Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Journal of Integrative Medicine 19 (2021) 219–225

Contents lists available at ScienceDirect

Journal of Integrative Medicine

journal homepage: www.jcimjournal.com/jim
www.journals.elsevier.com/journal-of-integrative-medicine

Original Research Article

Impact of the COVID-19 pandemic on intention to use traditional Chinese medicine: A cross-sectional study based on the theory of planned behavior

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ARTICLE INFO

Article history:
Received 18 July 2020
Accepted 11 December 2020
Available online 22 January 2021

Keywords:
Coronavirus disease 2019
Theory of planned behavior
Traditional Chinese medicine
Intention

ABSTRACT

Objective: Coronavirus disease 2019 (COVID-19) has become an increasingly severe public health emergency. Although traditional Chinese medicine (TCM) has helped to combat COVID-19, public perception of TCM remains controversial. We used the theory of planned behavior (TPB) to identify factors that affect the intention to use TCM.

Methods: A cross-sectional web-based survey of 10,824 individuals from the general public was conducted between March 16 and April 2, 2020. The participants were recruited using a snowball sampling method. Data were collected using a self-administered questionnaire, based on the TPB. The questionnaire consisted of demographic characteristics and TPB structures. Structural equation modeling was used to identify predictors of intention.

Results: The results indicated the model explained 77.5% and 71.9% of intention and attitude variance. Intention to use TCM had the strongest relationship with attitude ($P < 0.001$), followed by past behavior ($P < 0.001$), subjective norms ($P < 0.001$) and perceived behavioral control ($P < 0.001$). Attitudes toward TCM were significantly affected by perceived behavioral control ($P < 0.001$), subjective norms ($P < 0.001$) and cognition of TCM ($P < 0.001$).

Conclusion: Attitude is a key factor in determining the intention to use TCM, followed by past behaviors, subjective norms and perceived behavioral control. Our results offer important implications for health policy makers to promote the use of TCM.

Please cite this article as: Xia Y, Shi LSB, Chang JH, Miao HZ, Wang D. Impact of the COVID-19 pandemic on intention to use traditional Chinese medicine: A cross-sectional study based on the theory of planned behavior. *J Integr Med.* 2021; 19(3): 219–225.

1. Introduction

An outbreak of the novel coronavirus disease 2019 (COVID-19) occurred in 2019 and was declared a global pandemic in March 2020 [1]. As of July 14, 2020, the World Health Organization had reported 12,768,307 COVID-19 cases worldwide, including 566,654 confirmed deaths [2]. COVID-19 has challenged public health systems, straining and overwhelming healthcare facilities and settings, including community hospitals. In addition, it imposed substantial societal and economic burdens in China [3]. Currently, there is no specific anti-viral drug or vaccine to treat this lethal disease. Therefore, more strategies for COVID-19 are urgently needed.

Traditional Chinese medicine (TCM), including Chinese herbal medicines, Tuina (Chinese acupressure and massage) and acupuncture, has been practiced in the Chinese healthcare system for more than 2000 years [4–6]. TCM emphasizes enhancing the body's own resistance against disorders and plays a vital role in early intervention through individualized treatment. To many people, TCM is a daily preventative measure for maintaining health and is widely used to manage many chronic diseases, such as diabetes and cancer [7–9]. In addition, TCM has played an important role in treating infectious diseases [10]. TCM's ancient roots are documented in the *Inner Canon of Huangdi* [11]. Recently, a growing number of clinical and laboratory studies have supported the efficacy and safety of TCM in treating or preventing diseases, including COVID-19 [12–14]. In fact, the potential benefits of TCM have been described in

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https://doi.org/10.1016/j.joim.2021.01.013

recent editions of China's *National COVID-19 Diagnostic and Treatment Guideline* [15].

However, there are still doubts and prejudices about the effectiveness of TCM for treating human diseases, including COVID-19. According to the theoretical background of TCM, disease or morbidity is caused by imbalances between Yin and Yang [16]; this is not supported by Western medicine, as these are often considered metaphysical concepts. The diagnosis process of TCM is quite different from that of modern Western medicine. Due to the lack of scientific verification, the nature of TCM has been questioned [17], and the public's overall perception of TCM is quite complicated.

The theory of planned behavior (TPB), which originated from the theory of reasoned action, suggests that subjective norm (SN) and attitude determine behavioral intention, and the intention determines individual behavior [18]. Additionally, behavioral intentions are influenced by perceived behavioral control (PBC). The inclusion of PBC led to the complete and mature TPB model [19]. The TPB is one of the most important models for predicting individual behavior, and many researchers prefer to use it to investigate individual behavior in multiple fields, including the pharmaceutical sector, agriculture, online services and health-related behaviors [20–23].

Currently, the reasons for people choosing TCM therapies and the factors that affect motivation to undergo TCM treatment are not well defined. Therefore, this study identifies the factors that affect intention to use TCM and, hopefully, offers important implications for healthcare policy makers when making plans to promote TCM.

2. Materials and methods

2.1. Study design and recruitment

The protocol for this study is divided into four stages: (1) constructing the theoretical framework; (2) developing and piloting the questionnaires; (3) performing an internet survey; (4) conducting an empirical analysis. The study was reviewed and approved by the Ethics Committee of Southern Medical University, Guangzhou, Guangdong Province, China (Ethical approval number: NFYKDX002).

The present study adopted a cross-sectional design and a web-based recruitment strategy using questionnaire star software (website: https://www.wjx.cn/); it launched as a convenience sampling and finally broadened a snowball sampling in order to recruit more participants. Inclusion criteria were as follows: had access to the internet via smart-phone or computer; could read Chinese and understand the questionnaire; consented to participate after being informed of the risks and benefits of involving in the survey. Participants were encouraged to share the link with their family members, friends and colleagues. As an incentive for increasing the response rate, we provided a raffle with a chance to win shopping vouchers. Data collection started on March 16, 2020 and ended on April 2, 2020. The questionnaire was administered in Chinese and was translated into English for dataset building and data analysis purposes. Participants were informed that their responses would only be used for the purpose of the study and that filling out the questionnaire was voluntary and anonymous. On average, the survey took around 6 min to complete.

The target sample size was calculated according to Hair et al.'s recommendation of 15–20 observed values per studied variable [24]. In our study, there were 6 constructs (totaling 25 items), and the expected sample size was 500 (20 × 25) respondents.

2.2. Theoretical framework

The theoretical framework of this study was adapted from the TPB model. The TPB presents three dimensions that affect behavioral intentions: (a) the influence of important people or organizations on individual behavior (i.e., SN); (b) the perceived ease or difficulty of performing the behavior (i.e., PBC); and (c) an individual's positive or negative feelings toward the behavior (i.e., attitudes). Theoretically, behavioral intention, which is a combination of attitude, SN and PBC, is the best predictor of actual behavior (supplementary Fig. 1) [25,26]. Additionally, past behavior has been shown to exert persistent effects on the key constructs of psychological theories, such as TPB [27]. In order to include all known variables that are important for predicting a dependent variable, past behavior should be included in our research model [28–30].

The TPB model assumed that attitude is highly correlated with behavior [29]. Furthermore, two cognitions, including perceived usefulness and perceived ease of use, are positively related to attitude; the former has a more powerful effect than the latter. Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" [31]. In our study, we defined an individual's belief regarding the perceived usefulness of TCM as "cognition." Thus, if people believe that TCM is useful for treating COVID-19, they will be more inclined to choose TCM. Additionally, attitudes are also affected by SN and PBC [20]. Guided by the extended TPB, the present study identified predictors of intention to use TCM (Fig. 1). Specifically, the following hypotheses were proposed. Hypothesis 1 (H1): SN has a positive influence on intention to use TCM; Hypothesis 2 (H2): attitude positively affects the intention to use TCM; Hypothesis 3 (H3): PBC positively affects the intention to use TCM; Hypothesis 4 (H4): past behavior has a positive influence on intention to use TCM; Hypothesis 5 (H5): SN has a positive influence on attitudes toward TCM use; Hypothesis 6 (H6): PBC has a positive influence on attitudes toward TCM use; Hypothesis 7 (H7): cognition positively affects attitudes toward TCM use.

2.3. Questionnaire development

The questionnaire consisted of two sections. The first part collected participants' personal information, including gender, age, marital status, residence, educational attainment and annual family income. The second part was a self-designed TPB-based questionnaire. Based on the hypotheses of the study, the newly developed TPB-based questionnaire consisted of six domains, including cognition, attitude, SN, PBC, past behavior and behavioral intention. A multi-phase questionnaire development approach was adopted, including collecting related items from literature reviews and accepting comments from experts in the fields of TCM, health education, psychology and questionnaire development. At the beginning of development, the TPB-based questionnaire consisted of 33 items with seven hypotheses.

The face and content validity were reviewed and validated by a panel of experts. The expert panel consisted of five specialists in the fields of TCM, public health, psychology, health education and promotion. According to the panel's recommendations, three questions of attitude, two questions of SN and three questions of past behavior were removed. Subsequently, a pilot test was conducted among a small group of volunteers. These volunteers were asked to comment on the clarity and readability of the newly developed questionnaire. At this point, format and font size were modified according to the volunteers' suggestions. The pilot test shows that there was no further need to modify the content of the survey.

The final version of the TPB-based questionnaire consisted of 25 items across 6 dimensions. Seven items were used to assess the public's cognition of TCM. The attitude toward TCM was assessed by three items. In addition, the influence of significant social connections (family and friends) on an individual opinion about

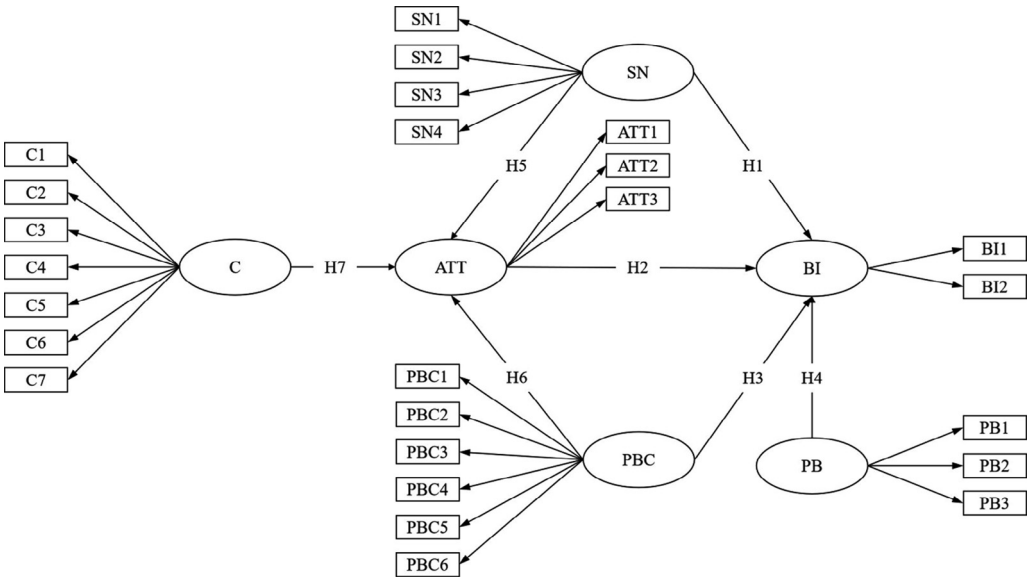

Fig. 1. Conceptual framework and hypotheses of the study. H1: SN have a positive influence on intention to use TCM; H2: attitude positively affects the intention to use TCM; H3: PBC positively affects the intention to use TCM; H4: PB has a positive influence on intention to use TCM; H5: SN has a positive influence on attitudes to TCM use; H6: PBC has a positive influence on attitudes to TCM use; H7: cognition positively affects attitudes toward TCM use. ATT: attitude; BI: behavior intention; C: cognition; H: hypothesis; PB: past behavior; PBC: perceived behavioral control; SN: subjective norm; TCM: traditional Chinese medicine.

choosing TCM was assessed using four items. Six items were used to assess the PBC of TCM. Furthermore, three items were used to assess past behavior and two items were used to assess the behavioral intention towards TCM. All items were measured on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The items of the questionnaire are presented in the Supplementary Table 1.

2.4. Data analysis

Structural equation modeling (SEM) was performed based on the proposed TPB model. First, using the principal component analysis method, exploratory factor analysis was conducted to evaluate factor loadings. Second, we employed confirmatory factor analysis to test the convergent and discriminant validity of the theoretically derived measurement model. Third, the reliability of the self-report questionnaire was tested. Cronbach's α was used to examine the reliability of latent variables. Fourth, goodness-of-fit statistics were obtained to test model fit. Additionally, multivariable linear regression was conducted to analyze the associations among socio-demographics and TCM behavior intention and its components. Statistical analyses were conducted using SPSS (version 25, IBM Corp., NY, USA) and AMOS (version 22, IBM Corp., NY, USA).

3. Results

3.1. Participant characteristics

A total of 10,980 respondents from 31 provinces throughout the country participated in the study. After eliminating the participants who finished the questionnaire in less than one minute, the final valid sample was composed of 10,824 participants (Supplementary Fig. 1), which was higher than the suggestion of at least 500 for data analysis. Participant demographic characteristics are shown in Supplementary Table 2. The mean age of the participants was 34.71 years old (standard deviation [SD] = 9.77) and more than half were female (53.83%). Respondents were largely from urban areas (n = 8100, 74.83%), married (n = 8100, 74.83%) and educated at the bachelor level or above (n = 7054, 65.17%). Most respondents had an annual family income higher than RMB 50,000 (n = 7543, 69.69%).

3.2. Reliability and validity tests

Values for Cronbach's α, Kaiser–Meyer–Olkin (KMO) measures, Bartlett's test of sphericity, factor loadings, composite reliability (CR) and average variance extracted (AVE) are presented in Supplementary Table 3. The results showed that the KMO value of each construct was greater than 0.734, except for behavior intention (0.50). Moreover, Bartlett's test of sphericity was statistically significant (P < 0.001). Cronbach's α is a measure of internal consistency, and the minimum level is 0.700 [32]. In this study, stable internal consistency for the measured constructs was indicated by high Cronbach's α (0.862–0.960).

Scale validity was determined based on convergent and discriminant validity of the measure's structure. Convergent validity was measured on the basis of factor loadings, CR and AVE. First, factor loadings indicated how much the variability of each item correlated with the latent construct, with the minimum standard threshold being 0.600 [33]. In our study, the factor loadings of all items ranged from 0.676 to 0.956, which suggested the questionnaire items were significantly associated with their proposed constructs. Second, CR values ranged from 0.867 to 0.961, showing that all constructs met the acceptable lower limit of 0.700 [34]. Third, the AVE of all measured items was above the recommended value of 0.500, indicating that the measurement model had good convergent validity [35] (Supplementary Table 3).

To test discriminant validity, the square root of the AVE was used. Discriminant validity can be verified when the square root of the AVE for each construct is larger than correlations with other constructs [36]. The diagonal values indicated that the scale had sufficient discriminant validity (Supplementary Table 4).

3.3. Measurement scores of respondents

The mean scores and SD for all measurements were calculated. The mean attitude score ranked first (mean = 4.181, SD = 0.770), followed by behavioral intention (mean = 4.003, SD = 0.920), PBC

(mean = 3.932, SD = 0.863), SN (mean = 3.929, SD = 0.871) and cognition (mean = 3.802, SD = 1.003). Furthermore, the average frequency of past TCM use was comparatively low (mean = 3.475, SD = 1.070).

3.4. Goodness-of-fit statistics

SEM is composed of a measurement model and a structural model. To evaluate the measurement model, we measured the fit indices, and the results indicated that χ^2/df was 2.678, which met the appropriate criteria [37]. Good absolute adaptation indices were also found, including root mean square error of approximation = 0.050 (< 0.080) [38], root mean square residual = 0.035 (< 0.050), goodness-of-fit index = 0.946 (> 0.900) and adjusted goodness-of-fit index = 0.932 (> 0.900) [39]. Values for incremental fit indices were as follows: comparative fit index = 0.976 (> 0.900), Tucker-Lewis Index = 0.972 (> 0.900) [40], incremental fit index = 0.976 (> 0.900), normative fit index = 0.975 (> 0.900) and relative fit index = 0.972 (> 0.900) [24]. Collectively, all indices suggested an acceptable model fit between the hypothesized model and empirical data (Supplementary Table 5).

3.5. Structural model and hypotheses testing

The structural model was used to test the seven proposed hypotheses. As shown in Fig. 2, SN (β = 0.190, P < 0.001) and PBC (β = 0.109, P < 0.001) had significant positive effects on the intention to use TCM, supporting H1 and H3. Additionally, attitude had a significant positive influence on behavioral intention (β = 0.451, P < 0.001), thus supporting H2. Path coefficients also showed significant associations with user intention and past behavior (β = 0.229, P < 0.001); hence, H4 was supported. In the tested model, the most important factor related to attitude was PBC (β = 0.413, P < 0.001), followed by cognition of TCM (β = 0.285, P < 0.001) and SN (β = 0.280, P < 0.001). Therefore, H5, H6 and H7 were supported. Overall, the model explained 77.5% of the variance in intention to use TCM (Table 1).

According to Supplementary Table 6, five demographic factors, including age, marital status, residence, educational level and annual family income had significant influence on behavior intention and attitude toward TCM. In addition to the above factors, gender also had influence on PBC. For SN, the major factors were marital status, residence and family annual income. From the perspective of TCM cognition, age and marital status had a positive effect and family annual income had a negative effect. Furthermore, gender, age, marital status, residence and educational level were positively correlated to past behavior. Collectively, five demographic variables explained the variance in behavior intention and attitude toward TCM (3.9% and 3.4%, respectively). In contrast, the extended TPB components explained 77.5% and 71.9% of intention and attitude variance. These results indicate that the demographic impact is relatively small.

4. Discussion

4.1. Key findings

With growing evidence for the effectiveness of the integration of Chinese medicine and Western medicine [6,8–10], public awareness of TCM's important role in the prevention and treatment of COVID-19 has increased. However, there are still many people who ignore the achievements of TCM in fighting disease. Generally, the reasons for the underutilization of TCM are unclear. In this study, using the framework of the TPB, we developed an instrument to investigate factors that potentially influence intention to use TCM.

Path analysis using SEM revealed that attitude, SN and PBC all played significant roles in predicting intention to use TCM, which is consistent with the findings of Mou et al. [41]. Another finding from this study was the correlation between past behavior and intention to use TCM. In our analysis, the model effect sizes, especially the influence of the constructs on behavioral intention, were attenuated with the inclusion of past behaviors, but not completely extinguished. This is consistent with previous research on the role of past behavior in pivotal model constructs [27,42], in which past behavior is regarded as the main predictive factor, reflecting the stability and sustainability of the behavior itself [43,44]. A possible reason that intentions are dominated by past behaviors is that past behaviors can reflect unconscious automatic psychological processes [28,45]. Thus, it is necessary to include past behaviors in

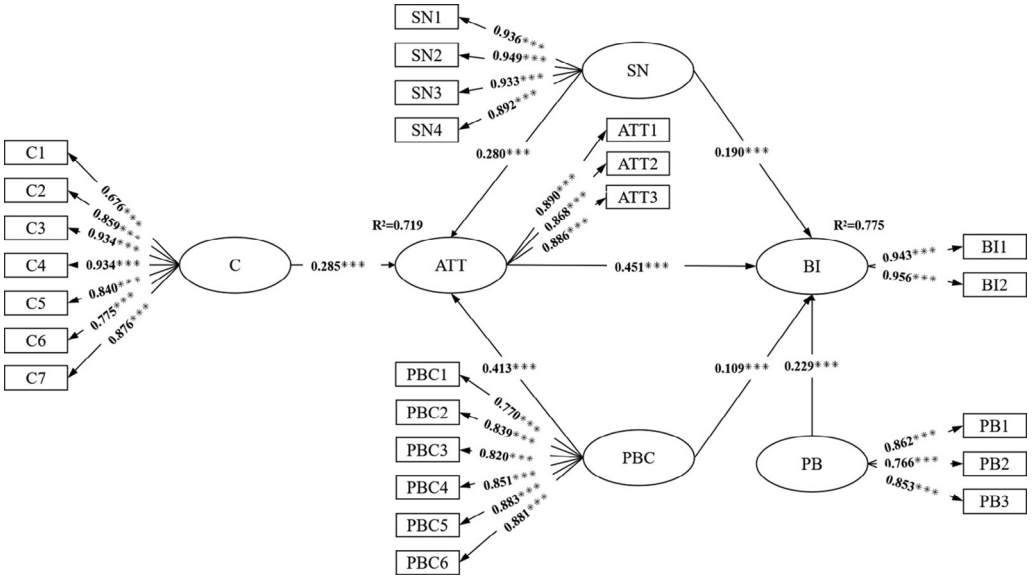

Fig. 2. Structural equation model on intention of TCM utilization based on the theory of planned behavior. Standardized path coefficients were presented; the solid lines indicate the paths with statistical significance. ATT: attitude; BI: behavior intention; C: cognition; PB: past behavior; PBC: perceived behavioral control; SN: subjective norm. ***P < 0.001.

Table 1
Maximum likelihood parameter estimates for the structural equation model.

Correlation of parameter	b	SE	CR	β	*P* value
ATT *vs* C	0.386	0.011	35.830	0.285	< 0.001
ATT *vs* SN	0.241	0.012	20.030	0.280	< 0.001
ATT *vs* PBC	0.361	0.013	28.663	0.413	< 0.001
BI *vs* ATT	0.555	0.013	41.330	0.451	< 0.001
BI *vs* SN	0.201	0.013	15.163	0.190	< 0.001
BI *vs* PB	0.211	0.009	22.885	0.229	< 0.001
BI *vs* PBC	0.117	0.016	7.304	0.109	< 0.001
C1 *vs* C	1.000			0.676	
C2 *vs* C	1.871	0.023	81.777	0.859	< 0.001
C3 *vs* C	1.970	0.022	87.764	0.934	< 0.001
C4 *vs* C	2.018	0.023	87.897	0.934	< 0.001
C5 *vs* C	1.998	0.025	80.417	0.840	< 0.001
C6 *vs* C	1.980	0.026	74.876	0.775	< 0.001
C7 *vs* C	1.915	0.023	83.219	0.876	< 0.001
ATT1 *vs* ATT	1.000			0.890	
ATT2 *vs* ATT	1.055	0.008	126.204	0.868	< 0.001
ATT3 *vs* ATT	1.007	0.008	131.573	0.886	< 0.001
SN1 *vs* SN	1.000			0.936	
SN2 *vs* SN	1.041	0.005	200.955	0.949	< 0.001
SN3 *vs* SN	1.005	0.005	187.038	0.933	< 0.001
SN4 *vs* SN	1.033	0.006	160.284	0.892	< 0.001
PBC1 *vs* PBC	1.000			0.770	
PBC2 *vs* PBC	1.044	0.011	95.913	0.839	< 0.001
PBC3 *vs* PBC	0.993	0.011	92.982	0.820	< 0.001
PBC4 *vs* PBC	0.924	0.01	95.830	0.851	< 0.001
PBC5 *vs* PBC	1.034	0.01	99.826	0.883	< 0.001
PBC6 *vs* PBC	1.037	0.01	99.447	0.881	< 0.001
PB1 *vs* PB	1.000			0.862	
PB2 *vs* PB	1.076	0.012	92.628	0.766	< 0.001
PB3 *vs* PB	1.000	0.01	102.976	0.853	< 0.001
BI1 *vs* BI	1.000			0.943	
BI2 *vs* BI	1.014	0.005	192.056	0.956	< 0.001

ATT: attitude; b: unstandardized path coefficient; BI: behavior intention; C: cognition; CR: critical value; PB: past behavior; PBC: perceived behavioral control; SE: standard error; SN: subjective norm; β: standardized path coefficient.

the TPB to confirm the model's adequacy in predicting Chinese people's intention to use TCM.

To the best of our knowledge, few studies have demonstrated the TPB framework's usefulness for creating an evaluation tool for TCM [42,46]. The present results therefore extend the TPB framework, by confirming that attitude, SN, PBC and past behavior are important factors that affect intention to use TCM in China. Furthermore, approximately 77.5% of the variance in behavioral intention was explained by these four factors, which indicates that the proposed constructs are the major reasons for an individual's intention to use TCM.

Additionally, we found that attitude toward TCM had the greatest impact on intention to use TCM, which was in line with the findings of previous research [47–49]. Attitude was found to be largely influenced by PBC, which is composed of facilitating conditions and self-efficacy. Furthermore, the results suggested that cognition has a significant positive impact on individual attitudes toward TCM. In the present study, cognitive factors describe the extent to which one person believes TCM can be useful.

Our findings indicated that, in the present sample, the mean scores for cognition of TCM were at a relatively high level, which was possibly related to respondents' educational attainment—approximately 65% had earned a bachelor's degree. Highly educated individuals could be more able to process information that identifies the usefulness of TCM, efficiently evaluate complex information and respond positively to reason-based cognition. This is consistent with previous work exploring the motivations behind the use of pollution masks in a sample of well-educated young people [50]. Furthermore, the high average score of TCM cognition indicates a high level of public recognition of TCM's usefulness for preventing and treating COVID-19. Actually, studies have shown that TCM has played an important role in recognizing and treating COVID-19 in China, including improving the clinical symptoms, reducing the mortality rates and increasing the recovery rates [11,15,51]. Finally, SN was also a predictor of attitudes, which has been found in many studies [52,53].

4.2. Implications

This study provides theoretical implications for better understanding the mechanism that underlies an individual's intention to use TCM. First, the findings showed that respondents' attitudes toward TCM significantly affected their intentions. Moreover, past behavior also strongly influenced intention. Additionally, SN and PBC were positively correlated with intention to use TCM. The major findings of the present study have significant practical implications for healthcare policy makers and professionals, especially those tasked with designing programs to encourage the use of TCM.

Hence, we make the following recommendations. First, healthcare policy makers should focus their efforts on public awareness and education, stimulating TCM use motivation through social networking and public media and convincing potential users that TCM serves both individual and collective interests. Second, from a government perspective, TCM provides a safe, economical and effective way to treat COVID-19 and other diseases. Thus, authorities should implement initiatives that inspire the willingness to use TCM, and they should strengthen public guidance on TCM use. Further initiatives should include cultivating excellence in physicians and professionals, through the integration of TCM and Western medicine, as well as improving their diagnostic and treatment skills. Third, an upgraded TCM legal system should be accompanied by better supervision, especially with stricter market access and more severe penalties for violations, to improve public trust in

TCM. Finally, another way to promote the intention to use TCM could include bolstering the public perception of TCM as an effective measure for disease prevention and treatment and encouraging its adoption as daily form of healthcare.

4.3. Strengths and limitations

The present study used TPB to provide a theoretical basis for the design of a structured questionnaire, which helped to explain the factors that influence intention to use TCM. Our research included a sufficiently large sample, which is essential for making reliable estimates of behavioral intentions. The findings of this study provide an empirical reference for healthcare policy makers when designing programs to promote TCM.

However, several limitations to the present work should also be considered. First, this study had a cross-sectional design, which did not allow for a dynamic assessment of changes in intentions. Notably, respondents' actual behaviors were not included in our proposed research model. Further research should investigate intentions and behaviors related to TCM through a combination of cross-sectional and longitudinal research. Second, as data collection was conducted online, highly educated and younger individuals may have been over-represented among the participants. Third, the use of self-report questionnaires to measure behavioral variables might have affected the accuracy of the results.

5. Conclusion

We found attitude to be a key determinant of intention to use TCM. The main constructs of the extended TPB, including past behaviors, SN and PBC, play important roles in predicting intention to use TCM. Therefore, a TPB-based model can effectively serve as a framework for predicting TCM intentions. Additionally, attitudes toward TCM are affected by the cognition of TCM, PBC and SN. Our results provide useful information for policy makers to encourage the use of TCM and promote public health.

Funding

We are grateful for the financial support from National Social Science Fund of China (No. 20VYJ069).

Authors' contribution

YX and DW contributed to the research conception and design. Material preparation and collection of data were performed by YX, LSBS, JHC and DW. Data analysis was performed by YX, LSBS and HZM. The first draft of the manuscript was written by YX, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Declaration of competing interest

The authors declare that there is no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.joim.2021.01.013.

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