Influences on the variation in prevalence of type 2 diabetes between general practices: practice, patient or socioeconomic factors?

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SUMMARY

Background: The prevalence of type 2 diabetes is known to vary between countries, districts and general practices. The influence of early detection and screening on the variation of prevalence between general practices has not previously been investigated.

Aim: To test the hypothesis that the prevalence of type 2 diabetes is associated with awareness of and screening for diabetes within general practices and to explore other factors that may explain the variation in prevalence between practices.

Design of study: Cross-sectional study of general practices.

Setting: Forty-two general practices in Newcastle and North Tyneside; 20% random sample of patients with type 2 diabetes (n = 1056).

Method: Factors thought to be associated with the variation of type 2 diabetes prevalence were collected from general practices through practice managers, medical records, and patient questionnaire. Pearson's correlation coefficient was used to quantify the association, and variables significant at the 5% level were entered into a multiple linear regression model.

Results: There was a wide inter-practice variation in age/sex standardised type 2 diabetes prevalence (range = 0.69% to 2.73%; P<0.001). There was no significant association between the prevalence of type 2 diabetes and the proportion of patients detected outside primary care or the proportion of patients detected through screening, accounting for only 2% and 3% of the variation in type 2 prevalence between practices, respectively. The mean Townsend deprivation score accounted for 42% of the variation in type 2 diabetes prevalence between practices, with more deprived practices having a higher prevalence.

Conclusion: This study suggests that socioeconomic deprivation, rather than detection through screening or awareness of diabetes, accounts for much of the variation in prevalence of type 2 diabetes between practices.

Keywords: type 2 diabetes; prevalence; socioeconomic factors; physician's practice patterns.

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Introduction

THE prevalence of type 2 diabetes is known to vary between countries,[1,2] districts,[3] and general practices.[4] Factors known to be associated with this variation include increasing age,[5] ethnicity,[6] obesity (particularly central obesity),[7] diet,[8] physical inactivity,[1,5] family history, and socioeconomic factors.[9,10] Other associated factors are hypertension, hyperlipidaemia (the metabolic syndrome), and steroid use.

In a previous study,[4] considerable variation was found in diabetes prevalence between eight general practices studied in Bristol. This variation in prevalence was associated with two deprivation indices (Jarman and Townsend scores). Although standardising for age differences between practices, this study did not explore alternative reasons for the variations between the practices in either the population demographics or different methods of working in the practices, and was limited by the small practice sample size.

Up to 50% of patients with type 2 diabetes may be undiagnosed[11] and screening can identify many of these patients.[12,13] Consequently, variations in the known prevalence of type 2 diabetes between practices may be related to earlier detection or screening in some practices, but this has not previously been investigated.

This study tests the hypothesis that the prevalence of type 2 diabetes is associated with awareness of, and screening for, diabetes within general practices and explores other factors that may explain the variation in prevalence between practices.

Method

Practices

Newcastle and North Tyneside comprises an area with major social and health inequalities. The population with diabetes is served by 72 general practices and two hospital diabetes centres. The ethnic minority population within the area was 2.8% in the 1991 census (compared with 5.9% in England and Wales). All 72 general practices in Newcastle and North Tyneside were invited to participate in this study. Forty-five agreed but three later withdrew, leaving 42 practices in the study.

Patient sample

Practices allowed access to their existing diabetes register. All patients with type 1 diabetes (defined as being less than 30 years of age at diagnosis and requiring insulin within six months of diagnosis) were removed from the registers for this study. A 20% random sample of the resulting registers of

HOW THIS FITS IN

What do we know?

There is a wide variation between practices in the prevalence of type 2 diabetes. Previous studies have related this to socioeconomic deprivation. Variations in other aspects of diabetes care have been related to practitioner and patient factors.

What does this paper add?

Variations in the prevalence of type 2 diabetes between practices are not related to practitioner behaviour in screening, early detection, diabetes awareness, or interest in diabetes. Practices with more deprived patients have a higher prevalence of type 2 diabetes.

patients with type 2 diabetes was taken. This constituted a total sample of 1056 patients.

Data collection

Data were collected on the variables listed in Table 1 from the practice manager (by means of a short questionnaire and interview), from the medical records of the patient sample and from a questionnaire to all patients. The data were collected into an Excel spreadsheet and analysed using SPSS for Windows.

Definitions

A research assistant examined the medical records of patients with type 2 diabetes for the method of diagnosis. Patients were excluded if they did not meet the 1999 WHO criteria for diagnosis of diabetes. A proxy measure for practice diabetes awareness was taken to be the proportion of patients diagnosed outside the practice (for example, at hospital or occupational medical). This was based on the assumption that practices that are more diabetes-aware would be more likely to have detected diabetes before attendance at hospital or other clinics. Patients were defined as being diagnosed through screening if they had not proffered symptoms at the time of diagnosis and the purpose of attendance was for health screening, as opposed to presentation of illness. Practices were also asked if they had a policy on screening for type 2 diabetes and which target groups they screened. Socioeconomic status was determined in three ways: the Townsend deprivation index for the location of the practice surgery; the average of the Townsend index for each patient in the sample with type 2 diabetes (mean Townsend score); and the proportion of patients for which the practice received deprivation payments (based on the Jarman deprivation index[14]). The Townsend index is based on five variables: unemployment, car ownership, non-owner house occupation, single-parent families, and household crowding.[15]

Patients were deemed to be hypertensive if they were prescribed antihypertensive medication or their three most recent readings were on average greater than 160/90 mmHg. They were deemed to have a lipid abnormality if they

Table 1. Data examined and their source.

Data	Data source
Diabetic patient data	
Age and sex	Medical records
Body mass index	Medical records
Hypertension	Medical records
Hyperlipidaemia	Medical records
History of cardiovascular disease	Medical records
Use of oral steroids	Medical records
Family history of diabetes	Patient questionnaire
Ethnicity	Patient questionnaire
Practice data	
Practice list size	Practice manager
Practice list age and sex	Practice manager
Hospital diabetes clinic referred to	Practice manager
Practice diabetes clinic	Practice manager
GP with diabetes interest	Practice manager
Diabetes screening	Practice manager
Patients misdiagnosed	Medical records
Diabetes awareness	Medical records
Diagnosed through screening	Medical records
Socioeconomic data	
Practice surgery deprivation score	Health authority
Diabetes patient deprivation score	Health authority
Practice deprivation payments	Practice manager

were prescribed a lipid-lowering drug or their most recent cholesterol was greater than 5.5 mmol/l. Body mass index and presence of cardiovascular disease were ascertained from the medical record.

Analysis

To adjust for the practices' different age and sex profiles, the crude practice prevalence of type 2 diabetes was directly standardised separately for men and women in six aggregated Korner age bands (0 to 44, 45 to 54, 55 to 64, 65 to 74, 75 to 84, and 85-plus years) to the England and Wales population age profile for 1998. Pearson's correlation coefficient was used to quantify the association between the variables listed in Table 2 and the standardised prevalence. Variables significant at the 5% level were entered into a multiple linear regression model with forward selection. In addition, two variables integral to the original hypothesis (proportion of patients detected outside primary care [used as a measure of diabetes awareness] and the proportion of patients diagnosed through screening) were also tested in the regression analysis.

A sample size of 42 practices is sufficient to provide 80% power to detect factors accounting for 15% of the variation in prevalence of type 2 diabetes at the 5% level of significance.

Results

Practices in the study were comparable with the overall population of practices in Newcastle and North Tyneside for total diabetes prevalence (mean prevalence in study practices = 2.06% versus 2.06% in non-participating practices) and deprivation (surgery Townsend index mean = 1.54 versus 1.01, $t = 0.595$, df = 70, $P = 0.554$). The study practices were significantly larger than the non-participating practices

Table 2. Variables tested for association with the practice age/sex adjusted prevalence of type 2 diabetes.

Practice level variable	Mean (SD)	Pearson's correlation coefficient with type 2 diabetes prevalence
Diabetic patient data		
% with obesity (BMI >30 kg/m^2)	44.0 (13.2)	0.4 ($P = 0.009$)[a]
% with hypertension (BP >160/90 mmHg)	61.5 (14.3)	0.09 ($P = 0.59$)
% with lipid abnormality (serum cholesterol >5.5 mmol/l)	65.9 (15.1)	−0.1 ($P = 0.51$)
% with recorded history of angina, myocardial infarction or heart failure	33.8 (11.9)	0.39 ($P = 0.01$)[a]
% on steroids	4.2 (5.0)	0.07 ($P = 0.64$)
% with first degree relative with type 2 diabetes	35.7 (10.4)	−0.07 ($P = 0.68$)
% non-white	5.0 (8.7)	−0.16 ($P = 0.32$)
Practice data		
Number of registered patients	7611 (3286)	0.025 ($P = 0.87$)
Referral to Newcastle General/North Tyneside General diabetes clinic	1.5 (0.5)	−0.18 ($P = 0.26$)
Practice diabetic clinic	1.05 (0.2)	−0.263 ($P = 0.09$)
GP with interest in diabetes	1.07 (0.3)	−0.19 ($P = 0.23$)
Target groups screened		
Hypertensive patients	1.44 (0.5)	−0.045 ($P = 0.78$)
Over 75-year-olds	1.59 (0.5)	−0.052 ($P = 0.75$)
Other high risk (CVD, IGT, obese, family history)	1.51 (0.5)	−0.064 ($P = 0.7$)
Medication reviews	1.93 (0.3)	−0.004 ($P = 0.98$)
Others (new patients, well-woman)	1.0 (0)	0 ($P = 1.0$)
% wrong diagnosis based on 1999 World Health Organization criteria	6.5 (8.7)	0.07 ($P = 0.67$)
% diabetic patients diagnosed outside primary care	29.8 (11.0)	−0.14 ($P = 0.38$)
% diabetic patients diagnosed after screening	52.1 (15.9)	0.16 ($P = 0.32$)
Socioeconomic data		
Townsend index from practice postcode	2.0 (3.4)	0.57 ($P<0.001$)[a]
Mean Townsend score from patient postcodes	1.6 (2.65)	0.65 ($P<0.001$)[a]
% of practice list receiving deprivation payments	21.3 (24.8)	0.36 ($P = 0.025$)[a]

[a]Significant at the 5% level. BMI = body mass index; BP = blood pressure; CVD = cardiovascular disease; IGT = impaired glucose tolerance.

(mean list size = 7374 versus 5502, t = 2.07, df = 70, P = 0.043), but there was no significant variation in standardised prevalence by practice list size in the study practices. The 42 practices had a total population with type 2 diabetes of 5304 patients and a total list size of 309 684 patients. The crude type 2 diabetes prevalence was 1.7% (range = 0.69% to 2.5%). There was considerable variation in age/sex standardised prevalence of type 2 diabetes between practices (Figure 1), from 0.75% to 2.73% (χ^2 = 312, df = 41, $P<0.001$) with a mean of 1.66% (SD = 0.43). Data completeness was greater than 90% for the majority of variables, ranging from 78% for ethnicity to 100% for practice characteristics.

Five variables were significantly associated with the standardised prevalence of type 2 diabetes: Townsend score of the practice surgery; mean Townsend score of the patients with type 2 diabetes; proportion of practice list receiving deprivation payments; proportion of patients with type 2 diabetes with a body mass index greater than 30 kg/m^2; and proportion of patients with type 2 diabetes with cardiovascular disease (Table 2). There was no significant association between the standardised prevalence and the proportion of patients detected outside primary care, the proportion of patients detected through screening, having a GP with an interest in diabetes, or having a practice policy on screening over-75s, hypertensives, other high-risk groups, medication reviews, and other groupings (Table 2).

The mean Townsend score accounted for 42% of the variation in type 2 prevalence between practices (regression coefficient = 0.65; 95% CI = 0.40 to 0.89, $P<0.001$) (Figure 2). Practices with greater deprivation were more likely to

have a higher prevalence of type 2 diabetes. Further variation in prevalence was not significantly accounted for by any of the remaining variables.

Discussion

Summary of main findings

This study suggests that socioeconomic deprivation, rather than screening behaviour and early detection of diabetes, accounts for much of the variation in prevalence between practices.

Comparison with other literature

The prevalence of type 2 diabetes and the large inter-practice variation in standardised prevalence in this study are similar to those reported in other studies.[4,16] We could find no previous studies that examined the influence of practitioner behaviour on variations in prevalence of diabetes between practices. There is, however, some suggestion that general practitioners with a special interest in diabetes contribute towards improved diabetes control among their patients[17] and are more likely to have a recall system and diabetes mini-clinic in their practices.[18] We found no such association between general practitioners with a special interest in diabetes and the variation in prevalence of type 2 diabetes. We would postulate that the influence of this measure is diminishing over time as an increasing number of practices report a general practitioner with an interest in diabetes (a rise from 18% in 1993,[17] to 68% in 1997,[18] to over 90% in this study in 2000). Doctors' knowledge,[19] health beliefs,[20] and personality[21] have also been postulated as
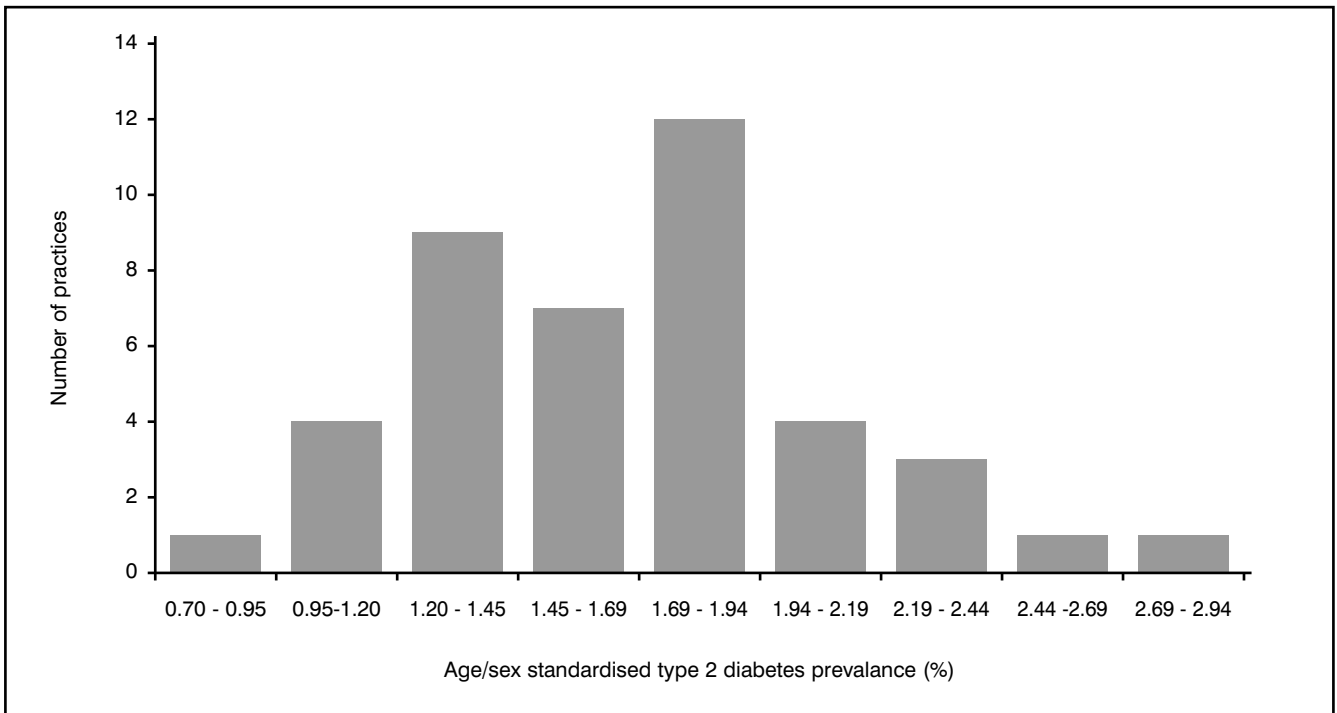
Figure 1. Practice prevalence of type 2 diabetes in Newcastle and North Tyneside in 1999 (age/sex standardised to the population of England and Wales in 1998).
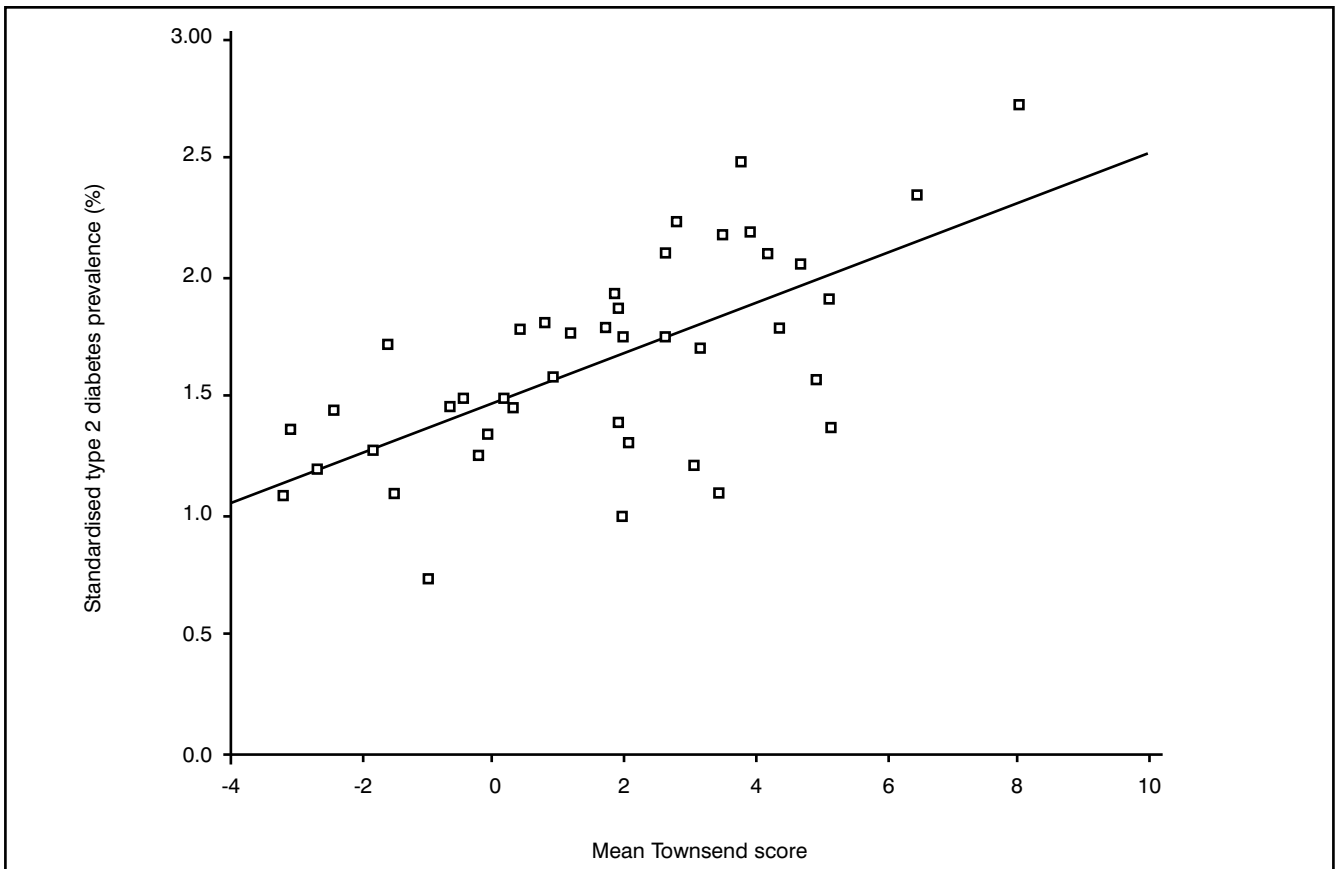

Figure 2. The association between age/sex standardised practice prevalence of type 2 diabetes and mean Townsend deprivation score for diabetic patients.

influences on diabetes control, but these have not been substantiated.

Strengths and limitations of the study

It may be that the measures used to describe practitioner behaviour in terms of diabetes awareness and screening behaviour were not sensitive enough. The measure used for diabetes awareness has only face validity and must therefore be viewed with caution. However, three different measures of diabetes screening activity in the practice all produced the same findings. The influences of practitioners on detection and screening of diabetes may be individual and may lose their influence when aggregated at the practice level. This would need testing with a further study looking at practitioner behaviour as individuals. Nevertheless, a strength of this study is its ascertainment of a wide range of potential confounding variables from several sources in a population with significant variations in prevalence.

It therefore seems most likely that the original hypothesis of this study has been disproved and that variations in the prevalence of type 2 diabetes between practices are not related to practitioner behaviour in screening, early detection, or diabetes awareness, but are related to socioeconomic deprivation. This relationship with deprivation could be owing to a true difference possibly related to unhealthy behaviours known to put people at risk of diabetes. Alternatively, the true prevalence could be the same in affluent and deprived areas and may be related to higher detection in deprived areas owing, for example, to a higher consultation rate and hence a higher likelihood of being tested.

Several biases can influence the interpretation of data from cross-sectional studies. If practices situated in deprived areas kept more accurate diabetes registers, this could account for the association between deprivation and increased prevalence of type 2 diabetes. However, it is known that practices in deprived areas are less likely to be well organised[22] and less likely to engage in activities such as audit, which can improve registers.[23] It seems more likely that registers in deprived areas may be less accurate. Under-recording in deprived areas would potentially underestimate the strength of the association between deprivation and type 2 diabetes prevalence. We chose to use data on patients with diabetes, as they were relatively complete and easily accessible. However, overall population-based data may be more useful, particularly in looking for associations between prevalence and body mass index. Few practices were able to provide complete population-based data and their usefulness would therefore diminish. In addition, we did not include any measure of physical activity or diet in the final analysis — factors that have been strongly associated with the development of type 2 diabetes.

Implications for future research and policy

The explanation for the association between socioeconomic deprivation and type 2 diabetes is unclear. It is likely that the underlying mechanism is a complex interaction between genetic factors and the environment. The list of risk factors that are suggested as a stimulus for screening does not currently include social class, so it is unlikely that the variation in prevalence reflects selective screening and earlier detection among the deprived. The evidence that health-damaging behaviour is more common in lower social groups continues to accumulate. There is a growing body of evidence that material and structural factors, such as housing and income, can affect health. In addition, certain living and working conditions appear to impose severe restrictions on an individual's ability to choose a healthy lifestyle. It is likely that lifestyle, especially diet and physical inactivity,[24] interact with genetic, fetal and infant nutrition factors,[25] to account for the higher prevalence of type 2 diabetes in deprived populations. Thus our findings might be explained by a true variation in incidence and prevalence across social classes, rather than simply variation in the detection rate for prevalent undiagnosed diabetes among deprived and affluent patients.

Associated with the increased prevalence of type 2 diabetes in deprived areas is an increased risk of illness,[26] an increased association with other cardiovascular risk factors,[9,27] increased hospital admissions,[28] and increased mortality.[29,30] At the same time, practices in deprived areas are less likely to be well organised,[22] to audit their activity,[23] or to provide diabetes care.[22,31,32] The 'inverse care law', whereby individuals with the greatest need are least likely to have access to appropriate care, applies to diabetes care. There is an obvious need to address these inequalities in healthcare provision, but it is clear that policies seeking to reduce inequalities that are focused entirely on the individual would be misguided. Instead, there is both a need for funding for diabetes care that reflects the increased demand on primary care in deprived areas, and an increased emphasis on implementing preventive strategies in deprived areas. The increased burden of diabetes in deprived populations demands a response that is comprehensive and incorporates health promotion, disease prevention, improved access to quality health care, improved disease management, and the political will to tackle the social inequalities that perpetuate the health divide.

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