

## Chronic disease detection and access:

does access improve detection, or does detection make access more difficult?

### Abstract

#### Background

The recorded detection of chronic disease by practices is generally lower than the prevalence predicted by population surveys.

#### Aim

To determine whether patient-reported access to general practice predicts the recorded detection rates of chronic diseases in that setting.

#### Design and setting

A cross-sectional study involving 146 general practices in Leicestershire and Rutland, England.

#### Method

The numbers of patients recorded as having chronic disease (coronary heart disease, chronic obstructive pulmonary disease, hypertension, diabetes) were obtained from Quality and Outcomes Framework (QOF) practice disease registers for 2008–2009. Characteristics of practice populations (deprivation, age, sex, ethnicity, proportion reporting poor health, practice turnover, list size) and practice performance (achievement of QOF disease indicators, patient experience of being able to consult a doctor within 2 working days and book an appointment >2 days in advance) were included in regression models.

#### Results

Patient characteristics (deprivation, age, poor health) and practice characteristics (list size, turnover, QOF achievement) were associated with recorded detection of more than one of the chronic diseases. Practices in which patients were more likely to report being able to book appointments had reduced recording rates of chronic disease. Being able to consult a doctor within 2 days was not associated with levels of recorded chronic disease.

#### Conclusion

Practices with high levels of deprivation and older patients have increased rates of recorded chronic disease. As the number of patients recorded with chronic disease increased, the capacity of practices to meet patients' requests for appointments in advance declined. The capacity of some practices to detect and manage chronic disease may need improving.

#### Keywords

chronic disease; early diagnosis; health services accessibility; primary health care.

### INTRODUCTION

The UK's pay-for-performance scheme for general practice, the Quality and Outcomes Framework (QOF), requires general practices to maintain registers of patients with selected chronic conditions; the numbers of patients in the registers at practice level are publicly available.<sup>1</sup> The numbers of patients recorded in these registers differs from the levels of prevalence indicated by population surveys.<sup>2</sup>

This difference is important because early disease detection enables earlier clinical management that may be followed by better healthcare outcomes. For example, it has been shown that mortality from coronary heart disease (CHD) is lower in those primary care trusts (PCTs) in which higher numbers of people are recorded as having hypertension on the general practice QOF registers.<sup>3</sup> This finding reflects evidence that stronger primary care orientation of health systems is associated with lower all-cause and cardiovascular mortality.<sup>4</sup>

Although the failure to detect chronic conditions is an important issue, it should be noted that, in some cases, detected conditions are not recorded in general-practice registers and, in others, patients are recorded in error as having a condition.<sup>5</sup> In this article, the focus is on the recorded detection of chronic conditions.

Six mechanisms have been argued to account for the beneficial impact of primary care on population health:

- greater access to needed services;
- better quality of care;
- a focus on prevention;
- early management of health problems;
- the cumulative effect of primary care characteristics; and
- reducing unnecessary and potentially harmful secondary care.<sup>6</sup>

The characteristics of greater access, a focus on prevention, and early management of health problems may be expected to promote increased detection and systematic recording of chronic diseases.

The QOF was introduced in 2004 to improve general practice management of selected chronic conditions.<sup>7</sup> It not only requires practices to maintain registers of patients who have chronic conditions, but also requires them to achieve targets for disease-management indicators. The rate of improvement in the care of patients with asthma or diabetes following introduction of the QOF was faster than previous trends, but there was no significant change in the rate of improvement in CHD.<sup>7</sup>

In addition to using a pay-for-performance scheme to strengthen the management of chronic conditions, a financial incentive scheme to improve access to general practice was introduced from 2006. Originally a separate scheme, in England it has been incorporated into the QOF; it consists of practices obtaining a financial reward, receipt

**MS Anwar**, MRCGP MASC Dip (Sp.I), clinical fellow; **R Baker**, MD, FRCGP, director; **N Walker**, MRCGP, PGCM, clinical fellow; **MJ Bankart**, BA, MSc, PhD, lecturer in medical statistics, NIHR CLAHRC for LNR, Department of Health Sciences, University of Leicester, Leicester, UK. **AG Mainous III**, PhD, professor, Department of Family Medicine, Medical University of South Carolina, Charleston, SC, US.

#### Address for correspondence

Richard Baker, Department of Health Sciences

University of Leicester, 22–28 Princess Road West, Leicester, LE1 6TP.

**E-mail:** rb14@le.ac.uk

**Submitted:** 14 July 2011; **Editor's response:**

18 August 2011; **final acceptance:** 18 October 2011.

©British Journal of General Practice

This is the full-length article (published online 30 Apr 2012) of an abridged version published in print. Cite this article as: **Br J Gen Pract 2012; DOI: 10.3399/bjgp12X641456.**

## How this fits in

For many chronic conditions, there are fewer patients recorded on practice disease registers than the numbers predicted by population surveys. In this study, characteristics of practices and their patient populations were related to the numbers of patients recorded on Quality and Outcomes Framework registers for coronary heart disease, chronic obstructive pulmonary disease, hypertension, and diabetes. Practices with greater numbers of older patients, higher self-reporting of poor health, and lower rates of patient turnover had more patients recorded as having chronic conditions. Practices with large numbers of patients with chronic conditions were less successful in enabling patients to book their appointments in advance.

of which is determined by the results of regular surveys on patients' experience of access to their practice.<sup>8</sup>

Access to health care has been defined in various ways, including:

- whether or not there is an adequate supply of services (for example, sufficient numbers of GPs);
- whether patients can readily make use of the services (for example, there are no financial or organisational barriers to access); or
- whether all those who could benefit from care are able to do so (that is, equity).<sup>9</sup>

The survey that is conducted addresses various aspects of the patient experience, including consultations with doctors and nurses; however, with regard to access, it is limited to patients' experience of being able to get through on the telephone and of getting appointments. Nevertheless, the survey findings do predict use of emergency hospital services. Using the survey, it has been shown that practices in which patients are more likely to report being able to consult their preferred GP have lower rates of emergency hospital admission,<sup>10</sup> and practices in which patients are more likely to report better telephone access have lower rates of attendance at hospital emergency departments.<sup>11</sup>

The current study was conducted to investigate associations between patient reports of access to general practice and recorded detection of chronic conditions in that setting. Specifically, in the light of evidence that a greater supply of primary

care physicians has been found to be associated with lower population mortality rates<sup>4</sup> and, based on the mechanisms proposed as accounting for the impact of primary care on population health,<sup>6</sup> it was hypothesised that practices with better reported access would have higher levels of recorded detection of chronic conditions.

## METHOD

The study was undertaken at practice level and included all 146 general practices in Leicester City and Leicestershire and Rutland primary care trusts (PCTs). The QOF includes 19 chronic conditions and, from these, the following four conditions were selected:

- diabetes;
- hypertension;
- CHD; and
- chronic obstructive pulmonary disease (COPD).

These are all common, have major impacts on public health and, as they have been included in the QOF since its launch in 2004, there has been ample time for practices to compile complete disease registers.<sup>12</sup>

Levels of recorded detection were taken from the QOF registers for 2008–2009.<sup>13</sup> The QOF requires practices to compile registers of the numbers of patients they have identified. Practices' recording rates for the diseases in question were calculated by dividing the number of patients on the particular disease register by the total number of patients registered at the practice.

Information relating to practice list size and achievement of clinical indicators — for example, control of blood pressure in hypertension or assessment of respiratory function in COPD — is also recorded in the QOF data. Overall clinical performance in each disease domain is then summarised in points representing the level of achievement of the indicators in the respective domain. These data are publicly available and were obtained from the NHS Information Centre.<sup>13</sup>

*The GP Patient Survey 2008/09*,<sup>14</sup> which was administered by the survey company Ipsos MORI to 5.6 million adults registered with general practices in England, was also used. It was available in English and 13 non-English languages, and could be completed online, by telephone, or by post. The questionnaire included 38 questions,

**Table 1. Practice characteristics (n = 146)**

Practice characteristic	Median (Q1, Q3)
Practice list size	5955 (3095, 9694)
Proportion aged ≥65 years	0.16 (0.12, 0.18)
Proportion white	0.91 (0.71, 0.97)
Proportion male	0.50 (0.49, 0.51)
IMD score	15.8 (10.0, 32.4)
Total practice list size with CHD, %	4.2 (3.7, 4.9)
Total practice list size with COPD, %	2.6 (2.1, 3.4)
Total practice list size with hypertension, %	13.0 (11.7, 15.0)
Total practice list size with diabetes, %	4.4 (3.7, 5.2)
QOF points attained, CHD %	100 (10, 100) <sup>a</sup>
QOF points attained, COPD %	100 (100, 100) <sup>b</sup>
QOF points attained, hypertension %	100 (100, 100) <sup>c</sup>
QOF points attained, diabetes %	100 (98, 100) <sup>d</sup>

<sup>a</sup>Minimum value 80%. <sup>b</sup>Minimum value 0%. <sup>c</sup>Minimum value 47%. <sup>d</sup>Minimum value 87%. CHD = coronary heart disease. COPD = chronic obstructive pulmonary disease. IMD = Index of Multiple Deprivation. IQR = interquartile range. Q1 = first quartile. Q3 = third quartile. QOF = Quality and Outcomes Framework.

covering information about the responder (age, sex, ethnicity, health), and experience of several aspects of services, including out-of-hours care and consultations, in addition to access.

As practices with more patients in poor health would be expected to have more patients with chronic diseases, included in the analysis was the proportion of responders reporting their health as poor in response to the survey question on health (patients were asked the following question, and were asked to respond with one of five options, ranging from excellent to poor: 'In general, would you say your health is ...?'). Two questions on access were used:

- 'Think about the last time you tried to see a doctor fairly quickly. Were you able to see a doctor on the same day or in the next 2 days the GP surgery or health centre was open?' This was limited to those patients who had tried to see a doctor fairly quickly in the previous 6 months; and
- 'Last time you tried, were you able to get an appointment with a doctor more than 2 full days in advance?' This was limited to those patients who had tried to book an appointment in the previous 6 months).

**Table 2. Variables from the GP patient survey included in the analysis of 146 practices**

Patient variable	Median % (IQR)
Proportion reporting poor health	5 (3 to 6)
Able to book an appointment >2 days in advance	72 (56 to 83)
Able to see a GP within 2 days	88 (81 to 93)
Response rate	43 (36 to 50)

IQR = interquartile range.

These questions represent two different aspects of access — being able to see a doctor quickly and being able to plan care in advance. The latter is relevant in the management of chronic disease and, for some patients, includes choosing to consult a particular doctor (relationship continuity<sup>15</sup>). As the response rate varied between practices, information on the survey response rate for each practice was obtained.

The Index of Multiple Deprivation (IMD) score from 2007 was used to indicate the level of socioeconomic deprivation in the practice population.<sup>16</sup> The IMD is derived from 38 indicators in seven domains: income, employment, education, health, housing, the environment, and crime. Higher scores indicate greater deprivation, the score has varied between PCTs in England from 8.1 (Surrey) to 48.3 (Heart of Birmingham).<sup>17</sup>

Information on practice list size, percentage of the practice aged ≥65 years, sex, ethnicity, and the proportion of the practice list joining and leaving the practice in 2008–2009 (turnover) were obtained from the PCT. An analysis using the General Practice Research Database to inform resource allocation in general practice has shown that the average time in consultation is 40–50% higher for new patients in their first year of registration compared with other patients.<sup>18</sup>

### Statistical methods

Initial descriptive analysis and univariable analysis preceded negative binomial regression. As the data were expected to be over dispersed counts, an appropriate analysis method was negative binomial regression. The log of the practice list size was used as an offset to adjust for varying practice list sizes.

Predictors were entered into the models in two groups using a sequential variable selection method. In group one were the population factors (percentage of practice population aged ≥65 years, IMD score, ethnic group, poor reported health, sex, current list size, and turnover). In group two were the primary care performance variables (the relevant QOF domain variable and the two access variables). All variables were retained in the models once entered. All analyses were carried out using SAS (version 9.1.3).

### RESULTS

A total of 146 practices were included. In 2008–2009, 1 024 126 patients were

**Table 3. Practice and patient characteristics of predicted detection rates by chronic disease. Negative binomial regression (n = 146 practices)**

Variable	IRR (95% CI)	% change	P-value
<b>Diabetes</b>			
IMD score	1.005 [0.999 to 1.01]	0.5	0.100
Aged ≥65 years, %	1.03 [1.01 to 1.05]	3	0.0004
White, %	0.99 [0.987 to 0.993]	-1	<0.001
Males, %	1.008 [0.996 to 1.02]	0.8	0.190
Reporting health as poor, %	1.03 [1.01 to 1.06]	3	0.005
Practice list size	0.99 [0.97 to 0.995]	-1	0.004
Patient turnover	0.98 [0.96 to 0.99]	-2	0.010
QOF points for diabetes	0.99 [0.96 to 1.01]	-1	0.240
Response rate, %	1.02 [1.01 to 1.03]	2	<0.001
Able to book appointment in advance	0.997 [0.995 to 0.999]	-0.3	0.040
Able to get appointment within 2 days	0.998 [0.992 to 1.003]	-0.2	0.350
<b>Hypertension</b>			
IMD score	1.0 [0.99 to 1.01]	0.2	0.550
Aged ≥65 years, %	1.05 [1.03 to 1.07]	5	<0.001
White, %	0.998 [0.995 to 1.01]	-0.2	0.110
Males, %	1.003 [0.99 to 1.02]	0.3	0.590
Reporting health as poor, %	1.03 [1.0 to 1.05]	3	0.020
Practice list size/1000	0.98 [0.97 to 0.99]	-2	<0.001
Patient turnover	0.98 [0.96 to 0.99]	-2	0.005
QOF points for hypertension	1.001 [0.99 to 1.01]	0.1	0.770
Response rate, %	1.02 [1.01 to 1.03]	2	<0.001
Able to book appointment in advance	0.997 [0.994 to 0.999]	-0.3	0.020
Able to get appointment within 2 days	0.996 [0.99 to 1.01]	-0.4	0.120
<b>Coronary heart disease</b>			
IMD score	1.01 [1.0 to 1.02]	0.8	0.005
Aged ≥65 years, %	1.06 [1.04 to 1.08]	6	<0.001
White, %	0.999 [0.996 to 1.01]	-0.1	0.440
Males, %	1.009 [0.99 to 1.02]	0.9	0.140
Reporting health as poor, %	1.04 [1.01 to 1.06]	4	<0.001
Practice list size/1000	0.99 [0.979 to 0.997]	-1	0.010
Patient turnover	0.99 [0.97 to 1.01]	-0.8	0.290
QOF points for CHD	1.02 [0.98 to 1.06]	1.8	0.310
Response rate, %	1.02 [1.01 to 1.03]	2	<0.001
Able to book appointment in advance	0.997 [0.995 to 0.999]	-0.3	0.040
Able to get appointment within 2 days	0.997 [0.992 to 1.01]	-0.3	0.310
Able to book appointment in advance	0.997 [0.995 to 0.999]	-0.3	0.040
<b>Chronic obstructive pulmonary disease</b>			
IMD score	1.02 [1.01 to 1.03]	2	<0.001
Aged ≥65 years, %	1.06 [1.03 to 1.09]	6	<0.001
White, %	1.01 [1.0 to 1.02]	1	<0.001
Males, %	1.01 [0.99 to 1.04]	1	0.190
Reporting health as poor, %	1.07 [1.03 to 1.11]	7	<0.001
Practice list size/1000	0.99 [0.97 to 1.00]	-1	0.100
Patient turnover	0.99 [0.96 to 1.02]	-0.8	0.580
QOF points for COPD	1.03 [1.01 to 1.06]	3	0.006
Response rate, %	1.02 [1.0 to 1.03]	2	0.030
Able to book appointment in advance	0.995 [0.991 to 0.999]	-0.5	0.020
Able to get appointment within 2 days	0.999 [0.99 to 1.01]	-0.1	0.880

The incident rate ratio (IRR) in the second column is the exponentiated beta coefficient from the regression model for each term in the model. Interpretation: subtracting 1 from the IRR, then multiplying by 100 gives the percentage change in the expected admissions count for a 1-unit increase in the predictor. IRRs < 1 represent decreases and IRRs > 1 represent increases in the expected count. Statistical model: negative binomial regression, using log of the list size as the offset. COPD = chronic obstructive pulmonary disease. IMD = Index of Multiple Deprivation. IRR = incident rate ratio. QOF = Quality Outcomes Framework.

registered with these practices. Table 1 presents information about the practices, including proportions of practice populations with the chronic conditions

included in this study. Levels of recorded detection were lower than predicted by estimates produced by the Eastern public health observatory<sup>19</sup> that have been modelled from national surveys, such as the Health Survey for England.<sup>19</sup> For CHD in people aged ≥16 years for 2008–2009, predicted prevalences were 5.0% for Leicester County and Rutland PCT and 5.1% for Leicester City PCT, but in this study 4.2% of practice populations (all age groups) were recorded on CHD registers; expected prevalences for COPD (all ages) were 2.6% and 4.2% respectively, compared with 2.6% recorded on registers; diabetes rates were 6.9% and 9.9% compared with 4.4%; and hypertension rates were 29.2% and 26.7% respectively, compared with 13.2% among the practices in this study.

The median survey response rate for practices in the study was 43.0%. Levels of reported access to practices were generally high (Table 2) but, in some practices, satisfaction with being able to book an appointment in advance was relatively low.

Table 3 outlines the practice and patient characteristics of predicted detection rates for diabetes, hypertension, CHD, and COPD. Recorded detection of diabetes was higher in practices with: more people aged ≥65 years, fewer white people, more people reporting having poor health, smaller list sizes, lower patient turnover, higher survey response rate, and fewer patients reporting being able to book an appointment in advance.

Recorded hypertension detection was higher in practices with: more older patients, more patients reporting poor health, smaller list sizes, lower patient turnover, higher survey response rates, and fewer patients reporting being able to book an appointment in advance.

Recorded detection of CHD was higher in practices with: greater deprivation, more older patients, more people reporting poor health, smaller list sizes, a higher survey response rate, and fewer patients reporting being able to book an appointment in advance.

Recorded detection of COPD was higher in practices with: more populations of greater deprivation, more older patients, more white patients, more people reporting poor health, higher QOF points for COPD, a higher survey response rate, and fewer patients reporting being able to book an appointment in advance.

## DISCUSSION

### Summary

In this study, practice and patient

characteristics [age, ethnicity, level of deprivation, poor health, survey response rates, patient turnover, list size] and practice performance (QOF points achieved, being able to book an appointment ahead) were associated with levels of detection of four major common conditions. However, the hypothesis that better patient-reported access would be associated with higher recorded detection of disease was not supported: a greater proportion of patients reporting being able to book appointments in advance was associated with lower recorded detection. This finding suggests that practices that have detected higher numbers of people with chronic conditions may have greater demands on them in terms of providing systematic chronic-disease management. Being able to manage the workload, means putting the ability to book appointments in advance under pressure.

Patients with chronic conditions are more likely to prefer to consult a doctor they have come to know and trust, and place seeing a doctor above seeing a nurse.<sup>20</sup> In a US healthcare setting, continuity has been shown to improve the detection of diabetes.<sup>21</sup> Even though much routine care for chronic conditions is provided by practice nurses, consultation rates with GPs increased between 2003–2004 and 2008–2009 in the UK.<sup>22</sup> Furthermore, the transfer of routine chronic-disease management to nurses that took place in most general practices with the introduction of the QOF was followed by a decline in patient perception of continuity.<sup>23</sup>

The lack of an association between disease detection and being able to consult a doctor within 2 days may be explained by the finding that most practices performed well in this aspect of access. Practices appear to have prioritised quick access to a doctor over being able to book in advance, perhaps to ensure patients with acute problems can be seen quickly.

The additional workload associated with newly registered patients may explain the association between higher patient turnover and lower recorded detection rates. The explanation for the finding that practices with higher list sizes tend to have lower recording of detected disease is uncertain, although larger practices tend to offer worse access and lower continuity.<sup>24</sup>

Having more patients who report their health as poor (and who will have more need for health care) was associated with a higher level of recorded chronic disease. Practices with lower proportions of white patients had higher numbers of people with

diabetes, reflecting the higher incidence of diabetes in Leicester's south Asian population; COPD detection, however, was higher in practices with more white patients, reflecting higher levels of smoking in Leicester's white population (28%) in comparison with local south Asians (14% for the entire local black and minority ethnic population).<sup>25</sup> The management of clinical performance was not related to levels of detection of hypertension or diabetes, although it was for COPD.

### Strengths and limitations

This study has a number of limitations. It was conducted in two PCTs only and, although there was wide population diversity in terms of deprivation and ethnicity, the findings may not be applicable to England as a whole. As only a small number of practices was included, the number of variables that could be included in the multivariate analysis was also limited. There may be some patients in whom a chronic condition has been detected but not recorded in a register. It is likely that other factors not included in the model also explain levels of recorded detection of chronic disease; for example, greater awareness of the practice team of the benefits of early disease detection, or higher levels of staffing.

The study also does not describe in detail the processes involved in detecting chronic disease in practices with different characteristics; an observational study in a selected sample of practices would be needed to understand the mechanisms accounting for the current findings. Furthermore, QOF data do not indicate when diagnoses were made; an analysis concentrating on new diagnoses would have been more sensitive to recent practice performance.

The survey response rate varied between practices, with a median response rate of 43%. The study adjusted for the variation in response rate between practices by including response rate in the regression models, but cannot be certain that non-response varied at random between practices. The mean response in England was 38.2%, but an analysis of the reliability of the findings concluded that the survey had resulted in reliable survey estimates of performance at the practice level on the two access questions used to calculate performance-related payments, both of which were included in this study.<sup>26</sup> This provides reassurance about the survey findings in the current study.

### Funding

Mohammed Saqib Anwar, M John Bankart, Nicola Walker, and Richard Baker are members of the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care (CLAHRC) for Leicestershire, Northamptonshire and Rutland (LNR). The views expressed in this paper do not necessarily reflect those of the NIHR or the Department of Health.

### Provenance

Freely submitted; externally peer reviewed.

### Competing interests

The authors have declared no competing interests.

### Acknowledgements

The study was a service evaluation project as defined by the National Research Ethics Service, and used publicly available data; therefore, NHS research ethics approval was not required. The study was approved by the University of Leicester Ethics Committee.

### Discuss this article

Contribute and read comments about this article on the Discussion Forum: <http://www.rcgp.org.uk/bjgp-discuss>

It should be noted that this cross-sectional study identifies associations and it is not possible to infer causation from the findings.

#### **Comparison with existing literature**

The study confirms that levels of detection of chronic diseases, as reflected by general practice disease registers, do not match the levels predicted in estimates based on population surveys.<sup>2</sup> Improved detection and recording are required to reduce the impact of these diseases. The general practice consortia being established in England should take steps to promote improved disease detection in partnership with local public health services. Community interventions are likely to be required, as well as action in general practices. Early detection in ambulatory care, along with prevention, control, or managing diseases,<sup>27</sup> helps to prevent hospitalisations and mortality.<sup>28</sup>

The finding that a greater patient-reported ability to book appointments in advance is associated with lower recorded levels of chronic disease suggests that the workload some practices in Leicestershire

are required to deal with is greater than they are able to manage effectively. In the practices in this study, rather than patient perception of improved access leading to improved detection of chronic diseases, more chronic disease appeared to strain the capacity of practice appointment systems. This conclusion is supported by a study showing an association between GP supply in England and recorded detection of CHD, stroke, and hypertension,<sup>29</sup> and by evidence from general practices in Scotland of a failure to match the supply of GPs to the demand for care in areas of deprivation.<sup>30,31</sup>

#### **Implications for practice**

Practices serving populations that have large numbers of people with chronic diseases may need commensurate resources, and should be incentivised to detect chronic disease, for example through adjustments to the QOF. Unless national policies are designed to increase the capacity of practices to detect and manage chronic disease, plans to shift services from hospitals to primary care are unlikely to be successful in improving health or saving costs.



## REFERENCES

1. NHS Information Centre. *The Quality and Outcomes Framework*. The Health and Social Care Information Centre, 2012. <http://www.ic.nhs.uk/statistics-and-data-collections/audits-and-performance/the-quality-and-outcomes-framework> [accessed 31 Jan 2012].
2. Martin D, Wright JA. Disease prevalence in the English population: a comparison of primary care registers and prevalence models. *Soc Sci Med* 2008; **68**(2): 266–274.
3. Levine SL, Baker R, Bankart MJG, Khunti K. Association of features of primary care with coronary heart disease mortality. *JAMA* 2010; **304**(18): 2028–2034.
4. Macinko J, Starfield B, Shi L. The contribution of primary care systems to health outcomes within Organization for Economic Cooperation and Development (OECD) countries, 1970–1998. *Health Serv Res* 2003; **38**(3): 831–865.
5. Jones RC, Dickson-Spillmann M, Mather MJ, *et al*. Accuracy of diagnostic registers and management of chronic obstructive pulmonary disease: the Devon primary care audit. *Respir Res* 2008; **9**: 62.
6. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q* 2005; **83**(3): 457–502.
7. Campbell S, Reeves D, Kontopantelis E, *et al*. Quality of primary care in England with the introduction of pay for performance. *New Engl J Med* 2007; **357**(2): 181–190.
8. Department of Health. *GP Patient Survey*. London: DoH, 2011. <http://www.gp-patient.co.uk> [accessed 31 Jan 2012].
9. Gulliford M, Figueroa-Munoz J, Morgan M, *et al*. What does 'access to health care' mean? *J Health Serv Res Policy* 2002; **7**(3): 186–188.
10. Bankart MJG, Baker R, Rashid A, *et al*. Characteristics of general practices associated with emergency admission rates to hospital: a cross sectional study. *Emerg Med J* 2011; **28**(7): 558–563.
11. Baker R, Bankart MJ, Rashid A, *et al*. Characteristics of general practices associated with emergency department attendance rates: a cross-sectional study. *BMJ Qual Saf* 2011; **20**(11): 953–958.
12. NHS Employers. *Investing in general practice. The New General Medical Services Contract*. Leeds: NHS Employers, 2003. [http://www.nhsemployers.org/SiteCollectionDocuments/gms\\_contract\\_cd\\_1302\\_09.pdf](http://www.nhsemployers.org/SiteCollectionDocuments/gms_contract_cd_1302_09.pdf) [accessed 31 Jan 2012].
13. The NHS Information Centre. *QOF 2010/11 results*. The Health and Social Care Information Centre, 2011. <http://www.ic.nhs.uk/statistics-and-data-collections/audits-and-performance/the-quality-and-outcomes-framework/the-quality-and-outcomes-framework-2008-09> [accessed 10 Apr 2012].
14. Ipsos MORI. *The GP Patient Survey 2008/09 technical report*. London: Department of Health, 2009. [http://www.gp-patient.co.uk/results/download/Y3/Y3\\_AnnualTechnical.pdf](http://www.gp-patient.co.uk/results/download/Y3/Y3_AnnualTechnical.pdf) [accessed 31 Jan 2012].
15. Haggerty JL, Reid RJ, Freeman GK, *et al*. Continuity of care: a multidisciplinary review. *BMJ* 2003; **327**(7425): 1219–1221.
16. Noble M, McLennan D, Wilkinson K, *et al*. *The English Indices of Deprivation 2007*. London: Department for Communities and Local Government, 2008. <http://www.communities.gov.uk/publications/communities/indicesdeprivation07> [accessed 31 Jan 2012].
17. Yorkshire & Humber Public Health Observatory. *IMD 2007 average PCT scores*. York: YHPHO, 2007. <http://www.yhpho.org.uk/resource/item.aspx?RID=10003> [accessed 31 Jan 2012].
18. British Medical Association. *Annex D: Carr-Hill resource allocation formula*. London: BMA, 2007. [http://www.bma.org.uk/employmentandcontracts/independent\\_contractors/general\\_medical\\_services\\_contract/investinggp.jsp?page=12](http://www.bma.org.uk/employmentandcontracts/independent_contractors/general_medical_services_contract/investinggp.jsp?page=12) [accessed 31 Jan 2012].
19. Eastern Public Health Observatory. *Archived modelled estimates and projections of hypertension for PCTs in England*. Cambridge: ERPHO, 2008. <http://www.erpho.org.uk/ViewResource.aspx?id=17905> [accessed 31 Jan 2012].
20. Turner D, Tarrant C, Windridge K, *et al*. Do patients value continuity of care in general practice? An investigation using stated preference discrete choice experiments. *J Health Serv Res Policy* 2007; **12**(3): 132–137.
21. Koopman RJ, Mainous AG III, Baker R, *et al*. Continuity of care and recognition of diabetes, hypertension and hypercholesterolemia. *Arch Intern Med* 2003; **163**(11): 1357–1361.
22. QResearch and The Health and Social Care Information Centre. *Trends in consultation rates in general practice 1995/1996 to 2008/2009: analysis of the QResearch® database*. NHS Information Centre, 2009. [http://www.ic.nhs.uk/webfiles/publications/gp/Trends\\_in\\_Consultation\\_Rates\\_in\\_General\\_Practice\\_1995\\_96\\_to\\_2008\\_09.pdf](http://www.ic.nhs.uk/webfiles/publications/gp/Trends_in_Consultation_Rates_in_General_Practice_1995_96_to_2008_09.pdf) [accessed 31 Jan 2012].
23. Campbell S, Reeves D, Kontopantelis E, *et al*. Effects of pay for performance on the quality of primary care in England. *New Engl J Med* 2009; **361**(4): 368–378.
24. Kontopantelis E, Roland M, Reeves D. Patient experience of access to primary care: identification of predictors in a national patient survey. *BMC Fam Pract* 2010; **11**: 61.
25. NHS Leicester City Directorate of Public Health and Health Improvement. *Choosing health in Leicester: reducing the impact of smoking. Briefing 3: improving smoking cessation services*. Leicester Primary Care Trusts, 2005. <http://www.phleicester.org.uk/Documents/Brief%203%20LSP%20Paper.pdf> [accessed 31 Jan 2012].
26. Roland M, Elliott M, Lyratzopoulos G, *et al*. Reliability of patient responses in pay for performance schemes: analysis of national General Practitioner Patient Survey data in England. *BMJ* 2009; **339**: b3851.
27. Institute of Medicine. *Access to health care in America*. Washington DC, US: National Academy Press, 1993.
28. Starfield B. Commentary on regular primary care lowers hospitalisation risk and mortality in seniors with chronic respiratory disease. *J Gen Intern Med* 2010; **25**(8): 758–759.
29. Soljak M, Samarasundera E, Indulkar T, *et al*. Variations in cardiovascular disease under-diagnosis in England: national cross-sectional spatial analysis. *BMC Cardiovasc Disord* 2011; **11**: 12.
30. Norbury N, Mercer SW, Gillies J, *et al*. Time to care: tackling health inequalities through primary care. *Fam Pract* 2011; **28**(1): 1–3.
31. Mercer SW, Watt GCM. The inverse care law: clinical primary care encounters in deprived and affluent areas of Scotland. *Ann Fam Med* 2007; **5**(6): 503–510.