



BMJ Open Factors influencing self-care behaviours of patients with type 2 diabetes in China based on the health belief model: a cross-sectional study

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ABSTRACT

Objectives The study aimed to explore the status and predictors of self-care behaviours in patients with type 2 diabetes in China based on the health belief model.

Design The cross-sectional study included 1140 patients aged ≥ 36 years with type 2 diabetes who had established health records in community health service institutions. A questionnaire was designed based on the health belief model, which mainly included perceived susceptibility, severity, benefits, barriers, effectiveness, sociodemographic characteristics and self-care behaviours.

Setting Using a multistage sampling method, 36 villages and communities were randomly selected in China.

Participants A total of 1260 patients with type 2 diabetes were contacted, but 118 refused to participate in the study. Of the 1142 participants, two were subsequently excluded, and the final number of participants included in the study was 1140 (90.5% response rate).

Results The average score of health beliefs was 0.71 (SD=0.08). The logistic regression analysis showed that sex, region, perceived severity, perceived barriers and perceived benefits were related to self-care behaviours.

Conclusions Perceived severity, benefits and barriers were key factors affecting self-care behaviours in patients with type 2 diabetes; health education for patients should be strengthened to improve the self-care level of patients with diabetes.

INTRODUCTION

The incidence of diabetes is growing rapidly worldwide, making diabetes a serious public health problem in the 21st century. Demographic changes, sociocultural transition and ageing in developing countries have made diabetes a global epidemic.¹ Therefore, the WHO has called diabetes a silent epidemic.² Between 2010 and 2030, the prevalence of type 2 diabetes is expected to increase by 70% in developing countries and 20% in developed countries.³ The International Diabetes Federation reported that there are currently 463 million patients with diabetes worldwide. The number is predicted to reach 578 million by 2030 and 700 million by 2045. Diabetes has

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This cross-sectional survey assessed factors affecting self-care behaviours in patients with type 2 diabetes in China.
- ⇒ Using a multistage sampling method, 36 villages and communities in China were randomly selected.
- ⇒ A self-designed questionnaire derived from the literature was developed to collect data.
- ⇒ The study used a cross-sectional design, wherein causal relationships could not be inferred from the results.
- ⇒ There is a possibility of recall bias or social desirability bias because of the use of self-reported questionnaire responses.

a devastating impact on individuals, society and countries. Every year, more than 4 million people die from diabetes, accounting for 11.3% of global deaths; moreover, diabetes accounts for 10% of global health spending.⁴

As an important part of a healthy lifestyle and lifelong development, self-care first appeared in the article 'Asthma Self Care',⁵ and Thomas believed that self-care means that patients themselves are the main participants in the treatment of diseases. Since then, the concept of self-care has been generally recognised in the care of chronic diseases.⁶ As a new type of disease management model, self-care of patients with chronic diseases has been gradually promoted in various settings in recent years, and the lifelong nature of diabetes has determined that self-care plays an important role in the comprehensive treatment of diabetes.⁷ Self-care behaviours mainly refer to healthy behaviours in which patients actively carry out diet control, health monitoring, physical exercise and drug therapy to control the occurrence and development of complications and to monitor and manage their own diseases. Studies have found that adherence to good self-care behaviours by patients with diabetes can effectively improve

blood sugar control as well as reduce and delay the occurrence of diabetic complications, eventually reducing the economic burden of the disease and improving the quality of life.^{8–10}

The health belief model (HBM) is a behavioural change theory that integrates cognitive theory and need motivation theory from the perspective of psychology.¹¹ Based on the HBM, individuals must first believe that they are susceptible to diseases (perceived susceptibility), recognise the risk and its perceived severity and adopt self-management behaviours.¹² Health beliefs could determine the degree to which patients comply with recommendations and adhere to self-care behaviours.¹³ Previous studies have demonstrated the successful application of HBM in explaining and predicting preventive health behaviours. A study by Dehghani-Tafti showed that the HBM can successfully explain and predict preventive health behaviours in patients with diabetes.¹⁴

Previous studies have shown that diabetic self-care behaviours in other countries are suboptimal. A study by Alrahbi¹⁵ indicated that diabetic self-care behaviours among Omanis are inadequate. Self-care behaviours among Jordanian patients with type 2 diabetes were also suboptimal.¹⁶ In recent years, the prevalence of diabetes among the Chinese population has increased, but the self-care behaviours of patients with diabetes have not been ideal. To date, most studies on diabetic self-care behaviours in China have included patients from a single province or city alone,^{17 18} and there are few studies on self-care behaviours of patients with diabetes across different regions.

Therefore, this study aimed to explore the factors influencing self-care behaviours of patients with type 2 diabetes in two provinces and a city in China and to provide countermeasures and a scientific basis for improving self-care behaviours in these patients.

METHODS

Study design

In this cross-sectional survey study, a questionnaire was developed for patients with diabetes to collect data based on literature review, expert evaluation, pilot study, and reliability and validity evaluation. The questionnaire mainly included three parts:

1. Sociodemographic characteristics: the first part of the questionnaire was developed by the researcher based on literature review. It comprised questions about sex, age, marital status, educational level, work status, type of medical insurance, family history of diabetes, account nature, household registration and personal monthly income.
2. Self-care behaviours of patients with diabetes: self-care behaviours were selected based on the Chinese Diabetes Management Guideline. It consisted of seven dimensions: foot care, drinking, smoking, medication adherence, self-tested weight, self-tested blood glucose and number of follow-ups. For each dimension, a pos-

Table 1 Variable assignment table

Variables	Assignment
Foot care	No=0, yes=1
Drinking	No=1, yes=0
Smoking	No=1, yes=0
Medication adherence	No=0, yes=1
Self-tested weight	No=0, yes=1
Self-tested blood glucose	No=0, yes=1
Number of follow-ups	<4=0, ≥4=1

itive and beneficial choice was scored 1, otherwise 0. The total score of self-care behaviours ranging from 0 to 7 (table 1), with higher scores representing better self-care behaviours.

3. HBM constructs: this part comprised 64 items derived from the available literature.^{17 19} According to the HBM, self-care behaviours are mainly related to the following five aspects: (A) perceived susceptibility (10 items): individuals' judgement of their own risk of diabetes (eg, 'Everyone can get diabetes'); (B) perceived severity (12 items): individuals' awareness of serious complications associated with diabetes (eg, 'Diabetes can easily cause damage to the feet'); (C) perceived benefits (11 items): individuals' perception of the benefits obtained after performing self-care behaviours (eg, 'Get treatment and medication guidance'); (D) perceived barriers (19 items): individuals' awareness of difficulties in adopting diabetes self-care behaviours (eg, 'Deal with diabetes complications in time'); and (E) perceived effectiveness (12 items): individuals' awareness of the ability to control blood glucose and reduce the delay of diabetic complications after performing self-care behaviours (eg, 'Regular blood glucose measurement'). All items were measured on a four-point scale, ranging from 1 (agree) to 0.25 (disagree) and 1 (very helpful) to 0.25 (hardly helpful); for the perceived barriers construct, the scores ranged from 1 (very difficult) to 0.25 (hardly difficult). Total health belief score=total score of perceived susceptibility+total score of perceived severity+total score of perceived effectiveness+total score of perceived benefits – total score of perceived barriers. Accordingly, the maximum score was 4, and the minimum score was 0.

Study measures

To determine reliability, the questionnaire was administered to 175 individuals who were not part of the study. According to this pilot study, the questionnaire was slightly modified. Cronbach's alpha coefficient for the health belief scale was 0.895, indicating good reliability. Moreover, the Cronbach's alpha coefficients for each HBM construct were 0.859 (perceived susceptibility), 0.837 (perceived severity), 0.906 (perceived benefits), 0.604 (perceived barriers) and 0.873 (perceived effectiveness). The construct validity was assessed using principal

component analysis. Seventeen factors were extracted, and the cumulative variance contribution rate was 0.615, which suggested the good construct validity. These results demonstrated that the questionnaire was internally consistent.

Sampling and data analysis

First, using a multistage sampling method, one province or municipality was randomly selected from each of China's eastern, central and western regions. The three selected locations were Zhejiang Province (eastern region), Anhui Province (central region) and Chongqing City (western region). Second, two non-capital cities were randomly selected from each province, one district and one county from each city, and two districts and two counties from each municipality—for a total of 12 counties/districts. Third, three townships or streets were randomly selected from each county or district. Lastly, a village or community was randomly selected from each township or street. A total of 36 villages or communities were randomly selected for this study. Subsequently, considering the differences in eastern, central and western regions of China, 420 patients were selected from each region, and a total of 1260 patients were selected; therefore, 35 patients with type 2 diabetes were randomly selected from each village or community. Thereafter, 1260 patients with type 2 diabetes were contacted, but 118 refused to participate in the study. Of the 1142 participants, two were excluded, and the final number of participants included in the study was 1140.

The selection criteria for patients with type 2 diabetes were as follows: (1) patients who were at least 36 years old and had established health records in local primary health institutions; (2) patients who were diagnosed with type 2 diabetes by medical institutions at or above the county/district level and had records of fasting blood glucose levels of ≥ 7 mmol/L for at least 1 year in the local primary health institutions' register; (3) patients with no obvious mental illness; and (4) patients with no hearing impairment or language/communication impairment.

The data were collected by trained graduate students from April 2018 to September 2018, and data collection was conducted with the help of community workers. Participants were invited to complete the questionnaire in 30 min, and the trained graduate students were available to answer questions and clarify any issues as participants filled out the questionnaires. EpiData V.3.1 software was used for the double-entry and consistency test to ensure data accuracy. Missing values of input data were also processed; if key variables were missing or the data were missing up to 5%, they were treated as invalid questionnaires. The mode was used to fill in the data for variables with a small amount of missing data.

The collected data were analysed using Statistical Package for the Social Sciences V.23.0. Descriptive statistics were used to show the sociodemographic and diabetic self-care behaviours. According to the median, the total score of self-care behaviours was dichotomised based on

a score of 3, considering self-care behaviour scores (≤ 3 is 0, >3 is 1) as dependent variables, and sociodemographic characteristics and HBM constructs as independent variables. Furthermore, the enter method was used for regression model building, and multivariable logistic regression analysis was conducted to predict the variables influencing self-care behaviours. A *p* value of <0.05 was considered statistically significant.

Patient and public involvement

No patients were involved.

RESULTS

This study recruited a total of 1140 participants, of whom, 719 (63.1%) were female, 710 (62.3%) were aged 65 years and older, 898 (78.8%) were married, 752 (65.9%) had low educational levels, 1089 (95.5%) were local residents, 652 (57.2%) participated in the New Cooperative Medical Scheme and 549 (48.2%) had a personal monthly income of <1000 yuan. Moreover, 361 patients (31.7%) were from the eastern region, 390 (34.2%) from the central region and 389 (34.1%) from the western region (table 2).

The average score of health beliefs of the participants was 0.71 ± 0.08 ; the scores of each dimension of the HBM were as follows: perceived susceptibility score (0.68 ± 0.16), perceived severity score (0.80 ± 0.16), perceived benefits score (0.81 ± 0.13), perceived barriers score (0.42 ± 0.09) and perceived effectiveness score (0.84 ± 0.15).

More than 50% of the participants (51.6%, $n=588$) performed foot care, and the majority of patients (97.6%, $n=1113$) showed medication adherence, whereas only 25.9% ($n=295$) adopted self-tested blood glucose. Approximately 20.1% ($n=229$) of participants adopted self-tested weight, 11.8% ($n=134$) were smokers, and 13.6% ($n=155$) were alcohol drinkers. Meanwhile, 76.6% of patients ($n=873$), actively had four follow-ups within 1 year (table 3).

Logistic regression analysis was used to examine the predictors of diabetes self-care behaviours based on the HBM (table 4). The results revealed that sex and region were significantly associated with self-care behaviours. There were also significant differences between some HBM constructs and self-care behaviours scores. Perceived severity, perceived benefits and perceived barriers were significantly associated with self-care behaviours.

DISCUSSION

The main purpose of this study was to assess the status and predictors of self-care behaviours based on the HBM as well as the sociodemographic characteristics of patients with type 2 diabetes in China. The findings indicated that some participants had poor self-care behaviours and that health belief played an important role in performing self-care behaviours. Xu *et al.*²⁰ developed a Chinese version of the Summary of Diabetes Self-Care Activities (SDSCA) scale, which was modified according to the

Table 2 Sociodemographic characteristics of patients with type 2 diabetes

Variables	n	%
Gender		
Male	421	36.9
Female	719	63.1
Age (years)		
<65	430	37.7
≥65	710	62.3
Marital status		
Married	898	78.8
Others	242	21.2
Educational level		
Illiterate	365	32.0
Primary school	387	33.9
Junior high school	248	21.8
High school and above	140	12.3
Account nature		
Non-agricultural	493	43.2
Agriculture	647	56.8
Work status		
No	1014	88.9
Yes	126	11.1
Household registration		
Local	1089	95.5
Others	51	0.5
Household size (persons)		
<3	690	60.5
≥3	450	39.5
Personal monthly income (RMB)		
<1000	549	48.2
≥1000	591	51.8
Family history of diabetes		
No	862	75.6
Yes	278	24.4
Distance from the primary health institution closest to home		
<1 km	732	64.2
≥1 km	408	35.8
Health insurance		
EMIUE	316	27.7
EMIUR	138	12.1
NCMS	652	57.2
Others	34	3.0
Areas		
Eastern	361	31.7
Central	390	34.2
Western	389	34.1

Continued

Table 2 Continued

Variables	n	%
EMIUE, essential medical insurance for urban employees; EMIUR, essential medical insurance for urban residents; NCMS, new cooperative medical system.		

Chinese culture, and invited 211 Chinese Americans in Midwestern Americans with type 2 diabetes to participate in the survey. They found that the self-care behaviours of the participants were suboptimal and that their self-care level was low. Furthermore, Al-Khawaldeh *et al*¹⁶ examined 223 Jordanian patients with type 2 diabetes using a revised SDSCA scale, and their survey revealed that the most frequently reported self-care behaviour for diabetes was medication compliance, whereas the least frequently reported behaviour was blood glucose testing, which is similar to the results of our study.

We found that sex, region, perceived severity, perceived benefits and perceived barriers were the significant predictors of self-care behaviours. Female patients had a higher level of self-care behaviour than male patients. In a Canadian diabetes population, De Melo *et al*²¹ reported significant differences in self-care behaviours for diabetes between male and female patients and showed that women were more likely to avoid certain foods due to concerns about fat or caloric content, indicating that

Table 3 Self-care behaviours of patients with type 2 diabetes

Variables	n	%
Foot care		
No	552	48.4
Yes	588	51.6
Medication adherence		
No	27	2.4
Yes	1113	97.6
Drinking		
No	985	86.4
Yes	155	13.6
Smoking		
No	1006	88.2
Yes	134	11.8
Self-tested blood glucose		
No	845	74.1
Yes	295	25.9
Self-tested weight		
No	911	79.9
Yes	229	20.1
Number of follow-ups		
<4	267	23.4
≥4	873	76.6

Table 4 Logistic regression analysis of self-care behaviours in patients with type 2 diabetes

Variables	B	OR	95% CI	P value
Constant	0.313	1.367		0.843
Gender	1.544	4.681	3.145 to 6.968	<0.001
Age	0.207	1.230	0.814 to 1.859	0.325
Marital status	-0.273	0.761	0.482 to 1.203	0.242
Educational level				0.165
Account nature	-0.372	0.689	0.363 to 1.310	0.256
Work status	-0.347	0.707	0.406 to 1.229	0.219
Household registration	-0.755	0.470	0.207 to 1.064	0.070
Personal monthly income	-0.057	0.944	0.562 to 1.588	0.829
Household size (persons)	-0.171	0.843	0.577 to 1.233	0.379
Family history of diabetes	-0.231	0.794	0.522 to 1.208	0.281
Distance from the primary health institution closest to home	0.194	1.214	0.829 to 1.779	0.319
Resident	0.416	1.516	0.889 to 2.585	0.127
Health insurance				0.472
Areas				<0.001
Perceived susceptibility	0.428	1.534	0.458 to 5.141	0.488
Perceived severity	1.483	4.406	1.341 to 14.479	0.015
Perceived benefits	1.930	6.889	1.752 to 27.097	0.006
Perceived barriers	-6.598	0.001	0.000 to 0.010	<0.001
Perceived effectiveness	1.314	3.721	0.710 to 19.510	0.120

Reference group: male; age <65 years; married; illiterate; non-agricultural; work status: no; local; personal monthly income <1000; household size <3; family history of diabetes: no; distance <1 km; rural; health insurance: others; western. outcome measure: scores of self-care behaviours ≤ 3 .

Bold value indicates P value less than 0.05.

female patients had healthier diet behaviours than male patients. Conversely, another study has shown that smoking can increase complications and reduce the life expectancy of patients with diabetes.²² In our study, there were fewer female patients who smoked than male patients, suggesting a better status of self-care among females than among males. Therefore, sex differences, including using different health management models, should be considered when conducting health education for patients with diabetes.

Furthermore, our study indicated that participants in the central region had lower levels of self-care than those in the western region. This difference in self-care behaviours between regions may be related to the socio-economic factors, cultural differences and health conditions of populations between regions.

Finally, our study found that perceived severity, perceived barriers and perceived benefits were significantly associated with self-care behaviours in patients. Perceived severity was a promoting factor for self-care behaviours, such that the higher the perceived severity, the better the self-care behaviours. This finding is similar to the finding reported by Daniel and Messer.²³ The reason may be that when patients are more aware about diabetes and its serious complications, they are more likely

to recognise it as a health threat and consciously adopt healthy behaviours. Meanwhile, Karimy *et al*²⁴ surveyed 210 women with diabetes in Iran and reported negative associations were found between perceived barriers and self-care behaviours. Barriers are the potential negative aspects of self-care behaviours, and perceived barriers may impede in undertaking recommended behaviours. A previous study conducted by Aalto and Uutela²⁵ and Jalilian *et al*²⁶ also found similar associations of perceived barriers and self-care behaviours, which is consistent with the results of our study. Additionally, Bernal *et al*²⁷ found a significant relationship between perceived benefits and self-care behaviours in 97 Spanish patients with diabetes. In our study, patients with higher levels of perceived benefits were more inclined to better self-care behaviours, consistent with the findings of Dehghani-Tafti *et al*.¹⁴ However, perceived susceptibility and perceived effectiveness had no significant associations with self-care behaviours, which may be due to differences in the study population, social culture and the types of self-care behaviours assessed.

This study had a few limitations that should be considered when interpreting the findings of this study. First, this was a cross-sectional study; therefore, a causal relationship between self-care behaviours and health beliefs

could not be inferred. In addition, all data were based on the self-report of participants; therefore, the findings might be limited by a recall bias or social desirability bias.

CONCLUSION

The findings of this study indicate that some Chinese patients with type 2 diabetes exhibit suboptimal self-care behaviours. Consequently, patients with diabetes might have an increased risk of developing diabetes-related complications, such as nephropathy and retinopathy. Several factors that affect the self-care behaviours of these participants, and further investigation is needed in this regard. This study supports support for the use of the HBM to assess the adherence of patients to self-care behaviours among patients with type 2 diabetes in China. Further research is recommended to examine how interventions can be designed to use the HBM as a part of patients education. Lastly, this study provides an essential framework for educating patients with diabetes so that they can increase their adherence to self-care behaviours and adopt more strategies to promote self-care behaviours.

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Competing interests None declared.

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Patient consent for publication Consent obtained directly from patient(s).

Ethics approval Ethical approval was obtained from the Research Ethics Committee of Anhui Medical University before data collection (reference number: 20150082). Participants gave informed consent to participate in the study before taking part.

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REFERENCES

- Delavari A, Mahdavi Hazaveh A, Norozi Nejad A. *The National diabetes prevention and control programme*. 2nd edn. Tehran: Seda Publishing Center, 2003: 24.
- Abdoli S, Ashktorab K, Ahmadi F. Barriers and facilitators the empowerment of people with diabete. *Journal of Endocrinology and Metabolism* 2008;10:455–64.
- Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res Clin Pract* 2010;87:4–14.
- International Diabetes Federation. *IDF diabetes atlas 2019*. 9th edition. Williams, 2019. <https://www.diabetesatlas.org/en/>
- Sun XM, Xue G. [Retrospect and prospect of self-management research]. *Advances in Psychological Science* 2008;16:106–13.
- Lorig KR, Holman H. Self-Management education: history, definition, outcomes, and mechanisms. *Ann Behav Med* 2003;26:1–7.
- Dong F, Sun LY, ZL Y. [Discussion on health management model of diabetes mellitus based on regional health information platform]. *Chin J of PHM* 2018;34:343–9.
- Alatawi YM, Kavookjian J, Ekong G, et al. The association between health beliefs and medication adherence among patients with type 2 diabetes. *Res Social Adm Pharm* 2016;12:914–25.
- Ayele K, Tesfa B, Abebe L, et al. Self care behavior among patients with diabetes in Harari, eastern Ethiopia: the health belief model perspective. *PLoS One* 2012;7:e35515.
- Wdowik MJ, Kendall PA, Harris MA, et al. Expanded health belief model predicts diabetes self-management in college students. *J Nutr Educ* 2001;33:17–23.
- Lei GQ. [A comparative study of health action research and classical behavior change theories]. *Chinese Journal of Health Education* 2017;33:764–7. (in Chinese).
- Karimy M, Montazeri A, Araban M. The effect of an educational program based on health belief model on the empowerment of rural women in prevention of brucellosis. *Arak Medical University Journal* 2012;14:85–94.
- Harvey JN, Lawson VL. The importance of health belief models in determining self-care behaviour in diabetes. *Diabet Med* 2009;26:5–13.
- Dehghani-Tafti A, Mazloomi Mahmoodabad SS, Morowatisharifabad MA, et al. Determinants of self-care in diabetic patients based on health belief model. *Glob J Health Sci* 2015;7:33–42.
- Alrahi H. Diabetes self-management (DSM) in Omani with type-2 diabetes. *Int J Nurs Sci* 2014;1:352–9.
- Al-Khawaldeh OA, Al-Hassan MA, Froelicher ES. Self-Efficacy, self-management, and glycemic control in adults with type 2 diabetes mellitus. *J Diabetes Complications* 2012;26:10–16.
- Tan MY. The relationship of health beliefs and complication prevention behaviors of Chinese individuals with type 2 diabetes mellitus. *Diabetes Res Clin Pract* 2004;66:71–7.
- Huang XM, Wang HP, Yin J. [Status quo of self-management behaviors and its influencing factors among type 2 diabetes patients in ShanDong province]. *Chin J Public Health* 2019;35:1474–6. (in Chinese).
- Sharifirad G, Entezari MH, Kamran A, et al. The effectiveness of nutritional education on the knowledge of diabetic patients using the health belief model. *J Res Med Sci* 2009;14:1–6.
- Xu Y, Pan W, Liu H. Self-Management practices of Chinese Americans with type 2 diabetes. *Nurs Health Sci* 2010;12:228–34.
- De Melo M, de Sa E, Gucciardi E. Exploring differences in Canadian adult men and women with diabetes management: results from the Canadian community health survey. *BMC Public Health* 2013;13:1089.
- Will JC, Galuska DA, Ford ES, et al. Cigarette smoking and diabetes mellitus: evidence of a positive association from a large prospective cohort study. *Int J Epidemiol* 2001;30:540–6.
- Daniel M, Messer LC. Perceptions of disease severity and barriers to self-care predict glycemic control in Aboriginal persons with type 2 diabetes mellitus. *Chronic Dis Can* 2002;23:130–8.
- Karimy M, Araban M, Zareban I. Determinants of adherence to self-care behavior among women with type 2 diabetes: an explanation based on health belief model. *Med J Islam Repub Iran* 2016;30:368.
- Aalto AM, Uutela A. Glycemic control, self-care behaviors, and psychosocial factors among insulin treated diabetics: a test of an extended health belief model. *Int J Behav Med* 1997;4:191–214.
- Jalilian F, Motlagh FZ, Solhi M. Effectiveness of self-management promotion educational program among diabetic patients based on health belief model. *J Educ Health Promot* 2014;3:75–9.
- Bernal H, Woolley S, Schensul JJ, et al. Correlates of self-efficacy in diabetes self-care among Hispanic adults with diabetes. *Diabetes Educ* 2000;26:673–80.