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Development and evaluation of the health belief model scale for exercise

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ABSTRACT

Objectives: This study was aimed to develop a health belief model scale for exercise among Chinese residents to describe the relationships between health beliefs and exercise for promoting residents to adopt or maintain exercise programs.

Methods: Participants were from two projects, Project 1 with 3833 participants and Project 2 with 7319 participants. A pool of 21 items was developed based on a small-scale qualitative study about health beliefs of exercise and literature. Internal consistency and construct validity of the scale were evaluated with Cronbach's α coefficient, exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and second-order confirmatory factor analysis.

Results: A final version of 18 items loaded on six factors which could explain 60.30-% of variance was observed after EFA. The internal consistency of the final version with 18 items performed in Project 1 was acceptable (0.609). The reliability of the six subscales was good with Cronbach's α coefficient of 0.628, 0.713, 0.628, 0.801, 0.676 and 0.838 for perceived benefits, perceived objective barriers, perceived subjective barriers, self-efficacy, perceived severity and cues to action, respectively. CFA and second-order CFA indicated a good fit to data.

Conclusions: The Health Belief Model Scale for Exercise (HBMS-E) is a valid and reliable instrument to assess health beliefs of exercise among residents in China. Understanding the health beliefs of exercise will help health professionals to develop effective interventions for health and evaluate the effectiveness. © 2020 The author(s). Published by Elsevier B.V. on behalf of the Chinese Nursing Association. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

What is known?

- The prevalence of physical inactivity has grown ever faster, leading to approximately 3.2 million deaths per year.
- Several instruments based on health belief model were developed and evaluated for measuring relationships between health beliefs and a disease or one kind of behavior, while few published papers were reported to develop and evaluate instruments based on the health belief model to measure the health beliefs with regard to exercise among residents in China.

What is new?

- The Health Belief Model Scale for Exercise (HBMS-E) is a valid and reliable instrument to measure relationships between health beliefs and exercise among adults.
- Perceived barriers, one of the most important components in health belief model, was classified to perceived objective barriers and perceived subjective barriers to develop more specific interventions.

1. Introduction

Regular exercise is beneficial for overall health, particularly in later life [1]. Regular exercise can limit the development and progression of chronic diseases and disabling conditions and increase active life expectancy [2]. Whatever an adult does any amount of physical activity, he or she will gain some health benefits and 150 min of moderate-intensity aerobic activity per week is

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Table 1
Demographic characteristics [n (%)].

Demographic Characteristics	Project 1 for EFA (N = 3833)	Project 2 for CFA (N = 7319)
Age, Mean ± SD	43.20 ± 15.00	41.80 ± 15.60
Gender		
Male	1716 (44.8)	3631 (49.6)
Female	2117 (55.2)	3624 (49.5)
Missing values	0	64 (0.9)
Educational level		
Primary school or below	421 (11.0)	826 (11.3)
Middle school	1678 (43.8)	3001 (41.0)
High school	1039 (27.1)	1951 (26.7)
University and above	666 (17.4)	1528 (20.9)
Missing values	29 (0.8)	13 (0.2)
Monthly household income(RMB)		
<3000	987 (25.8)	1521 (20.8)
3000–3999	618 (16.1)	1132 (15.5)
4000–4999	660 (17.2)	1132 (15.5)
5000–9999	1096 (28.5)	2190 (29.9)
≥10000	442 (11.5)	1334 (18.2)
Missing values	30 (0.8)	10 (0.1)

Table 2
Factor loading of rotated factor analysis of the Health belief Scale for Exercise.

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
1. I think that the rational amount of every day is conducive to good health.	0.07	0.07	0.03	0.05	0.76	−0.15
2. I believe that the regular exercise every day is beneficial to control chronic diseases.	0.05	0.08	−0.01	0.15	0.77	0.04
3. I'm sure that the regular exercise every day is good for weight control	0.08	0.02	−0.04	0.19	0.73	−0.01
4. I do not find suitable sports venues around	0.07	0.01	0.74	−0.03	0.00	−0.00
5. Nobody companies with me to exercise	−0.06	−0.04	0.78	−0.011	−0.00	0.05
6. I have no time to exercise	−0.19	−0.05	0.65	0.010	−0.02	0.25
7. I have not found proper exercise	−0.17	−0.05	0.66	−0.01	−0.01	0.37
8. I'm too lazy to exercise	−0.41	0.04	0.24	−0.03	0.01	0.57
9. I think that it's painful to exercise	−0.18	0.04	0.20	−0.01	−0.02	0.75
10. I can not see the benefits of exercise	0.10	−0.03	0.09	−0.08	−0.10	0.78
11. I'm sure that I can exercise every day	0.79	0.08	−0.11	0.13	0.06	−0.12
12. I'm sure that I can exercise every day even through nobody company with me	0.77	0.07	−0.07	0.16	0.02	−0.14
13. I'm sure that I can find time to exercise	0.69	0.17	−0.16	0.21	0.05	−0.10
14. Lack of exercise makes me less energetic	0.30	0.12	−0.02	0.63	0.04	−0.07
15. Lack of exercise can increase the risk of chronic diseases	0.06	0.10	−0.00	0.78	0.23	0.01
16. Lack of exercise can increase my weight	0.06	0.14	−0.02	0.78	0.18	−0.06
17. I think I have enough exercise every day.	0.60	−0.01	0.007	−0.08	0.08	0.07
18. I think I am intend to increase my physical activity level.	0.43	0.38	0.03	0.12	0.08	−0.08
19. My friends always remind me to exercise.	0.10	0.88	−0.06	0.11	0.06	0.03
20. My family always remind me to exercise	0.06	0.88	−0.06	0.12	0.05	0.00
21. My doctors always remind me to exercise	0.09	0.79	0.01	0.07	0.07	0.01
Eigenvalue	4.48	2.63	1.79	1.65	1.07	1.04
Explained Variance(%)	21.33	12.54	8.51	7.87	5.09	4.95
Cumulative Variance(%)	21.33	33.87	42.38	50.25	55.34	60.30

Note: Factor 1: self-efficacy, Factor 2: cues to action, Factor 3: perceived objective barriers, Factor 4: perceived severity, Factor 5: perceived benefits, Factor 6: perceived subjective barriers.

substantial to reduce the risk of many chronic diseases [3]. However, the prevalence of physical inactivity has grown ever faster, leading to approximately 3.2 million deaths per year [4]. In China, the rate of regular exercise among residents aged from 20 to 69 years old was only 18.7% in 2013 [5]. Such data shows that Chinese people are largely inactive.

An understanding of the determinants that cause physical inactivity among residents is essential for health professionals to develop interventions. A review categorized these determinants into three types, characteristics of the person and his lifestyle habits, characteristics of the environment and the activity itself [6]. Physical activity determinants could also be divided into two broad categories: individual characteristics, including motivations, self-efficacy and so on; and environmental characteristics, for instance, access, cost, and time barriers [7]. Many determinants could influence exercise participation, and their correlations were very complex.

Several theories have been utilized to explain and predict exercise behavior. The self-determination theory was used to explore the relationships between autonomy support, psychological need satisfaction, motivational regulations and exercise behavior [8]. A meta-analysis suggested that the theory of planned behavior was more effective than the theory of reasoned action in explaining exercise behavior and the relationship between the constructs of the theory and exercise behavior was larger [9]. A critical literature review also reported that the theory of planned behavior was a more promising theory to explain and predict exercise behavior [10]. The theory of planned behavior, the self-efficacy theory, and the trans-theoretical model of behavior change, with self-determination theory were the most supported theories in the exercise domain [11].

Health Belief Model (HBM) has also been applied in large number of studies to explain and predict exercise behavior. HBM is one conceptual framework that can be conducted to predict and

Table 3
Reliability coefficients of subscales.

Subscales	Number of items	Items	Cronbach's α if Item Deleted	Cronbach's α	Cronbach's α of subscale if some items deleted
Perceived benefits	3	a1	0.56	0.63	
		a2	0.50		
		a3	0.52		
Perceived objective barriers	4	a4	0.70	0.71	
		a5	0.64		
		a6	0.65		
		a7	0.62		
		a8	0.53		
Perceived subjective barriers	3	a9	0.40	0.63	
		a10	0.64		
		a11	0.64		
Self-efficacy	5	a12	0.65	0.74	0.80
		a13	0.67		
		a17*	0.77		
		a18*	0.74		
		a14*	0.68		
Perceived severity	3	a15	0.50	0.66	0.68
		a16	0.52		
		a19	0.72		
		a20	0.74		
Cues to action	3	a21	0.86	0.84	

Note: *item was deleted finally.

explain physical activity [12]. HBM was utilized to explore physical activity engagement among older adults [13]. HBM was used to enhance physical activity during pregnancy among 90 pregnant women [14]. HBM was applied to identify determinants with physical activity in different age and different cultural backgrounds and it also was utilized to investigate the factors associated with physical activity among middle-aged women [15]. An education plan based on HBM on the physical activity of women with hypertension was investigated [16].

The original model of HBM includes the following four parts: perceived benefits, perceived susceptibility, perceived severity and perceived barriers [17]. Later, self-efficacy [18] and cues to action [19] were added to the model. Therefore, by now, six key domains are included in the model [12]. Perceived benefits of exercise will influence the probability of an individual adopting or maintaining an exercise program. More benefits will arouse more willingness to do exercise. Although perceived benefits will promote an individual to do exercise, perceived barriers such as inconvenience or lack of time may to some extent inhibit the participation in exercise programs or influence adherence to exercise programs. Self-efficacy is the confidence in one's ability to exercise. Self-efficacy was significant in increasing physical activity in Chinese immigrant women [20]. Cues to action, will encourage an individual to take a health action. If an individual decides to adopt an exercise program, firstly, he must believe that he is susceptible to health problems. An individual will not seek exercise behavior, unless he reviews himself as potentially vulnerable to physical inactivity and views this condition as a threat [11]. Significant findings for perceived benefits, perceived severity, perceived susceptibility, perceived barriers, cues to action and self-efficacy were showed in intention to change exercise behavior over time [21]. Health belief variables had a significant correlation with exercise participation among Jordanian myocardial infarction (MI) patients [22].

HBM is effective and powerful to predict and explain exercise behavior. Several instruments based on HBM were developed and evaluated the HBM constructs and health-related problems. Champion's health belief model (CHBM) scales for breast cancer and screening behavior were developed and revised [23,24]. It was also translated in Spanish version for breast cancer screening-mammography [25] and in Arabic version [26]. HBM scales for testicular cancer [27], for cervical cancer [28], and for diabetes [29]

were also developed and evaluated.

There have been a couple of previous studies to explore the factors of physical activity. An understanding of the determinants that cause physical inactivity among residents is essential for health professionals to develop interventions. However, this study was different from prior researches in this line. This paper was aims to develop a HBM scale that can be used as a tool to explore determinants influencing one's physical activity in the future. Several literature developed and evaluated a HBM scale for measuring relationships between health beliefs and a disease or assessing correlations between health beliefs and behaviors. However, few published papers were designed to develop and evaluate instruments based on the HBM to measure the health beliefs with regard to exercise behavior among residents in China. Therefore, this study was designed to develop a HBM scale for exercise, and to explore the effect sizes of health beliefs in explaining and predicting the exercise behavior. Besides, in the study, the perceived barriers, one of the most important components in HBM, was classified to perceived objective barriers and perceived subjective barriers to develop more specific interventions. Meanwhile, the second-order confirmatory factor analysis was utilized to further explore the internal correlations of constructs of the HBM with exercise behavior.

2. Methods

2.1. Participants

Participants were from two projects, "Shunyi Community Diagnosis project" (Project 1), performed from July to September in 2014 and "Tongzhou Community Diagnosis project" (Project 2), performed from July to October in 2015. Both were conducted on general adult population in Beijing, and were cross-sectional studies. The methods of data collecting and interviewing, the inclusion and exclusion criteria were also the same. In both studies, probability proportional to size (PPS) sampling and proportional quota sampling were conducted to select participants according to demographic characteristics such as age, gender. Face-to-face interviews with a self-administrated questionnaire were conducted. That is, one trained investigator asked one participant questions in sequence and then marked the answers on the questionnaire. There

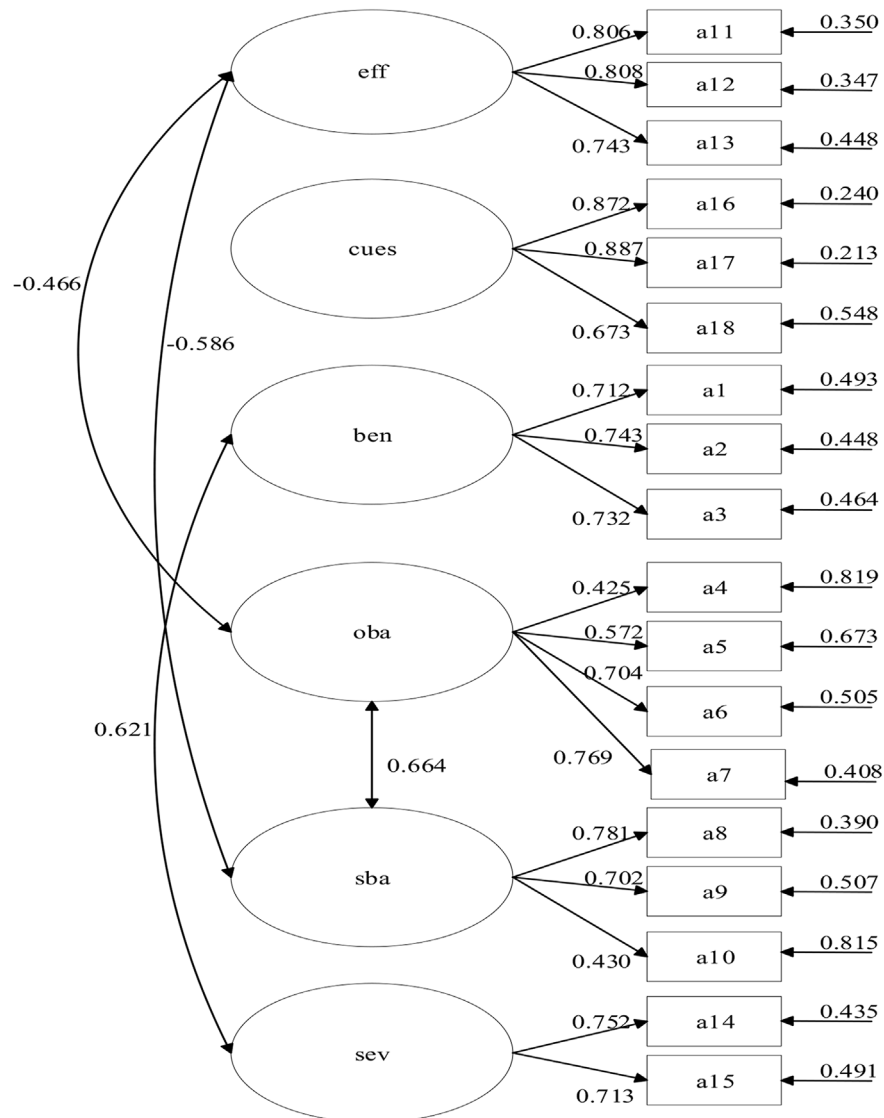


Fig. 1. The Confirmatory factor analysis model.

Large circles represented latent factor or theoretical construct. Rectangles represented measured variables or items. The parameter estimates were shown in parentheses. All factor loadings were statistically significant ($P < 0.05$). Model-fit indices were statistically acceptable [CFI = 0.96, NFI = 0.95, RMSEA = 0.05, SRMR = 0.03, $\chi^2 = 2037.7$, $df = 120$]. eff: self-efficacy; cues: cues to action; oba: perceived objective barriers; sba: perceived subjective barriers; ben: perceived benefits; sev: perceived severity.

were usually 7 to 10 trained workers for interview and 2 to 4 trained supervisors for quality control. After participant finished his questionnaire, he should submit the questionnaire to the auditor for auditing. During the inspection, the auditor would ask him some questions randomly to control quality.

Residents aged 18 and above and having ability to answer our questionnaire were recruited in this study. People unwillingness to participate in our investigation, living in two districts less than six months, or having no competence were excluded in the study.

2.2. Ethics statement

The study was approved by an institutional (IRB00001052-15041), and all participants signed informed consent forms before they were enrolled into the study. The researcher explained to participants that participation will entirely voluntary and the data will be treated anonymously and confidentiality and it will be used just for research purposes.

2.3. Instrument

Data was collected using a self-administrated questionnaire including three sections. The first section was about demographic characteristics such as age, gender, education level and income per person monthly, and the second part was the Health Belief Model Scale for Exercise (HBMS-E).

Initially, before the scale was developed, a small-scale qualitative study about health beliefs of exercise was conducted in Shunyi Community. There were 20 individuals involved with different characteristics to make sure that participants were from diverse demographic backgrounds. Firstly, some questions were asked to explore whether those subjects were familiar with those components of the HBM. For example, about the component of the perceived benefits of exercise, those subjects were asked that did you know the benefits of exercise. Secondly, collecting and analyzing those answers, and choosing 2 to 4 answers as items for each part of the HBM. Then evaluating the internal consistency and

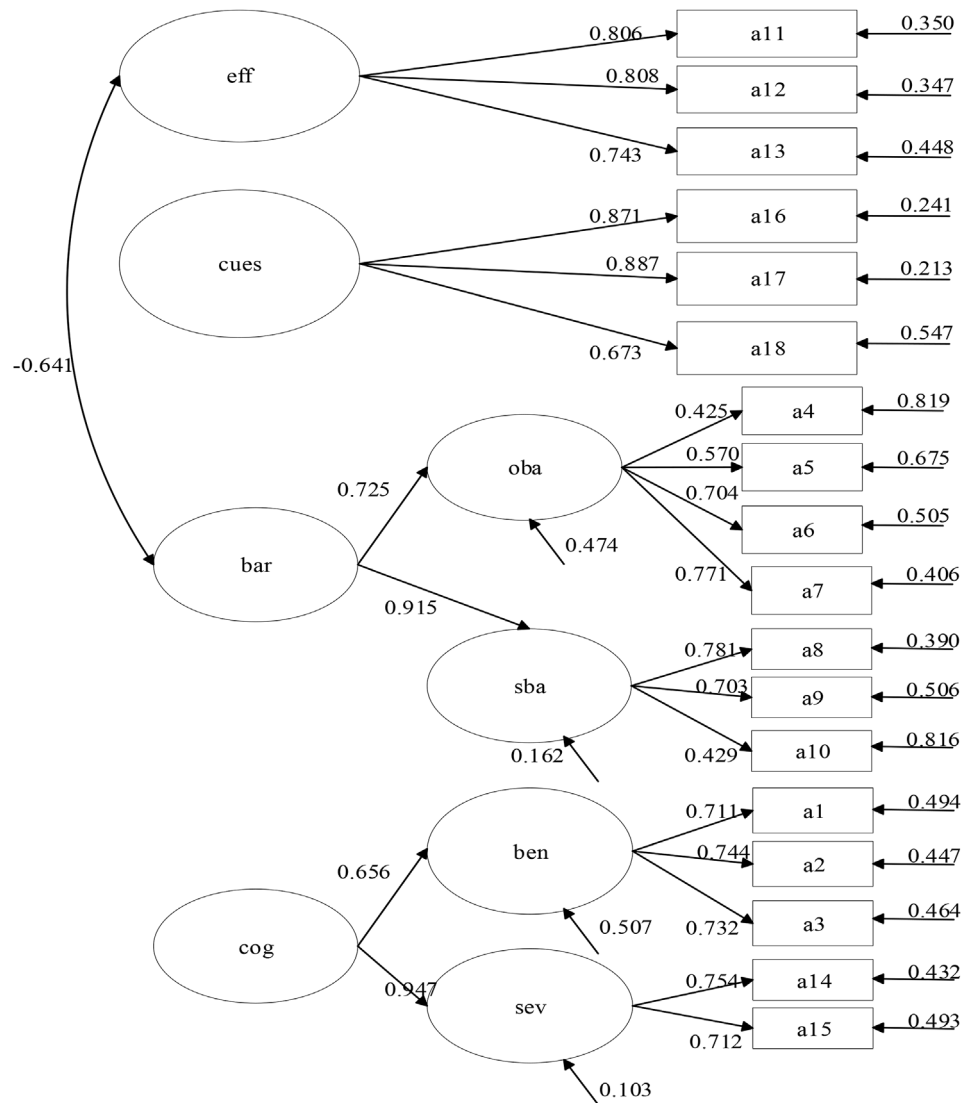


Fig. 2. The Confirmatory factor analysis second-order factors

All factor loadings were statistically significant ($P < 0.05$). Model-fit indices were statistically acceptable [CFI = 0.96, NFI = 0.95, RMSEA = 0.05, SRMR = 0.04, $\chi^2 = 2077.0$, $df = 125$]. eff: self-efficacy; cues: cues to action; oba: perceived objective barriers; sba: perceived subjective barriers; ben: perceived benefits; sev: perceived severity; bar: barriers; cog: cognitive.

construct validity of the scale with Cronbach's α coefficient, exploratory factor analysis (EFA), confirmatory factor analysis (CFA).

Then, based on the qualitative study and literature, first draft was developed and then discussed repeatedly. Finally, a pool of 21 items were generated and used in Project 1. Then, a comprehensive review was conducted to evaluate the validity and reliability of those items. Deleting three items, the final version included 18 items loaded on six factors: perceived benefits of exercise (3 items), perceived severity of physical inactivity (2 items), perceived self-efficacy (3 items), cues to action (3 items), perceived objective barriers (4 items) and perceived subjective barriers (3 items). These items of factors were measured on a Likert scale of 1 (totally disagree) to 5 (totally agree). Higher scores represented stronger feelings about that construct. That is, higher scores indicated higher level of self-efficacy, perceived benefits, cues to action, perceived objective and subjective barriers and perceived severity of physical inactivity.

2.4. Data analysis

Data was processed by EpiData 3.1 and analyzed by SPSS 18.0 and Mplus version 7.0. Mean and Standard Deviation (SD) were used to describe continuous variables, and frequency and percentages were used to describe categorical variables. The internal consistency was evaluated by Cronbach's α coefficient. The minimally acceptable reliability for preliminary research in the range of 0.5–0.6 was recommended [30]. The construct validity of the scale was measured using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). In the present study, EFA performed in Project 1, and CFA performed in Project 2.

In EFA, the factor structure was extracted by principal component analysis with varimax rotation. The Kaiser-Meyer-Olkin (KMO) and Bartlett's tests of sphericity were conducted to assess whether the sample was appropriated for EFA. The loading criterion was set equal or greater than 0.6 that was greater than 0.4 which was considered appropriate [31]. The cross-loaded with a difference in loadings was less than 0.1. The item-total correlation was set

equal or greater than 0.3 [32]. Factors with an eigenvalue greater than 1 were extracted.

In CFA, the model fitness was assessed by various fit indices including relative Chi-square (χ^2/df), Comparative Fit Index (CFI), Non-Normed Fix Index (NNFI/TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMA). Generally, a model showed good fit to data, if the following criteria were met: CFI>0.90 [33], TLI>0.90 [33], RMSEA<0.08 [34] and SRMR<0.08 [35]. Second-order confirmatory factor analysis was used to further explore internal correlations. Maximum Likelihood Estimator (MLR) was used to construct and fit the model for the data was not normal distribution. Although listwise deletion has several shortcomings, considering our sample size is large enough, listwise deletion is rational to deal with missing data in present study.

Generally, a *P-value*<0.05 was considered as statistically significant.

3. Results

3.1. Demographic characteristics

As shown in Table 1, Project 1 enrolled a total of 3833 subjects with the mean age of 43.20 (*SD* = 15.00) years and Project 2 had 7319 participants with the mean age of 41.80 (*SD* = 15.60) years. About 44.8% participants in Project 1 were male and 43.8% participants had a middle school degree, while in Project 2 49.6% participants were male and 41.0% participants had a middle school degree. With regard to income per month, 28.5% in Project 1 and 29.9% in Project 2 had income between RMB 5000 and RMB 9999.

3.2. Exploratory factor analysis (EFA)

Table 2 showed that the results of exploratory factor analysis (EFA) were acceptable. The KMO was 0.82 and the Bartlett's tests of sphericity was significant (*P* < 0.001), revealing sampling adequacy. Six factors based on HBM were extracted with an eigenvalue greater than 1. These factors together contributed to 60.30% of the variance. The item (self-efficacy 18) "I think I intend to increase the amount of exercise" was deleted for its loadings on all factors were lower than 0.6.

3.3. Reliability

The internal consistency of this scale was acceptable (0.65) and more details were shown in Table 3. According to the results of exploratory factor analysis and the results of reliability, item 17 and item 18 belonging to the factor of self-efficacy were removed because if both were deleted, the subscale reliability of self-efficacy could increase largely from 0.72 to 0.80 and the self-efficacy subscale would become more simply. Item 14 was deleted for three reasons. Firstly, if it was deleted, the reliability of the perceived severity subscale could increase to 0.68 from 0.66, and the subscale could become simpler. Besides, the operability of the item was not good. That is, it was difficult for participants to answer. Therefore, the final version included 18 items and the internal consistency was also acceptable (0.61). The Cronbach's α coefficients of the six subscales ranged from 0.63 to 0.84.

3.4. Stability

The internal consistency of the final version with 18 items performed in Project 1 was acceptable (0.61), and that was also acceptable in Project 2. The KMO was 0.82 and the Bartlett's tests of sphericity was significant (*P* < 0.001) in Project 2. The reliability

of the six subscales was good with Cronbach's α 0.76, 0.72, 0.67, 0.83, 0.70 and 0.85 for perceived benefits, perceived objective barriers, perceived subjective barriers, self efficacy, perceived severity and cues to action, respectively. The results suggested that this scale was stable.

3.5. Confirmatory factor analysis (CFA)

The final version with 18 items was tested in Project 2 and CFA was used to measure the construct validity of the scale. Fig. 1 showed that the results indicated that the model showed good fit to data ($\chi^2 = 2037.70$, *df* = 120, *P* < 0.001, CFI = 0.96, NFI = 0.95, RMSEA = 0.05, SRMR = 0.03). Standardized parameter estimates were presented in the CFA (Fig. 1). The correlations of latent factors, not all but only four large correlations between perceived objective barriers and self-efficacy (−0.47), perceived subjective barriers and self-efficacy (−0.59), subjective barriers and objective barriers (0.66), and perceived severity and perceived benefits (0.62) were high large. Assumptions were made that perceived objective barriers and subjective barriers were belong to the higher-order factor of perceived barriers; perceived benefits and perceived severity were belong to another higher-order factor of cognition. Second-order confirmatory factor analysis was used to further explore the internal correlations. Fig. 2 showed that the second-order factors model was acceptable (CFI = 0.96, NFI = 0.95, RMSEA = 0.05, SRMR = 0.04, $\chi^2 = 2077.0$, *df* = 125, *P* < 0.001).

4. Discussion

In this study, a final version of 18 items loaded on six factors could explain 60.296% of variance. The internal consistency of the final version with 18 items performed in Project 1 was acceptable (0.609) and CFA indicated a good fitness of data. The results showed that the structure of the HBMS-E could be accepted and HBM could be utilized as a tool to explore the factors influencing one's physical activity. Besides, it was effective for researchers to promote one's exercise that classifying the perceived barriers into perceived objective barriers and perceived subjective barriers to develop more specific interventions.

HBM was effective in the field of exercise or physical activity. Some HBM scale for some health issues have been developed and evaluated. Although there are several theoretical models using in exercise or physical activity behavior, some of them focus on exercise or physical activity interventions, while HBM focuses on explaining and predicting exercise behavior [36]. Health belief questionnaire was originally developed to explore the relationships between health beliefs and CHD exercise adherence [37]. A HBM based instrument for exercise behavior was developed and evaluated for preventing osteoporosis in pre-menopausal women [38]. This study was aimed to measure determinants of exercise, so HBM was employed and it was acceptable.

The construct of perceived barriers is very important in explaining and predicting exercise behavior. Overcoming barriers of exercise should be included in the exercise intervention programs, and access and time barriers are the most common barriers of exercise [7]. One of the strongest factors associated with physical activity was time constraint [39]. One literature divided perceived barriers into perceived objective barriers and perceived subjective barriers, and it was effective to find the most important determinant of using alt-restriction-spoons behavior [40]. In the present study, we categorized perceived barriers into objective barriers such as the access of exercise facilities and subjective barriers, for instance, an individual was too lazy to do exercise, in order to develop special and particular interventions to increase exercise. Besides, in this study, the construct of perceived susceptibility was

ignored considering the origin model was developed to explain and predict infectious diseases, while this study was conducted to exercise behavior.

As a result of exploratory factor analysis, six factors including 21 items were extracted totally. The six-factor model could explain 60.30% of variance, which is better than that of the HBM scale for Cervical Cancer, accounting for only 45.8% of the variance [28]. After exploratory factor analysis, one item (self-efficacy 18 item) was deleted for its factor loadings in all factors lower than 0.6.

According to the internal consistency, three items (self-efficacy 17 and 18 items and perceived severity 14 item) were removed. If they were deleted, the reliability of self-efficacy subscale and perceived severity subscale could increase largely and become simpler and more practical. The final version included 18 items loaded on six factors: perceived benefits (3 items), perceived severity (2 items), perceived objective barriers (4 items), perceived subjective barriers (3 items), self-efficacy (3 items), and cues to action (3 items). Although the reliability of HBM scale for exercise was acceptable, the internal consistency of the total scale was not better than that of HBM scale in diabetic patients [29].

Confirmatory factor analysis also showed that factor structure of this scale was appropriate. The indices of the structural model except relative chi-square (χ^2/df) suggested the model had a good fit to the data. The chi-square was 2037.7 suggesting that the model did not fit well with the data. However, the chi-square was more sensitive to sample size. In this study, as the sample size ($N = 7319$) was very large, it might not be a good index to examine the model fit. In order to further explore the internal correlations, second-order confirmatory factor analysis not the bi-factor model was employed. Because the second-order confirmatory factor analysis showed a good fit to data and the second-order confirmatory factor analysis was more simply than bi-factor model [2,41].

This study had a few limitations. Firstly, more studies should be designed on HBM scale to explore the culture adaptation among different countries and cultures. Secondly, there are some determinants such as an individual's unhealthy lifestyle or environment that can influence whether he or she will adopt or maintain an exercise program, but in this study, they were not included in. In future researches, more determinants should be taken into consideration. Thirdly, this is a cross-sectional study, so, the ability to explain the causal correlations between variables and exercise was limited. Finally, for the data analysis, the criterion validity was not tested and the GFI value was not calculated which should be considered in the future.

5. Conclusions

In conclusion, the exploratory factor analysis and confirmatory factor analysis indicated that the HBMS-E had a good structure. The Cronbach's α coefficient indicated that the internal consistency of the final scale was acceptable. The present study reported the stages of developing and evaluating the HBMS-E in Chinese residents. The results of this present study suggested the scale was a valid and acceptable instrument to measure the health beliefs of exercise among residents.

CRedit authorship contribution statement

Shiyan Wu: Methodology, Data Curation, Formal analysis, Investigation, Software, Writing-original draft. **Xinglin Feng:** Resources, Data Curation, Validation, Investigation, Writing- Original draft. **Xinying Sun:** Conceptualization, Methodology, Validation, Investigation, Supervision, Writing-Reviewing and Editing

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Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnss.2020.07.006>.

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