

# Primary care factors associated with cervical screening coverage in England

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## ABSTRACT

**Background** The National Health Service Cervical Screening Programme was established to decrease the incidence and mortality of cervical cancer in England.

**Methods** To identify socioeconomic and general practice factors associated with cervical screening coverage in England, a national cross-sectional study was conducted using data on 26 497 476 female patients registered with 7970 practices in 152 English primary care trusts (PCTs). The 2008–09 data on cervical screening coverage rates from the quality and outcomes framework (QOF) database were used with data on QOF indicators, staffing levels and socioeconomic status.

**Results** The mean cervical screening coverage rate was 78.5% at the PCT level and 83.5% at the practice level. At both levels, cervical screening coverage was significantly negatively associated with the index of multiple deprivation score, percentage of female patients aged 25–49 years and percentage of ethnic minority patients. Also, at the practice level, the percentage of female patients aged 50–64 years, overall QOF score and records and information score were significantly positively associated with cervical screening coverage.

**Conclusions** Cervical screening coverage was significantly lower in PCTs and practices serving higher percentages of younger-aged women, non-Caucasian individuals and those living in socioeconomic deprivation. It is therefore important to adopt strategies to improve cervical screening coverage in these groups.

**Keywords** cancer, population-based and preventative services, screening

## Background

Cervical cancer is globally the second most frequently found malignancy in women,<sup>1</sup> with yearly occurrence of around 400 000 new cases<sup>2</sup> and 250 000 deaths.<sup>3</sup> In Europe, the number of new cervical cancer cases was around 54 800 in 2008, with 25 000 resultant deaths.<sup>4</sup> The UK accounted for 2250 of these new cases<sup>5</sup> and 830 deaths.<sup>6</sup>

Cervical screening involves sampling cervical epithelial cells via the Papanicolaou smear test<sup>7</sup> or liquid-based cytology<sup>8</sup> in an attempt to detect pre-malignant lesions known as cervical intraepithelial neoplasia (CIN). When CIN is detected, cervical biopsies are then performed to confirm the diagnosis<sup>3,7</sup> so that treatment can be started early and thus prevent progression to cervical cancer. In England, the National Health Service Cervical Screening Programme (NHSCSP) has been in place since 1988.<sup>3,9</sup> It

currently aims to ensure that cervical screening tests are performed on all suitable women aged between 25 and 64 years of age,<sup>10</sup> at intervals of 3 years for women aged 25–49 years and 5 years for women aged 50–64 years.<sup>10</sup> Although the programme is overseen by the NHSCSP, each primary care trust (PCT) is responsible for managing the screening programme within their region.<sup>11</sup> The NHS Call and Recall system, which holds information on all women who are eligible to undergo cervical screening, is also responsible for sending invitation and reminder letters so

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that cervical screening can be performed, usually at the local general practice.<sup>11</sup> The result letters are sent from the laboratory to the patient, patient's general practice and PCT so that further action can be taken as needed.<sup>11</sup>

The NHSCSP has resulted in an increase in the proportion of women attending regular screening tests,<sup>9,10,12</sup> although more recently there has been a slow decline in cervical screening coverage.<sup>10,12</sup> The screening programme has also resulted in a marked reduction in the incidence of advanced cervical cancers, with a decrease of around 35% in the number of new cases compared with that in the 1980s.<sup>9</sup> The mortality rate due to cervical cancer has also been declining at a rate of around 1.5% per year since 1950<sup>9</sup> and cervical screening is considered to have prevented 4500 deaths every year in the UK.<sup>3</sup> However, despite the evidence outlining its effectiveness, cervical screening coverage can vary widely among general practices and primary care organizations.<sup>10</sup> A wide range of factors have been shown to influence cervical screening coverage, namely socioeconomic factors,<sup>13–20</sup> characteristics of the medical professional performing the screening test,<sup>13,15,21–23</sup> structure and organization of medical centres,<sup>15,17</sup> individual's health status<sup>16,17</sup> and opinions regarding cervical screening.<sup>14,18,21,24</sup>

The aim of this study was to determine the sociodemographic, socioeconomic and practice factors associated with cervical screening coverage in England at both PCT and general practice levels. PCTs are NHS organizations that fund general practices located within a defined geographical region<sup>25</sup> and analysis at both levels is ideal as the aggregation of practice data can result in loss of important associations that may have been apparent at a practice level.<sup>25</sup> Also, the health system in England offers universal health care that is free at the point of delivery to all its residents through the NHS, including preventive programmes such as cervical screening. As there are no financial barriers to receiving a cervical screening test, the impact of other factors, such as general practice characteristics, socioeconomic status and ethnicity can be assessed. Standardized collection of data on cervical screening nationally and the availability of other data on PCT, general practice and population characteristics were the other advantages of carrying out this study using information from England.<sup>26</sup>

## Methods

A national cross-sectional study was carried out using data on women registered with 8229 practices in 152 PCTs. Data analysis was conducted between May 2010 and July 2011 at both practice and PCT levels, and with the exception of cervical screening coverage data [in which both the PCT and

practice level data were obtained directly from the quality and outcomes framework (QOF) database], the PCT data were obtained by calculating the mean of practice data. In this study, cervical screening coverage was defined as the percentage of eligible women in England between the ages of 25 and 64 years who had undergone a successful cervical screening test within the preceding 5 years, which is in line with the definition provided by the Health and Social Care Information Centre.<sup>10</sup>

### QOF data

QOF is a 'pay-for-performance' system established in England that enables participating general practices to be monitored in their achievement of various clinical and non-clinical goals. It works by allocating a set of points based on the practice's success in meeting performance targets. QOF consists of four domains (clinical, organizational, patient care experience and additional services), and each domain is in turn composed of numerous indicators. In 2008–09, QOF contained information on 8229 practices within 152 PCTs in England.

Cervical screening coverage data at practice and PCT levels for the period of April 2008 to March 2009 were obtained from the QOF database on the Information Centre for Health and Social Care website.<sup>27,28</sup> Overall QOF achievement scores and records and information scores for the period of April 2008 to March 2009 were used as indicators of the organizational capacity of both practices and PCTs. Overall QOF achievement score represents the total QOF score achieved by each practice and is obtained by the summation of scores achieved within each domain. A maximum QOF score of 1000 can be achieved by each practice and the score can be expressed as a percentage of the total available.<sup>29</sup> The records and information score is composed only of indicators that reflect the accuracy of record keeping by the practices,<sup>30</sup> and was therefore used as a reflection of the organizational efficiency of each practice and PCT. Examination of the possible association between overall QOF score, records and information score and cervical screening coverage at both practice and PCT levels was considered to be important as high overall QOF scores were significantly positively correlated with cervical screening rates in general practices in one PCT.<sup>31</sup>

### Staffing data

The number of full-time general practitioners per 100 000 population as of September 2007 at the practice level was obtained from the Information Centre for Health and Social Care database.<sup>32</sup> Using this data, the number of female patients per full-time general practitioner per 100 000

population was calculated and used as an indicator of the patient load in the practices and PCTs in this study. This was an important variable to examine as one study showed that the likelihood of not undergoing cervical screening was greater in practices with larger patient list sizes and also in practices employing only one general practitioner.<sup>15</sup>

### Care quality commission data

The index of multiple deprivation (IMD) score data was taken from the 2004 Department of Communities and Local Government (DCLG) IMD database.<sup>33</sup> The IMD score is calculated from seven domains which consist of 'housing, employment, health, education, crime, income and education/training',<sup>34</sup> with a higher score representing greater degree of socioeconomic deprivation. Also, the estimated number of patients of different ethnicities and number of female patients within 5-year age bands registered with each practice as of April 2008 were obtained from the care quality commission. This then enabled us to calculate the proportion of non-Caucasian patients (defined as Asian/Asian other, Black/Black other and Mixed and other), as well as the proportion of female patients aged 25–49 and 50–64 years at practice and PCT levels.

### Statistical analysis

The baseline characteristics of all the variables under investigation were calculated at practice and PCT levels. Then, the univariate correlation between cervical screening coverage and the predictor variables was evaluated at both PCT and practice levels using Spearman's rank correlation coefficients. Finally, the association between cervical screening coverage and predictor variables was determined at practice and PCT levels using multiple regression and reverse stepwise multivariate linear regression analyses. Data sets were compiled

using Microsoft Excel and all statistical analyses were conducted using Stata 10.

## Results

Data on cervical screening coverage was available for 152 PCTs and 8229 general practices in England. Practices that did not possess information on at least one of the predictor variables ( $n = 259$ ) were excluded from analysis and hence data on 26 497 476 women registered with 7970 practices were used for this study.

Summary of data obtained at PCT and practice levels is shown in Table 1. At the PCT level, cervical screening coverage ranged from 65.8 to 85.8%, with the mean and median of 78.5 and 79.6%, respectively. At the practice level, cervical screening coverage ranged from 0 to 100%, with the mean and median of 83.5%. There were wide variances in IMD scores and percentage of ethnic minority patients at both PCT and practice levels. In particular at the practice level, the maximum value for the percentage of ethnic minority patients was high at 99.7%, with high proportions of ethnic minority patients being found in some urban areas.

### Regression modelling

At the PCT level, all predictor variables, with the exception of the records and information score, were significantly correlated with cervical screening coverage. The percentage of female patients aged between 25 and 49 years was most strongly negatively correlated (correlation coefficient ( $R$ ) =  $-0.76$ ,  $P < 0.001$ ), and the percentage of female patients aged 50–64 years was most positively correlated ( $R = 0.78$ ,  $P < 0.001$ ) with cervical screening coverage. At the practice level, all predictor variables were significantly

**Table 1** Summary of cervical screening coverage and predictor variables at PCT and practice levels

	PCT					Practice				
	Mean	SD	Min–Max	Median	IQR	Mean	SD	Min–max	Median	IQR
Cervical screening coverage (%)	78.5	3.7	65.8–85.8	79.6	4.7	83.5	7.3	0–100	83.5	6.9
IMD score	24.3	9.7	7.7–51.1	23.2	15.7	23.6	12.6	2.2–71.9	21.3	18.6
Ethnic minority pts (%)	16.7	18.6	0.9–71.4	8.5	17.7	17.0	22.9	0–99.7	6.2	17.7
Female pts, 25–49 years (%)	36.2	4.6	28.0–51.7	34.9	3.8	36.0	6.0	11.3–78.4	34.9	5.8
Female pts, 50–64 years (%)	17.1	2.7	9.6–22.3	17.6	3.6	17.2	4.1	0.06–30.6	17.7	5.4
No. of female pts per GP	964.6	116.6	637.9–1283	969.7	139.1	960.4	345.0	46.3–5814	903.3	307
QOF achievement score	95.6	1.8	87.9–98.4	96.0	2.2	95.6	4.9	36.7–100	96.6	4.0
Records and information score	95.1	3.2	78.7–98.7	96.0	2.8	95.0	10.7	5.9–100	98.0	3.9

pts, patients; GP, general practitioner.

correlated with cervical screening coverage. The most negatively correlated predictor variable was the percentage of ethnic minority patients ( $R = -0.30$ ,  $P < 0.001$ ) and the most strongly positively correlated variable was the overall QOF score ( $R = 0.37$ ,  $P < 0.001$ ).

In multiple regression analysis at the PCT level, the IMD score, percentage of female patients aged 25–49 years and percentage of ethnic minority patients were the only predictor variables to be significantly associated with cervical screening coverage and all three variables remained significant in the model following reverse stepwise linear multivariate regression analysis ( $R^2 = 68\%$ ). At the practice level, all predictor variables with the exception of the number of female patients per full-time general practitioner were significantly associated with cervical screening coverage in multiple regression analysis, and all of these predictor variables also remained significant in the multivariate model ( $R^2 = 21\%$ ). The results of the multiple regression and multivariate regression analyses at PCT and practice levels are shown in Table 2.

## Discussion

### Main findings of this study

At both PCT and practice levels, socioeconomic factors such as the proportion of female patients aged 25–49 years, IMD score and percentage of ethnic minority patients were

significantly negatively associated with cervical screening coverage. However, the QOF indicators (overall QOF score and the records and information score) were significantly positively associated with cervical screening coverage only at the practice level. Therefore, practice factors included in this study may be more influential at the practice level than at the PCT level in determining cervical screening coverage, and their influence at the practice level may have become diluted on aggregation of the data. Lastly, the number of female patients per full-time general practitioner, which was used as an indirect measure of ease of access, was not significantly associated with cervical screening coverage at either PCT or practice level and therefore it may not be a crucial determinant of cervical screening coverage.

### What is already known on this topic

The lower attendance of non-Caucasian women in cervical screening programmes has been previously documented<sup>14,20</sup> and in one study, Asian women in particular were less likely to undergo cervical screening than Caucasian women.<sup>17</sup> In a study based in the UK,<sup>35</sup> non-Caucasians were significantly less knowledgeable than Caucasians regarding the presence of the cervical screening programme. These authors therefore inferred that the knowledge that a screening programme exists is an important

**Table 2** Multiple regression and reverse stepwise linear multivariate regression analyses at PCT and practice levels

	PCT			Practice		
	Regression coefficient	95% CIs	P value	Regression coefficient	95% CIs	P value
Multiple regression						
IMD score	-0.09	-0.13 to -0.04	<0.001	-0.04	-0.05 to -0.03	<0.001
Ethnic minority pts (%)	-0.04	-0.07 to -0.001	0.043	-0.04	-0.05 to -0.03	<0.001
Female pts aged 25–49 years (%)	-0.37	-0.52 to -0.21	<0.001	-0.04	-0.08 to -0.01	0.005
Female pts aged 50–64 years (%)	0.14	-0.21 to 0.49	0.44	0.20	0.14 to 0.26	<0.001
No. of female pts per GP	0.001	-0.002 to 0.005	0.48	0.000022	-0.0004 to 0.0004	0.919
Overall QOF score	0.20	-0.10 to 0.51	0.19	0.35	0.32 to 0.39	<0.001
Records and information score	-0.03	-0.16 to 0.11	0.69	0.07	0.05 to 0.08	<0.001
Reverse stepwise linear multivariate regression						
IMD score	-0.09	-0.14 to -0.05	<0.001	-0.04	-0.05 to -0.03	<0.001
Ethnic minority pts (%)	-0.04	-0.07 to -0.006	0.02	-0.04	-0.05 to -0.03	<0.001
Female pts aged 25–49 years (%)	-0.38	-0.53 to -0.23	<0.001	-0.04	-0.08 to -0.01	0.005
Female pts aged 50–64 years (%)	—	—	—	0.20	0.14 to 0.25	<0.001
No. of female pts per GP	—	—	—	—	—	—
Overall QOF score	—	—	—	0.35	0.32 to 0.39	<0.001
Records and information score	—	—	—	0.07	0.05 to 0.08	<0.001

pts, patients; GP, general practitioner.

prerequisite to taking part. Additionally, the lower rates of cervical screening coverage among younger women may be attributable to several factors. For instance, younger women may be busier with work and household commitments, and younger women aged 25–37 years frequently cite work and household commitments as one of the main reasons for not attending cervical screening.<sup>36</sup> Furthermore, the effect of list inflation has been shown to underestimate true cervical screening coverage rates, especially in the 25–34 age group,<sup>37</sup> and it may have contributed to the lower cervical screening coverage rates seen with younger women in our study. List inflation is a phenomenon in which the patient population registered with a general practice is actually larger than those living within that area, as individuals move to another area without informing the practice or are registered with several practices simultaneously. This appears to occur more commonly in areas with highly mobile local populations, namely younger individuals living in large urban areas.<sup>37,38</sup>

Education level,<sup>17,18,20</sup> type of employment,<sup>13,20</sup> social deprivation and poverty<sup>13,15,19</sup> have all been linked to poor cervical screening attendance and the link between socioeconomic deprivation and lower cervical screening coverage was again confirmed in our study. Additionally, it has been shown that the amount of knowledge regarding the cervical screening programme is also lowest among individuals of lowest occupational status<sup>35</sup> and therefore educating these individuals about cervical screening is likely to play an important role in improving attendance.

Lastly, this study revealed a significant positive relationship between cervical screening coverage and QOF indicator scores at the practice level, and QOF achievement scores have been shown to impact hospital admission rates resulting from certain chronic diseases. For instance, high QOF achievement scores were significantly associated with lower coronary heart disease-associated hospital admission and mortality rates,<sup>39</sup> and also with lower chronic obstructive pulmonary disease-associated hospital admissions.<sup>25</sup> Therefore, more organized practices achieving higher QOF scores may be better at monitoring and delivering health care to the local population, and hence implementation of policies that can improve these factors may also increase cervical screening coverage.

### What this study adds

The results of this study help in identifying the groups of women in which cervical screening attendance should be improved. One study showed that the same groups of individuals were also the least educated about cervical screening

programmes<sup>35</sup> and therefore increasing the level of knowledge about the importance of cervical screening may be the crucial first step in promoting attendance. Furthermore, in one US study,<sup>40</sup> the incidence of cervical cancer and subsequent mortality was significantly greater in women of non-Caucasian ethnicity and lower socioeconomic status, thus making it even more crucial to augment cervical screening coverage in these groups of women.

However, improving cervical screening coverage is a challenging task and requires a multi-faceted approach involving cooperation from patients, physicians, individual practices and policy-makers to be successful. The NHSCSP has implemented a wide variety of measures to increase the ease of access to cervical screening in England, such as the publication of educational material in multiple languages and provision of audio-visual aids.<sup>41</sup> Also the Call and Recall system, which is used for accurate record keeping and results notification<sup>42</sup> requires accurate contact details of women in the cervical screening age group. This can however be problematic, particularly among younger women living in urban areas, who may change their addresses frequently.<sup>37</sup> Furthermore in a randomized controlled study comparing the effectiveness of different cervical screening reminder methods in the form of a telephone call from a nurse, letter from a public health specialist and letter from a celebrity,<sup>43</sup> only a small overall increase in cervical screening attendance (2.7%) was seen. Also, none of these methods resulted in a significant increase in cervical screening when compared with no intervention.<sup>43</sup> Therefore, it may be more important to focus on the reasons for non-attendance rather than simply reminding individuals to undergo screening. On this note, several qualitative studies have attempted to elucidate individual reasons for not taking part in cervical screening and unsurprisingly the reasons were vast and complex. One study concluded that women who had regular cervical screening did so because they felt an obligation to conform to the social norm.<sup>44</sup> Other studies have revealed deep-seated personal opinions regarding cervical screening, such as fear, embarrassment, pain and disinterest.<sup>36,45</sup> Therefore, strategies that increase the accessibility of cervical screening and also deal with individual concerns are likely to be most effective.

Finally, this study illustrates the fact that performance indicators such as cervical screening coverage can be substantially influenced by population factors such as age, ethnicity and socioeconomic status. Therefore, using crude performance data to determine the quality of care provided at general practice and PCT levels can be misleading. This is an important issue as the UK government has announced this year that the general practice performance data will be made publicly available in the near future.<sup>46,47</sup>

### Strengths and limitations of this study

The main strength of this study was the use of data obtained at a national level, which included information on nearly 26.5 million patients registered with general practices in England. The main limitation in this study arose from the study design. Although we had a large population sample, this was nevertheless a cross-sectional ecological study and hence we could not be certain of the direct cause–effect relationship between the dependent and independent variables. Also, the cervical screening coverage data obtained from the NHS Information Centre for Health and Social Care did not include data on women who may have had opportunistic cervical screening in private health clinics. However, as the great majority of the UK population receive health care through the NHS, the number of women having regular cervical screening tests in this way is likely to be small. Lastly, 259 practices had to be excluded from analysis as it was missing information on at least one predictor variable. However, as they constituted only 3.1% of the practices, the validity of the study results will not be compromised.

### Conclusions

Our study findings illustrate that population and health system characteristics remain important influences on participation in preventive interventions such as cervical screening, even in a health system that offers free of charge access to universal health care. Also, in the 21st century, >20 years after the start of the cervical screening programme in England, socio-economic, ethnic and age-related disparities still exist. Therefore, to improve cervical screening coverage in England, efforts should focus on developing and implementing strategies for improving cervical screening attendance in the young, socioeconomically disadvantaged and ethnic minority women.

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