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The Status and Influencing Factors of Knowledge and Behavior of Diabetes Prevention among Elderly Individuals in Rural China

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Abstract

Background: This study was designed to investigate the status of diabetes-related health literacy among the elderly in rural China and to explore the influencing factors.

Methods: The "Chinese Public Diabetes Prevention and Control Literacy Questionnaire" and a general socio-demographic questionnaire were completed by the participants selected by the multistage cluster random sampling method. The collected data were used to analyse the factors affecting diabetes-related health literacy of the rural elderly.

Results: A total of 867 elderly aged 60 years and over participated in this study. The average score for diabetes-related health literacy was 18.64 ± 8.68; among the study population, 2 individuals, 408 individuals, and 457 individuals were in the high, medium, and low levels of health literacy, respectively. The results of a statistical analysis showed that sex (OR=1.511, 95% CI: 1.052-2.172), marital status (OR=0.571, 95% CI: 0.384-0.849), personal annual income (OR=1.575, 95% CI: 1.009-2.457), history of hyperglycaemia (OR=0.363, 95% CI: 0.184-0.717), and pre-diabetes (OR=23.406, 95% CI: 15.661-34.981) were the main influencing factors of diabetes-related health literacy among the elderly in Yiyang City, Hunan Province.

Conclusion: The level of diabetes-related health literacy was very low among the elderly in China's rural areas. This indicates that diabetes health education for the rural elderly population should be strengthened through multiple channels in the future, and more attention should be paid to older male adults with unstable marriage, poor economic conditions, prediabetes, and no history of hyperglycaemia.

Keywords: Diabetes mellitus; Rural Health; Hyperglycaemia; Prediabetes

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Background

Health literacy refers to the individuals' ability to acquire, understand, and process basic health information and services and to make decisions that help maintain and improve their own health [1]. Studies have confirmed that health literacy is an important factor affecting health. People with low health literacy do not follow their doctor's advice or self-care procedures well, and they cannot effectively use the complex health care systems, resulting in increased personal and national health expenditures [2,3].

Diabetes is one of the largest global health emergencies of the 21st century. Diabetes is among the top 10 causes of death globally and together with the other three major Non-Communicable Diseases (NCDs) (cardiovascular disease, cancer and respiratory disease) account for over 80% of all premature NCD deaths. It may cause various complications such as retinopathy, neurological mutations, cardiovascular diseases, etc., engendering a huge disease burden and economic losses to human society [4]. In 2010, the prevalence of diabetes and prediabetes in adults in China was 11.6% and 50.1%, respectively, affecting approximately 114 million and 493 million people [5]. One study suggests that people can effectively prevent the occurrence of type 2 diabetes via practicing appropriate interventions, and the implementation of these behaviours needs to be based on a certain level of diabetes-related health literacy [6]. It is an effective and easy measure to reduce the incidence of diabetes in the rural elderly by improving their diabetes-related health status.

This study aims to provide a reference for formulating an intervention for type 2 diabetes among the rural elderly by understanding the status of health literacy of diabetes in a rural elderly

population in Yiyang, Hunan, and analysing the influencing factors.

Materials and Methods

Participants

A cross-sectional survey was conducted among rural elderly residents of Yiyang City, from April to July 2015. Using a multistage cluster random sampling method, three counties were randomly selected from the seven counties in Yiyang City; four townships were then randomly chosen from each county; finally, three or four villages were randomly selected from each township. In the end, a total of 42 natural villages were selected as survey sites.

Local residents with a registered permanent residence or those without such a residence but who had resided locally for 6 months and were aged 60 years old were invited to participate in this study voluntarily; these individuals were identified as subjects. We excluded people who could not complete the communication tasks of this study. Also, in our study, patients who meet the diabetes diagnosis were excluded because those one may have good diabetes-related health literacy under the influence of doctors, furthermore, these patients are no longer at high risk in the field of diabetes prevention.

This research survey was approved by the Medical Ethics Committee of the Institute of Clinical Pharmacology, Central South University. All investigated subjects signed informed consent. Informed consent was obtained individually from all participants in the study.

Measurement

General information: The self-administered questionnaire was used to collect general information, concerning the subjects, including age, sex, education level, marital status, personal annual income, and history of hyperglycaemia (experiences with blood glucose levels higher than normal but not indicative of a diabetes diagnosis), family history of diabetes (individuals with immediate family members who have diabetes), chronic disease history (hypertension, coronary heart disease, hyperlipidaemia or other chronic diseases).

Diabetes-related health literacy

The level of diabetes-related health literacy was measured using the "Chinese Public Diabetes Prevention and Control Literacy Questionnaire", prepared by the China Health Education Center. The questionnaire has high intrinsic reliability and constructs validity, with a Cronbach's α of 0.866 and a split-half coefficient of 0.721. The questionnaire includes diabetes knowledge, diabetes-related preventative behaviour, and the acquisition and utilization of diabetes information, which are counted as 29 points, 15 points and 10 points, respectively.

The diabetes knowledge section assessed typical symptoms of diabetes, complications of diabetes, high risk factors of developing diabetes and methods to prevent diabetes; the score of this section was 1 point for a correct answer and 0 points for a wrong answer or a "don't know" response. Diabetes-related preventive behaviour mainly involved questions on the average amount of time spent sitting every day, the frequency of exercise and physical examinations, the regularity and taste of the subjects' daily diet, and their current situation regarding smoking and alcohol consumption. Sitting less than 6 hr each day, exercising 3 or more times a week, undergoing more than one physical examination per year, having a regular and light daily diet, not smoking, and not drinking or drinking little or occasionally were defined as good diabetes-related preventive behaviors. The main contents of the section on acquisition and utilization of diabetes information were related to factors influencing the acquisition of diabetes information, the channels of getting information, and levels of trust in information sources and utilization of the Internet. Having lots of diabetes knowledge, considering whether diabetes knowledge can address needs, getting diabetes information easily, understanding this information well, and being able to identify correct diabetes information were considered to indicate good information acquisition and utilization ability. Those who showed good behaviour or good information acquisition and utilization were scored 2 points, while others scored 0 points.

The sum of the scores of the 50 items in the questionnaire was the final score of the subjects. In addition, according to the commonly used division criteria in mathematics, the scores were ranked from low to high to calculate the critical values of 73% and 27% of the total score, which were used as the demarcation points to divide the

Table 1: Characteristics of the elderly who participated in the survey.

Characteristics	Number	Percent
Age (years)		
60-69	476	54.9
70-79	339	39.1
≥ 80	52	6
Gender		
Male	368	42.4
Female	499	57.6
Marital status		
Stable (married)	621	71.6
Unstable (unmarried, divorced, widowed)	246	28.4
Education level		
Primary school and below	713	82.2
Junior high school and above	154	17.8
Personal annual income (yuan)		
≤ 2800	169	19.5
>2800	698	80.5
History of hyperglycaemia		
Yes	66	7.6
No	801	92.4
Family history of diabetes		
Yes	52	6
No	815	94
History of chronic disease		
Yes	393	45.3
No	474	54.7
Prediabetes		
Yes	434	50.1
No	433	49.9
BMI		
Lean	42	4.8
Normal	553	63.8
Overweight	201	23.2
Obese	71	8.2

Table 2: The status of the diabetes-related health literacy.

	Low level n (%)	Medium level n (%)	High level n (%)	Z -value	*P*- value
Age (years)				2.614	0.271
60-69	240(50.4)	235(49.4)	1(0.2)		
70-79	186(54.9)	152(44.8)	1(0.3)		
≥ 80	31(59.6)	21(40.4)	0(0)		
Sex				-1.162	0.245
Male	203(55.2)	163(44.3)	2(0.5)		
Female	254(50.9)	246(49.1)	0(0)		
Marital status				-2.353	0.019
Stable (married)	311(50.1)	310(49.9)	0(0)		
Unstable (unmarried, divorced, widowed)	146(59.3)	98(39.8)	2(0.8)		
Education level				-0.533	0.594
Primary school and below	379(53.2)	332(46.6)	2(0.3)		
Junior high school and above	78(50.6)	76(49.4)	0(0)		
Personal annual income (yuan)				-2.07	0.038
≤2800	101(59.8)	68(40.2)	0(0)		
>2800	356(51.0)	340(48.7)	2(0.3)		
History ofhyperglycaemia				-3.249	0.001
Yes	22(33.3)	44(66.7)	0(0)		
No	435(54.3)	364(45.4)	2(0.2)		
Family history of diabetes				-2.182	0.029
Yes	35(67.3)	17(32.7)	0(0)		
No	422(51.8)	391(48.0)	2(0.2)		
History of chronic disease				-4.601	0
Yes	241(61.3)	151(38.4)	1(0.3)		
No	216(45.6)	257(54.2)	1(0.2)		
Prediabetes				-18.327	0
Yes	364(83.9)	69(15.9)	1(0.2)		
No	93(21.5)	339(78.3)	1(0.2)		
BMI				11.476	0.009
Lean	24(57.1)	18(42.9)	0(0)		
Normal	269(48.6)	283(51.2)	1(0.2)		
Overweight	117(58.2)	83(41.3)	1(0.5)		
Obese	47(66.2)	24(33.8)	0(0)		

subjects' diabetes-related health literacy into high, medium and low levels.

Anthropometric measurements

Physiological and biochemical measurements mainly included height, weight, and blood glucose level. Height was measured to the nearest 0.1 cm using a rangefinder, and weight was measured without shoes and in light indoor clothing to the nearest 0.1 kg. BMI was computed according to the following formula: BMI=kg/m^2. Subjects were defined as being lean (BMI<18.5), normal (18.5<BMI<24.0), overweight (24.0<BMI<28.0) or obese (BMI ≥ 28.0), according to Chinese standards.

The oral glucose tolerance test (OGTT) was used to detect the subjects' blood glucose level. Subjects were instructed to maintain their usual physical activity and diet and to discontinue the use of drugs (such as diuretics, phenytoin sodium, etc.) that might affect the test results for a minimum of 3 days before the OGTT. Each subject was orally administered 75 g of anhydrous glucose powder dissolved in 300 ml of water within 5 min after an overnight fast of at least 10 hr. The venous blood was taken from the forearm on fasting and 2 hr after oral glucose; the blood samples were stored at -80°C and analyzed for blood glucose (mmol/L) for no more than 1 hr with commercially available reagents in the biochemical laboratory of the primary care centre in each village. Subjects with impaired fasting glucose (6.1 mmol/L ≤ fasting plasma glucose <7.0 mmol/L) and/or impaired glucose tolerance (7.8 mmol/L ≤ 2-hr post-glucose load <11.1 mmol/L) were diagnosed as having prediabetes.

Data analysis

All statistical analyses were conducted using SPSS Version 18. Basic information about the subjects was described by the percentage, mean ± SD. The Kruskal-Wallis H test was utilized to examine group differences in the level of diabetes-related health literacy among

Table 3: Results of ordinal regression analysis of influencing factors for diabetes-related health literacy.

Factor	b	S_b	Waldc^2	P	OR (95% CI)
Gender					
Male	0.37	0.184	4.055	0.044	1.448 (1.009-2.076)
Female					1.000 (Ref)
Marital status					
Stable (married)	-0.56	0.202	7.694	0.006	0.571 (0.384-0.849)
Unstable (unmarried, divorced, widowed)					1.000 (Ref)
Personal annual income (yuan)					
≤ 2800	0.444	0.226	3.848	0.05	1.559 (1.001-2.428)
>2800					1.000 (Ref)
History of hyperglycaemia					
Yes	-1.008	0.345	8.525	0.004	0.365 (0.186-0.718)
No					1.000 (Ref)
Prediabetes					
Yes	3.167	0.204	242.078	0	23.736 (15.913-35.405)
No					1.000 (Ref)

individuals aged 60 and above. Ordinal regression analysis was used to analyse the influencing factors of diabetes-related health literacy. Multivariate analysis included adjustment for age, sex, marital status, education level, individual annual income, and prediabetes, history of hyperglycaemia, family history of diabetes, chronic disease history, and BMI. Diabetes-related health literacy was divided into high, medium, and low levels as dependent variables. These variables were included in the regression model for ordinal regression analysis, and the OR value was calculated using the formula OR=exp(b) to explore risk factors for low diabetes-related health literacy. Statistically significant results were defined as $p<0.05$.

Results

The characteristic of the subjects

A total of 867 elderly people aged 60 and over were included in the analysis. The subjects' average age was 69.38 ± 6.55 years; 42.4% of participants were male, and 72.5% were married individuals. Most of the subjects were educated at primary school or below (82.2%) and had a personal annual income of 2800 Yuan or more (80.5%). Only a small number of the subjects had a history of hyperglycaemia (7.6%) and a family history of diabetes (6.0%). There were 393 subjects with chronic diseases; of those subjects, 71.5% had hypertension, 4.8% had coronary heart disease, 3.1% had hyperlipidaemia, 20.6% had other chronic diseases, and 18.6% had more than 2 chronic diseases. Regarding weight, 23.2% of the subjects were overweight, and 8.2% were obese. Table 1 summarizes the demographic characteristics of all the elderly who participated in this study.

Diabetes-related health literacy status

The average score of diabetes-related health literacy of the subjects was 18.64 ± 8.68 points; among the participants, there were 408 individuals with medium levels of health literacy and 457 persons with low levels; only 2 individuals were classified as having a high level of literacy. Univariate analysis was conducted using the Kruskal-Wallis H test to determine the effects of different characteristics and health literacy among the subjects. The results showed that there were significant differences in the composition of the level of diabetes-related health literacy among the elderly, with differences in marital status, personal annual income, hyperglycaemia history, diabetes family history, chronic disease history, prediabetes, and BMI ($P<0.05$) (Table 2).

Factors affecting diabetes-related health literacy

The results of the ordinal regression analysis of factors influencing the level of diabetes-related health literacy among the rural elderly are shown in Table 3.

The model likelihood ratio test showed that the ordinal regression model was statistically significant ($c^2=400.200$, $P<0.01$). The independent factors affecting the level of diabetes-related health literacy in the rural elderly were sex, marital status, personal annual income, history of hyperglycaemia, and prediabetes, after controlling for variables such as age, sex, marital status, education level, personal annual income, prediabetes, history of hyperglycaemia, family history of diabetes, chronic disease history, and BMI. Elderly subjects who were male (OR=1.511, 95% CI: 1.052 to 2.172) with a unstable marriage (OR=0.571, 95% CI: 0.384 to 0.849), had a lower personal annual income (OR=1.575, 95% CI: 1.009 to 2.457), and had prediabetes (OR=23.406, 95% CI: 15.661 to 34.981) were more likely to have a low level of diabetes-related health literacy, but subjects with a history of hyperglycaemia (OR=1.511, 95% CI: 1.052 to 2.172) had a positive effect on their diabetes-related health literacy level.

Discussion

Of the 867 respondents in the surveyed rural areas of Yiyang City, Hunan Province, only 2 individuals had a high level of diabetes-related health literacy, and more than half were at low levels. This result is far lower than the survey of public diabetes health literacy in six provinces of China in 2013 [7], which illustrates that the diabetes-related health literacy of people aged 60 and above in the rural areas of Yiyang City, Hunan Province is at a relatively low level.

Health literacy enables people to obtain and better understand health-related information and use this information in their daily life to effectively promote their own health status [8]. Diabetes health literacy can affect people's behaviours, such as medical compliance, blood glucose control, health service utilization and so on [9-11].

At present, the phenomenon of low health literacy is more common in the elderly population [12], and diabetes is developing faster in rural areas than in urban areas; these are the reasons why the public health sector should pay more attention to the factors that influence the diabetes-related health literacy of the elderly in rural areas and develop a practical health education strategy.

This study found that men's diabetes-related health literacy levels were lower than those of women. Because of the differences in the division of labour between men and women in rural families in China, women will spend more time and energy on health-related information in their daily lives; there are similar findings in other studies [13,14]. The elderly in "maritally stable" get more care in daily lives, had relatively strong self-care awareness, and focused more on elderly chronic diseases. Thus, the health information knowledge they accessed was more active, and this finding is reflected in other studies [15,16]. The elderly with poor economic conditions have few opportunities to improve their quality of life after solving the problem of food and clothing. It is difficult to actively acquire knowledge of health among the elderly with poor self-care awareness, and their levels of diabetes-related health literacy were lower compared to those of older people with good economic conditions; this, too, has been observed in previous studies [15,16]. A history of hyperglycaemia was a protective factor for diabetes-related health literacy. This may be because this group of older adults had previous experience with blood glucose values above the normal range, prompting them to increase their awareness about preventing diabetes; thus, they had more knowledge about diabetes and good diabetes-related preventive behaviours. The elderly participants with prediabetes had lower levels of diabetes health literacy than did those without prediabetes, which was screened through OGTT during the study period. Currently, public awareness of prediabetes is still insufficient. This may be because these elderly participants did not pay attention to the prevention of diabetes in their lives and had little knowledge of diabetes-related information; therefore, it was shown that the elderly with prediabetes had lower levels of diabetes-related health literacy. In addition, in other studies of health literacy, similar findings have not yet been made. This study was cross-sectional, so the causal relationship between prediabetes and diabetes-related health literacy cannot be inferred.

Males with unstable marriage, poor economic conditions exhibited lower levels of diabetes-related health literacy; those in this elderly sub-population were less likely to correctly identify the proper answers to questions, displaying bad diabetes-related preventive behaviour and showing poor ability concerning the acquisition of diabetes information and its utilization. Our study was the first time that a history of hyperglycaemia was found to be a protective factor for diabetes-related health literacy in the rural elderly and that prediabetes existed as a risk factor at the same time. These findings help to identify an area of diabetes-related health literacy that should be improved in the Chinese rural elderly, namely, health education programmes targeted towards increasing the level of diabetes-related health literacy in the rural male elderly with poor economic conditions, no history of hyperglycaemia, and pre-diabetes. Further research is needed in order to determine whether diabetes-related health literacy can affect the occurrence of diabetes, and intervention studies of health literacy should be implemented not only to improve the quality of life among the rural elderly but also to reduce of the country's disease burden.

Conclusion

The findings from this study suggest that the elderly population in China's rural areas has low levels of health literacy about diabetes prevention and control. Males with unstable marriage, poor economic conditions exhibited lower levels of diabetes-related health literacy; those in this elderly sub-population were less likely to correctly identify the proper answers to questions, displaying bad diabetes-related preventive behaviour and showing poor ability concerning the acquisition of diabetes information and its utilization. Our study was the first time that a history of hyperglycaemia was found to be a protective factor for diabetes-related health literacy in the rural elderly and that prediabetes existed as a risk factor at the same time. These findings help to identify an area of diabetes-related health literacy that should be improved in the Chinese rural elderly, namely, health education programmes targeted towards increasing the level of diabetes-related health literacy in the rural male elderly with poor economic conditions, no history of hyperglycaemia, and pre-diabetes. Further research is needed in order to determine whether diabetes-related health literacy can affect the occurrence of diabetes, and intervention studies of health literacy should be implemented not only to improve the quality of life among the rural elderly but also to reduce of the country's disease burden.

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Authors' Contribution

HX designed the study, critically revised the manuscript. TZ performed the statistical analyses and critically revised the manuscript. TZ contributed to the research question, the drafting and final approval of the manuscript. HX is the guarantor of this work, and as such, had full access to all the data in the study and accepts responsibility for the integrity of the data and the accuracy of the data analysis. All authors read and approved the final manuscript.

Ethics approval and consent to participate: Informed written consent was obtained from participants prior to data collection. This research survey was approved by the Medical Ethics Committee of the Institute of Clinical Pharmacology, Central South University.

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