ORIGINAL ARTICLE

Prevalence, awareness, treatment and control of diabetes mellitus among the elderly: The 2011 National Health and Morbidity Survey, Malaysia

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Abstract

Diabetes mellitus is an important cardiovascular risk factor. The objective of this study was to provide population-based estimates on the prevalence, awareness, treatment and control rate of diabetes among the older persons in Malaysia. Analysis of secondary data from a cross-sectional national population-based survey was done, which was conducted in 2011 throughout Malaysia. A total of 2764 respondents (15.5%) were older persons. The overall prevalence of diabetes among older persons was 34.4% in which 65.2% were aware of their diabetes status. Out of those who were aware, 87.5% had been treated. Only 21.8% of those treated had their diabetes controlled. The results of multiple logistic regression showed that the factors associated with higher awareness rates were women, Indians and higher income groups; factors associated with higher treatment rates were urban residents and those who were married and widow/widower/divorcee. There was a high overall prevalence, awareness and treatment rate of diabetes among older persons in Malaysia but with suboptimal control rate.

Introduction

Diabetes mellitus (DM) is a metabolic disorder characterised by chronic high blood glucose levels with disturbance of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin resistance or both. Diabetes is a chronic disease associated with significant morbidity and mortality due to specific diabetes-related complications, for examples, microvascular complications (such as retinopathy, nephropathy and neuropathy), macrovascular complications (such as ischemic heart disease, stroke and peripheral vascular disease) and impaired quality of life.[1]

Diabetes is a major public health problem worldwide. According to World Health Organization, DM is one of the main risk factors for cardiovascular disease worldwide.[2] The number of people with diabetes is increasing as evident from the findings of a series of global estimates of current and predicted future prevalence of diabetes.[2–4] International Diabetes Federation (IDF) Diabetes Atlas showed that in 2011, there were 366 million people with diabetes; this was expected to rise to 552 million by 2030. Most people with diabetes live in low and middle-income countries.[4]

Shaw et al.[3] also estimated that the global prevalence of DM among adults aged 20–79 years would increase from 6.4% (affecting 285 million adults) in 2010 to 7.7% (439 million adults) by 2030. From year 2010 to 2030, there would be a 69% increase in numbers of adults with DM in developing countries and a 20% increase in developed countries. Recent epidemiologic study from South East Asia by Gupta et al.[5] also suggested that the prevalence of DM has increased exponentially in these areas. Similarly, in Malaysia, there is a clear trend of increasing prevalence of DM among the adult aged 30 years and older, from 8.3% in 1996 to 14.9% in 2006 and 20.8% in 2011.[6–8]

This rising trend is due to many factors such as population growth, population aging, urbanisation and increasing prevalence of obesity and physical inactivity.[2] In fact, diabetes is a common illness in the older persons as the prevalence increases with age. Studies by Porapakkham et al.[9] and Margaret et al.[10] revealed that the proportions of population affected by DM were increasing in the countries, which have higher proportion of ageing societies. In Malaysia, the older population aged ≥60 years has also been rapidly increasing from a total of 1.40 million (6.3% of total population) in 2000 to an estimation of 2.13 million (7.4%) in 2010. This is expected to increase to 3.44 million

(9.9%) in 2020.[11] Recent study in Malaysia by Rampal et al.[12] also showed that the prevalence of diabetes was lowest (8.5%) in the 30–39 age group and increased steadily with age to 22.7% for those who were more than 60 years old. Therefore, the burden due to DM is likely to rise steadily in Malaysia because of population ageing.[9,13]

Diabetes is amongst the leading causes of death worldwide. Roglic et al.[14] estimated that in the year 2010, the total number of excess deaths attributable to diabetes worldwide was 3.96 million in the age group 20–79 years or 6.8% of global (all ages) mortality. Diabetes accounted for 6% of deaths in adults in the African region and 15.7% in the North American region. Therefore, diabetes is a considerable cause of premature mortality, a situation that is likely to worsen especially in low and middle income countries as the diabetes prevalence increases. As diabetes is an important risk factor for cardiovascular diseases (CVD),[2,15–17] therefore, awareness, treatment and effective control of DM are essential for the overall reduction of diabetic complications and to prevent premature CVD morbidity and mortality.[18–22]

Despite the importance and benefits of diabetic control, the control rates of the diabetes patients is still suboptimal.[7,9,23] In Malaysia, there are few population based studies, which have been conducted to assess the prevalence, level of awareness, treatment and control of DM among the general adult population.[6–8,12] However, these studies have not focused on the older persons aged 60 years and older in Malaysia. This information is important for public education, disease management, rational planning and overall health care resource allocation especially among older diabetic population.[2,18]

Purpose of this study

The objective of this study was to provide population based estimates on the prevalence, awareness, treatment and control of DM among the older persons aged 60 years and older in Malaysia and also to determine the socio-demographic factors associated with rates of awareness, treatment and control of DM among the older persons.

Methods

Selection of study participants

National Health and Morbidity Survey (NHMS) 2011 was conducted by the Institute for Public Health, National Institutes of Health and sponsored by Ministry of Health,

Malaysia. The study was approved by the Ministry of Health ethical committee and the detail description of the sampling methods was described in NHMS 2011 protocol.[8] Briefly, the study design was a cross-sectional national population-based survey, using two-stage stratified random sampling conducted from April to July 2011 throughout Malaysia. The estimated sample size at the national level was based on the respondents stratified by urban/rural and states. To ensure national representativeness, two-stage stratified random sampling was used. The two strata were primary stratum, which were made up of the states of Malaysia, including federal territories; and secondary stratum, which were made up of urban and rural stratum formed within the primary stratum. The allocation of sample to the state, urban and rural was done proportionally to the population size. A bigger number of samples were allocated to the states with a bigger population size such as Selangor, Johor and Sabah, and fewer number of samples were allocated to the states with a smaller population size such as Perlis, Melaka and Putrajaya.

We managed to analyse the sample of older persons (60 years of age or older) participating in NHMS 2011 survey and a total of 2764 older persons were included. Out of this, a total of 2708 respondents agreed to participate in the DM module and had their blood glucose level tested, giving a response rate of 98.0%.

Questionnaire and biochemical measurements

Socio-demographic characteristics were obtained via face-to-face interview using a structured questionnaire (DM Module). DM Module consisted of four main questions: "Have you ever done any blood glucose level testing in past 12 months?", "Have you been told by any doctor or medical assistant that you have diabetes?", "What type of treatment or advice is given to control your diabetes?" and "Where did you usually get as your treatment for diabetes?". This pre-tested questionnaire was bilingual (Malay and English) with a questionnaire manual prepared as a guide to the data collectors, which consisted of different races to avoid language barrier.

Respondents were asked to fast overnight. Capillary blood glucose test was performed at respondent's house on a pre-arranged date based on the convenience of the household.

Finger-prick fasting capillary blood glucose test was performed by using CardioCheck meter, which had been validated and calibrated

by the supplier before the study. The test was performed by the nurses who had been trained on the techniques of using the meter and they were also briefed on the criteria for referral of respondents with health problems. Respondents with high fasting blood glucose level were referred to the nearest health facility using a structured referral letter for further evaluation and management.

Definitions and diagnostic criteria

The definition of "known diabetes" was defined as a self-report by a respondent who had been told by a doctor or medical assistant that they have diabetes. The diagnosis was further verified by asking them if they were on any kind of treatments or advice for their diabetes and where did they usually seek treatment for diabetes. A respondent was classified as having "undiagnosed diabetes" when the respondent was not known to have diabetes and had a fasting capillary blood glucose (FBG) level of 6.1 mmol/L or more.[24] Overall DM included known and undiagnosed diabetes patients. Awareness of diabetes was defined as having been told to have diabetes by medical personnel (known diabetes). Known diabetes was further inquired about their treatment status. Currently on drug treatment for diabetes was defined as a self-report of respondents currently taking any form of treatment (not including traditional medicine) for the condition. Controlled diabetes was defined as having a desirable blood glucose level (with FBG of lower than 6.1 mmol/L) among respondents who had known diabetes and being treated.

Statistical analysis

Statistical analysis was performed using SPSS for windows version 16.0 (SPSS Inc. Chicago, USA). Data were weighted on the basis of complex sample design. The baseline demographic characteristics of the respondents, prevalence, awareness, treatment and control rates of diabetes mellitus were analysed using descriptive statistics. To estimate independent association factors, binary logistic regression analyses were used to determine the association between socio-demographic characteristics and the awareness, treatment and control of diabetes mellitus among the older persons. Adjusted odds ratios were calculated with adjustment of various covariates, including sex, age, ethnicity, education level, strata, marital status, occupation and household income. The odd-ratios (ORs) and 95% confidence intervals

(CIs) were calculated. A value of $p < 0.05$ on the two-tailed test was considered statistically significant.

Results

Characteristics of the participants

A total of 2764 respondents (15.5%) were older persons aged 60 years or more out of the 17,783 respondents aged 18 years or older for the DM module in NHMS 2011. Table 1 shows the baseline socio-demographic characteristics of the study population. The mean age of the study respondents was 68.7 ± 7.2 years. The majority of the older persons (79.9%) was in the 60–74 years age group, 79.0% had primary education or less and more than half (66.1%) of all older persons were married. The majority of the study respondents (72.4%) was unemployed or retired. The total household income per month of the majority of respondents (61.6%) was below RM 2000.

Table 2 shows the overall prevalence, awareness, treatment and control of diabetes among older persons aged 60 years and more in NHMS 2011. The overall prevalence of diabetes (known and undiagnosed) among older persons was 34.4% (95% CI: 31.9–36.9). More than half of them [65.2% (95% CI: 60.3–69.9)] were aware of their diabetes status. Out of those who were aware, 87.5% (95% CI: 83.8–90.5) were currently treated. However, only 21.8% (95% CI: 17.8–26.5) have their diabetes controlled on treatment. There was no difference in terms of prevalence, awareness, treatment and control rate by gender.

Factors associated with diabetic awareness, treatment and control

For older person with diabetes, the results of multiple logistic regression (Table 3) showed that factors associated with higher awareness rates were women (aOR = 1.63; 95% CI: 1.21–2.19), Indians ethnic group (aOR = 2.67; 95% CI: 1.50–4.76) and those from higher income groups (aOR = 1.79; 95% CI: 1.20–2.67) as compared to their counterparts. Factors associated with higher treatment rates were urban residents (aOR = 1.63; 95% CI: 1.02–2.62), those who were married (aOR = 7.58; 95% CI: 1.82–31.6) and widow/widower/divorcee (aOR = 6.63; 95% CI: 1.54–28.54). For those who were on diabetic treatment, there was no determinant significantly associated with controlled of fasting blood glucose level.

Table 1. Socio-demographic characteristics of respondents for diabetes module among older persons aged 60 years and more in NHMS 2011 (N = 2764)

Variables	N	%
Sex		
Men	1286	46.5
Women	1478	53.3
Age groups (years)		
60–74	2208	79.9
> 75	556	20.1
Ethnicity		
Malays	1516	54.8
Chinese	796	28.8
Indians	203	7.3
Other Bumiputras	205	7.4
Others	44	1.6
Education		
Primary or less	2183	79
Secondary or more	581	21
Strata		
Urban	1386	50.1
Rural	1378	49.9
Marital status		
Single	51	1.8
Married	1825	66.1
Widow/ Widower /divorcee	887	32.1
Occupation		
Employed	686	27.6
Unemployed/ retiree	1800	72.4
Household income (RM)		
< 1,000	1151	41.6
1001–2000	551	20.0
> 2001	1062	38.4

Table 2. Prevalence, awareness, treatment and control rate of diabetes mellitus among older persons aged 60 years and more in NHMS 2011

Variables	Men % (CI)	Women % (CI)	Total % (CI)
Prevalence (n = 2708)	36.4 (32.6–40.4)	32.4 (29.3–35.6)	34.4 (31.9–36.9)
Awareness (n = 949)	60.6 (53.6–67.3)	70.1 (64.1–75.5)	65.2 (60.3–69.9)
Treatment (n = 618)	90.5 (85.8–93.8)	84.7 (78.9–9.2)	87.5 (83.8–90.5)
Control among treated (n = 473)	19.9 (14.5–26.6)	23.6 (18.1–30.3)	21.8 (17.8–26.5)

Notes: Awareness of diabetes was defined as having been told to have diabetes by medical personnel (known diabetes). CI, confidence interval. Treatment for diabetes was defined as a self-report of the respondents currently taking any form of diabetes treatment (not including traditional medicine) for the condition. Control among treated was defined as respondents who were known diabetes and being treated with a desirable blood glucose level (FBG of lower than 6.1 mmol/L).

Table 3. Factors associated with awareness and treatment of diabetes among older persons aged 60 and more in NHMS 2011

Variables	Awareness (*N* = 949)		Treatment (*N* = 618)		Control among treated (*N* = 473)	
	Crude OR (95%CI)	Adj.OR (95%CI)	Crude OR (95% CI)	Adj. OR (95% CI)	Crude OR (95% CI)	Adj. OR (95% CI)
Sex						
Men	1.00	1.00	1.00	1.00	1.00	1.00
Women	1.61 (1.23–2.11)**	1.63 (1.21–2.19)**	0.75 (0.47–1.21)	0.65 (0.38–1.12)	0.93 (0.61–1.42)	0.73 (0.41–1.31)
Age (years)						
60–74 > 75	1.06 (0.74–1.51)	1.03 (0.68–1.56)	1.63 (0.93–2.86)	1.40 (0.72–2.72)	1.04 (0.59–1.85)	0.87 (0.44–1.70)
	1.00	1.00	1.00	1.00	1.00	1.00
Ethnicity						
Malays	1.00	1.00	1.00	1.00	1.00	1.00
Chinese	1.26 (0.92–1.74)	1.21 (0.86–1.71)	1.44 (0.80–2.59)	1.40 (0.71–2.75)	0.88 (0.54–1.44)	0.87 (0.48–1.56)
Indians	2.84 (1.66–4.86)**	2.67 (1.50–4.76)**	1.28 (0.62–2.64)	1.07 (0.49–2.36)	0.52 (0.26–1.06)	0.49 (0.22–1.10)
Other Bumiputras	0.94 (0.52–1.71)	0.82 (0.41–1.65)	1.09 (0.36–3.26)	0.81 (0.25–2.56)	0.97 (0.37–2.57)	1.06 (0.31–3.56)
Others	0.59 (0.17–2.08)	0.57 (0.14–2.35)	0.25 (0.04–1.55)	0.26 (0.03–2.28)	0.00 (0.00)	1.07 (0.60–1.92)
Education						
Primary or less	1.00	1.00	1.00	1.00	1.00	1.00
Secondary or more	1.27 (0.92–1.76)	1.30 (0.90–1.89)	1.22 (0.70–2.14)	1.08 (0.56–2.06)	1.07 (0.66–1.72)	1.07 (0.60–1.92)
Strata						
Urban	1.44 (1.10–1.89)*	1.16 (0.84–1.60)	1.61 (1.01–2.57)*	1.63 (1.02–2.62)*	0.82 (0.53–1.24)	0.95 (0.55–1.62)
Rural	1.00	1.00	1.00	1.00	1.00	1.00
Marital status						
Single	1.00	1.00	1.00	1.00	1.00	1.00
Married	1.18 (0.38–3.66)	2.25 (0.65–7.74)	7.23 (1.75–29.79)*	7.58 (1.82–31.60)*	0.90 (0.09–8.82)	3.188 (0.00)
Widow/Widower/divorcee	1.31 (0.42–4.13)	1.79 (0.51–6.26)	6.28 (1.47–26.74)*	6.63 (1.54–28.54)*	1.11 (0.11–10.97)	5.248 (0.00)
Occupation						
Employed	1.00	1.00	1.00	1.00	1.00	1.00
Unemployed/retiree	1.60 (1.16–2.21)*	1.40 (0.98–2.00)	1.15 (0.65–2.03)	1.36 (0.70–2.62)	0.84 (0.48–1.45)	0.95 (0.50–1.80)
Household income (RM)						
<1000	1.00	1.00	1.00	1.00	1.00	1.00
1001–2000	1.79 (1.24–2.58)*	1.79 (1.20–2.67)*	0.68 (0.36–1.28)	0.70 (0.36–1.37)	1.70 (0.96–2.99)	1.45 (0.75–2.81)
>2001	1.88 (1.38–2.55)**	1.71 (1.23–2.37)*	0.76 (0.44–1.32)	0.63 (0.35–1.14)	1.54 (0.94–2.53)	1.73 (0.97–3.08)

OR, odds ratio; CI, confidence interval.
*p < 0.05
**p < 0.001

Discussion

This study demonstrated that the prevalence of DM in Malaysian older persons aged 60 years and older was high. The overall prevalence of DM among older persons was 34.4% as compared with 20.8% for adult population aged 30 years and more in Malaysia in 2011.[8] Our prevalence of diabetes in older population was higher than other recent surveys among older respondents in Thailand (14.8%),[9] United States (21.2%),[10] Europe (24%)[25] and Monastir City, Tunisia (27.4%).[26] Danaei et al.[27] had reported that diabetes was rising globally, driven by both population growth and ageing with increasing age-specific prevalence. Therefore, effective preventive interventions are needed and health systems should prepare to detect and manage diabetes and its sequelae.

In this study, the overall awareness and treatment rate among older diabetic patients in Malaysia were high, that is, 65.2% and 87.5%, respectively. The proportion of awareness and treatment rate among older persons was much higher than those of adults population in Malaysia in 2011 (i.e., 51.4% and 79.9%, respectively)[8] and older population in Thailand in 2004 (i.e., 58.8% and 53.1% respectively).[9] However, the study by Margaret et al.[10] revealed that older person from United States in 2009 had higher awareness rate (71.4%) but with lower treatment rate (50.9%) as compared with the older population in Malaysia.

In Malaysia, the higher awareness was mainly among the older women, Indian ethnic groups and those from higher income groups. Previous study conducted by Margaret et al.[10] also found that older women with diabetes were significantly more likely to be aware of their condition than men. Similarly, Porapakkham et al.[9] reported that among the older population, men were more likely to be unaware of their diabetes mellitus than women. In Malaysia, more effort should be focused to increase the awareness of diabetes among the older men, Malay and Chinese ethnic groups and those from lower income groups in order to ensure early treatment, effective diabetic control and prevention of diabetic complications.

As for diabetes treatment among older population, the higher treatment rates were among urban residents, those who were married and widow/widower/divorcee. A previous study conducted among older persons in Thailand by Porapakkham et al.[9] also found that those who lived in rural areas and

peripheral regions were less likely to be treated. This finding might reflect the problem of accessibility and the quality of care among this disadvantaged group.

The overall control rates for DM in this study was low, that is, only 21.8% of all older persons treated for diabetes achieved good blood glucose level control (based on the fasting capillary blood glucose lower than 6.1 mmol/L). Our control rate of diabetes among older persons was lower than the finding by Porapakkham et al.[9] from Thailand; 26.4% of their older population had good blood glucose level control (based on the fasting plasma glucose of lower than 7.8 mmol/L). Moreover, Margaret et al.[10] from United States reported that 50.4% of their older population had good blood glucose level control (based on the level of glycosylated haemoglobin of lower than 7%) as compared to Malaysian older persons.

The poor control rate of diabetes among older persons could be due to various reasons such as lack of self-ability to take prescribed medications, lack of caregiver's supervision in taking medications and the complexity of treatment regime, which can affect the older persons' compliance to treatment and subsequently lead to poor diabetic control. Many studies in various clinical settings also have documented poor diabetes control among the older populaion.[28,29] These studies provided the evidence that better quality of diabetic care is needed to ensure better diabetic control especially among older population. The quality of care in older DM needs to be improved further in order to achieve target diabetic control among the older persons and subsequently to reduce the overall cardiovascular risk.[15,16] Even though good glycaemic control is important to prevent overall diabetic complications, physician has to be extra cautious in treating older person with diabetes in order to prevent unwanted side effect such as severe hypoglycaemia, which could lead to severe morbidity and mortality.

However, there was no socio-demographic determinant significantly associated with controlled of fasting blood glucose level. This finding is consistent with recent study by Margaret et al. from United States who showed that there were no significant associations between socio-demographics characteristics and control of diabetes among older persons aged 65 and older.

In our study, the overall awareness and treatment rate for older persons with DM were high but the control rates were still suboptimal. More efforts are needed to

motivate physician to improve diabetic control rates. The improvement can be achieved by more intensive physician education especially on the importance of tight diabetic control based on the latest DM guidelines.[24] In addition, the diabetes control can further be improved by empowering the patient with the self-care ability such as better dietary control and physical activity, self-monitoring of blood glucose level and more simpler drugs regime such as fixed drugs combination.

The strength of this study was the NHMS 2011 data; the analyses of secondary data could provide more precise estimates of prevalence, awareness, treatment and control of DM among older persons in Malaysia.

Such information may be helpful to the health care policy maker to strengthen the existing diabetic control programme and to encourage interventions to improve the awareness, treatment rate and reduce the prevalence of sub-optimal diabetes control especially among the older persons. Moreover, by understanding the factors affecting awareness and treatment may lead to improvement in these aspects.

One of the limitations of this study was that we might overestimate or underestimate the overall prevalence of DM because of the self-reported data (for known DM). Another limitation for this population-based study was that only single fasting capillary blood glucose (FBG) level was measured because of limited operational budget and logistics reasons. The use of FBG with the cut-off point of 6.1 mmol/L instead of fasting plasma glucose level to suggest the possibility of diabetes (according to the 2009 guideline on management of type 2 diabetes)[24] may lead to misclassification of diabetes.

The other limitation in this study was that the control of diabetes was reliant solely on the capillary blood glucose level (instead of glycosylated haemoglobin levels), which was not reflective of the true control of diabetes, again due to the limited operational budget and logistics reasons.

In view of rapid growth in this older population in Malaysia,[11] more efficient patients' and physicians' education and efforts are required to improve the overall diabetes patients management. As compared to the younger patients, the older diabetes patients may suffer from more complications and have poorer quality of life. Therefore, more efforts and resources should be allocated to manage these groups of patients to ensure more quality care can be provided. Moreover,

all these efforts must be accompanied by primary preventive strategies in modifying lifestyle, for example, adopting healthy dietary habits, increasing physical activity and reducing obesity in order to reduce the overall prevalence rate of diabetes among older persons.[26,30] Contribution of non-governmental organization in diabetic control programme should be enhanced to complement that of the Ministry of Health to implement various strategies to reduce the diabetic prevalence, to increase the awareness and treatment rates among diabetes patients.

Conclusions

There was a high overall prevalence, awareness and treatment rate of diabetes among the older persons in Malaysia but with suboptimal control rate. There is an urgent need for more holistic public health interventions to reduce the overall prevalence and unawareness of diabetes especially among older persons and to improve the overall rates of treatment and control.

This study can serve as an important benchmark for further efforts towards the better management of older diabetes patients in Malaysia. More research on diabetes in older persons must be directed in light of these findings in order to confirm the reasons for the lower awareness rate among the Malay men of the lowest income group and lower treatment rate among the rural unmarried/single diabetes patients.

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