Diabetes in Victoria, Australia: the Visual Impairment Project

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Abstract

Objectives: To establish the prevalence and characteristics of self-reported diabetes in a representative sample of Victorian residents aged 40 years and older, and to compare the vision between people with and without self-reported diabetes.

Design: Cross-sectional survey.

Setting: Nine randomly selected suburban Melbourne clusters and four randomly selected rural Victorian clusters.

Participants: 4,744 subjects (86% participation rate) aged ≥40 years.

Main outcome measures: Subjects answered a detailed questionnaire which provided demographic details, body mass index, and the duration and treatment of any diagnosis of diabetes. Refraction was performed and best-corrected visual acuity was measured.

Results: The prevalence of self-reported diabetes was 5.1%. In a multivariate analysis, self-reported diabetes was positively associated with age ($p<0.01$), male sex ($p=0.01$), higher body mass index ($p=0.01$), Mediterranean ethnicity ($p=0.01$), unemployment ($p=0.05$) and lack of private health insurance ($p<0.05$). People with self-reported diabetes were more likely to have mild or moderate levels of visual impairment than people who reported no previous diagnosis of diabetes ($p<0.01$).

Conclusions: Diabetes in Victoria is more prevalent among men and among people of Mediterranean origin. When planning educational programs and health service delivery, it is also important to consider that, compared with the general population, people with diabetes are less likely to be employed or to have private health insurance, and are more likely to have impaired vision.

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Diabetes mellitus has been estimated to affect 900,000 Australians and risk factors – such as obesity and physical inactivity – are increasing.[1] As well as the enormous burden to those affected, diabetes costs the Australian community more than $1 billion annually.[1] Reducing the burden of diabetes requires the delivery of co-ordinated, multi-disciplinary health care and educational services which enable people to best manage their own health. Doing this effectively depends on a comprehensive understanding of the characteristics of the population affected, so that services can be targeted appropriately.

The Visual Impairment Project (VIP)[2] is a large, population-based, epidemiological study which is ongoing in the state of Victoria. It has been designed to investigate the distribution and determinants of eye disease, the impact of blindness and visual impairment on individuals, and the use of and barriers to eye health-care services. This report analyses the epidemiology of self-reported diabetes using cross-sectional data collected during the baseline phase of the project between 1992 and 1996. We describe the prevalence of self-reported diabetes in our cohort and treatment methods used to control glycaemia. We have used multiple logistic regression modelling to determine biological and socio-economic associations with diabetes and to evaluate vision in people with diabetes.

Methods

A stratified cluster sampling method was used to select participants. Each cluster consisted of two adjacent Census collector districts. The urban component of the project contained nine Melbourne suburban clusters that were randomly selected from within the Melbourne Statistical Division, while the rural component contained four randomly selected clusters from throughout the rest of the State. The only restriction placed on the random selection of pairs of Census collector districts was that each pair had to have at least 100 eligible residents; no pairs had to be culled because of this restriction. Eligible residents were defined as people aged 40 years and older who had resided in their homes for at least six months. A private household census was conducted to identify eligible residents. The urban component of the study was conducted from 1992 to 1995 and the rural component was conducted in 1996.

A screening questionnaire was administered in the home to establish contact with eligible residents and to determine basic demographics. When respondents were not available, repeated visits were made to the home. Eligible residents were then invited to attend a local, temporary test site for a more comprehensive interview. Those who were unable to attend the test site were offered a modified home visit so that as much information as possible could be obtained.

At the test site, another interview was conducted by trained interviewers. It elicited further demographic details and a medical history, including a history of medication use. Participants were classified into various ethnic groups on the basis of their report of their parents' country of birth. Body weight and height were reported by subjects and Body Mass Index (BMI) was calculated

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as weight(kg)/height(m).[2] Participants were also asked how satisfied they were with their current level of vision and whether or not they had noticed a change in their vision within the past 10 years.

The interview included specific questioning about whether subjects had ever been diagnosed with diabetes mellitus, the year in which such a diagnosis was made and current medications used to treat diabetes. Assignment of diabetes status in this report is based on self-report of a medical diagnosis of diabetes. The questions relating to diabetes have been previously validated and employed by Welborn et al.[3]

Presenting visual acuity was determined with an ETDRS (Early Treatment Diabetic Retinopathy Study) four-metre chart. Any spectacle correction worn was measured with a Humphrey Automatic Lens Analyser (model 330, Humphrey Instruments, Dublin, CA). A Humphrey Automatic Refractor (Humphrey Instruments, Dublin, CA) was used to measure the objective refraction in all subjects who read less than 53 letters (6/7.5 or 20/25) in either eye. This was then refined by subjective refraction, to determine best corrected visual acuity.

Double entry of data with comparison was used to minimise errors in the dataset. Statistical analyses were performed using SAS version 6.09 (SAS Institute Inc, Cary, NC). The statistical procedures used in this research included summary statistics, t-tests, chi-square analyses and multiple logistic regression models. These procedures are documented in the SAS/STAT users' guide.[4] 'Cluster' was used as a dummy variable in the multiple logistic regression models to determine the effect of the cluster sampling on the odds ratio (OR) estimates and confidence limits. A p-value of <0.05 was considered to be statistically significant.

The Royal Victorian Eye and Ear Hospital human research ethics committee approved the project. Informed consent was obtained from all participants.

Table1: Comparison of subjects with and subjects without self-reported diabetes.

	Subjects with self-reported diabetes % (n) in subgroup n total = 239	Subjects without self-reported diabetes % (n) in subgroup n total = 4,478	OR adjusted for age, sex, BMI and ethnicity (95% CI)
Age (years)			
Mean	64.5	58.4	
Median	64	57	
Range	42-97	40-90	
40-49	10.0 (24)	27.5 (1230)	Reference group
50-59	18.4 (44)	28.7 (1286)	1.43 (0.81-2.51)
60-69	38.9 (93)	24.3 (1089)	4.02 (2.42-6.65)
70-79	25.5 (61)	14.5 (651)	5.08 (2.98-8.65)
80	7.1 (17)	5.0 (222)	4.22 (1.97-9.08)
Male	56.5 (135/239)	46.1 (2064/4478)	1.53 (1.13-2.07)
Body Mass Index	n total = 197	n total = 3,703	
Mean	27.8	25.8	
Median	26.9	25.4	
Range	18.1-48.0	15.7-47.0	
<20	4.6 (9)	6.0 (222)	1.09 (0.50-2.36)
20-25	25.9 (51)	41.0 (1518)	reference group
25-30	43.2 (85)	38.1 (1409)	1.66 (1.15-2.40)
≥30	26.4 (52)	15.0 (554)	2.91 (1.92-4.40)
Ethnicity	n total=235	n total = 4,439	
Anglo-Celtic	60 (141)	73.9 (3279)	Reference group
Italian	14.9 (35)	7.7 (343)	1.83 (1.13-2.95)
Greek	10.2 (24)	5.6 (249)	2.08 (1.81-3.65)
Other European	11.9 (28)	9.8 (434)	1.37 (0.85-2.21)
Other	3.0 (7)	3.0 (134)	1.77 (0.69-4.54)
In paid employment (full- or part-time)	25.6 (60/234)	45.2 (2,011/4,450)	0.67 (0.44-1.00)
Completed secondary school	37.6 (86/229)	53.4 (2,332/4,371)	0.82 (0.59-1.14)
Has private health insurance	38.5 (92/239)	51.3 (2,297/4,475)	0.73 (0.54-0.99)
Lives alone	19.3 (46/238)	13.7 (613/4,469)	1.38 (0.94-2.04)
Best corrected visual acuity (best eye)	n total = 238	n total = 4,475	
6/6 or better	53.4 (127)	74.7 (3,343)	Reference group
6/6-6/12	42.0 (100)	24.2 (1,082)	1.78 (1.27-2.50)
6/12-6/18	2.9 (7)	0.5 (21)	6.37 (1.88-21.6)
6/18-6/60	1.3 (3)	0.4 (16)	
6/60-3/60	0.4 (1)	0.1 (5)	
worse than 3/60	0.0 (0)	0.2 (8)	worse than 6/18: 1.59 (0.35-7.21)

Further details about the methodology of the VIP that are not directly relevant to the present paper are published elsewhere.[2] A comparison of participants with non-participants from the urban component of the VIP has also been published.[5] This comparison revealed that, although non-English speaking residents were significantly less likely to participate than English-speaking residents, the minimum participation rate among various language groups was 76%.

Results

In total, 5,520 subjects were identified as being eligible to participate in the rural and urban components of the VIP. Of these, 776 did not participate, giving a response rate of 86%. In the urban clusters, the overall response rate was 84% (3,271/3,912). In the rural clusters, the overall response rate was 92% (1,473/1,608).

There were 239 people who reported a previous diagnosis of diabetes and 4,478 who reported no previous diagnosis of diabetes, giving an overall prevalence of 5.1%. Of the 239 people who reported a diabetes diagnosis, 168 came from the urban sample and 71 from the rural sample. The prevalence of self-reported diabetes did not differ significantly between the urban and the rural samples (5.2% and 4.9% respectively, p=0.69). The prevalence of potential risk factors for diabetes such as age, gender, type of diabetes treatment and duration of diabetes also do not vary significantly between the urban and rural cohorts (all p>0.05, data not shown). Therefore, data from the two samples were combined for analysis.

The mean duration of diagnosis was 9.1 years (median 6, range 0-57). Eight people with diabetes (3.4%) reported a diagnosis before the age of 30. The number of people with diabetes who reported using medications to control their diabetes was 172 (72%). There were 39 people with diabetes who used insulin (16.6%) and 133 people with diabetes who used oral hypoglycaemic agents (56.6%). This included four people with diabetes who reported using both insulin and oral hypoglycaemics. A further four people with diabetes reported using medications for diabetes control but did not report what these medications were.

Table 1 shows comparisons of subjects who reported a previous diagnosis of diabetes with those who reported no previous diagnosis of diabetes. Only those variables which significantly differed between the two groups (p<0.05) in a univariate analysis are presented. The table also shows the effect of adjusting for age, sex, BMI and ethnicity by multivariate logistic regression. Age was not normally distributed in the sample and was adjusted for in 10-year increment categories using dummy variables. BMI was adjusted for as a continuous variable, as it was normally distributed in the study population. Ethnicity was adjusted for in the categories shown using dummy variables. The reported odds ratios for age, sex, BMI and ethnicity are adjusted for each of the other three variables. The cluster sampling design did not have a significant effect on the odds ratios or the confidence limits, therefore the estimates assuming simple random sampling have been

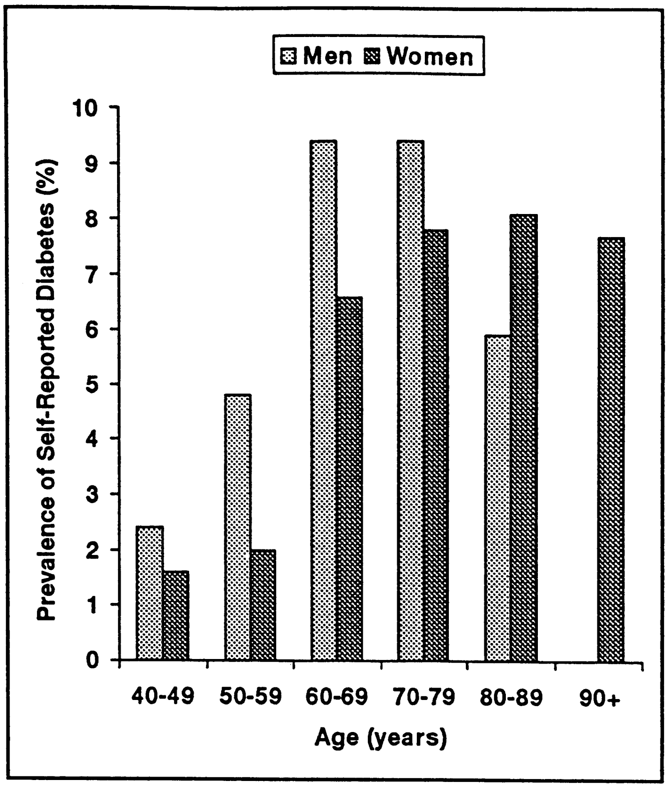

Figure 1: Prevalence of self-reported diabetes by gender and age.

presented. Figure 1 shows the increasing prevalence of diabetes with increasing age, for both sexes. Figure 2 shows how the prevalence of self-reported diabetes varied with ethnicity, for both sexes.

No statistically significant difference was found between subjects with self-reported diabetes and those without self-reported diabetes, in terms of whether or not a spectacle correction was worn for distance, whether or not a change in vision had been noticed in the past 10 years or satisfaction with vision (all p>0.05, data not shown).

Discussion

Our study provides population-based, cross-sectional data with a high response rate from a representative sample of the Victorian community aged 40 years or older. The sampling frame was derived from a household census and thus avoids the possible selection bias incurred when the sampling frame is derived from the electoral role.[6]

The overall prevalence of self-reported diabetes of 5.1% is comparable with the similar Blue Mountains Eye Study (BMES),[7] which found an overall prevalence of self-reported diabetes of 5.9% in a population from Western Sydney aged 49 years and older. Our data demonstrate an increase in prevalence with increasing age for all age groups until the group older than 90 years, where the prevalence falls (see Figure 1). The BMES found age-specific prevalences of self-reported diabetes of 4.1% for subjects aged <60 years, 7.0% for subjects aged 60-69 years, 6.6% for subjects aged 70-79 years and 5.5% for subjects more than 80 years of age. The apparent decline in diabetes prevalence in the

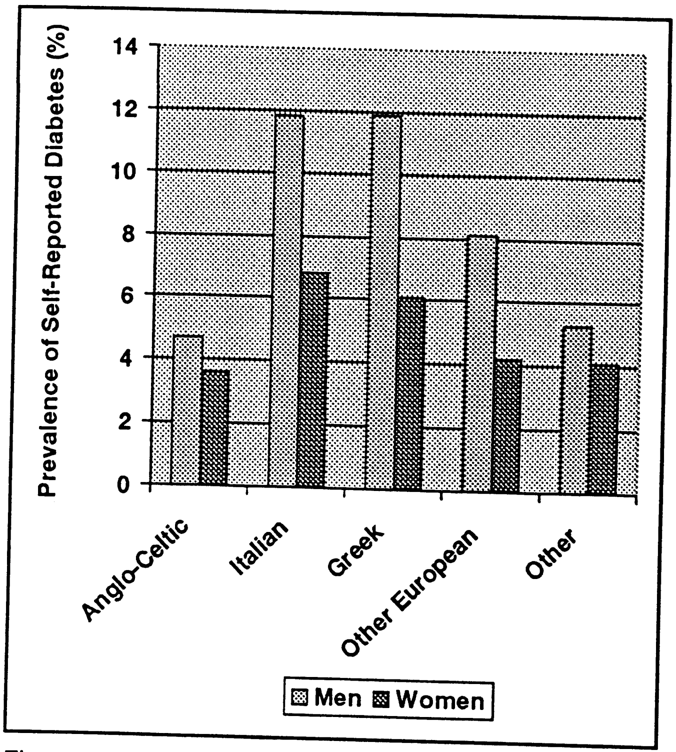

Figure 2: Prevalence of self-reported diabetes by gender and ethnicity.

oldest age groups in both studies probably reflects a higher mortality among older people with diabetes compared to older people without diabetes.

Diabetes prevalence, adjusted for age, gender and ethnicity, increased with increasing BMI. Obesity has been implicated as a risk factor for Non-Insulin Dependent Diabetes Mellitus (NIDDM) in many studies world-wide.[1,8] Up to 80% of people with NIDDM have been obese in some reports.[8] This risk is greatest when there is a central distribution of body fat (abdominal obesity). It is attributed to obesity-induced insulin resistance, which affects a broad range of tissues in obese patients and has a multi-factorial cellular aetiology.[8] Of concern is that obesity levels are rising in both men and women in virtually all age groups in Australia.[1]

Diabetes prevalence, adjusted for age, sex and BMI was significantly higher among subjects with Italian and Greek ancestry compared with subjects of Anglo-Celtic ancestry (see Figure 2). Similarly, the 1989/90 National Health Survey[3] found significantly higher prevalences of self-reported diabetes among people born in Southern Europe (3.3% for males and 3.5% for females), compared with people born in Australia (1.6% for males and 1.7% for females) ($p<0.01$ for both sexes). The World Health Organization's Ad Hoc Diabetes Reporting Group has published global estimates for the prevalence of diabetes. This involved collating diabetes prevalence information from investigations in 32 countries world-wide, including data by Verillo et al. from two populations in Italy.[9] Subjects were aged 30 to 64 years and diabetes status was determined by glucose challenge testing. The age-adjusted diabetes prevalences in the two Italian populations were 7.7% and 10.7% for men and 5.2% and 9.8% for women. These do not stand out as being high compared with the other populations described world-wide. The only groups in this report which would be expected to have a largely Anglo-Celtic ethnicity were five populations of non-Hispanic whites in the US. Age-adjusted diabetes prevalences in these study groups ranged from 2.9% to 8.4% for men and from 2.9% to 7.8% for women.

There was a significantly higher prevalence of self-reported diabetes among men than women. This finding replicates that of other large studies of predominantly Anglo-Celtic, adult populations in Australia, including the BMES[7], the 1989/90 National Health Survey,[3] The National Heart Foundation Risk Factor Prevalence Study,[10] and the Busselton 1981 Survey.[11] Examination of the World Health Organization's global estimates for prevalence of diabetes does not show any obvious world-wide trend of a higher diabetes prevalence in males.[9] Interestingly, the higher prevalence in men in our data was seen across all ethnic groups and all age categories except age ≥80 years (see Figures 1 and 2). It has been suggested that the slightly higher prevalence of diabetes in men in Australia is due to the slightly higher excess of obesity in males in Australia relative to females.

In our study, people with self-reported diabetes were less likely to be in paid employment and less likely to have private health insurance after adjusting for age, sex, ethnicity and BMI. This suggests that having diabetes may be significantly disadvantageous in terms of being able to access employment and health care services. People with self-reported diabetes were more likely to live alone and were less likely to have completed secondary school. After adjusting for age, sex, ethnicity and BMI, these differences were not statistically significant. This potentially indicates a confounding effect of these variables on living alone and on education level, a lack of statistical power for such adjustments, or confounding due to some unmeasured factor(s). There is also the potential that the temporality of the association is not correct due to the cross-sectional nature of the data.

People who reported having diabetes were more likely to have mild (worse than 6/6, up to and including 6/12) or moderate (worse than 6/12, up to and including 6/18) levels of visual impairment than people who reported no previous diagnosis of diabetes ($p<0.01$). In contrast, however, whether or not a change in vision had been noticed in the past 10 years and whether or not people were satisfied with their vision did not vary significantly between the two groups. This may reflect a difference between the subjective perception of satisfactory visual function and the subjective measurement of visual acuity. People with self-reported diabetes were also more likely to have more severe levels of visual impairment (worse than 6/18), but this finding was not statistically significant due to the small number of people with severe visual impairment in our sample.

Our findings demonstrate that people with self-reported diabetes in Victoria are more likely to be males and to be older, overweight and of Mediterranean ethnicity. They are also more likely to be visually impaired, not employed and lack private health insurance. All these factors are important to consider when planning support structures, education programs and health service delivery for people with diabetes. A higher diabetes prevalence among men and among people of Mediterranean ethnicity has also been found in other Australian studies.[3,7,10,11] No explanation for this has yet been published. Information from the current AUSDIAB Survey should identify any confounding variables which may provide a greater understanding of diabetes in Australia.

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