




Psychometric measure beliefs and preventive behaviors toward COVID-19 based on Health Belief Model (HBM): Validation of a questionnaire

Mitra Moodi¹, Hamid Salehiniya², Fatemeh Baghernezhad Hesary^{3*}, Mohammadreza Miri¹

Received: 23 Jun 2020

Published: 6 Oct 2021

Abstract

Background: The COVID-19 epidemic is a newly emerging infectious disease. This study was conducted to design an appropriate psychometric questionnaire of cultural and social characteristics to evaluate beliefs and preventive behaviors toward COVID-19 among the Iranian's population according to change behavior theory as health belief model (HBM).

Methods: The study population included all those who had access to social networks and answered the questionnaire voluntarily. The sample size in this study was 350 people. In this cross-sectional study, a questionnaire was designed using scientific sources and based on the health belief model, and its face and content validity was determined by Content Validity Ratio (CVR), and reliability was determined by the internal consistency; Test-retest was applied to examine the internal consistency of the questionnaire. Data were analyzed using SPSS software version 19. Cronbach's alpha and Intra-class Correlation Coefficient (ICC) were used for the assessment of the reliability of data.

Results: Initially, the questionnaire was designed based on the literature reviews and expert's opinion in the field of health education with 79 items. After that, 2 of them were deleted and corrected qualitatively by performing the face and content validity of some items. Therefore, finally, a questionnaire with 77 questions was approved. Based on the constructs of the health belief model, the domains of the questionnaire included perceived sensitivity, severity, benefits barrier, self-efficacy, knowledge and behavior. The content validity of the questionnaire was confirmed. The Cronbach's alpha and ICC for each domain were greater than 0.7.

Conclusion: The Questionnaire of beliefs and preventive behaviors toward COVID-19 based on HBM is a valid and reliable instrument in the Iranian population that could be used in related research.

Keywords: COVID-19, Preventive behaviors, Health belief model, Validity

Conflicts of Interest: None declared

Funding: This article is extracted from a Research project supported by Birjand University of Medical Sciences (5329).

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Cite this article as: Moodi M, Salehiniya H, Baghernezhad Hesary F, Miri M. Psychometric measure beliefs and preventive behaviors toward COVID-19 based on Health Belief Model (HBM): Validation of a questionnaire. *Med J Islam Repub Iran.* 2021 (6 Oct);35:130. <https://doi.org/10.47176/mjiri.35.130>

Introduction

The COVID-19 epidemic is a newly emerging infectious disease that was identified in Wuhan, China in late 2019 and then spread rapidly across the world. Coronavirus is a global threat to public health, and no specific

vaccine or drug has been developed for it (1). However, several studies are under way, including studies on the use of improved plasma (2). According to current information, some animals such as bats are the primary and natural host

Corresponding author: Dr Fatemeh Baghernezhad Hesary, ftbagher@bums.ac.ir

¹ Social Determinants of Health Research Center, School of Health, Birjand University of Medical Sciences, Birjand, Iran

² Department of Epidemiology and Biostatistics, School of Health, Social Determinants of Health Research Center, Birjand University of Medical Sciences, Birjand, Iran

³ Department of Public Health, Ghayen School of Nursing and Midwifery, Birjand University of Medical, Birjand, Iran

↑What is “already known” in this topic:

A standard questionnaire regarding the behaviors preventing the spread of Covid 19 has not been designed (based on the Health Belief Model) in Iran.

→What this article adds:

In this study, an appropriate questionnaire was designed to assess the beliefs and behaviors that prevent the spread of Covid 19 in Iranian society. The questionnaire can be used to assess preventive behaviors to make a plan and necessary implement interventions.

of Coronavirus 19, then after the process of human-to-human transmission begins and an epidemic is formed (3). The disease is spread from person to person through infected droplets by coughing or sneezing. Of course, the virus can survive on the surface for hours. The most common symptoms of COVID-19 are similar to SARS and include fever, dry cough, chest pain, difficult breathing, and unusual symptoms include headache, body aches, runny nose, nausea and vomiting, and nasal congestion. Patient segregation and supportive therapies including oxygen therapy, fluid intake, and antibiotic therapy, are used to treat secondary infections. The mortality rate for COVID-19 in China was 2.1 percent, and the death rate for patients admitted to the hospital was 11 to 15 percent (4). The COVID-19 epidemic of the new virus has been more widespread in humans than that of progression of the epidemic which is caused by other types of coronaviruses, indicate the extremely high transmission potential of this new virus. Currently, due to the lack of effective treatment and vaccines, the best method to deal with this disease is to avoid infection and prevent its spread through protective behavior and personal health (3). To stop the spreading of this infectious disease, prevention guidelines must be followed correctly by individuals (5). Simple precautions are effective in preventing the possibility of spreading of the COVID-19:

Wash your hands regularly with soap and water or disinfect them with an alcohol solution, observe a distance of at least 1-2 meters with other people (social distance), do not touch your eyes, nose, and mouth, Respiratory hygiene during sneezing and coughing and stay at home and refrain from attending rallies (6). Previous studies have shown that preventive behavior against infectious diseases of the respiratory tract, such as SARS, H1N1, is influenced by people's knowledge, attitude, and risk perception (5). The use of behavior change models is recommended to identify health-related behaviors (7). By using behavior

change models, it is possible to determine the main factors that affect a person's behavior, the relationship between these factors, and the conditions in which these relationships occur. The health belief model (HBM) is one of the most common models of behavior change (8). This model was applied in the 1950s by social psychologists to predict the factors influencing preventive health behaviors (9). In addition, this model emphasizes limited preventive actions, which were generally simple behaviors and most members of the target group have self-efficacy (10). It reveals the relationship between beliefs and behavior, and it is assumed that preventive behavior is based on one's beliefs. These beliefs include the following:

- The Vulnerability of the person to the disease
- The effect of the disease on the person's life expectancy
- The effect of health behavior on reducing the susceptibility and severity of the disease (11).

Structures of the HBM include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. According to this model, people must first feel the risk (perceived susceptibility) of the problem. Then they should understand the depth of the risk and the severity of its various complications (perceived severity), with the positive symptoms they receive from their surroundings (Cues to Action), believe in the usefulness and applicability of preventive behaviors (perceived benefits), and find the deterrents to such behaviors less costly than the benefits (perceived barriers), ultimately being able to do more preventive behaviors (self-efficacy) to take preventive action (11). Besides, reminders (media advertisements, recommendations of others, illness of family members or friends, etc.) and social demographic and psychological factors (age, gender, personality traits, social class, etc.) on preventive behaviors of people are affected (12). Figure 1 shows a schematic view of the HBM in preventive health behaviors.

Human behavior is very complex. Theories are the tools

The Health Belief Model

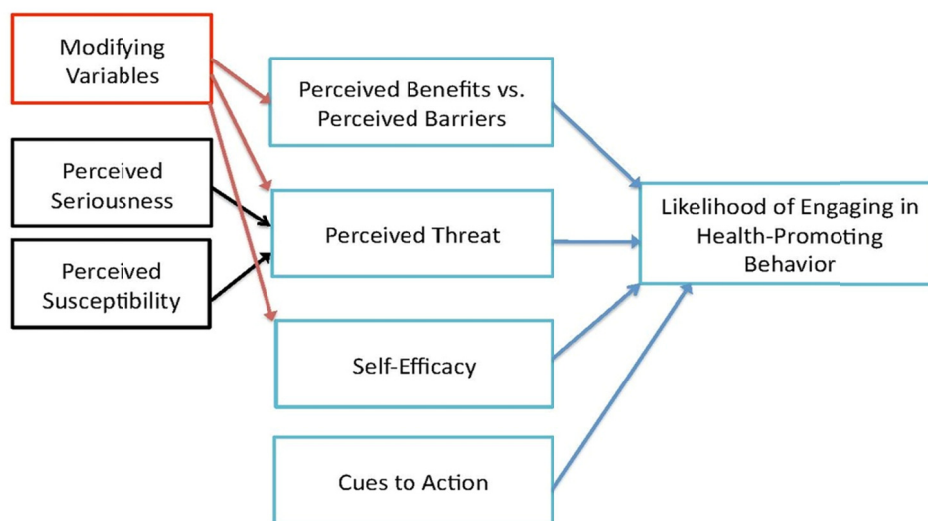


Fig. 1. HBM Framework

for understanding what affects health and designing effective interventions. Although no theory is perfect in health education, the theory is a tool for better understanding what affects health. The HBM is one of the most common theories of behavior change that is used in relation to preventive behaviors. In this theory, the factors influencing behavior, relationships between factors, and existing conditions are identified (10). The reason for using this model is to understand why people do not accept health issues and explain the behavior of people who did not consider themselves to be sick (11). Gathering information and measuring each model's structures requires the use of a valid and reliable questionnaire based on indigenous culture. The questionnaire is one of the most widely used tools for data collection, especially in social science research. The main purpose of the research questionnaire is to obtain valid and reliable information (13). In addition, validity and reliability are two important and fundamental features in tool evaluation (14). Reliability is trustworthy in measuring research results every time a study is repeated, and the validity of the questionnaire is the degree to which a test measures the purpose of the study.

Valid tool utilizing increases the chances of measuring what is being estimated (15). To the best of our knowledge, there is no questionnaire in the Persian language in Iran for evaluating the beliefs and preventive behaviors toward COVID-19. Thus, the present study considering the importance of preventive behaviors in reducing the transmission and prevalence of COVID-19 was conducted to measure the preventive behaviors against COVID-19 based on HBM, psychometrically.

Methods

This methodological study is part of a larger survey that was performed between April 9 and May 12, in 2020, in Iran. The study population included all those individuals who had access to social networks and can answer the questionnaire voluntarily. Sampling was done by available and collaborative volunteers (Convenience sampling). In order to get this purpose, the questionnaire was prepared online and the link was sent to individuals in public and private messages via social media by smartphone (in various social channels and groups such as Telegram and WhatsApp). Inclusion criteria were having a smartphone and being a member of at least one popular virtual social media in Iran.

Ethical approval was obtained from the Ethics Committees of Birjand University of Medical Sciences (IR.BUMS.REC.1399.003).

The questionnaire development process was performed in three basic stages, including item generation, determining face & content validity, and determining the reliability of the questionnaire.

Stage 1: Item generation

A deductive approach was used to generate items. In this approach, the theoretical definition of the construct under examination is used as a guide for the development of items. In this study, HBM was used as a theoretical

framework for item construction. Two methods were used for item generation. At first, the item generation phase began with a comprehensive review of existing published scientific sources on the knowledge, beliefs, and health behaviors toward coronavirus or other infectious diseases such as SARS, MERS and Ebola (5, 16-18). In the second phase, several focus groups were designed to gain a comprehensive understanding of the potential knowledge, beliefs and preventive behaviors related to COVID-19 in the target population and to propose items related to the seven constructs of HBM (Perceived susceptibility, Perceived severity, Perceived Benefits, Perceived barriers, Perceived self-efficacy, Cues to action and preventive behaviors) and knowledge. The members of these focus groups were 10 specialists in fields of health education and health promotion, epidemiology, public health and also community health nursing. At the beginning of the group discussion, one of the researchers stated the purpose of the group discussion and the objectives of the study. Individuals were asked to comment on preventative behaviors in relation to COVID-19. After summarizing the opinions of the experts, the questionnaire was reviewed again in the group discussion session and was approved by the members. The active participation of all individuals was one of the strengths of the group discussion. The average of each of these group discussions lasted 45-50 minutes. It should be noted that the group discussion was conducted in accordance with the health protocol and social distance at the School of Health.

Stage 2: Determining the face & content validity of the questionnaire

Face validity is a mental judgment about the operation of a construct (13). In order to examine the face validity of the questionnaire qualitatively, 20 questionnaires were provided, and it was evaluated in terms of comprehension, the difficulty level of sentences and words, appropriateness and the relationship between the questions and necessary correction by experts. Qualitative content validity is a comprehensive review by a group of experts to determine whether the items in the questionnaire cover all the behaviors to be measured (19). Content validity is defined as the degree to which questionnaire items reflect content (13). The evaluated validity of instrument content is one of the most important parts of instrument validity evaluation. The purpose of this assessment is to answer the question of whether the content of the instrument can measure the target. Content validity is one of the best methods to report evidence in support of the questionnaire, and using the views of experts will achieve the appropriate feedback on the quality of questions. To determine the content validity, the questionnaire was provided to the panel of experts (10 experts in health education and health promotion, epidemiology, community health nursing and biological statistics) and the questionnaire was reviewed based on criteria such as compliance with grammar, how to write, time to completing the questionnaire, the appropriateness and relevance of the questions to the subject and the necessary feedback. The most common quantitative methods used by researchers to determine content validity

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are the content validity index (CVI) and content validity ratio (CVR). In this study, two indicators of CVR and CVI were calculated quantitatively. To determine the CVR, the specialists rated their opinions about the necessity of each item on a 3-point Likert format (necessary, helpful but not necessary and not necessary). The following formula was used to calculate the content validity ratio:

$$CVR = \frac{nE - \frac{N}{2}}{\frac{N}{2}}$$

nE = is the number of specialists who have answered the "necessary" option, and N is the total number of specialists. At this stage, the ratios obtained for each item of the questionnaire were compared with the numbers given in the lawashe table (20) and values greater than 0.62 were accepted. The CVI was used to ensure the three criteria of relevance, clarity, and simplicity using a four-point Likert format for each item based on the Lynn pattern (21). For calculating CVI, the number of experts giving a rating of 3 or 4 to each item, divided by the total number of experts. If the score of CVI is higher than 0.79, the content validity of the questionnaire is confirmed. If it is between 0.70 and 0.79, it needs revision and if it is less than 0.70, the item must be deleted (22).

Stage 3: Determining the reliability of the questionnaire

For reliability analysis, the standard advice is to have at least 5 participants per item on your scale. Reliability is a type of convergent validity that aims to evaluate the correlation between the items of an instrument (13). The reliability of a questionnaire is determined by the internal matching method or Cronbach's alpha calculation. Cronbach's alpha coefficient above 0.7 means that the questionnaire has good internal consistency and acceptable reliability (23). In this study, Cronbach's alpha coefficient was used to assess the reliability of each of the seven subscales separately, including Knowledge, Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Perceived Self-efficacy and Preventive behaviors. For calculating Cronbach's Alpha coefficient,

questionnaires were completed by 350 people to measure the internal consistency of the method. Also, after the validity was approved, the final questionnaire was given to 40 participants to complete. Two weeks later, they were given the questionnaire to be completed again. Using the Intra-class Correlation Coefficient (ICC), the questionnaire was analyzed, and all the questions that had an ICC greater than 0.7 were considered acceptable. The data collected were analyzed using SPSS software version 21.

Results

Overall, 79 initial items in blueprint were generated based on HBM constructs, which includes 8 items for Perceived susceptibility, 9 items for Perceived severity, 6 items for Perceived benefits, 15 items for Perceived barriers, 13 items for Perceived self-efficacy, 19 items for preventive behaviors of COVID-19 and 7 items for knowledge. A 5-point Likert scale (completely agree to completely disagree scored 1-5) was used as a response rate for beliefs questions and a 5-point Likert scale (Never, very rarely, sometimes, most of the time, always respectively assigned 1-5 scores) for preventive behaviors and also, multi-choice question for knowledge. A score of 0 and one was given to the wrong and correct answers, respectively. For all of the subscales, except the perceived barriers, a higher score means a higher level than this subscale.

The average age of the participants was 37.68±10.91 years. 103 were males (29.4%), and 247 were females (70.6%).

After stage 1 (Item generation), 79 questions were designed, which were deleted and corrected qualitatively by performing the face and content validity of some items, CVI value of the questionnaire was 0.97.

The CVR values of each question are shown in Table 1.

In this study, the reliability of the subscales of the questionnaire was measured by the calculation of Cronbach's alpha for a total of 350 study participants. As it is observable in Table 2, Cronbach's alpha coefficient for the questionnaire constructs is between 0.73 and 0.91. Also, ICC for all subscales was greater than 0.7.

Table 1. CVR Index of beliefs and preventive behaviors from coronavirus disease-19 based on HBM

Structure	Questions	CVR
Knowledge	What is the cause of corona disease?	1
	How long is the incubation period of coronavirus COVID-19?	1
	How is the incidence of coronavirus COVID-19 compared to influenza?	1
	Which of the following groups are at high risk for coronavirus COVID-19?	0.9
	What are the most common symptoms of coronavirus COVID-19?	1
	How is COVID-19 transmitted?	1
	What is the best way to prevent coronavirus COVID-19?	1
Perceived Susceptibility	According to my health condition and living and working conditions, I am at risk for COVID-19.	1
	Because COVID-19 is so contagious, I am at risk for COVID-19.	1
	Only the elderly are at risk for COVID-19.	1
	If I touch or kiss people, I get COVID-19	1
	If I don't stay at home, I get COVID-19.	1
	If I don't wash my hands regularly with soap and water, I get COVID-19.	1
	If I don't disinfect the surface at home and at work, I get COVID-19.	1
	God protects me even if I do not follow the principles of health and prevention.	0.9
Sickness and death are in the hands of God, and prevention is not important	0.8	

Table 1. Ctd

Structure	Questions	CVR
Perceived severity	COVID-19 can affect many people in a short period.	1
	COVID-19 is a dangerous disease that can cause serious complications	1
	COVID-19 is a serious and dangerous threat due to its high rate of transmission.	0.9
	The spread of the COVID-19 has many social, economic and health consequences	0.9
	Having a coronavirus disease has a negative effect on my job or education.	1
	If I get COVID-19, my family members may get it too.	1
	COVID-19 can be fatal.	1
	I'm very worried about losing a relative because of the corona.	1
	Hearing the news of Corona's death fears me.	1
COVID-19 has no specific treatment or vaccine.	0.9	
Perceived benefits	By following a healthy diet and exercising, you can boost your immune system to prevent the development of new COVID-19.	1
	Self-care and staying at home reduce the anxiety and stress caused by COVID-19.	1
	Resting and drinking fluids during illness can help to faster recovery of the disease	1
	Washing hands with soap and water are the best and the easiest method to prevent COVID-19.	1
	Home quarantine and non-contact with other scan prevent from COVID-19.	1
Perceived barriers	By not traveling during an outbreak, I prevent myself, my family, and others from getting COVID-19.	1
	Self-care against COVID-19 is hard and time- consuming.	1
	Frequent hand washing with soap and water is difficult	1
	Staying at home is hard and boring.	1
	I forget not to shake hands when I meet others.	1
	I don't disinfect surfaces due to boredom.	1
	Due to the allergy to disinfectants, I do not disinfect surfaces.	1
	I don't disinfect surfaces for fear of the side effects of disinfectants.	1
	Due to skin problems, we do not wash our hands regularly with soap and water	1
	Due to the lack of access to sanitary ware (soap, disinfectants, masks, etc.), I do not follow the health behaviors /items	1
	Sanitary ware such as masks, gloves and antiseptic gels are very expensive.	1
	Due to economic problems, I do not have access to healthy food and fruit to improve my immune system.	1
	I can't stay at home because of my job	1
	I don't know how to wash your hands properly.	1
	I don't know how to properly disinfect surfaces	1
I don't know how to use the mask properly.	1	
Perceived Self-efficacy	I can prevent COVID-19 by following personal hygiene	1
	As much as possible, I can avoid being in crowded areas or reduce its duration.	1
	I can use the mask when in crowded places	1
	I can't shake hands with others and not kiss.	1
	I can't touch my eyes, nose and mouth.	1
	I can hold my mouth and nose with my handkerchief or elbow when I cough or sneeze.	1
	I can wash my hands regularly with soap and water.	1
	I can use a gel or disinfectant solution when needed	1
	I can disinfect surfaces properly.	1
	I can keep a distance of 1-2 meters from others when communicating.	1
	I can manage the stress of coronavirus disease by communicating properly with my family.	1
During home quarantine, I can strengthen the spirit of vitality and cooperation with proper planning and the participation of family members.	1	
I can get news and information about COVID-19 from reputable sources.	1	
Preventive Behaviors	Wash your hands regularly with soap and water	1
	Refrain from kissing and shaking hands with others	1
	Use your handkerchief or elbow when coughing and sneezing	1
	Keep a distance of 1-2 meters from others	1
	Don't go to crowded places and stay at home as much as possible	1
	Daily disinfection of surfaces at home or at work that comes in contact with hands	1
	Dispose of handkerchiefs, gloves and masks used healthy and safely	1
	Wearing a mask when confronted with a person suspected of having coronavirus disease or being in crowded places	1
	Avoid contact with hands, nose, mouth and eyes	1
	Wear gloves when in contact with contaminated objects and surfaces	1
	Exercise and physical activity at home	1
	Eating healthy foods	1
	Eat at least 3 servings of fruits and vegetables a day	1
	Proper ventilation of the home or work environment by an intermittent window opening	1
	Prevent unnecessary attendance at medical centers	1
	Disinfect personal items	1
	No smoking	1
	No hookah use	1
Adherence to the principles of social distance and non-travel.	1	

Discussion

COVID-19 is a global threat to public health (1). The best way to deal with this disease is to avoid contamina-

tion and prevent its spread through simple preventive and protective behaviors (3). In many studies, the HBM has been used to investigate preventive behaviors in infectious diseases (18-20). According to the HBM, one of the fac-

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Table 2. Cronbach's Alpha and ICC Results Questionnaire for Preventive Behavior Based on the Health Belief Model

Constructs	Cronbach's Alpha	ICC (95% CI , P-value)
Knowledge	0.91	0.90 (0.88-0.92, p<0.001)
Perceived Susceptibility	0.73	0.73 (0.71-0.75, p<0.001)
Perceived severity	0.77	0.77 (0.73-0.80, p<0.001)
Perceived barriers	0.82	0.82 (0.79-0.84, p<0.001)
Perceived benefits	0.80	0.80 (0.77-0.83, p<0.001)
Perceived Self- efficacy	0.89	0.88 (0.87-0.90, p<0.001)
Health Behaviors	0.89	0.88 (0.86-0.90, p<0.001)

tors affecting the adoption of health behavior is people's belief, which means that people believe that prevent behavior can be useful, the disease is dangerous, and the barriers to behavior compared to their benefits are less important (9). Constructs of HBM (perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and perceived self-efficacy) can be effective in strengthening preventive behaviors (11). Preventive behaviors in MERS have been influenced by the awareness and attitude of people towards the perceived severity and perceived benefits of preventive behaviors (5). Kim et al. reported that perceived susceptibility with MERS was low, and people found quarantine useless for control (17). The findings of the study showed health belief Model could be used with an emphasis on perceived benefits in preventive behaviors of Influenza A (24). Another study indicates that being highly knowledgeable regarding the disease preventive methods was not associated with highly perceive susceptibility about HIV and there was near fifty percent of participants who did not perceive benefits (25). Findings of the study showed that Knowledge and self-reported preventive behaviors and moderate risk perception (26). Different instruments can be used to measure people's beliefs about the disease at different times and places (22). Since collecting accurate information requires the use of valid and reliable tools based on community culture, this study aimed to develop an appropriate questionnaire in the field of preventive behaviors against the spread of coronavirus 19 based on HBM psychometrically. Content validity of the questionnaire was achieved by experts which is one of the best methods to report evidence in support of tools, and using the views of experts in studies will lead to the achievement of appropriate feedback about questionnaire quality (16). The Cronbach's alpha of the questionnaire was 0.82, so the internal consistency of the instrument was confirmed. Due to the appropriateness of the content validity index (CVI) and content validity ratio (CVR), the questionnaire is approved as a valid scale and has psychometric properties for the use and measurement of preventive behaviors against coronavirus infection and spread. One of the limitations of this study is a large number of questions' tool and the questionnaires can be completed only through virtual space. The advantage of the questionnaire is that it can be used to investigate preventive behaviors related to the prevention and spread of COVID-19 in different groups and places.

Conclusion

In the present study, a reliable and valid questionnaire for assessing the Knowledge, beliefs, and preventive be-

haviors toward COVID-19 among the Iranian population was developed based on the HBM. This questionnaire has an empirical and theoretical framework for further research and tailored interventions to promote the preventive behaviors toward COVID-19 in the community.

Acknowledgment

The authors thank the research deputy of Birjand University of Medical Sciences for the financial support of the study (Code: 5329).

Conflict of Interests

The authors declare that they have no competing interests.

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