0.86 to 0.91	<0.01	1.01	0.99 to 1.04	0.31
Unknown	0.65	0.64 to 0.65	<0.01	0.71	0.70 to 0.72	<0.01
<b>Age</b>						
<5	1.80	1.77 to 1.84	<0.01	1.63	1.60 to 1.66	<0.01
5–14	1			1		
15–24	1.41	1.39 to 1.44	<0.01	1.65	1.62 to 1.68	<0.01
25–44	1.66	1.63 to 1.68	<0.01	1.86	1.83 to 1.89	<0.01
45–64	1.83	1.80 to 1.86	<0.01	2.13	2.09 to 2.17	<0.01
65–74	2.24	2.20 to 2.28	<0.01	2.57	2.51 to 2.62	<0.01
>74	3.25	3.19 to 3.30	<0.01	3.54	3.48 to 3.62	<0.01
<b>FTE nurses</b>						
≤2	1			1		
>2 and ≤4	1.04	0.94 to 1.14	0.46			
>4 and ≤6	1.09	0.93 to 1.28	0.26			
>6 and ≤8	1.43	1.08 to 1.89	0.01			
>8 and ≤19	1.29	0.92 to 1.82	0.14			
Unknown	1.04	0.91 to 1.18	0.59			
<b>FTE GPs</b>						
≤2	1			1		
>2 and ≤4	1.17	1.03 to 1.32	0.01	1.17	1.04 to 1.32	0.01
>4 and ≤6	1.25	1.11 to 1.40	<0.01	1.25	1.12 to 1.40	<0.01
>6 and ≤8	1.21	1.06 to 1.37	<0.01	1.23	1.08 to 1.39	<0.01
>8 and ≤19	1.34	1.17 to 1.54	<0.01	1.36	1.19 to 1.56	<0.01
Unknown	4.68	2.86 to 7.65	<0.01	4.07	2.52 to 6.57	<0.01
<b>IMD</b>						
1st quintile	1			1		
2nd quintile	1.05	1.03 to 1.06	<0.01	1.04	1.02 to 1.05	<0.01
3rd quintile	1.06	1.04 to 1.07	<0.01	1.06	1.04 to 1.07	<0.01
4th quintile	1.09	1.08 to 1.11	<0.01	1.11	1.10 to 1.13	<0.01
5th quintile	1.15	1.13 to 1.17	<0.01	1.17	1.15 to 1.19	<0.01
Unknown	0.96	0.92 to 0.99	0.03	1.18	1.14 to 1.23	<0.01
<b>Smoking status</b>						
Current smoker	1			1		
Non-smoker	0.89	0.88 to 0.90	<0.01	0.88	0.87 to 0.89	<0.01
Ex-smoker	1.09	1.08 to 1.10	<0.01	0.96	0.95 to 0.97	<0.01
Unknown	0.82	0.81 to 0.83	<0.01	1.12	1.11 to 1.14	<0.01
<b>QOF achievement score</b>						
1st quintile	1			1		
2nd quintile	1.02	0.89 to 1.16	0.82			
3rd quintile	1.09	0.95 to 1.24	0.21			
4th quintile	1.04	0.92 to 1.17	0.57			
5th quintile	1.05	0.93 to 1.19	0.42			
Unknown	2.25	1.48 to 3.41	<0.01			
<b>Training practice</b>						
No	1			1		
Yes	1.10	1.03 to 1.19	0.01			
Unknown	4.07	2.49 to 6.66	<0.01			
<b>Rurality</b>						
Urban >10 000 to less sparse	1			1		
Hamlet, village, town, & fringe	1.10	0.99 to 1.22	0.08			

<sup>a</sup>The random effect parameter for each analysis is practice. <sup>b</sup>The multivariate columns only include data for those covariates that had a significant effect on consultation rate. FTE = full-time equivalent. IMD = Index of Multiple Deprivation. QOF = Quality and Outcomes Framework.

For all three consultation types, consultation rates increased with age, females consulted more than males, and Asian patients consulted more, and Chinese patients less, than white patients.

Consultation rates also increased with level of deprivation: consultation rates for those with scores in the most deprived quintile were between 13% and 18% higher than for those with scores in the least deprived quintile. Practices with more GPs or nurses had higher consultation rates than those with fewer GPs or nurses, which probably reflects greater availability of appointments in surgeries with higher staff to patient ratios.

### Strengths and limitations

This study has several strengths. First, it provides robust data on patient and practice characteristics associated with consultation rates, which can be used to inform workforce planning, and fair allocation of resources. Second, these findings are based on a large and broadly representative sample of patients from general practices across England.<sup>23</sup> Third, through linkage between data from a range of sources, and use of multilevel statistical models, this study has been able to demonstrate the independent effect of patient and practice characteristics, which might otherwise be confounded in single-level analyses. For example, the analyses have highlighted the independent impact of both age and deprivation on consultation rates, which may not be apparent in studies based only on practice-level data, where practices with more deprived populations also tend to have fewer older patients.<sup>24</sup> Fourth, all analyses of consultation rates reflect activity rather than demand, and the number of consultations conducted is constrained by the number of appointments available. Because patients with different characteristics are 'competing' for the same number of appointments in a practice, using individual patient data within a multilevel model helps to identify individual factors associated with consultation rates that may not be apparent in a practice-level analysis. Although this is a major strength of the current study, the findings may still underestimate the relationship between patient characteristics, such as deprivation or age and activity, because practices in some areas tend to have a high proportion of deprived or older patients, and activity will still be constrained by appointment availability.

In terms of limitations, as with all routinely collected data, data are subject to coding and



**Table 5. Multilevel, univariate, and multivariate analyses of nurse consultations, 2013–2014<sup>a</sup>**

	Univariate			Multivariate <sup>b</sup>		
	Rate ratio	95% CI	P-value	Rate ratio	95% CI	P-value
<b>Sex</b>						
Male	1			1		
Female	0.97	0.96 to 0.98	<0.01	1.01	1.00 to 1.02	0.01
<b>Ethnicity</b>						
White	1			1		
Asian	0.94	0.91 to 0.97	<0.01	1.04	1.01 to 1.08	0.01
Chinese	0.79	0.71 to 0.88	<0.01	0.89	0.80 to 1.00	0.04
Black	0.91	0.87 to 0.94	<0.01	0.99	0.95 to 1.03	0.70
Other/mixed	0.86	0.83 to 0.90	<0.01	0.96	0.92 to 0.99	0.02
Unknown	0.78	0.77 to 0.78	<0.01	0.83	0.82 to 0.84	<0.01
<b>Age</b>						
<5	1.58	1.53 to 1.62	<0.01	1.46	1.42 to 1.50	<0.01
5–14	1			1		
15–24	1.24	1.21 to 1.28	<0.01	1.40	1.36 to 1.44	<0.01
25–44	1.30	1.27 to 1.33	<0.01	1.43	1.40 to 1.47	<0.01
45–64	1.46	1.42 to 1.49	<0.01	1.64	1.59 to 1.68	<0.01
65–74	1.85	1.81 to 1.90	<0.01	2.06	2.00 to 2.12	<0.01
>74	2.37	2.31 to 2.43	<0.01	2.59	2.52 to 2.67	<0.01
<b>FTE nurses</b>						
≤2	1			1		
>2 and ≤4	1.19	1.06 to 1.33	<0.01	1.23	1.09 to 1.38	<0.01
>4 and ≤6	1.22	1.02 to 1.46	0.03	1.30	1.07 to 1.59	0.01
>6 and ≤8	1.92	1.39 to 2.65	<0.01	2.03	1.47 to 2.81	<0.01
>8 and ≤19	1.77	1.20 to 2.61	<0.01	1.87	1.29 to 2.70	<0.01
Unknown	1.01	0.87 to 1.17	0.90	0.94	0.82 to 1.09	0.42
<b>FTE GPs</b>						
≤2	1			1		
>2 and ≤4	0.93	0.79 to 1.08	0.34	0.91	0.79 to 1.06	0.23
>4 and ≤6	1.01	0.87 to 1.17	0.91	0.95	0.83 to 1.10	0.51
>6 and ≤8	0.97	0.82 to 1.14	0.71	0.89	0.75 to 1.05	0.15
>8 and ≤19	1.14	0.95 to 1.36	0.15	0.88	0.72 to 1.07	0.20
Unknown	9.15	3.97 to 21.13	<0.01	9.03	4.11 to 19.84	<0.01
<b>IMD</b>						
1st quintile	1			1		
2nd quintile	1.03	1.01 to 1.04	<0.01	1.02	1.00 to 1.03	0.04
3rd quintile	1.04	1.02 to 1.06	<0.01	1.04	1.02 to 1.06	<0.01
4th quintile	1.05	1.03 to 1.07	<0.01	1.07	1.05 to 1.09	<0.01
5th quintile	1.10	1.08 to 1.12	<0.01	1.13	1.11 to 1.15	<0.01
Unknown	1.33	1.27 to 1.40	<0.01	1.55	1.48 to 1.63	<0.01
<b>Smoking status</b>						
Current smoker	1			1		
Non-smoker	0.92	0.90 to 0.93	<0.01	0.91	0.90 to 0.92	<0.01
Ex-smoker	1.11	1.09 to 1.13	<0.01	0.98	0.97 to 1.00	0.02
Unknown	0.91	0.90 to 0.93	<0.01	1.11	1.08 to 1.13	<0.01
<b>QOF achievement score</b>						
1st quintile	1					
2nd quintile	0.92	0.78 to 1.09	0.34			
3rd quintile	0.93	0.79 to 1.09	0.36			
4th quintile	0.94	0.80 to 1.09	0.38			
5th quintile	0.97	0.83 to 1.13	0.67			
Unknown	2.54	1.40 to 4.64	<0.01			
<b>Training practice</b>						
No	1					
Yes	1.02	0.93 to 1.12	0.69			
Unknown	9.26	4.01 to 21.41	<0.01			
<b>Rurality</b>						
Urban >>10 000 to less sparse	1					
Hamlet, village, town, & fringe	1.06	0.93	1.21	0.36		

<sup>a</sup>The random effect parameter for each analysis is practice. <sup>b</sup>The multivariate columns only include data for those covariates that had a significant effect on consultation rate. FTE = full-time equivalent. IMD = Index of Multiple Deprivation. QOF = Quality and Outcomes Framework.

recording errors. Furthermore, complete data were not available for all patients, and unknown categories were included in models that may be difficult to interpret. For example, 55% of data on patient ethnicity were missing. The completeness and validity of ethnicity recording in Hospital Episode Statistics and CPRD have been examined in previous research, and completeness of ethnicity recording was slightly higher than that observed in the present study.<sup>25</sup> However, for those patients for whom data on ethnicity were recorded, proportions in each ethnic group were consistent with those observed in census data.<sup>25</sup> This indicates that data on ethnicity are equally likely to be missing regardless of ethnic group; hence, associations observed in this study would remain unchanged by more complete information. Finally, data were used for consultations that involved direct contact with a patient, be that in person or on the telephone. There are other activities that generate workload for clinicians which do not require direct patient contact, such as writing referral letters, and this analysis also does not include the substantial workload in general practice carried out by administrative staff.

### Comparison with existing literature

These findings support those in previous studies which found that consultation rates were higher among females than males,<sup>26</sup> among Asian patients,<sup>27</sup> and among older patients,<sup>6</sup> and increased with level of deprivation.<sup>28</sup>

### Implications for policy and practice

The current workload formula for the allocations of resources to clinical commissioning groups was developed by NHS England in 2016.<sup>29</sup> This model has already been used for the allocation of resources to clinical commissioning groups for the year 2016–2017, and NHS England is planning to use the same model to allocate resources for the next 4 years (until 2020–2021). In this model, NHS England considers the effect of only four variables (sex and age group, rurality, deprivation, and number of new registrations) on duration of consultation, the proxy variable it uses to measure workload. In the alternative model in the current study, the effect of six variables not considered in the NHS England model (ethnicity, smoking status, number of FTE GPs, number of FTE nurses, QOF performance score, and practice training status) on consultation rate, a proxy variable for workload, were also measured. NHS England reports that:

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### Ethical approval

Clinical Practice Research Datalink (CPRD) research is covered by a broad NRES Ethical Approval System. This project received approval from the CPRD Independent Scientific Advisory Committee. Approved Independent Scientific Advisory Committee protocol (number 15\_120R).

### Provenance

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### Competing interests

FD Richard Hobbs is a GP partner (Modality Partnership) and director of the NIHR School for Primary Care Research. Chris Salisbury is a GP in Bristol. Tim A Holt is a GP in London and GP adviser to the CPRD (but not in its employment). No other authors have declared any competing interests.

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*A number of other potential factors were considered [for the model used] but were either not available in the anonymised dataset, the data were not of sufficient quality, or data were not available for every GP practice in the country to permit implementation.<sup>29</sup>*

Through linkage of data from a variety of sources, the authors of the current study have demonstrated the independent effect of 10 (in the analyses, sex and age were two separate variables) patient and practice characteristics on consultation rate. The analyses in this study show robust trends in patient-level and practice-level factors associated with workload across three types of consultation. The authors believe this model is of greater utility than that currently used by NHS England because

it will inform the development of more sophisticated staffing models, and resource allocation formulae, than analyses that have only considered a limited number of explanatory variables, and/or practice-level variables.

These findings can also be used to help identify practices in particular areas that may need to be targeted for additional support, including infrastructure such as consultation space, because of their predicted higher workload. For example, the findings show that practices in areas that have more older patients living in deprived areas (as in some seaside towns), or a higher proportion of patients from Asian ethnic groups, are likely to experience high workload, and this should be accounted for in workforce planning.

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