Diabetes knowledge among older adults with diabetes in Beijing, China.

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Abstract:

Aims and objectives. To explore the relationships of demographic and clinical variables and attendance at diabetes educational programmes with diabetes knowledge among a community sample of older Chinese adults with type 2 diabetes residing in Beijing.

Background. Knowledge of diabetes is an important component of diabetes self-management. Level of education, duration of diabetes, visits to a dietician and diabetes self-management are associated with diabetes knowledge. A few studies have examined these relationships in older Chinese with diabetes.

Design. A descriptive correlational study.

Methods. The study was conducted in face-to-face interviews with 108 older adults with type 2 diabetes and an average age of 68 (SD = 8·41) years residing in six residential apartment complexes in Beijing. Along with the assessment of diabetes knowledge and diabetes self-management, assessments of glucose, blood pressure, body mass index (BMI) and waist circumference were obtained.

Results. Age and systolic blood pressure were negatively associated with diabetes knowledge. Diabetes knowledge was not related to diabetes self-care activities or glucose level. A regression model with age, education and clinical variables significantly predicted diabetes knowledge, explaining 29% of the variance in knowledge. Participants who had a family history of diabetes, visited traditional Chinese medicine (TCM) doctors and ophthalmologists and attended diabetes educational programmes were more likely to have high scores on diabetes knowledge.

Conclusions. Age, education, a family history of diabetes, visits to TCM providers and ophthalmologists and attending diabetes class are factors associated with increased levels of diabetes knowledge.

Relevance to clinical practice. Healthcare providers need to provide age-specific, low literacy and family-focused diabetes education programmes and consider integrating principles and holistic perspectives of TCM in diabetes educational programmes for older Chinese with diabetes.

Keywords: China | diabetes | diabetes knowledge | older Chinese adults | nursing

Article:

Introduction and background

China has a high prevalence of diabetes. It is estimated that 9·7% or 92·4 million of Chinese adults have diabetes. In addition, up to 15·5% or 148·2 million additional Chinese adults are believed to be prediabetic. Older Chinese adults (over 55 years of age) tend to have high rates of diabetes, as much as 20·4% higher than younger age groups (Yang et al. 2010). Despite its high prevalence among the Chinese, however, many with the disease have inadequate knowledge about its effects and proper treatment and consequently fail to follow effective practices of diabetes self-management (Chan & Molassiotis 1999).

Because knowledge of diabetes is an important component of diabetes self-management, it is critical to determine what adults know about the disease and the self-management behaviours that they should use to address their disease status. Previous studies have found that age and occupation were associated with diabetes knowledge, with older persons having less knowledge and white-collar workers having the highest scores on diabetes knowledge (He & Wharrad 2007). Older adults with less than a high school education also have been found to have significantly lower knowledge scores than other groups (Bruce et al. 2003, McPherson et al. 2008). Greater diabetes knowledge also has been found to be associated with number of diabetes medications taken, longer histories of diabetes and frequent contacts with health providers (McPherson et al. 2008). In addition, women have been reported as being more knowledgeable about diabetes when compared with men (Gill et al. 2008, McPherson et al. 2008), and higher levels of diabetes knowledge have been associated with diabetes educational programme attendance, dietician visits and self-monitoring of blood glucose levels (Bruce et al. 2003, Lee & Shiu 2004). Diabetes knowledge also has been found to be significantly associated with glycosylated haemoglobin A1C (McPherson et al. 2008).

Because of the critical importance of knowledge about the disease and the complexities of diabetes self-management, older Chinese adults with inadequate diabetes knowledge might not be able to effectively self-manage their diabetes. Xu et al. (2008) reported finding that the level of diabetes knowledge of older people with type 2 diabetes in China indirectly affected their self-management behaviours through impacting their self-efficacy and belief in treatment effectiveness. The study reported here was conducted to further investigate the relationships of

diabetes knowledge with diabetes self- management, demographic and clinical variables, attendance at diabetes educational programmes and visits to healthcare providers among a sample of older Chinese with self-reported diabetes living in community settings.

Methods

Design and data collection

The sample for this study was comprised of 108 adults age 50 and older with type 2 diabetes recruited from six large (350–400 unit) high-rise residential apartment complexes in two major districts in Beijing, China. Three of the complexes for recruitment were facilities where one of the co-authors supervised nursing students in practice, and three were selected based on their close proximity. Each complex had an activities centre, which was used to collect data from study participants. Study participants had to be at least 50 years old, self-report being diagnosed as having diabetes, present no apparent cognitive impairment (oriented to place and time) and speak Mandarin Chinese.

Recruitment of participants was achieved by posting flyers on information bulletin boards located in each of the residential complexes and through contacts with complex administrators, who agreed to inform residents about the study. Of a total of 111 individuals recruited, three individuals were excluded because they did not report having a medical diagnosis of diabetes. The remaining 108 agreed to participate. Prior to conducting this study, approval was obtained from the Institutional Review Board of the first author's university and from the managers of community centers where respondents were recruited. The purpose of the study and safeguards for confidentiality were presented in oral and written forms. After obtaining signed informed consent, participants' blood pressure, glucose level, weight, height and waist circumference were measured and a questionnaire on diabetes knowledge and diabetes self-care activities was administered. Face-to-face interviews were conducted by native Chinese registered nurses (first and fourth authors). The entire data collection session took between 40 and 50 minutes. Participants received a towel set after completing the study.

Measures

Demographic and diabetes self-care information

Demographic information collected included age, gender, education, income, marital status, family history of diabetes, length of time diagnosed with diabetes, diagnosed medical conditions

(self-reported) and use of medications and alternative therapies including traditional Chinese medicine (TCM) for diabetes treatment. A diagnosis of diabetes, heart disease or hypertension was ascertained by asking participants whether they had been informed by a doctor that they had heart disease, hypertension or diabetes, or whether they were currently taking medications for any of these conditions. Education status about diabetes was assessed by asking whether participants had ever attended an educational session on diabetes or whether they had ever received pamphlets on diabetes from their doctors or nurses. These questions were dichotomously coded as yes or no. Physical activity level was obtained by asking respondents to report the number of minutes per day and number of days per week they engaged in moderate physical activity. These values were compared with the recommendations of the Centers for Disease Control and Prevention (2010) and the World Health Organization (2008) of 30 or more minutes of moderate activity 5 or more days a week.

Diabetes knowledge questionnaire

The Diabetes Knowledge Questionnaire (DKQ), originally developed for Mexican-American adults with type 2 diabetes (Garcia et al. 2001), was used in the study. The DKQ measures knowledge of causes of diabetes, facts about diabetes/physiology, symptoms of diabetes and diabetes management. Valid responses to the items are ‘yes’, ‘no’ or ‘I don’t know’. A correct answer receives one point and correct items are summed for a possible score between 0 and 24, with higher scores indicating greater levels of diabetes knowledge. The DKQ was translated from English into Chinese by a native bilingual translation specialist and then back translated by a different native bilingual speaker and checked for accuracy, clarity and content equivalence by conducting forward and back translations to verify translation equivalence (Berry 2002). For example, item 8 (‘A fasting blood sugar level of 210 mg/dl is too high’) in the original scale was modified to ‘a fasting blood sugar level of 11·5 mmol/l is too high’, based on the unit of measurement used in China. Reliability of the 24-item version of the DKQ was 0·78; construct validity was established with Mexican-American adults with type 2 diabetes (Garcia et al. 2001). Cronbach’s alpha was 0·89 in the current study.

Diabetes self-care activities

The Revised Summary of Diabetes Self-Care Activities scale (SDSCA) (Toobert et al. 2000) was used to measure diabetes self-management. The Revised SDSCA measures diet, exercise, blood sugar testing, foot care, smoking, self-care recommendations and medications. Participants are asked to check the number of days in the past week they had performed health management activities. An average mean rating of items is used; higher scores indicate higher levels of diabetes self-care activities. The SDSCA scale has been reported as a reliable and valid self-report measure of diabetes self-management (Toobert et al. 2000). Cronbach’s alpha in the

current study was 0·80. Forward translation into Chinese and back translation of the SDSCA were performed by separate native bilingual speakers.

Physiological measures

Fasting glucose was obtained through capillary finger stick using a glucose meter. Accuracy of the glucose meter was checked using controls each time before glucose was measured. Participants were informed not to drink or eat after midnight before the test was conducted.

Body weights and heights were measured using a portable weight scale and wall tape measure. These two measures were used to calculate BMI (body mass index) (National Heart Lung Blood Institute 1998). Respondents' BMIs were categorised based on the WHO's obesity classification ranges for Chinese people: overweight if BMI was between 24–27·9 kg/m2 and obese if BMI was >28 kg/m2 (World Health Organization 2000).

Waist circumference was measured from the area above the hip bone and below the rib cage over the umbilicus with a Gantt tape. Central obesity was defined based on the WHO's waist circumference recommendations for Chinese men and women as >85 and 80 cm, respectively (World Health Organization 2000).

A standardised cuff measurement protocol was used to measure blood pressure (Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure 2003). Participants were asked to sit quietly for a minimum of 5 minutes before taking their pressures. Participants were considered hypertensive if they either reported using antihypertensive medications or their blood pressure reading was ≥130/80 mmHg (American Diabetes Association 2011).

Statistical analysis

Descriptive statistics were used to describe sample characteristics and level of diabetes knowledge. Pearson's and Spearman's correlations were used to identify potential explanatory variables accounting for impact of diabetes knowledge on diabetes self-care activities. Independent t-test analyses were performed to examine differences between gender and diabetes knowledge. Multiple and logistic regression analyses were used to explore the relationships of demographic and clinical variables with diabetes knowledge. Determination of statistical significance was based on $p < 0·05$.

Results

Demographics of participants

The characteristics of the sample are presented in Table 1. The average age of participants was 68 years (± 8·41) ranging from 50–86 years. Approximately 64% were women and had less than a high school education (64·8%). Most (72·2%) of the samples were married; about a fifth (20·6%) were widows or widowers. The great majority lived with either a spouse or children (80·0%). Most participants had monthly family incomes of between RMB1001 and 2000 (U.S equivalent $145–$295) or less. A majority of participants reported having health insurance.

Table 1. Frequency distribution of demographic variables (n = 108)

Variables	***n***	**Mean**	**SD**	**%**
Age	108	68·13	8·41	
Gender				
Female	69			63·9
Male	39			36·1
Education				
No education	3			2·8
Elementary school	39			36·1
Middle school	28			25·9
High school	20			18·5
College	16			14·8

Variables	***n***	**Mean**	**SD**	**%**
Marital status				
Married	84			78·5
Widowed	22			20·6
Single or divorced	1			0·9
Income				
Less than 500 Yuan	4			3·8
500–1000 Yuan	20			18·9
1001–2000 Yuan	34			32·1
2001–3000 Yuan	34			32·1
3001–4000 Yuan	7			6·6
4001–5000 Yuan or above	7			6·6
Health Insurance				
Has insurance	91			85·8
Currently smoking				
Yes	14			13·5
Parent have diabetes				
Yes	21			29·6

The average duration of diabetes diagnosis was 8·60 years (± 7·35). The majority of participants reported taking medications for their diabetes; a small number were on insulin. Some participants used both Western medicines and TCM to treat diabetes. One-third reported a family history of diabetes and 72·2% of participants reported their health as fair or poor.

A little more than half of participants had hypertension, but less than half indicated having a heart problem, and only about 1 in 20 reported having had a stroke. Almost half of the participants (45·4%) reported being diagnosed with two or more chronic conditions, including heart diseases, hypertension, kidney disease or stroke. A number of the respondents were taking medications for various health conditions, including hypertension (56·2%), heart disease (40·2%) and high cholesterol (19·6%). Most participants visited a physician in the past 12 months; one-third visited an ophthalmologist, but only a few of them had seen a dentist or a TCM physician (Table 2).

Table 2. Frequency distribution of clinical variables (n = 108)

Variables	Mean	SD	n	%
BMI	24·93	3·31	107	
BMI group				
<24			46	43·4
24–27·9			44	41·5
28 and higher			16	15·1
Waist circumference				
Male	74·31	48·94	39	
Female	66·58	35·72	68	
Health				
Fair/poor			78	72·2
Excellent/good			30	27·8
Visited your doctor in past 12 months for diabetes				
Yes			91	84·3

Visited dentist in the past 12 months		
Yes	42	39·3
Visited an ophthalmologist in the past 12 months		
Yes	40	37·7
Took medicine for cholesterol		
Yes	21	19·6
Took medicine for heart disease		
Yes	43	40·2
Took medication for hypertension		
Yes	59	43·8
Currently taking diabetic medication		
Yes	89	86·4
Given materials about diabetes		
Yes	56	52·3
Attended diabetes class		
Yes	50	46·3
Visited traditional Chinese medicine doctor in the past year for diabetes		
Yes	41	38·0
Used traditional Chinese medicine for diabetes		
Yes	30	27·8
Have high blood pressure		
Yes	62	57·9
Trouble with kidneys		
Yes	11	10·3

The majority of participants had blood pressure levels above the normal range (130/80 mmHg); the mean systolic blood pressure was 133·72 mmHg (SD = 23·05) and the mean diastolic pressure was 82·18 mmHg (SD = 18·52). Approximately half had a high fasting glucose level (49·1%), with an average of 144·13 mg/dl (SD = 54·66). Average BMI was 24·92 kg/m2 (± 3·31); less than half of the participants were overweight (41·5%) and only 15·1% were obese. However, based on central obesity measurement, 53·8% of men had waist circumference >85 cm and 64·1% of women measured >80 cm qualifying them as being obese. About 3·5% currently smoked, but 43% had a history of smoking. More than half of the participants (56·5%) did not meet recommended guidelines for physical activity; a majority reported no aerobic exercise (72·2%). A little over half (52·3%) reported receiving pamphlets on diabetes from their healthcare providers; 46·3% had attended a diabetes educational session.

Diabetes knowledge

The mean number of correct answers on the Diabetes Knowledge Questionnaire was 12·71 (SD = 5·86) with a range from 0–22 and a median score of 14. The percentages of correct items by age group (<65 years vs. >65 years) are shown in Table 3. Younger respondents scored significantly higher on the DKQ (14·61 vs. 11·96) than the older study participants. The items receiving the most correct responses were ‘A fasting blood sugar level of 210 is too high’ (87·6%), followed by ‘Cuts and abrasions on diabetics heal more slowly’ (83·8%) and ‘Diabetes can damage my kidneys’ (79·0%). The questions least frequently answered correctly were ‘Diabetes is caused by failure of the kidneys to keep sugar out of the urine’ (30·2%), ‘Regular exercise will increase the need for insulin or other diabetic medication’ (27·6%) and ‘A person with diabetes should cleanse a cut with iodine and alcohol (13·3%).’

Table 3 has been omitted from this formatted document.

Age ($r = -0{\cdot}29$, $p = 0{\cdot}003$), level of education ($r = 0{\cdot}42$, $p = 0{\cdot}001$) and hypertension ($r = -0{\cdot}19$, $p = 0{\cdot}04$) were significantly associated with diabetes knowledge. However, no significant relationships were found between diabetes knowledge and diabetes self-care activities ($r = 0{\cdot}06$, $p = 0{\cdot}60$) or blood glucose level ($r = -0{\cdot}08$, $p = 0{\cdot}42$) or BMI ($r = -0{\cdot}16$, $p = 0{\cdot}09$). There was no difference in diabetes knowledge between men and women ($t = 0{\cdot}59$, d.f. = 106, $p = 0{\cdot}559$).

Associations between demographics, diabetes knowledge and diabetes self-care activities

As shown in Table 4, univariate logistic regression analyses were conducted to examine the associations between demographic and clinical variables, attendance at diabetes educational programmes and diabetes knowledge. Significant associations were found in diabetes

knowledge, adjusting for age, with demographic and clinical variables. Participants who attended diabetes educational programmes were more likely to have a high level of diabetes knowledge (OR = 1·08, 95% CI: 1·00–1·16, p = 0·041). Participants who had a family history of diabetes were 1·16 times as likely to have a high level of diabetes knowledge as those whose parents did not have diabetes (OR = 1·16, 95% CI: 1·03–1·30, p = 0·014). Participants who visited a TCM doctor were 1·11 times more likely to have a high level of diabetes knowledge (OR = 1·11, 95% CI: 1·03–1·20, p = 0·010) and those who visited an ophthalmologist were also more likely to have a high score on diabetes knowledge (OR = 1·08, 95% CI: 1·00–1·16, p = 0·049). No other significant associations were detected between demographic and clinical variables, and receipt of diabetes educational materials with level of diabetes knowledge.

Table 4. Odds ratios and 95% confidence interval on demographic and clinical variables and attendance of diabetes educational programme adjusting for age (n = 108)

Variables	Diabetes knowledge	95% CI
Attended diabetes class	1·079*	1·003–1·162
Received educational materials	1·029	0·958–1·105
Duration of diabetes <5 year vs. >5 year	1·010	0·941–1·083
Met recommended physical activity level Yes vs. No	1·015	0·948–1·088
Glucose level, normal vs. high	1·015	0·948–1·086
Systolic blood pressure, normal vs. high	0.970	0·896–1·044
Taking diabetes medication	1·036	0·938–1·145
Visited traditional Chinese medicine doctor	1·110*	1·025–1·201
Taking traditional Chinese medicine for diabetes	1·072	0·988–1·164
Visited doctors	1·067	0·975–1·169
Visited ophthalmologist	1·079*	1·000–1·163
Visited dentist	1·056	0·981–1·137
Family history of diabetes	1·155*	1·030–1·295

*$p < 0·05$.

Predictors of diabetes knowledge

The predictive value of selected demographic and clinical variables – age, education, a family history of diabetes, visits to a Chinese medicine doctor or ophthalmologist in the past year and attendance at diabetes educational programmes – was tested using multiple regression, controlling for age and education. A two-level hierarchical multiple regression analysis was conducted with the demographic variables of age and level of education as a first block followed by a second block of variables: family history of diabetes, visit to an ophthalmologist regarding diabetes diagnosis, visit to a TCM doctor for diabetes treatment and attendance at a diabetes educational programme. Table 5 presents the results of the regression analysis. In the first step of the model, demographic variables accounted for 18% of the variance in diabetes knowledge, and level of education was a significant predictor. In the second step, demographic variables, along with clinical variables and attendance at diabetes educational programmes, made a significant contribution to the prediction of diabetes knowledge, explaining 29% of the total variance in diabetes knowledge, with level of education and family history of diabetes as strong predictors.

Table 5. Summary of hierarchical regression analysis for variables predicting diabetes knowledge (n = 108)

Predictor	R^2	**Diabetes knowledge**	
		ΔR^2	**β**
Step 1	0·18	0·16**	
Age			−0·09
Education			0·39**
Step 2	0·29	0·24*	
Age			−0·02
Education			0·35**
Family history of diabetes			0·07
Visited traditional Chinese			0·19
Attendance of diabetes educational programme			0·23*

*$p < 0·05$; **$p < 0·01$.

Discussion

Our study shows that there are important diabetes knowledge deficiencies in older Chinese adults with diabetes. The average response score for the DKQ indicated that the sample was able to provide correct answers to only about half of the questions. More importantly, more than half of the participants did not know many of the causes and the physiology of diabetes (Table 3). For example, a majority gave incorrect answers for ‘Eating too much sugar and other sweet foods is a cause of diabetes’ (item #1), ‘Diabetes is caused by failure of the kidneys to keep sugar out of the urine’ (item #3) and ‘Kidneys produce insulin’ (item #4). On the positive side, a majority of participants correctly answered questions on the facts and physiology such as diabetes can cause slow healing of cuts and abrasions (item #15) and can damage kidneys (item #19).

Greater diabetes knowledge was associated with higher levels of education, having a family history of diabetes, and younger age. Our findings are congruent with a previous study that reported low levels of education and no family members with diabetes were positively related to lower diabetes knowledge among Chinese people with type 2 diabetes in Shanghai (He & Wharrad 2007). It is known that patients with adequate knowledge about diabetes and diabetes self-care are more likely to have better glycaemic control (McPherson et al. 2008) and patients with parents with a history of diabetes are more likely to know about the symptoms and treatment for diabetes. Unlike other studies on diabetes knowledge (He & Wharrad 2007, Gill et al. 2008, McPherson et al. 2008), in the present study, gender was not associated with diabetes knowledge in this study. Our data did not show any gender differences in diabetes knowledge.

The finding that the participants who were <65 years old were more knowledgeable about causes of diabetes, signs and symptoms of diabetes and diabetes care than those who were 65 years or older is consistent with previous studies which have reported that older adults with diabetes have less knowledge about diabetes than younger adults (He & Wharrad 2007, Gill et al. 2008, McPherson et al. 2008). An association between increasing age and low diabetes knowledge might be related to the fact that older adults tend to have more comorbidities, which might lead to confusion about signs and symptoms specific to diabetes and those of other diseases (Gill et al. 2008). Other factors may include literacy level. For example, in the present study, age was significantly negatively associated with level of education. This is consistent with another study which reported that linguistic barriers were associated with poor diabetes knowledge among Chinese Americans (Hsu et al. 2006).

Significant associations between clinical variables and diabetes knowledge were found in this study. Participants who attended a diabetes educational programme had higher scores on diabetes

knowledge. The results show that 46·3% of participants reported attending a diabetes education programme and more than half (52·3%) had received educational materials on diabetes. It is notable, however, that receiving pamphlets or materials on diabetes was not significantly related to higher levels of diabetes knowledge. This suggests that simple informational leaflets on diabetes given out by health providers may not be an effective way to communicate important health information; more interactive means of communicating educational materials are necessary. The results also suggest that diabetes education programmes may be a key factor in increasing diabetes knowledge. This is consistent with Bruce et al. (2003), who reported that attendance at education programmes, visits to dieticians and self-monitoring of blood glucose instructions all were significantly related to greater diabetes knowledge. Wei and colleagues (Wei et al. 2008) also found attendance at diabetes education programmes improved diabetes management with regard to weight, systolic blood pressure and fasting blood glucose in adults with diabetes in China.

Interestingly, reported visits for diabetes treatment of either to TCM doctors or to an ophthalmologist, but not Western medicine physicians, were related to higher diabetes knowledge scores. This was true, even though a large majority (84·3%) of participants reported visiting Western medicine physicians in the past year. Western medicine physicians in China usually spend little time with patients in outpatient settings owing to their practice demands, and they are likely to provide limited education about diabetes management. Commonly used therapeutic methods of TCM providers such as Qigong and Tai Chi, which integrate Chinese herbal medicine, dietary therapy, and physical and mental exercises, may provide a more effective means of communicating essential lifestyle and self-care information to help older Chinese understand the causes and symptoms of diabetes and the benefits and demands of diabetes self-management (Covington 2001). This is consistent with the observation that diabetes knowledge does not necessarily translate into better diabetes self-care (Chan & Molassiotis 1999, He & Wharrad 2007) or to acceptance of treatment and self-care practices (Xu et al. 2008). Ultimately, the relationships patients have with their health providers and the value they place on the information and treatment they receive addressing their symptoms and concerns may be most important.

Diabetes knowledge scores had no association with systolic blood pressure or blood glucose level or BMI. These findings are consistent with previous studies which found that diabetes knowledge had no relationship to glycemic control (He & Wharrad 2007), suggesting that a high level of diabetes knowledge may not necessarily translate to effective diabetes self-management. Pathophysiological reasons, such as an individual’s reactions to medications, rather than a deficiency in diabetes knowledge or non-compliance, may be another explanation for the lack of

significant relationships between physiologic measures and diabetes knowledge scores in this study (He & Wharrad 2007).

Finally, higher levels of diabetes knowledge were not associated with diabetes self-care management with regard to exercise, diet, blood sugar testing, foot care, smoking or recommended medications, as measured by the SDSCA. Contradictory findings on the relationship between diabetes knowledge and diabetes self-care management behaviours have been reported (Chan & Molassiotis 1999, He & Wharrad 2007). For example, McPherson et al. (2008) found that higher levels of knowledge about diabetes self-management were associated with better clinical outcomes. Another study found that diabetes knowledge was associated with diabetes self-management through self-efficacy and beliefs about effective treatments (Xu et al. 2008). However, our findings are consistent with a study of older Chinese adults with diabetes in Hong Kong that showed no relationship between diabetes knowledge and self-reported diabetes management (T'ang et al. 1999). This suggests that other factors, such as functional impairment, may limit diabetes self-management activities in older adults (Bruce et al. 2003).

Limitations

Several limitations need to be considered with respect to generalising the findings of this study. First, the study used convenient settings and a convenience sample of community residents who self-reported having diabetes, thus those who had low socioeconomic status and low levels of literacy may have been missed. Second, glucose tests performed only once may not be a reliable indicator of diabetes control. Third, the instruments were administered using face-to-face interviews, which might have introduced social desirability that may have influenced what respondents reported. Fourth, because the design of the study was cross-sectional, the findings may not represent longer-term effects of diabetes knowledge on diabetes self-management.

Conclusion

Among older adults with type 2 diabetes living in mainland China, diabetes knowledge including its causes and management may be limited. Being under age 65, having a high school or greater education and a family history of diabetes were associated with diabetes knowledge. Attending diabetes education programmes and visits to TCM doctors or an ophthalmologist also were

related to higher diabetes knowledge scores. Healthcare providers need to provide age-specific, low literacy diabetes education programmes for older Chinese with diabetes.

Relevance to clinical practice

The findings of this study have several clinical implications. The first is that diabetes education programmes might be more effective among older adults in China if they integrate the concepts and principles of TCM. Second, the key to improving knowledge of diabetes and promoting better patient glycaemic control is to focus on changes in lifestyle behaviour that are natural and acceptable to older Chinese (Lou et al. 2011). This means more education of patients to encourage effective diabetes self-management. Including family members in diabetes education for better understanding of disease process and diabetes self-management is recommended in future research. It also is important to encourage patients to become better informed about the disease process and what they can do to help control the disease. Healthcare providers need to develop more effective ways to teach older Chinese adults about diabetes management that focus on the benefits of behaviour changes on diabetes outcomes, including information on diet, exercise and self-monitoring, in addition to the traditional emphasis on diabetes treatment by medications. Healthcare providers also need to assess literacy levels of older Chinese adults and explain the content of diabetes education materials provided to them to make sure that older Chinese adults with diabetes understand the information.

A third implication is that a more holistic assessment of older adults with diabetes and family members' knowledge of diabetes and their understanding of the importance of diet and physical activities, medications and monitoring of diabetes is crucial for providing effective diabetes education and counselling to older Chinese adults with diabetes and their family members. It is important to use health-seeking opportunities to inform and assess older Chinese adults who have diabetes or at risk for diabetes. Needs assessment, goal setting and problem solving should be integrated in diabetes education programmes. Outcome measures in diabetes education programmes should include diabetes self-efficacy, coping skills, diabetes complications and health-related quality of life. Finally, healthcare providers who work with older Chinese adults with diabetes need to consider education, income and literacy level when providing education programmes tailored to this population.

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Contributions

Study design: JH; data collection and analysis: JH, KJG, HL, HZ and manuscript preparation: JH, KJG, HL, HZ, AAG.

Conflict of interest

The authors have no conflicts of interest.

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