

How Much do Diabetic Patients Know About Diabetes Mellitus and its Complications?

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Abstract

Introduction: A Singapore study reported that 99% of diabetics had received some diabetes mellitus (DM) education. Another study reported that the Singapore public is generally well-informed about DM but whether diabetics are well-informed is not known. The objectives of this study were to determine DM knowledge of diabetics visiting the Emergency Department (ED) and to determine the diabetics' knowledge versus practice gap. **Materials and Methods:** A pre-tested questionnaire was used to survey a convenient sample of ED patients and visitors. The respondents were required to answer 43 questions on areas including "Risk Factors", "Treatment and Management" and "Monitoring". A point was awarded for each correct response. Diabetics were asked if they practised the items described in "Treatment and Management" and "Monitoring" sections. **Results:** There were 95 diabetics and 91 non-diabetics surveyed, with no difference in the mean age or the proportion of men. There was no difference ($P = 0.51$) between the diabetics' mean score of 29.2/43 (68.1%) and the non-diabetics' 28.3/43 (65.9%). The younger diabetics tended to score higher with those ≤ 54.99 years obtaining the highest score of 34.2/43 (79.5%) in the study. More than 50% of diabetics practised what they knew of self-care but 25% were ignorant of key aspects like need for home glucose monitoring and regular ophthalmic reviews. Only 21.2% diabetics performed home glucose monitoring though another 42.1% knew they should but were not doing it. **Conclusion:** In this study, knowledge of DM was similar between diabetics and non-diabetics even though younger diabetics obtained higher scores. Diabetes education resulted in better-informed diabetics and changed practices but 25% were ignorant of some key aspects. Among the informed diabetics, various issues need to be addressed to close the gaps between knowledge and practice.

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Introduction

Diabetes mellitus (DM) is a common and growing healthcare problem in Singapore with a prevalence of 9% in 1998.¹ Since the 1990s, the Ministry of Health, Singapore has identified DM as a priority condition for disease control.

Diabetes education should be an integral part of treatment of DM, the desired outcome being a diabetic person "equipped with diabetes self-care knowledge and empowered to make informed therapeutic decisions to minimise his or her health problems arising from diabetes".² A study by Tan et al³ conducted in one of the government outpatient service (OPS) clinics in the mid-1990s showed that educational intervention improved diabetics' knowledge of the disease, self-care and long-term control.

A comprehensive care programme has since been available at the OPS, providing structured care of diabetes in which screening and treatment initiatives, patient education by specialist nurses and self-monitoring of glucose by patients are encouraged. Comprehensive care is also available in the hospitals where nurse clinicians and doctors educate patients on DM management.

A study by Lee et al in 1998⁴ reported that 99% of a sample of 1697 diabetic subjects in Singapore had received some DM education. Another study by Wee et al in 1999⁵ reported that a cross-sectional survey of 1337 members of the Singapore public were generally well-informed about DM except for a few areas. Yet, on a daily basis, a significant number of diabetic patients are presenting to the Emergency Departments (ED) of restructured hospitals

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with metabolic, infective, microvascular, macrovascular or treatment complications. The questions that beg asking are whether diabetic subjects are well-informed about their illness and its complications, and for those who are informed, whether they practice what they know. The objectives of this study were to determine the DM knowledge level of diabetic subjects visiting the ED and to determine the gap between knowledge and practice amongst diabetic subjects.

Materials and Methods

The study was conducted in the form of a field interview in the ED of Tan Tock Seng Hospital, which had an annual attendance of 131,127 in year 2002.⁶ The survey was carried out over a period of 10 days from 26 November 2002 to 5 December 2002. The subjects chosen were a convenient sample of diabetic patients of age 15 and above who registered at the ED between 10 am and 6 pm daily and non-diabetic patients or visitors matched by age and gender to the diabetic subjects. The subjects were approached when their acute symptoms were relieved or stabilised, e.g., after hypoglycaemia had been corrected, or after analgesia had been administered to those with ischaemic chest pain or with fractures. Patients with severe cognitive impairment or those who were too ill to be interviewed and foreign workers were excluded. Participation was voluntary. The hospital ethics committee approved the study.

The questionnaire was available in English, Chinese and Malay languages. Three of the authors (JO, DT, HKY) piloted the questionnaire and conducted the interviews with the subjects. The questionnaire was divided into the following sections, each focusing on different aspects of DM: presenting complaint for diabetics, family history, general knowledge with 8 questions, e.g. "Is it correct to say that diabetes mellitus is a condition of high blood sugar?", risk factors with 6 questions, e.g. "Is it correct to say that diabetes mellitus could be a result of a high sugar diet?", symptoms and complications with 12 questions, e.g. "Is it correct to say that a diabetic patient may have frequent urination?", treatment and management with 13 questions, e.g. "Is it correct to say that a diabetic patient should go for regular eye check-up?" and monitoring with 4 questions, e.g. "Is it correct to say that a diabetic patient should test blood sugar at home?". A system of point allocation was employed with 1 point being awarded for each correct response and none for an incorrect or unsure response. The maximum possible score was 43. Questions in presenting complaint, family history and sources of information sections were not scored.

All the questions in the questionnaire used by Wee et al⁵ were retained. The following were added: (1) diabetic subjects were identified, (2) presenting complaints of the diabetic subjects were recorded, (3) diabetics were asked

about their attendance at diabetic counselling and regular review with their doctor and (4) diabetic subjects were asked if they practised the items described in the treatment and management and monitoring sections, e.g., "Is it correct to say that a diabetic person should go for regular eye check-up?" would be followed by "Do you go for eye check-up regularly?". If the diabetic subject gave the correct answer to the first question and replied that he/she was going for regular eye review, it would be recorded as "correct answer–appropriate practice". If the diabetic subject gave the correct answer but replied that he/she was not going for regular eye review, then it would be recorded as "correct answer–inappropriate practice". If the diabetic patient gave the incorrect answer to the first question and replied that he/she was having or not having regular eye review, it would be recorded as "incorrect answer–appropriate practice" or "incorrect answer–inappropriate practice", respectively.

Data were analysed using the Statistical Package for Social Studies (version 11.0). The chi-square test was used for categorical data and Student's *t*-test for continuous data, with statistical significance set at *P* value ≤ 0.05 where appropriate.

Results

A total of 186 subjects were interviewed, of which 95 were diabetics and 91 were non-diabetics. Thirty-seven persons (11 diabetics and 26 non-diabetics) declined to be interviewed. The mean age of the diabetics was 59.7 years (standard deviation [SD] 11.6 years), which was not significantly different (*P* = 0.18) from the mean age of 57.5 years (SD 10.9 years) of the non-diabetics (Table 1). The median age of 61 years among the diabetics was slightly higher than that of the non-diabetics, which was 56 years. Both groups had 51.6% of male subjects. About half of the diabetics reported a positive family history of DM while almost 32% of non-diabetics also had a positive family history. For both groups, diabetic parents were identified as the predominant contributors to a positive family history.

Among the 95 diabetic subjects, 85 (89.5%) reported that they had regular reviews with their physician, of which 40 (42.1%) went to the OPS, 26 (27.4%) were with the restructured hospitals, 15 (15.8%) were with general practitioners (GP) and 4 (4.2%) with specialist physicians in private practice. Less than two-thirds (64.2%) of the diabetic group reported having ever attended a diabetic education programme or counselling session. Among the 62 diabetics who had such counselling, 23 (37.1%) attended the education or counselling session within the previous 3 months, 6 (9.7%) attended the session between the previous 3 to 12 months and 33 (53.2%) attended the

session more than 1 year ago. There was no correlation between ever attending an education or counselling session and the type of physician providing regular DM care.

Twenty-one (22.1%) diabetics presented with complaints directly related to DM, its complications or treatment, e.g. hypoglycaemia and foot gangrene, while 34 (35.8%) presented with complaints indirectly related to DM, e.g. ischaemic chest pain and stroke symptoms. Nineteen (20%) diabetics complained of symptoms not related to DM, e.g. wounds and fractures, and 21 had complaints that were indeterminate with regards to relationship with DM.

Out of a maximum possible score of 43, the percentage mean score obtained by diabetics was 68.1% (SD 27.2), which was not significantly different ($P = 0.51$) from the 65.9% (SD 18.4) obtained by the non-diabetics. The median score for the 95 diabetics was 33 (range, 0 to 43), slightly higher than 28 scored by the 91 non-diabetics (range, 0 to 41). There was no difference between the scores obtained by male and female non-diabetic subjects. The male diabetic subjects were significantly younger ($P = 0.004$) with mean age 56.5 years (SD 11.6) and obtained a mean score of 75.4% (SD 19.6) which was significantly higher ($P = 0.008$) than the score of 60.4% (SD 31.9) obtained by the female diabetics, whose mean age was 63.2 years (SD 10.8). Figure 1 is a graphical representation of the scores obtained by the subjects. Just as there was no significant difference in the overall scores between the 2 groups, there was also no difference in the scores for each of the sections as shown in Table 1.

For both groups, the knowledge level as indicated by mean scores was inversely proportional to respondents' age as shown in Table 2. The trend was for younger diabetics to score higher than their non-diabetic counterparts, the difference reaching statistical significance ($P = 0.04$) among those ≤ 54.99 years. However, the overall score for subjects age ≥ 65 years was significantly lower ($P < 0.001$) than younger subjects.

Among the diabetics, the mean score of those who attended education sessions was 72.1% (SD 25.2), which

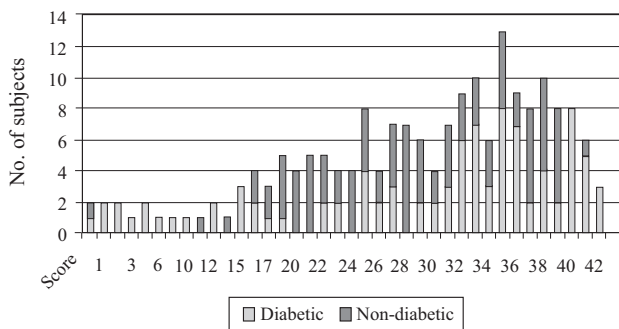


Fig. 1. Scores obtained by diabetics and non-diabetics.

Table 1. Characteristics and Scores of Diabetic and Non-diabetic Subjects

Section	Diabetic (n=95)	Non-diabetic (n=91)	P value
Age (years)			
Mean \pm SD	59.7 \pm 11.6	57.5 \pm 10.9	0.18
Median (range)	61 (35 to 87)	56 (31 to 86)	NA
Proportion of men	51.6%	51.6%	0.56
Positive family history of diabetes mellitus	49.5%	31.9%	0.05
Scores			
Overall score			
Mean \pm SD	68.1% \pm 27.2	65.9% \pm 18.4	0.51
Median (range)	33 (0 to 43)	28 (0 to 41)	NA
General knowledge			
% (SD)	39.9 (27.5)	37.4 (24.8)	0.52
Median (range)	3 (0 to 7)	3 (0 to 8)	NA
Risk factors			
% (SD)	66.3 (31.1)	62.5 (25.3)	0.35
Median (range)	5 (0 to 6)	4 (0 to 6)	NA
Symptoms and complications			
% (SD)	72.2 (34.8)	70.9 (25.2)	0.77
Median (range)	11 (0 to 12)	9 (0 to 12)	NA
Treatment and management			
% (SD)	75.6 (33.2)	76.7 (19.5)	0.79
Median (range)	12 (0 to 13)	11 (0 to 13)	NA
Monitoring			
% (SD)	75.5 (27.8)	77.7 (29.9)	0.60
Median (range)	3 (0 to 4)	3 (0 to 4)	NA

NA: not applicable; SD: standard deviation

Table 2. Scores of Diabetic and Non-diabetic Subjects in Different Age Bands

Age bands	Diabetic	Non-diabetic	P value
Age ≤ 54.99 years			
Number of subjects	30	39	
Mean score \pm SD	79.5% \pm 20.9	69.8% \pm 16.4	0.04
Median score (range, 6 to 43)	37	31	NA
55 \leq Age ≤ 64.99 years			
Number of subjects	32	28	
Mean score \pm SD	74% \pm 20.5	68.8% \pm 16.4	0.29
Median score (range, 7 to 42)	34	30	NA
Age ≥ 65 years			
Number of subjects	33	24	
Mean score \pm SD	52.1% \pm 31	56.1% \pm 20.7	0.59
Median score (range, 0 to 43)	26	24	NA

NA: not applicable; SD: standard deviation

was higher than 62.7% (SD 28.8) scored by those who had not attended any DM education session, even though the difference did not reach statistical significance ($P = 0.09$). There was no correlation between the mean scores and the type of physician providing regular DM care.

Table 3. Knowledge and Practice Gap among Diabetic Subjects

Sections in questionnaire	Correct answer– Appropriate practice (%)	Correct answer– Inappropriate practice (%)	Incorrect answer– Appropriate practice (%)	Incorrect answer– Inappropriate practice (%)
Treatment and Management				
Take diabetic medication	100	0	0	0
Carry sweets when they are out	16.8	25.3	3.2	54.7
Exercise regularly	40	34.7	8.4	16.8
Have good weight control	50.5	14.7	10.5	24.2
Go for regular eye check-up	44.2	18.9	7.4	29.2
Have a low fat and high fibre diet	67.4	10.5	12.6	9.5
Care for toes and feet	75.8	5.3	12.6	6.3
Consume alcohol	55.8	5.3	32.7	6.3
Donate blood	60	0	40	0
Smoke cigarette	60	3.2	24.2	12.6
Wear tight shoes	62.1	2.1	32.7	3.2
Skip meals	17.9	3.2	24.2	54.7
Monitoring				
Test blood glucose level at home	21.1	42.1	3.2	33.7
Test urine glucose level at home	20	37.9	0	42.1
Attend diabetic counselling	64.2	0	0	35.8
Attend regular reviews with a doctor	89.5	0	0	10.5

Among 16 items where knowledge versus practice gap could be determined, 10 items had 50% or more of diabetics answering correctly and adopting the appropriate practice, as shown in Table 3. However, only 3 items, i.e. taking DM medications, regular reviews with their doctor and care of toes and feet, had 75% or more of diabetics answering correctly and adopting the practice.

Four items out of 16 had 25% or more of the diabetics knowing the right thing to do but not doing it: blood or urine glucose monitoring at home, exercising regularly and carrying sweets when they were out of the house. The common reasons cited for not performing home glucose monitoring were that of cost, difficulty in using the blood glucose monitor, e.g. poor eyesight, difficulty in loading or using the lancet, and the belief that glucose monitoring during consultation with their physician was sufficient. Lack of motivation and “no time” were the 2 common reasons given by those who were not exercising regularly. Age difference did not affect compliance. Three items had 25% or more of diabetics adopting the correct practice but not knowing the correct answer: wearing tight shoes, consuming alcohol and donating blood.

Six items had 25% or more of diabetics not knowing the right answer and not adopting the appropriate practice, including the need for regular ophthalmic review, not skipping meals and home monitoring of blood or urine glucose level. For these respondents who did not give the correct answers, 50% to 65.4% had reported that they had attended DM education or counselling programme. Again, age was not statistically different among this group of “incorrect answer–inappropriate practice” diabetics.

Respondents were asked to indicate their sources of information where diabetic knowledge was concerned as shown in Figure 2. Majority of diabetics (86.3%) identified healthcare professionals while non-diabetics (79.1%) identified friends and relatives as their main source of information. Information obtained from television and radio programmes were of almost equal significance for both groups. When compared to the older subjects, a significantly higher proportion of subjects younger than 55 years identified talks and seminars ($P = 0.02$), books and other printed medium ($P < 0.0001$) and the Internet ($P = 0.006$) as their sources of information.

Discussion

Much has been written internationally^{7,8} of the need to help diabetic persons maintain good control of DM in order to prevent and minimise complications. Locally, 2 reports

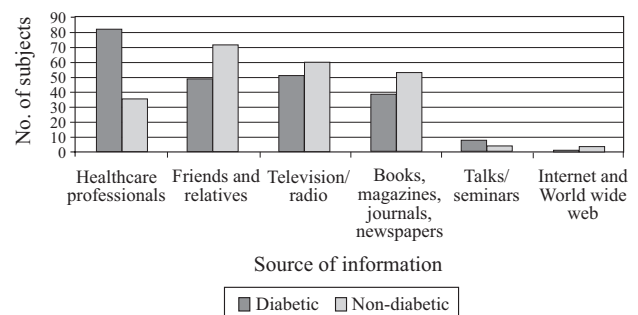


Fig. 2. Sources of information on diabetes mellitus. Note: Respondents may have more than one source of information.

by Lee et al,^{4,9} provided a “timely snapshot of the status of diabetes care in Singapore”¹⁰ in 1998. Compared to one of the studies by Lee et al⁴ in which 99% of a sample of 1697 diabetic subjects had received some DM education, only 64.2% of the 95 diabetics in this study reported that they had attended a DM education or counselling session. A difference in the definition and understanding of diabetic education and counselling may account for the above discrepancy between the 2 studies. For the present study, subjects were asked to recall whether they had attended a formal session conducted by a doctor or nurse during which the expressed purpose was to enhance their understanding of DM, its complications, self-care and the role of healthcare services. It was always possible that some subjects had forgotten or had not recognised that they had attended a formal DM education or counselling session. For the group of diabetics with regular physician consultations and yet not referred for DM education and counselling, it is important to remind these physicians that “all individuals with diabetes should have access to diabetes self-management education”² and that “diabetes education should ideally be given by a health professional with specific training in the field of diabetes education.”²

The scores obtained by the diabetic and non-diabetic subjects were similar and several explanations were possible. Firstly, diabetics who had not attended any DM educational programme scored lower than those who had attended DM education sessions, thus lowering the overall score for diabetics. Secondly, public education about DM has been so pervasive and comprehensive that most members of the public in Singapore had heard and understood much about DM. Thirdly, the content in education and counselling programmes for diabetics is very similar to health education on DM for the public, hence, the scores are very similar for the 2 groups of subjects. Finally, more than 30% of the non-diabetic respondents had positive family history for DM and most non-diabetics cited “Friends and Relatives” as their source of information on DM. It would be reasonable to assume that diabetic family members would share their knowledge with the non-diabetics, hence, the similar scores between diabetics and non-diabetics in this study. Though the mean score obtained by diabetics who had attended diabetic education sessions was higher than the score of those diabetics who had not attended any education sessions, the difference did not reach statistical difference. The numbers of diabetics who had attended diabetic education sessions versus those who had not were too small to permit further analysis.

The diabetics <55 years had the highest mean and median scores overall while the non-diabetics <55 years had the highest scores among the non-diabetics. One possible explanation was that these younger subjects were better

educated but this could not be ascertained, as educational level was not captured during the survey. However, the finding that a higher proportion of younger subjects reported attending talks, reading books and using the Internet as sources of information was a reflection of higher literacy rate and educational attainment. For the younger diabetics, the onset of their disease most likely coincided with the maturation of the comprehensive diabetic care and management program started in the early 1990s in Singapore. Hence, the younger diabetics might have benefited from the holistic and comprehensive management strategies, leading to their high scores.

This has major implications for public health education programmes and planning. While some members of the public in Singapore may still need DM prevention education programmes, others may need programmes and interventions that will encourage them to practice what they know and adopt a healthier lifestyle. In this aspect, the results from the knowledge versus practice section among diabetics deserve further discussion. It was encouraging that for most of the items assessed in “Treatment and Management” and “Monitoring” sections, half or more of the diabetics had the knowledge and reported that they adopted appropriate practices. For the respondents who answered incorrectly but were practicing the appropriate measures, 2 possible explanations could be postulated. Firstly, the practices in themselves were not popular, e.g. blood donation, wearing of tight shoes and consumption of alcohol. Thus, though the respondents had the appropriate practice, the reasons for doing so had nothing to do with their DM knowledge related to these practices. A second explanation, especially relevant to elderly or disabled subjects dependent on others in activities of daily living, would be that care-givers, e.g. family members and domestic helpers, possessed the knowledge and helped the respondents in their correct practice.

The first finding of concern was that among the diabetics who understood the need to monitor their glucose level, those not doing it far outnumbered those who were performing home glucose monitoring. Our finding of 21.1% diabetics practising home blood glucose monitoring showed very little improvement from the 19.7% reported by Lee et al⁴ in 1998. The second finding of concern was that one-quarter or more of the diabetics are ignorant of key information and practices like (1) the need for home monitoring of glucose, preferably blood glucose level, (2) the need for DM education and counselling and (3) the need for regular ophthalmic reviews. Perhaps even more disturbing was that 50% to 65.4% of the “incorrect answer–inappropriate practice” diabetics reported that they had attended DM education sessions, which meant that either these key aspects were not included in the DM education

session, or the diabetics did not remember or understand their importance.

Without doubt, diabetic education in Singapore has come a long way and has clearly helped half or more of the diabetics represented in this study. However, the findings from this study suggest that more work needs to be done. About a third of the diabetics reported that they had never attended a diabetic education session. Among those who had attended, some key aspects of DM and self-care were either missed out, or the subjects forgot or did not understand their importance, resulting in their ignorance and not adopting appropriate practices. For other diabetics, factors like cost, difficulty in using the blood glucose monitor and lack of motivation prevented them from adopting what they knew to be the appropriate practice. To achieve the aim that "all individuals with diabetes should receive effective, up-to-date and appropriate diabetes education",² physicians must make timely referral for their patients, DM education programme providers must ensure competent educators and quality programmes, and patient compliance issues must be addressed.

In the study by Wee et al,⁵ 1337 members of the Singapore public scored a mean of 66.1% in a questionnaire survey conducted at several busy Mass Rapid Transit stations in 1999. It was therefore interesting to note that using a questionnaire adapted from Wee et al, the mean scores of 68.1% by diabetics and 65.9% by non-diabetics in the present study were very similar to that from the study by Wee et al. Given the differences in the study populations of the 2 studies, it would be difficult to postulate the reasons for the similarities in overall scores. Where the sources of information was concerned, the finding by Wee et al⁵ and the non-diabetic subjects in our study was very similar, in that, "Friends and Relatives" play the most important role while the Internet proved to be the least important. In our diabetic subjects, however, healthcare professionals dominate as the main source of information. The implications for DM education planners are clear: investing in the training of DM healthcare professionals and designing quality programmes will reap returns in better-informed diabetics adopting appropriate self-care measures. These diabetics in turn will pass the knowledge on to their non-diabetic friends and relatives, as noted by Wee et al⁵ that "diabetic education therefore benefits not just the patients but also their friends and relatives."

The use of a convenient sample of patients and visitors to the ED of a single institution would limit the extent to which the study sample was representative of the general population at large. Secondly, a questionnaire survey of this nature did not allow verification with regards to whether diabetics were telling the truth when they reported that they practised the appropriate measures. Thirdly, to minimise

fatigue in the subjects in view of the acute care setting of a busy ED, information on educational level and income was not requested during the survey. It was conceivable that despite matching for age and gender, these 2 factors might still have influenced the scores. Finally, the relatively small sample size did not allow for subgroup analysis that might have yielded interesting information e.g. comparison of the diabetics who attended diabetic education sessions versus those who had not.

Conclusion

The level of DM knowledge among the sample of diabetics presenting acutely to an ED of a restructured hospital in this study did not differ greatly from that of non-diabetics, and from that of a general population sample in 1999.⁵ Diabetes education resulted in better-informed diabetics and changed practices among half of them but 25% were ignorant of some key information and practices. Among the informed diabetics, various issues e.g. cost and lack of motivation need to be addressed to close the gaps between knowledge and practice, especially with regards to home glucose monitoring and regular exercise. Investment in the training of healthcare professionals and quality DM education programmes should result in better-informed diabetics and changed practices, and by word of mouth, better-informed non-diabetics.

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