Collation and comparison of multi-practice audit data: prevalence and treatment of known diabetes mellitus

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SUMMARY

Background. *Different methods have been used to determine the prevalence and treatment of diabetes. Despite the large number of studies, previous estimations of prevalence and treatment have been carried out on relatively small numbers of patients, and then in only a few practices in single geographical regions.*

Aim. *To investigate the feasibility of collating data from multi-practice audits organized by primary care audit groups in order to estimate the prevalence and treatment of patients with known diabetes, and to discuss the methodological issues and reasons for variation.*

Method. *A postal questionnaire survey of all primary care audit groups in England and Wales that had conducted a multi-practice audit of diabetes between 1993–1995. Prevalence rates and patterns of diabetic care were compared with other community-based surveys of known diabetes from 1986–1996 identified on MEDLINE.*

Results. *Twenty-five (43%) audit groups supplied data from multi-practice audits of diabetes. Seven (28%) multi-practice audits involving 259 practices fulfilled the inclusion criteria for prevalence estimation. The overall prevalence of diabetes based on a population of 1 475 512 patients was 1.46% (range between audit groups = 1.18% to 1.66%; $c^2 = 308$; df = 6; $P<0.0001$). Male to female ratio was 1.15:1. Treatment of diabetes could be ascertained for 10 (40%) audit groups comprising 319 practices. Of these, 23.4% (range = 16.5%–27.4%) were controlled by diet, 48.5% (range = 43.6%–55.8%) were prescribed oral hypoglycaemic drugs, and 28.2% (range = 25.0%–32.4%) were treated with insulin. There were significant variations between audit groups in treatment pattern ($c^2 = 250$; df = 18; $P<0.0001$).*

Conclusion. *Prevalence and treatment rates of diabetes and other chronic diseases can be assessed and compared using data from multi-practice audits. Collation of audit data could improve the precision of quantitative estimates of health status in populations. A standard method of data recording and collection may provide a new approach that could considerably improve our ability to monitor disease and its management.*

Keywords: diabetes mellitus; prevalence; treatment; multi-practice audits.

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Introduction

MANY studies have been published reporting prevalence rates of diabetes. However, estimates have differed considerably depending on the methods used to determine prevalence.[1-14] General practice surveys of known diabetes prevalence rates have, in recent studies, ranged from 1.2 to 1.8%.[11,14] Methods of estimating prevalence rates have included using GP registers,[5,10,11] postal questionnaires,[1] house-to-house enquiries,[3] hospital registers,[2,7,8] repeat prescription systems,[3] and district diabetic registers.[14] The prevalence rates of known diabetes in recent surveys have been substantially higher.[12-14] Other studies have ascertained total prevalence (including previously undiagnosed cases) using glucose tolerance tests.[15] One study also included a capture–recapture method using multiple independent data sources, and demonstrated a completeness of ascertainment of the survey of 90.1%.[16]

Despite the large number of studies, previous estimations of prevalence have been carried out on a relatively small number of patients[1-9] and in only a few general practices. Some recent studies have involved relatively larger numbers of diabetic patients[10-12] but these have been carried out in single geographical regions. Prevalence estimations from single geographical areas may not be representative of the general population and may fail to identify areas of high prevalence that might need additional support to ensure equity of provision. The aim of our study was to identify and compare possible existing sources of information to estimate the prevalence of known diabetes. We also sought to estimate the treatments of patients with diabetes in the general population. Since the introduction of clinical audit in general practice,[17] many audits have been undertaken and consequently much data about performance have been collected.[18] Audit groups, formerly known as medical audit advisory groups (MAAGs), have been conducting multi-practice audits involving large numbers of general practitioners (GPs).[19] We carried out a study to collate data from multi-practice audits undertaken in different locations around the country, and compared our results with prevalence rates from previous surveys. Therefore, an additional aim of the study was to identify the methodological issues to consider when collating audit data, in order to estimate disease prevalence.

Method

Recruitment

This study was part of a study of the performance measures of care of patients with diabetes. A comprehensive list of audit groups that had coordinated multi-practice audits of diabetes was constructed using information from a survey of audit groups undertaken in 1994, supplemented by a survey of all those groups that had either not responded to the first survey or had responded but reported that no diabetes audit had been undertaken.

A data collection form was produced, which requested details of diabetic treatment, number of patients included in the audit, and the total number of patients in the practices. The data collection form was piloted in six audit groups prior to being sent to all groups that had undertaken a multi-practice diabetic audit. A reminder and data collection forms were sent to non-responders and they were also followed up by a telephone call. The results were transferred to summary sheets. To ensure optimum data quality, audit group staff were asked to verify the information and to provide any missing data. Returned data were reviewed by two members of the project team and transferred to a database.

Criteria for inclusion
The criteria for inclusion of the multi-practice audits were as follows:

- *Diagnosis of diabetes mellitus.* Data were included if the audit group had conducted the multi-practice audit on all patients with diabetes in the practice. Audits were excluded if they had included only a subset of patients with diabetes; for example, only those with type 1 or type 2 diabetes. Since the criteria for classifying diabetes as insulin dependent varies, patients were classified according to treatment (insulin, oral hypoglycaemic drugs only, or diet only).
- *Representative population.* Although studies of specific groups (for example, groups classified by ethnicity or deprivation) yield useful information about prevalence, only a population-based study can provide rates suitable for comparison between audits.[20,21] Audits that included only patients in specific groups or ages were therefore excluded.
- *Accurately defined denominator.* Information on the population at risk had to be available so that appropriate denominators could be used to estimate the prevalence. Age and sex information was not generally available for either the diabetic population or the practice population .
- *Large populations.* Small practice numbers in an individual multi-practice audit may signify a high degree of self-selection by involved practices. If audits involving few practices have systematically included those with higher or lower prevalence than average, this could represent a potent source of bias. Therefore, only multi-practice audits that had more than 1000 diabetic patients were included in this study. This figure was arbitrary and was based on the assumption that audits with small numbers of patients may include a biased sample of practices.
- *Audits conducted for similar periods.* Prevalence rates over different periods cannot be easily compared with each other. The longer the time over which rates are averaged, the more they will reflect secular trends.[22] Only data on multi-practice audits completed between 1993 and 1995 were collated.

A pooled analysis was performed on the data supplied by audit groups satisfying these inclusion criteria. For comparison of prevalence rates with other studies, a MEDLINE search from 1986–1996 was conducted to identify previous community-based surveys in the United Kingdom (UK) that reported total prevalence and treatment of known diabetes. Search terms included diabetes mellitus, prevalence, treatment, and management. Any cross-references from these studies were also included. Only studies that estimated the prevalence of all known diabetes (type 1 and type 2) conducted in the UK were identified.

Results

Prevalence
Twenty-five (43%) audit groups out of the 58 that had completed the first cycle of a diabetic audit supplied data from multi-practice audits of diabetes. Of the 25 audit groups that supplied the data, only seven (28%) multi-practice audits involving 259 practices provided data on the denominator. All seven audits fulfilled all other inclusion criteria for prevalence estimation. Data from other audit groups could not be used because they were audits of the structure of care, or data were supplied as bar chart percentages, or they were conducted on specific sub-groups. Three audit groups were from the north of England, three from the south, and one was from Wales. In our study, the overall prevalence of diabetes in a total population of 1 475 512 people was 1.46%. There was considerable variation in prevalence between the seven groups, with rates ranging from 1.18% to 1.66%. This variation was highly statistically significant and so cannot be attributed to random variation ($\chi^2 = 308$; df = 6; $P<0.0001$). Four audit groups supplied the data for the sex distribution of diabetes mellitus, giving an overall male to female ratio of 1.15:1. Audit groups used various methods of identifying patients with diabetes (Table 1). Table 2 shows the prevalence of known diabetes in other recently published community studies.

Pattern of diabetic care
The treatment of diabetes could be ascertained for 10 (40%) audit groups comprising 23 423 patients from 319 practices (Table 3). Table 4 shows the treatment of diabetes from our collated audit data in comparison with other recently published studies. Overall, 23.4% were controlled by diet alone, 48.5% were being prescribed oral hypoglycaemic drugs, and 28.2% were treated with insulin. There were significant variations in treatment pattern ($\chi^2 = 250$; df = 18; $P<0.001$).

Discussion

The prevalence of known diabetes in our study of nearly 1.5 million people from 259 practices was 1.46%, which is similar to the rates found in recent large studies.[12,13] However, recent surveys in single geographical regions have reported higher prevalence rates.[10,14] The study by the Royal College of General Practitioners (RCGP) centennial practices[13,23] showed a prevalence of 1.6%. This was based on 5678 diabetic patients from 48 different practices who are particularly motivated, providing weekly returns to the RCGP. These practices are larger, employ more trainee doctors, and have younger doctors.[24] The prevalence of 1.8% in the study in Tyneside[14] was based on only 559 diabetic patients. Previous surveys have been carried out in single geographical areas and may not therefore be generalizable to the UK as a whole. Our results from seven geographically different populations may therefore provide a better estimate of current prevalence in the UK.

The percentage of diabetic patients treated by diet alone in previous surveys has ranged from 16.0%–28.7%. For oral hypoglycaemic drugs the range has been 40.4%–54.0%, and for insulin, 25.0%–39.5%. The results in our study are therefore comparable. This study also reported a slightly higher prevalence rate of diabetes mellitus in males which has been observed in previous studies.[11,13,14]

Issues that merit further consideration are the possible causes of bias in this type of data collection and the possible reasons for the significant variation in prevalence and treatment patterns in different areas. The extent of variation is sufficient to call into question the appropriateness of aggregating data from different audits in different areas.

Sources of potential bias

To estimate the prevalence of a disease, it is important to study a large, unbiased population sample. In collating audit data, sources of bias may include information bias, diagnostic and ascertainment bias, and selection bias.[22]

Table 1. Prevalence of diabetes estimated for seven audit groups. (NR = not reported.)

Audit group	Year audit completed	Number of practices undertaking audit	Total number of patients	Total number of patients with diabetes	Male: female ratio	Percentage prevalence of diabetes (95% CI)	Methods used for identifying patients with diabetes
A	1995	33	197 246	2702	1.07:1	1.37 (1.32–1.42)	a,b,c,d,e,f
B	1995	29	145 056	2283	1.18:1	1.57 (1.51–1.64)	a,b,c
C	1995	39	257 364	3541	1.22:1	1.38 (1.33–1.42)	a,b,c,d,e,f
D	1995	33	117 447	1923	NR	1.64 (1.57–1.71)	a,b,c,f
E	1994	41	218 492	2574	1.1:1	1.18 (1.13–1.23)	Practices responsible for identifying patients
F	1993	21	138 746	1881	NR	1.36 (1.30–1.42)	a,b,c,f
G	1993	63	401 161	6671	NR	1.66 (1.62–1.70)	b,c

a = disease register; b = patient records; c = computer records; d = district register; e = hospital register; f = repeat prescriptions.

Table 2. Prevalence studies of known diabetes (type 1 and type 2) in total populations from 1986–1996. (NR = not reported.)

Study	Year study undertaken	Number of diabetic patients	Number of practices	Method of identifying diabetic patients	Prevalence (%)	Range
Norwich[4]	1987	590	8	GP notes, prescriptions, case ascertainment	1.28	NR
Powys[5]	1989	469	NR	GP registers	1.01	NR
Tyneside[6]	1991	668	12	GP registers/records	1.30	NR
Trowbridge[7]	1992	405	NR	GP and hospital registers	1.31	NR
Islington[8]	1992	4674	NR	GP and hospital registers, PPA returns	1.17	NR
Bristol[9]	1992–1993	1082	8	Observation data from practices	1.51	1.31–2.29
Poole[10]	1992–1993	4130	36	GP records	1.60	0.8–2.6
Tunbridge Wells[11]	1993	2574	41	GP registers	1.18	NR
Manchester[12]	1993	3463	64	GP records	1.20	0.49–2.15
RCGP Practices[13]	1993	5678	48	Network of sentinel general practices	1.60	1.2–2.8
North Tyneside[14]	1994	559	NR	District diabetic register	1.80	NR

Table 3. Treatment of diabetes for 10 audit groups.[a]

Audit group	Total number of patients (%)		
	Diet alone	Oral hypoglycaemic drugs	Insulin
A	687 (27.2)	1134 (44.9)	706 (27.9)
B	624 (27.4)	1064 (46.8)	587 (25.8)
C	814 (23.2)	1771 (50.5)	921 (26.2)
E	424 (16.5)	1326 (51.5)	824 (32.0)
F	257 (17.6)	815 (55.8)	389 (26.6)
G[b]	422 (22.7)	959 (51.6)	477 (25.7)
H	529 (23.0)	1197 (52.0)	576 (25.0)
I	313 (25.6)	591 (48.4)	317 (26.0)
J	353 (26.9)	580 (44.1)	381 (29.0)
K	1052 (24.0)	1914 (43.6)	1419 (32.4)

[a]Treatment for 638 patients not known. [b]Systematic sampling used.

Table 4. Treatment of diabetes in previous studies compared with that of pooled audit data.

Study	Year study undertaken	Number of diabetic patients in study	Treatment		
			Diet alone	Oral hypoglycaemic drugs	Insulin
London[20]	1988	378	17.0	46.0	35.0
Poole[2]	Not reported[a]	917	20.1	40.4	39.5
Powys[5]	1989	469	16.0	54.0	30.0
Dudley	1989–1990	452	21.7	53.3	25.0
Tyneside[6]	1991	668	23.5	47.0	28.7
Trowbridge[7]	1992	405	19.0	51.0	30.0
Bristol[9]	1992–1993	1082	28.7	46.1	25.1
Poole[10]	1992–1993	4130	23.2	45.6	30.4
Tunbridge Wells[11]	1993	2574	16.5	51.5	32.0
Collated audit data	1993–1995	23 423	23.4	48.5	28.2

[a]Study published in 1988.

Information bias may arise from inaccurate data collection. Retrieval of data can be difficult and must be carried out by someone with experience of general practice records. It is difficult to confirm details of audits and accuracy of the diabetic registers of individual practices, and a major limitation in the collation of audit data may be poorly conducted data collection.

Diagnostic bias occurs if, for example, participating practices have categorized a higher proportion of their population as diabetic through use of incorrect diagnostic criteria, opportunistic glycosuria screening, or a lower clinical threshold for diagnostic testing. Ascertainment bias may occur if different methods are used to identify individuals with diabetes for audit purposes in different areas. The methods used in these audits for identifying patients with diabetes are comparable to the methods used in previous studies. However, it was not possible in our survey to check the validity of the diagnosis of patients reported to have diabetes.

Selection bias will occur because of the self-selection of practices that undertake multi-practice audits and in the selection of audit groups that provide data and have appropriate data for comparison or aggregation. Our study of performance measures for the care of patients with diabetes did show that the practices represented the expected range of partnership size. However, there is also some evidence that the practices that do not provide structured care (and are probably less likely to contribute to multi-practice audit) may differ systematically in terms of prevalence.[25]

All these potential biases would be reduced by an increase in the standardization of these types of multi-practice audits and the inclusion of a large number of practices. The data would then be more directly comparable and the practice populations more representative of the whole population.

Explanation of variations between multi-practice audits

Despite the potential for bias, the large variations observed are also likely to reflect real geographic differences in prevalence and treatment patterns. Variations could be due to demographic differences between populations. Our study has reported crude rates, and comparisons are therefore difficult because age-specific and age-adjusted rates could not be ascertained. However, individual patient audit data would allow estimation of age-specific prevalence and treatment of patients with diabetes. Rates also vary appreciably between ethnic groups[26] and with deprivation.[27] Investigation of these issues is not usually possible when aggregating multi-practice audit data, but comparison can highlight unexpected differences or local deficiences in care that merit further investigation. Thus, such data may act as a stimulus for improvement in care with the potential for reduction in equity. These data may also assist in local purchasing and providing bodies with service development.

There is evidence over the past decade that the number of diabetic patients has increased.[28] In planning future health care, the monitoring of trends such as prevalence and incidence is a necessary prerequisite. Aggregated audit data from comparable audits can be one way of monitoring such trends. The findings in our survey are consistent with the secular rise in the prevalence of diagnosed diabetes that has been observed in previous studies.[1] However, it is not possible to be sure to what extent the increase is due to improved detection. Only population surveys that assess the prevalence of undiagnosed diabetes can distinguish increases in true prevalence from improved detection rates. Nevertheless, comparison of audits over time could provide useful evidence of local and national secular trends.

The creation of continuous morbidity registers to obtain data of sufficient quality for epidemiological purposes has been proposed previously.[13] Burnett and colleagues concluded that the task of developing district diabetic registers may prove a major task in many inner-city health districts.[8] It has been argued that the identification of all diabetic patients is within the competence of GPs, and audit groups may have a role in coordinating annual identification of patients and evaluating the care that they receive within the district.[11]

This study shows that the method used in this survey is practical and suitable for epidemiological studies. It does not demand cooperation of patients and it includes all patients regardless of age. This type of study is relatively simple and inexpensive to perform. Although it cannot replace epidemiological field surveys, it can give a reasonably fair estimate of prevalence in a population. Data from studies similar to this may permit insight into local public health and indicate ways to improve care. Formal training and standardization of data collection are desirable, and it may be appropriate for audit groups to undertake such training prior to setting up a multi-practice audit for any chronic disorder. Accuracy can be increased if the information could be transmitted electronically to a district health authority or to a central register that carried out prevalence estimations, similar to that set up by the RCGP centennial practices.[13] If GPs are willing to attain this level of recording then it would be in the interest of audit groups and the National Health Service (NHS) to direct resources to support them in two ways; first by providing training in data recording and collection, and secondly by providing means of collating and transmitting data for aggregation. Further research also needs to be carried out into the best methods of collating and aggregating audit data. In our study, there were large differences between the audits regarding audit design, and consequently only just over a quarter of audits could be used to estimate the prevalence. A standardized audit protocol could reduce the influence of methodological problems and thereby the variation in reported prevalence. With careful and appropriate use, this would provide a new approach that could considerably improve our ability to monitor disease.

We conclude that the prevalence rates of chronic disorders can be assessed and compared using data from multi-practice audits. The collation of audit data could improve the precision of quantitative estimates of health status in populations and increase understanding of variation between populations.

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