Original Article

Understanding of Diabetes Mellitus and Health-preventive Behaviour Among Singaporeans

Lai Yin Wong,[1] _BA (Economics and Statistics)_, Matthias PHS Toh,[1,2] _MBBS, MMed (Public Health), FAMS_

Abstract

   __Introduction__: To study the understanding and perceived vulnerability of diabetes mellitus among Singapore residents, and determine the predictors associated with screening for diabetes mellitus among the people without the condition. __Materials and Methods__: A population-based survey was conducted from December 2004 to October 2005 involving Singapore residents aged 15 to 69 years. Using a standard questionnaire, Health Survey Officers interviewed household members on their understanding and perceived vulnerability of diabetes mellitus and associated cardiovascular risk factors. Data were analysed using SPSS v13. __Results__: The response rate was 84.5%. Of 2,632 respondents, 291 (11.1%) have diabetes mellitus. Compared to respondents without diabetes, respondents with the disease had better understanding of diabetes and they had favourable health practice of screening for cardiovascular risk factors. Having diabetes mellitus was not associated with a healthier lifestyle. Among non-diabetics, those who had a family history of diabetes had better knowledge and health practices than those who had not. They were significantly more likely to recognise the symptoms and signs (61.5% vs 54.5%) and the causes of diabetes (70% vs 58.2%); and were more likely to have ever tested for diabetes (76.1% vs 60.4%), with _P_ <0.001. Socio-demographic characteristics, family history, understanding and perception on the vulnerability of diabetes were identified as predictors associated with health screening for the disease. __Conclusion__: Among all respondents, better understanding was found to be associated with favourable health-preventive behaviours. However, it did not translate into healthier lifestyle. Cultural and socio-demographic profiles must be factored in for any effort on lifestyle modifications.

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   Key words: Diabetes, Health Screening, Understanding, Vulnerability

Introduction

   The prevalence of diabetes mellitus is reaching epidemic levels worldwide.[1,2] The World Health Organization (WHO) estimated that the number of people with diabetes mellitus is expected to rise from 171 million in 2000 to 366 million in 2030, as a result of population ageing and urbanisation.[3] This will inevitably increase the proportions of death from cardiovascular diseases. In Singapore, diabetes mellitus is the 8th leading cause of death with 3% of all deaths being attributable to diabetes alone.[4]

   In the Singapore National Health Survey 2004,[4] it was found that about 50% of people with diabetes were undiagnosed. Many people were unaware of the subtle symptoms associated with diabetes such as excessive thirst and frequent urination. Early detection of this disease is possible with regular health screening. In 2003, the

Singapore Ministry of Health (MOH) Clinical Practice Guidelines (CPG) for health screening[5] recommended that screening for diabetes mellitus should begin at the age of 40 years old, and be considered at an earlier age if risk factors were present. Individuals found to have normal glucose tolerance on screening and who do not have risk factors for developing diabetes should repeat screening at 3-yearly intervals. For those with other diabetic risk factors, repeat screening may be performed more frequently at annual intervals.

   Individuals with family history of diabetes mellitus are at higher risk of developing the condition and lifestyle modification can help reduce this risk.[6-8] Multiple studies showed that lifestyle behaviours such as regular physical activities and healthy dietary choices were associated with lower risk of developing diabetes.[9-12] However, people

[1] Health Services and Outcomes Research, National Healthcare Group, Singapore

[2] Clinical Services, National Healthcare Group Polyclinics, Singapore

Address for Correspondence: Ms Wong Lai Yin, Health Services and Outcomes Research, National Healthcare Group, 6 Commonwealth Lane, #04-01/02 GMTI Building, Singapore 149547.

Email: lai_yin_wong@nhg.com.sg

with family history of the disease do not necessarily consider themselves to have an increased personal risk.[13] Unless people deem a condition as serious, feel vulnerable to it,[14] and feel that they can do something to avoid it,[15] they are unlikely to take preventive measures. Risk- and health-seeking behaviours are largely determined by an individual's knowledge, attitude, beliefs and health practice. Individuals often adjust their lifestyle within the framework of his cultural influences, economic status, knowledge and resources, regardless of clinical recommendations.[16]

This study aims to examine the general understanding and perceived vulnerability of diabetes mellitus and the differences in lifestyle and health-preventive behaviour of Singaporeans with and without diabetes mellitus and determine the predictors associated with screening for diabetes mellitus among the people without the condition.

Materials and Methods

This study was part of a nation-wide population-based survey to assess knowledge, attitude, beliefs, health practices and lifestyle behaviour relating to diabetes, cardiovascular diseases, asthma and mental health. The paper reports the findings on diabetes. The survey questionnaire was developed with inputs from the endocrinologists, refined after face validity test and cognitive testing and pilot tested before its official launch.

The survey was conducted from December 2004 to October 2005 in Singapore. A randomised database with 11,200 household addresses was obtained from the Department of Statistics in Singapore. A sample size of 3000 respondents aged 15 to 69 years was calculated based on the random selection of 1 eligible member per household for the survey.

A total of 15 Health Survey Officers (HSO) were recruited. They were trained to administer the survey using the same methodology to ensure standardisation. Prior to data collection, the National Healthcare Group (NHG) issued a press release informing the public about the aim of the survey and the forthcoming visits. Households were randomly selected by a central coordinator and information letters were mailed to these households two weeks before the interview.

The HSOs made home visits to conduct direct face-to-face interviews. If the household member refused to participate or remained uncontactable after 3 visits, the household on the right or the left of the original address would be selected. Should there be another refusal or 3 futile visits, the household would be considered as a non-respondent. If the selected household was vacant, non-existent or if the household members were out of the country throughout the duration of survey, a replacement address would not be obtained.

The questionnaire consists of a "household" section and an "individual" questionnaire. The head or representative of each household was first approached to complete the "household" section which enumerated all members living in the same household who were Singapore residents aged 15 to 69 years. For each household member, the presence of diabetes mellitus, hypertension, and asthma as diagnosed by a western-trained doctor was recorded.

For each chronic disease, one household member would be selected for the "individual" questionnaire. When 2 or more eligible household members had the same chronic disease, only 1 person would be randomly selected, using a random number table for varying household sizes. If all the members of a household did not have any chronic diseases of interest, one member would be randomly chosen using the random number table. If the selected participant(s) refused to participate in the interview, he would be considered a non-respondent.

Information on the demographic characteristics, socio-economic status, health screening experience and lifestyle relating to cardiovascular diseases and diabetes mellitus were collected from the individual questionnaire. The level of understanding of diabetes mellitus was obtained from respondent's 3 responses to each open-ended question on the causes and the symptoms and signs of diabetes mellitus.

An additional 200 patients from the NHG Polyclinics with known chronic diseases or vascular risk factors were included in the sampling frame. The purpose was to check the degree of accuracy and ensure proper recording by the interviewers. These responses were not included in the final analysis. All questionnaires were centrally collected and audited for completeness and consistency. Data anomalies were clarified with respondents whenever necessary.

We studied the characteristics of individuals with and without diabetes. For the latter group, we compared the difference in understanding and perceived vulnerability of those with and without family history of diabetes mellitus and factors associated with screening for diabetes mellitus. The family history includes the medical history of spouse, parent, child, siblings, grandparent, first-degree cousin, first-degree aunt/uncle, first-degree niece/ nephew.

The Statistical Packages for Social Sciences (SPSS) v13 was used for data analysis. Univariate analysis was first performed to identify differences between categorical groups, where probability $P < 0.05$ was considered statistically significant. Stepwise logistic regression, where appropriate, was used to predict independent variables associated with health screening. Approval from the National Healthcare Group Domain-Specific Review Board (NHG DSRB) was obtained before the start of this survey.

Results

A total of 3556 randomised addresses were distributed to HSOs to make household visits. There were 336 households that were non-contactable after 3 visits, 157 after replacement with the neighbour, and 179 houses which were vacant, non-existent, not found or occupants out of country during the survey. Of the 3220 households contacted, 425 refused to participate (after replacement with the neighbour), giving a household response rate of 86.8%.

Of the 7388 eligible individuals identified, 2852 were selected for the "individual" questionnaire. Only 2779 individuals were surveyed, as 73 refused to participate, yielding an individual response rate of 97.4%. The overall response rate for the survey was 84.5% [household response rate (86.8%) x individual response rate (97.4%) x 100%].

After removing 130 responses from common households and 17 responses for validation, 2632 responses were analysed.

Table 1 shows the socio-demographic profile of the study respondents and the Singapore population in 2000.[17-20] There were more female (55%) than males (45%), 2 in 3 were aged 40 years and above and the Chinese made up 70.9%, Malays 17.3% and Indians 9.5%. About 23.1% of them had tertiary education and 5.5% had no formal education. The majority stayed in HDB 4- and 5-room apartments (38.6% and 30.3% respectively). Study respondents were older than the general population. This was expected because the prevalence of chronic conditions increased with age and people in the study had one or more chronic conditions.

Table 1. Socio-demographic Characteristics of Respondents

Socio-demographic characteristic		All survey respondents (n = 2632)		Singapore Census 2000 (15-69 y)*
		No.	%	%
Gender	Male	1184	45.0	49.9
	Female	1448	55.0	50.1
Age group (y)	15-39	901	34.2	54.1
	40-69	1731	65.8	45.9
Ethnic group	Chinese	1866	70.9	76.8
	Malay	456	17.3	13.9
	Indian	250	9.5	7.9
	Others	60	2.3	1.4
Highest educational level	No formal qualification	146	5.5	14.5
	Primary	502	19.1	11.1
	Secondary	1134	43.1	37.5
	ITE / Pre-U / JC†	242	9.2	11.4
	Tertiary	608	23.1	25.5
House type	HDB† 1-2 rooms	125	4.7	-
	HDB† 3 rooms	562	21.4	-
	HDB† 4 rooms	1016	38.6	-
	HDB† 5 rooms / Executive flats	798	30.3	-
	Condominium	29	1.1	-
	Landed properties	102	3.9	-
Occupation‡	Professional, Technical & Managerial	818	53.7	43.5
	Clerical, Sales & Services	414	27.2	26.7
	Production & Related	211	13.8	19.3
	Cleaners & Labourers	76	5.0	6.8
	Others	5	0.3	3.6

*   Source : Singapore Department of Statistics, Census of Population 2000
†   ITE: Institute of Technical Education; Pre-U: Pre-University; JC: Junior College; HDB: Housing Development Board
‡   Excluded students, housewives, and part-timers
Note : Occupation of respondents was coded according to the Singapore Standard Occupational Classification 2000, Singapore Department of Statistics

Prevalence of Diabetes Mellitus

A total of 291 (11.1%) respondents reported to have diabetes mellitus, higher than the prevalence of 8.2% reported by the Singapore National Health Survey 2004. The prevalence was significantly higher among the Malays and Indians compared to Chinese, individuals aged 40 to 69 years compared to those aged 15 to 39 years; individuals with pre-university and below compared to those with tertiary education; those who live in public Housing Development Board (HDB) or Executive flats compared to those staying in private homes; those who worked in Clerical, Sales & Services, and Production & Related industries compared to Professional, Technical and Managerial jobs; as well as those with family history of diabetes mellitus (Table 2). Prevalence of diabetes mellitus increased with age and was higher among men than women for all age groups except the male in the age group of 65 to 69. This may be attributed to small sample size for this group.

The Understanding of Diabetes Mellitus, Health Screening Experience and Lifestyle

More respondents with diabetes than non-diabetics knew the symptoms and signs of diabetes (68.0% vs 56.2%, P >0.001). Correct answers included unquenchable thirst, excessive appetite, frequent urination, unexplained weight loss and overall fatigue (Table 3). Nonetheless, knowledge on causes of diabetes shown in Table 3 did not differ between the 2 groups (61.4% vs 61.0%).

A significantly higher proportion of individuals with diabetes mellitus compared to those without were aware that "diabetes cannot be cured" (75.3% vs 62.2%, P <0.001) and "if a person is totally well, he can be suffering from diabetes" (76.6% vs 72.7%, P <0.001) (Table 4).

Apart from being more knowledgeable in diabetes, individuals with diabetes mellitus were more likely to have checked their cardiovascular risk factors such as blood

Table 2. Socio-demographic Characteristics of Respondents With and Without Diabetes Mellitus

Socio-demographic characteristic		No. of respondents	Respondents reported to have diabetes mellitus n = 291		*P* value*
		n = 2632	No.	%	
Gender	Male	1184	136	11.5	ns
	Female	1448	155	10.7	
Age group (y)	15-39	901	11	1.2	<0.001
	40-69	1731	280	16.2	
Ethnic group	Chinese	1866	153	8.2	<0.001
	Malay	456	78	17.1	
	Indian	250	51	20.4	
	Others	60	9	15.0	
Education	Pre-U† and below	2024	270	13.3	<0.001
	Tertiary	608	21	3.5	
House type	HDB† 1-2 room flats	125	17	13.6	0.038
	HDB† 3-5 room / Executive flats	2376	268	11.3	
	Condominium / Landed properties	131	6	4.6	
Occupation‡	Professional, Technical & Managerial	818	41	5.0	<0.001
	Clerical, Sales & Services	414	42	10.1	
	Production & Related	211	40	19.0	
	Cleaners & Labourers	76	5	6.6	
	Others	5	0	0	
Family history of diabetes	Yes	726	170	23.4	<0.001
	No	1906	121	6.3	

*   Using chi-square test where *P* <0.05 was considered significant

†   Pre-U: Pre-University; HDB: Housing Development Board

‡   Excluded students, housewives, and part-timers

Note : Occupation of respondents was coded according to the Singapore Standard Occupational Classification 2000, Singapore Department of Statistics

Table 3. Knowledge on Signs and Symptoms, and Causes of Diabetes Mellitus

Description	With diabetes		Without diabetes		Total	
	No.	%	No.	%	No.	%
Total	873	100	7023	100	7896	100
Signs and symptoms of diabetes						
Correct answers	**594**	**68.0**	**3949**	**56.2**	**4543**	**57.5**
Weakness and fatigue	152	17.4	987	14.1	1139	14.4
Thirsty	182	20.8	891	12.7	1073	13.6
Frequent urination	100	11.5	426	6.1	526	6.7
Poor healing of wounds	22	2.5	503	7.2	525	6.6
Ants around urine	22	2.5	496	7.1	518	6.6
Weight loss	40	4.6	346	4.9	386	4.9
Hungry	29	3.3	149	2.1	178	2.3
High sugar level in urine	4	0.5	93	1.3	97	1.2
Itchiness	36	4.1	30	0.4	66	0.8
Numbness	6	0.7	15	0.2	21	0.3
High blood sugar level	1	0.1	13	0.2	14	0.2
Incorrect answers	**118**	**13.5**	**883**	**12.6**	**1001**	**12.7**
Dizzy	21	2.4	183	2.6	204	2.6
Eyesight problem	30	3.4	161	2.3	191	2.4
Obesity	17	1.9	98	1.4	115	1.5
Swelling	3	0.3	111	1.6	114	1.4
Poor appetite	3	0.3	38	0.5	41	0.5
Concentrated urine	1	0.1	38	0.5	39	0.5
Others	43	4.9	254	3.6	297	3.8
Don't know	**161**	**18.4**	**2191**	**31.2**	**2352**	**29.8**
Causes of diabetes						
Correct answers	**536**	**61.4**	**4286**	**61.0**	**4822**	**61.1**
Unhealthy diet	269	30.8	2224	31.7	2493	31.6
Hereditary	118	13.5	985	14.0	1103	14.0
Physical inactivity	65	7.4	641	9.1	706	8.9
Obesity	55	6.3	268	3.8	323	4.1
Pancreas/insulin problem	19	2.2	94	1.3	113	1.4
Unhealthy lifestyle	7	0.8	48	0.7	55	0.7
Old age	3	0.3	26	0.4	29	0.4
Incorrect answers	**73**	**8.4**	**458**	**6.5**	**531**	**6.7**
High blood sugar level	22	2.5	138	2.0	160	2.0
Pressure and stress	20	2.3	99	1.4	119	1.5
High blood pressure	16	1.8	87	1.2	103	1.3
Alcoholic drinks	2	0.2	26	0.4	28	0.4
Others	13	1.5	108	1.5	121	1.5
Don't know	**264**	**30.2**	**2279**	**32.5**	**2543**	**32.2**

pressure (98.3% vs 82.5%, *P* <0.001) and blood cholesterol (82.8% vs 52.5%, *P* <0.001) in the preceding year compared to individuals without diabetes mellitus. However, this did not translate into adoption of a healthier lifestyle. There was no significant difference in the prevalence of smoking, regular alcohol consumption and regular exercise between both groups, with overall prevalence rates of 14.1%, 2.7% and 28.4% respectively.

Relationship Between Family History and the Understanding and Perceived Vulnerability of Diabetes Mellitus Among People Without Diabetes Mellitus

Among individuals without diabetes mellitus, those with family history of diabetes mellitus had a better understanding on the disease. They were also more likely to recognise the symptoms and signs (61.5% vs 54.5%, *P* <0.001), as well as the causes of diabetes (70% vs 58.2%, *P* <0.001); and be aware that "if a person is totally well, he can be suffering from diabetes" (80.9% vs 70.1%, *P* <0.001).

Having family history of diabetes was also found to be associated with greater risk perceptions and adoption of healthier practices (Table 4). Compared to individuals without family history of diabetes, a higher proportion of individuals with family history thought that they could develop diabetes later in life (79.7% vs 71.0%, *P* <0.001). They were more likely to have ever tested for diabetes (76.1% vs 60.4%, *P* <0.001), checked blood pressure (84.7% vs 81.8%) and blood cholesterol (58.1% vs 50.7%, *P* <0.01) in the preceding year. There was no significant difference in the rates of regular physical activities and alcohol consumption between both groups (Table 4) for primary prevention of diabetes mellitus, despite having significantly lower smoking prevalence among the people with family history (11.0% vs 14.8%, *P* <0.05).

Relationship Between Health Practice and the Socio-Demographic Profiles, Understanding, Perceived Vulnerability of Diabetes Mellitus Among People Without Diabetes Mellitus

Univariate analysis was performed on the individuals without diabetes mellitus to examine the association of screening for diabetes mellitus with a person's understanding and perceived vulnerability of the disease, socio-demographic characteristics and lifestyle. More people aged between 40 and 69 years (71.8% vs 51.6%, *P* <0.001), and significantly more Indians and those with tertiary education and family history had been screened for diabetes (Table 5). More individuals who had screened for diabetes were aware that "diabetes cannot be cured" (65.4% vs 57.7%, *P* <0.001) and "if a person is totally well, he can be suffering from diabetes" (77.1% vs 64.6%, *P* <0.001); think that they could develop diabetes later in life (75.9% vs 68.0%, *P* <0.001). However, there were no significant statistical differences in terms of house type, occupation

and lifestyle behaviours such as alcohol consumption, exercise and smoking between those who had and had not screened for diabetes.

A stepwise logistic regression was used to predict the factors associated with screening for diabetes mellitus among people without the condition. The factors used in the model included (i) socio-demographic characteristics, (ii) family history of diabetes mellitus, (iii) understanding of diabetes mellitus and (iv) perceived vulnerability of diabetes mellitus (Table 6).

Among individuals without diabetes mellitus, those aged 40 to 69 years (adjusted OR, 2.9; 95% CI, 2.4-3.5) were more likely to have undergone screening for the disease than people aged 15 to 39 years. Indians were more likely than Chinese (adjusted OR, 1.8; 95% CI, 1.3-2.5) and those with tertiary education more likely than those with Pre-U or below (adjusted OR, 1.7; 95% CI, 1.3-2.1) to have undergone screening. Respondents were also more likely to undergo screening if someone in the family had the same disease condition (adjusted OR, 1.8; 95% CI, 1.4-2.2) or if they knew that a person could be suffering from diabetes even if he was well (adjusted OR, 1.7; 95% CI, 1.4-2.1). Those who were aware that "diabetes cannot be cured" and thought that they "can develop diabetes later in life" were 1.2 (95% CI, 1.0-1.5) and 1.3 (95% CI, 1.0-1.5) times more likely to have undergone screening for diabetes mellitus respectively.

Discussion

This study found that the respondents with better understanding of diabetes mellitus were more likely to have favourable health practices. Among individuals without diabetes, those with family history of diabetes had better knowledge and more favourable attitude than those without, as they believed they were vulnerable to the disease. This was associated with higher rates of screening for diabetes and other cardiovascular risk factors such as high blood pressure and high blood cholesterol according to MOH's CPGs.[5] However, in terms of lifestyle behaviours, apart from having fewer current smokers among those with family history, there was no significant difference in physical activities and alcohol consumption between the 2 groups.

There are several limitations in this cross-sectional study. The study is unable to show the temporal relationship between developing diabetes and having better knowledge of the condition and favourable health practice of screening for cardiovascular risk factors. This study did not examine the individual's perception of the possibility of primary prevention of diabetes and their level of vulnerability of developing diabetes. Different beliefs of their risk of developing the disease are likely to initiate different lifestyle behaviour modifications. This study questionnaire did not include the barriers associated with health screening such

Table 4. Understanding of Diabetes Mellitus, Health Screening and Lifestyle of Respondents

All respondents					
Factor	**With diabetes mellitus [a]** **n = 291**		**Without diabetes mellitus[b]** **n = 2341**		**P value*** **[b] vs [a]**
	No.	**%**	**No.**	**%**	
Understanding of diabetes mellitus					
If a person is totally well, can he/she be suffering from diabetes? (Yes)	223	76.6	1701	72.7	<0.001
Can diabetes be cured? (No)	219	75.3	1456	62.2	<0.001
Health screening					
Have you had your blood pressure checked in the preceding year? (Yes)	286	98.3	1931	82.5	<0.001
Have you had your blood cholesterol checked in the preceding year? (Yes)	241	82.8	1228	52.5	<0.001
Lifestyle					
Current smoker[1] (No)	244	83.8	2016	86.1	ns
Regular exercise[2] (Yes)	71	24.4	676	28.9	ns
Regular / frequent drinking[3] (No)	279	95.9	2283	97.5	ns
Respondents without diabetes mellitus					
Factor	**Family history [c]** **of diabetes mellitus** **n = 556**		**No family history [d]** **of diabetes mellitus** **n = 1785**		**P value*** **[d] vs [c]**
	No.	**%**	**No.**	**%**	
Understanding of diabetes mellitus					
If a person is totally well, can he/she be suffering from diabetes? (Yes)	450	80.9	1251	70.1	<0.001
Can diabetes be cured? (No)	356	64.0	1110	62.2	ns
Perceived vulnerability of diabetes mellitus					
Do you think you can develop diabetes later in life? (Yes / maybe)	443	79.7	1267	71.0	<0.001
Health screening					
Have you ever been tested for diabetes? (Yes)	423	76.1	1078	60.4	<0.001
Have you had your blood pressure checked in the preceding year? (Yes)	471	84.7	1460	81.8	ns
Have you had your blood cholesterol checked in the preceding year? (Yes)	323	58.1	905	50.7	0.003
Lifestyle					
Current smoker[1] (No)	495	89.0	1521	85.2	0.023
Regular exercise[2] (Yes)	165	29.7	511	28.6	ns
Regular / frequent drinking[3] (No)	544	97.8	1739	97.4	ns

* Using chi-square test where P <0.05 was considered significant
[1] Excluded ex-smokers who stopped smoking for ≥12 months.
[2] Participate in any form of sports for at least 20 min per occasion, for 3 days or more per week.
[3] At least 1 day a week.

as cost, inconvenience and lack of time. Despite training of the HSOs, there may have been translation bias for interviews of non-English speaking respondents.

Despite the limitations, this study has identified the target groups with high risk of developing diabetes mellitus, as well as the predictors associated with screening for diabetes mellitus. Our findings were also consistent with numerous other studies which concluded that people with family history of diabetes were more likely to engage in diabetes screening;[21,22] and knowledge did not necessarily alter behaviour or predict outcomes.[23-26]

Consistent with other studies[21] was the positive association between family history and perception on their vulnerability to the disease among those without diabetes mellitus. These results demonstrated the importance of family background and social factors on the perception of diseases and health-preventive behaviours.

As concerns of patients and health practitioners often differ, the disparity between clinical and lay models is often medically labelled as non-adherence.[27,28] A prospective

Table 5. Socio-demographic Factors Associated with Screening for Diabetes Mellitus among the Respondents without Diabetes Mellitus

Socio-demographic characteristic		No. of respondents without diabetes mellitus	Screened for diabetes mellitus n = 1501		P value*
		n = 2341	No.	%	
Gender	Male	1048	686	65.5	ns
	Female	1293	815	63.0	
Age group (y)	15-39	890	459	51.6	<0.001
	40-69	1451	1042	71.8	
Ethnic group	Chinese	1713	1088	63.5	0.002
	Malay	378	238	63.0	
	Indian	199	149	74.9	
	Others	51	26	51.0	
Education	Pre-U† and below	1754	1103	62.9	0.032
	Tertiary	587	398	67.8	
House type	HDB† 1-2 room flats	108	69	63.9	ns
	HDB† 3-5 room / Executive flats	2108	1348	63.9	
	Condominium / Landed properties	125	84	67.2	
Occupation‡	Professional, Technical & Managerial	777	539	69.4	ns
	Clerical, Sales & Services	372	229	61.6	
	Production & Related	171	114	66.7	
	Cleaners & Labourers	71	44	62.0	
	Others	5	4	80.0	
Family history of diabetes	Yes	556	423	76.1	<0.001
	No	1785	1078	60.4	

*   Using chi-square test where $P <0.05$ was considered significant
†   Pre-U: Pre-University; HDB: Housing Development Board
‡   Excluded students, housewives, and part-timers.
Note : Occupation of respondents was coded according to Singapore Standard Occupational Classification, 2000, Singapore Department of Statistics

study conducted in Kuwait found that barriers to regular exercises included extensive hot summers, the lack of time, and presence of chronic conditions such as osteoarthritis, musculoskeletal problems and bronchial asthma, as well as the employment of domestic helpers.[29-31] These barriers are similar to those in Singapore with persistent hot summer weather; a fast pace of life and common engagement of domestic helpers. Addressing patients' own perceptions of barriers, values, motivations and goals are more effective in initiating behaviour change than having adequate knowledge level alone.[25] Cultural and socio-demographic characteristics need to be considered before clinical recommendations are made. Hence, the challenge now is to develop ways to assist and motivate patients to initiate their lifestyle modifications within the framework of their own background and social circumstances.

The Singapore National Health Survey 2004 found that half (49.0%) of the people with diabetes was undiagnosed prior to the survey, with more Malays (55.6%) and Chinese (50.4%) compared to Indians (38.0%).[4] Our findings also showed that Indians were more likely to engage in diabetes screening. Therefore, the public education on diabetes must reach out to the asymptomatic people, particularly targeting those at risk of the disease. Screening for diabetes even when one has no symptom and sign of diabetes needs to be strongly encouraged, especially among all persons aged 40 and above, those belonging to lower educational levels and persons with a family history of diabetes. This study also found that respondents with diabetes had less favourable lifestyle behaviours compared with those without diabetes. The public must be encouraged to adopt healthy lifestyle, stop smoking, increase physical activity and reduce alcohol consumption. This is especially pertinent for people with diabetes.

Table 6. Independent Factors Significantly* Associated with Screening for Diabetes Mellitus among Respondents without the Condition

Factor		Screened for diabetes	
		Adj OR	95% CI
Socio-demographic characteristics			
Age group (y)	40-69	2.9	2.4-3.5
	[15-39]		
Ethnic group	Indian	1.8	1.3-2.5
	[Chinese]		
Education	Tertiary	1.7	1.3-2.1
	[Pre-U† and below]		
Family history of diabetes	Yes	1.8	1.4-2.2
	[No]		
Understanding of diabetes mellitus			
If a person is totally well, can he/she be suffering from diabetes?	Yes	1.7	1.4-2.1
	[No]		
Can diabetes be cured?	No	1.2	1.0-1.5
	[Yes]		
Perceived vulnerability of diabetes mellitus			
Do you think you can develop diabetes later in life?	Yes / maybe	1.3	1.0-1.5
	[No, Don't know]		

* P <0.05 by stepwise logistic regression analysis
† Pre-U = Pre-University
[ ] depicts reference group; Adj OR: adjusted odds ratio;
CI: confidence interval
Odds ratio adjusted for house type, occupation and lifestyle

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