

Design and Psychometrics of the Awareness and Self-Care Performance Questionnaire of Diabetic Patients in the Coronavirus Disease 2019 Pandemic

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Abstract

Background: The sudden emergence of the coronavirus disease 2019 (COVID-19) epidemic worldwide has led to numerous problems for patients with chronic diseases, such as diabetics, due to the lack of required information to deal with the disease. The present research aims to investigate the design and psychometrics of the Awareness and Self-Care Performance Questionnaire of diabetic patients during the COVID-19 pandemic.

Methods: The present methodological study aimed to investigate the design and psychometrics of the Awareness and Self-Care Performance Questionnaire. The face and content validity were assessed through both quantitative and qualitative studies. For the quantitative study, 100 diabetic patients were randomly selected during the COVID-19 pandemic. The reliability of the questionnaire was assessed using the internal consistency method by Cronbach's alpha coefficient.

Results: The original version of the questionnaire was designed with 82 items and the final version with 56 items (awareness [32 items] and self-care performance [24 items]) with seven areas, including disease characteristics, prevention ways, ways of disease transmission, disease symptoms, disease risk factors, diet, and care methods. The content validity index (CVI) was 0.97, the content validity ratio (CVR) was 0.93, and the internal consistency of the questionnaire was calculated to be 0.80 using Cronbach's alpha coefficient, showing the appropriate validity and reliability of this questionnaire.

Conclusion: The Awareness and Self-Care Performance Questionnaire of diabetic patients in the COVID-19 pandemic possesses the required validity and reliability to evaluate the knowledge level of diabetic patients in infectious pandemics, such as COVID-19, and it has the applicability to be used in similar conditions. It is suggested that the questionnaire's construct validity be measured to enhance the content validity.

Keywords: Awareness and self-care performance, Questionnaire, Diabetes mellitus, Psychometrics, Coronavirus disease 2019

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Introduction

The coronavirus disease 2019 (COVID-19) pandemic, similar to other infectious pandemics of the current century, has increased the risk of diseases and problems for high-risk individuals around the world. COVID-19 is a new acute and primarily respiratory viral disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (1,2). Research has shown that among the high-risk groups in infectious pandemics are diabetic patients, with a high risk of infection and mortality (3). It has been predicted that the number of patients with diabetes will increase by 12.2% (783.2 million) in the world by 2045 (4). Research has also demonstrated that the mortality rate by

COVID-19 among diabetic individuals is 9.2%, while this rate is 1.4% for healthy individuals (3).

If diabetes is properly controlled, the risk of infecting with COVID-19 acute symptoms will be the same as normal individuals, but if not controlled, the individual will face complications and problems stemming from diabetes due to blood sugar fluctuations (5). The negative effect of infectious pandemics on community health, particularly in patients with chronic diseases, reveals the significance of evaluating the awareness and performance of high-risk individuals in infectious pandemics to control the disease and prevent the progress and incidence of disease complications (6). Patients' higher awareness



leads them to feel more responsible in self-care (7). Self-care performance indicates the health maintenance process through healthy behaviors, attention, and disease management (8), which can be influenced by factors such as knowledge, attitude, skills, barriers, and facilitators (9).

Based on evidence, increased self-care performance culminates in promoted health, increased satisfaction, and improved quality of life (10). In a cross-sectional study, Akalu et al reported knowledge, attitude, and practice toward COVID-19 among patients with chronic diseases in hospitals in northwestern Ethiopia to be poor. In this study, a researcher-made questionnaire with qualitative content validity was used (11). In another cross-sectional study using a researcher-made questionnaire and taking into account the qualitative content validity, Legese et al reported that about half of the patients with chronic diseases referring to Ethiopian public hospitals during the COVID-19 pandemic had favorable knowledge, attitude, and performance toward COVID-19 (12). In addition, in their cross-sectional descriptive study, de Lima Filho et al did not report favorable knowledge of Brazilian diabetic elderly subjects regarding COVID-19. In this study, the checklist of the Brazilian Ministry of Health guidelines was used without reporting its validity and reliability (13). Moreover, in their cross-sectional study conducted to determine the knowledge, attitude, and performance of the people of Qazvin province regarding COVID-19, Hosseinkhani et al reported that the people of Qazvin province had an acceptable level of awareness, attitude, and performance toward COVID-19. A researcher-made instrument with qualitative content validity and appropriate reliability was used in the mentioned study (14).

It is totally necessary to use appropriate tools to measure the awareness and self-care performance of diabetic patients to detect their educational needs, particularly under critical conditions, such as COVID-19. Numerous tools have been developed to evaluate diabetes knowledge, including the Michigan Diabetes Knowledge Test (MDKT) (15), Diabetes Knowledge Questionnaire (DKQ) (16,17), Development of the Diabetes Knowledge (DKN) Scale (18), Ped Carb Quize (PCQ) (19), Diabetes Numeracy Test (DNT) (20), and Patient Diabetes Knowledge Questionnaire (PDKQ) (21). These tools have been developed and approved in the United States (15-17,19,20), Australia (18), and Malaysia (21), and seeking various objectives. The MDKT was the first tool developed to assess knowledge about general issues and insulin. The DKQ evaluates general knowledge of diabetes (16,17), while the PCQ assesses the diet's carbohydrate amount and the required insulin dose (19). The DNT evaluates computational skills for diabetes, such as interpreting food labels, calculating insulin doses based on blood glucose levels, and correcting carbohydrate levels (20), and the PDKQ deals with the diabetic patient knowledge in seven

areas, including information about diabetes, disease treatment, nutrition, detrimental effects of diabetes, disease control, risk factors, and physical activity (21).

An overview of the aforementioned studies shows that the tools developed on diabetes with different objectives have been adopted and accepted in other countries, and those limited studies that have been conducted concerning investigating the awareness and self-care performance of diabetic patients in the COVID-19 pandemic, because of the urgent need to develop research on diabetic patients under difficult conditions of the COVID-19 pandemic, have sometimes used researcher-made questionnaires with minimal CVIs. In such a situation, the lack of appropriate tools to assess the diabetic patients' levels of awareness and performance during the COVID-19 pandemic in our country paves the way for modeling from other countries, while our country, as one of the developing countries, due to various social, economic, and cultural issues, demands different approaches to deal with clients. All these requirements are satisfied in the light of acquiring complete knowledge of the status of diabetic patients. In this regard, the concept explanation is proposed as the foundation of research aiming to develop tools. Given that the quality of a study depends on the adequacy of the data collection tool (22), the theoretical explanation and the detailed definition of the concept under investigation in the applied field are of particular importance to develop tools. Therefore, if the researcher does not clarify the intended concept scientifically, then the presented definition will not have sufficient adequacy to develop the tool structures (23). In this regard, nursing researchers will play a substantial role in explaining the cultural concepts of society using appropriate tools to assess the client's needs. Hence, the current research was conducted to investigate the design and psychometrics of the Awareness and Self-Care Performance Questionnaire of diabetic patients during the COVID-19 pandemic.

Methods

The present research was a methodological study aiming at investigating the design and psychometrics of the Awareness and Self-Care Performance Questionnaire of diabetic patients during the COVID-19 pandemic. According to Polit-O'Hara and Hungler, a methodological study includes stages such as tool formulation, validity determination, and tool assessment (24).

The research population consisted of diabetic patients and the research unit in this study included diabetic patients referring to Bushehr Diabetes Clinic in 2022. To determine the sample size to carry out face validity and content validity, Lin believes that the number of experts needed to judge the tool content is optional, but a minimum of 5 and a maximum of 10 people should comment in this regard (25), which in this research, the maximum number of the intended people, i.e., 10 people,

was used.

The design and psychometrics of the Awareness and Self-Care Performance Questionnaire was conducted according to Waltz's method (26) in four stages: 1) Choosing a conceptual model to determine the dimensions of the topic under investigation, 2) determining the goals of the tool, 3) formulating a preliminary plan, 4) engineering the measurement tool, which consists of using processes, a set of items, and scoring rules of tools.

In the first stage, with a targeted review of related articles and studies, the theoretical and practical concept of the Awareness and Self-Care Performance Questionnaire of diabetic patients during the COVID-19 pandemic was formulated.

In the second stage, those goals that are applicable in an operational and targeted manner to measure the awareness and self-care performance in the COVID-19 pandemic were determined. To this aim, the goals were chosen based on the studies conducted in this field and the instructions and care recommendations of the World Health Organization (WHO) regarding COVID-19.

In the third stage, relevant and appropriate items for measuring each of the objective and practical references aligned with the measurement goals were suggested, and 82 items were initially designed. Then, according to the opinions of ten people from the specialized panel of faculty members concerning the research subject who were experts in tool designing, the items were examined in terms of observing grammar, using appropriate words, and placing items in the proper place, both in terms of appearance and qualitative content. Finally, the number of items was reduced to 56 items in 2 areas; 32 questions were designed in the awareness section and 24 questions were designed in the self-care performance section.

In the fourth stage, for the questionnaire's validity, face validity and content validity were employed by two qualitative and quantitative methods (content validity ratio [CVR] and content validity index [CVI]). In addition, for the questionnaire's reliability, internal consistency by calculating Cronbach's alpha was used.

In face validity using qualitative and quantitative methods, the questions were provided to 10 patients with diabetes. To determine the qualitative face validity, the participants were asked to evaluate the questions from three aspects: Level of difficulty, appropriateness, and ambiguity. In the qualitative evaluation of the items, no specific suggestion was received from the participants. In the following, to determine the quantitative face validity of the questionnaire, the importance of the items from the perspectives of ten diabetic patients was assessed on a five-point Likert scale ranging from "absolutely important" to "not important at all," and the respondents' opinions were applied in revising the items. At this stage, the item impact quantitative method was used to reduce and remove inappropriate expressions and determine the

importance of each item (the item impact score) (16,17).

To calculate the CVR, the opinions of 10 experts and professionals in the field of diabetes, COVID-19, and tool development were used. Each item was assessed using three ranges: The item is necessary, the item is useful but not necessary, and the item is not necessary. In this method, based on the Lawshe's table for 10 experts, the items with CVRs over 0.62 were retained. To confirm the content validity, the CVI was calculated. To calculate this index, three criteria, including simplicity and fluency, relevance, and clarity, are used, with a 4-point Likert scale for each item (27).

The Awareness and Self-Care Performance Questionnaire is scored on a 3-point Likert scale: True = 3, I do not know = 2, and false = 1. Questions 22, 16, 29, and 30 are reversed, so their scoring on the Likert scale includes false = 3, I do not know = 2, and true = 1. The score range of awareness is between 32 and 96. A higher score denotes greater awareness, and vice versa. The self-care performance questionnaire is scored on a 5-point Likert scale: Not at all = 1, rarely = 2, sometimes = 3, often = 4, and always = 5. Questions 50, 45, and 51 are reverse questions, so their scoring on the Likert scale includes not at all = 5, rarely = 4, sometimes = 3, often = 2, and always = 1. The score range of self-care performance is between 24 and 120. A higher score denotes greater self-care, and vice versa.

To assess the internal reliability, the questionnaire was distributed to 26 diabetic patients. These patients were chosen using convenience sampling and had medical records at the diabetes clinic. The questionnaire was distributed online through a link created in Google Forms using domestic social network messengers such as Bale, Eitaa, Soroush, and Shad. The inclusion criteria included having an active medical file in the Bushehr diabetes clinic, having reading and writing literacy, having a smartphone, being able to connect to the Internet, not having a known mental disorder according to the individual's self-report, not having known speech and hearing problems, and being over 18 years old. After receiving the participants' responses, the data were calculated using SPSS software version 26 and Cronbach's alpha.

Results

According to the study results, the mean age of the patients was 52.64 years, 81% were married, 55% were female, 35% had an under-diploma degree, and 67% had a family history of diabetes (Table 1).

The findings of the preliminary investigation indicated that the concept of awareness and self-care practices among diabetic patients during the ongoing pandemic has led to an enhanced understanding of the disease, its prevention, transmission, symptoms, risk factors, dietary requirements and therapeutic strategies for managing the disease.

Table 1. Patients' demographic variables in the coronavirus disease 2019 pandemic

Variable	Frequency (%)
Gender	
Female	55 (55)
Male	45 (45)
Marital status	
Single	7 (7)
Married	81 (81)
Death of spouse	7 (7)
Divorced	5 (5)
Education	
Under diploma	35 (35)
Diploma	33 (33)
Associate	8 (8)
Bachelor	19 (19)
Master	5 (5)
A family history of diabetes	
Yes	67 (67)
No	33 (33)
Age (year)	52.64* (10.12**)
Duration of diabetes (years)	9.7* (6.06**)

* The mentioned numbers are mean scores.

** The numbers mentioned are standard deviations.

The results of the second stage revealed that according to the operational goals, it is possible to use the guidelines and recommendations of the WHO regarding COVID-19 to measure the awareness and self-care performance of diabetic patients in the COVID-19 pandemic.

In the third stage, 82 items were first designed. Then, according to the opinions of ten people from the specialized panel of faculty members concerning the research subject that were expert in tool designing, the items were examined in terms of observing grammar, using appropriate words, and placing items in the proper place, both in terms of appearance and qualitative content. Finally, the number of items was reduced to 56 items in 2 areas; 32 questions were designed in the awareness section and 24 questions were designed in the self-care performance section. In the fourth stage of the questionnaire's psychometrics, the face validity results showed that no specific suggestion was received in the qualitative evaluation of the items from the participants, and the results of quantitative face validity in this study showed an impact score of higher than 1.5 for all items, indicating that all items are of required importance.

1. In the fourth stage, for the questionnaire's validity, face validity and content validity were employed by two qualitative and quantitative methods (CVR and CVI). In addition, for the questionnaire's reliability, internal correlation by calculating Cronbach's alpha was used. Assessing the content validity results indicated that

the mean CVR values of the questionnaire were 0.92 in the awareness section and 0.93 in the self-care performance section. The minimum and maximum CVR values for the items were calculated as 0.80 and 1, respectively. Also, the mean CVI values of the questionnaire were 0.95 in the awareness section and 0.98 in the self-care performance section. The minimum and maximum CVI values for the items were calculated as 0.76 and 1, respectively. The mean CVI and the mean CVR of the total questionnaire (the awareness and the self-care performance section) were calculated as 0.97 and 0.93, respectively (Table 2).

Assessing the reliability results indicated that the questionnaire's reliability by calculating Cronbach's alpha coefficient was 0.65 in the awareness section and 0.85 in the self-care performance section, with the total questionnaire's reliability of 0.80. The final self-care Awareness and Self-Care Performance Questionnaire was obtained with 56 items (32 items in the awareness section and 24 items in the self-care performance section) in seven areas of disease characteristics, ways of prevention, ways of disease transmission, disease symptoms, disease risk factors, diet, and care methods. The Awareness and Self-Care Performance Questionnaire is scored on a 3-point Likert scale: True=3, I do not know=2, and false=1. Questions 22, 16, 29, and 30 are reversed. The score range of awareness is between 32 and 96. The self-care performance questionnaire is scored on a 5-point Likert scale: Not at all=1, rarely=2, sometimes=3, often=4, and always=5. Questions 50, 45, and 51 are reverse questions. The score range of self-care performance is between 24 and 120.

Discussion

This study aims to investigate the design and psychometrics of the Awareness and Self-Care Performance Questionnaire in diabetic patients during the COVID-19 pandemic. It is an innovative study in Iran that differs from others by measuring awareness and self-care performance using specific measurement tools, rather than general ones (14,28). The results of the current study revealed that the present questionnaire possesses the required validity and reliability to evaluate the knowledge levels of diabetic patients in the COVID-19 pandemic. In the present study on the design and psychometric process of the questionnaire based on Waltz's method and during 4 stages, first, the concepts of awareness and self-care performance of diabetic patients in the COVID-19 pandemic were addressed based on a literature review, and instances of awareness and self-care performance of diabetic patients in the COVID-19 pandemic based on literature review in 2 areas, i.e., awareness and self-care performance, were stated. Compared to the present study, Ehsani and colleagues' study used Honarvar and colleagues' questionnaire (which investigated the awareness, attitude, and performance of adults toward

Table 2. The mean values of impact score, content validity index, and content validity ratio in the final version of the Awareness and Self-Care Performance Questionnaire in diabetic patients in the coronavirus disease 2019 pandemic

Field	Number	Items	Impact score	CVI	CVR
Awareness	1	The causative agent of COVID-19 is a virus.	4.8	0.96	0.80
	2	There is a possibility of contracting COVID-19 in all ages.	5	0.93	1
	3	The spread of COVID-19 in a short period resulted in the infection of many individuals in society.	4.14	1	1
	4	Elderly individuals, individuals with chronic diseases, and obese individuals are more likely to get a severe form of COVID-19 than others.	4.9	0.83	0.80
	5	The incubation period of COVID-19 (from the infection time to the onset of symptoms) is 2-14 days.	5	0.96	1
	6	Frequent hand-washing with soap and water prevents COVID-19.	4.05	0.93	1
	7	Disinfection of hands with alcohol and disinfectants prevents the spread of COVID-19.	4.05	0.96	0.80
	8	The minimum time required to wash hands is 20 seconds.	3.52	0.96	0.80
	9	Wearing a face mask is effective in preventing COVID-19 infection.	5	1	1
	10	To prevent the infection of COVID-19, one should avoid going to crowded places, such as train stations, and using public transportation.	4.9	1	1
	11	At least 1.5 meters of social distance must be observed.	4.9	1	1
	12	Individuals should avoid touching their eyes, nose, and mouth with contaminated hands.	5	1	1
	13	The COVID-19 vaccine plays an effective role in reducing the infection with COVID-19 and the disease severity.	4.32	1	1
	14	COVID-19 is spread through respiratory droplets of infected individuals.	4.8	1	1
	15	Quarantine of individuals infected with COVID-19 is one of the effective ways to reduce the virus spread.	4.9	1	1
	16	A symptomatic person with a positive COVID-19 test who is in home quarantine can enter the society as soon as he/she feels better.	3.4	0.90	1
	17	Fever, fatigue, dry cough, and body pain are common symptoms of COVID-19.	3.4	1	1
	18	A person may be infected with COVID-19 and have no symptoms.	3.96	1	1
	19	COVID-19 can also be accompanied by gastrointestinal symptoms (nausea, vomiting, diarrhea...).	4.8	0.96	0.80
	20	Like a cold, COVID-19 can be accompanied by nasal congestion, runny nose, and sneezing.	3.44	1	0.80
	21	COVID-19 can lead to changes in the blood sugar levels of diabetic patients.	4.33	0.86	0.80
	22	Special care is not necessary during complications of the COVID-19 vaccine (fever, body pain, headache...).	1.98	1	1
	23	If the COVID-19 vaccine is injected, and the vaccine complications are prolonged for more than a week, it is necessary to perform a PCR test (throat sputum test).	2.52	0.76	0.80
	24	In case of infection with COVID-19, the injection of the COVID-19 vaccine will be postponed in coordination with the doctor.	4.8	1	0.80
	25	Blood sugar control drugs, including insulin, should be stopped before and after the COVID-19 vaccine injection.	2.22	0.96	0.80
	26	Consumption of various vitamins (vitamin C, vitamin D) is effective in preventing and recovering from COVID-19.	4.9	1	1
	27	Increasing fluid consumption is effective in reducing the severity of COVID-19.	4.8	1	1
	28	Eating high-fat foods increases blood sugar.	4.23	1	1
	29	Lemon has no sugar and diabetics can consume it without any restrictions.	3.12	1	1
	30	Dates and honey have natural sugar and do not increase blood sugar.	1.65	0.80	0.80
	31	Smoking culminates in increased blood sugar levels in the body.	1.75	0.90	1
	32	Corona can increase blood sugar in diabetics.	2.66	0.96	0.80
Self-care performance	33	Before eating any food at home, I wash my hands with soap and water.	3.66	1	1
	34	Outside the house, when necessary, I disinfect my hands with alcohol and other effective substances.	4.14	1	0.80
	35	I use a face mask when meeting people, particularly outside the house.	5	1	1
	36	I keep a distance of at least one and a half meters when talking to people.	5	1	1
	37	I do not touch my eyes, nose, and mouth with unwashed hands.	5	1	1
	38	When sneezing and coughing, I cover my mouth and nose with a bent elbow or a tissue.	5	1	1
	39	I avoid going to crowded places like train stations and using public transportation in COVID-19 conditions.	4.8	1	1
	40	Even, if possible, I avoid eating outside the house during the COVID-19 outbreak.	4.05	1	0.80
	41	After injecting the COVID-19 vaccine, I will continue to observe precautionary measures (disinfecting hands, wearing a face mask, observing social distance, etc.).	4.23	1	1

Table 2. Continued.

Field	Number	Items	Impact score	CVI	CVR
	42	Before and after vaccination, I take blood sugar control drugs as usual.	5	0.96	1
	43	I avoid eating high-fat foods.	4.23	1	1
	44	In case infection with COVID-19, I will take all kinds of vitamins according to the doctor's recommendation.	3.2	1	1
	45	I use herbal medicines to strengthen the immune system against COVID-19 without consulting a doctor.	4.7	1	1
	46	I take 2 to 3 teaspoons of cinnamon daily to reduce blood sugar.	1.6	0.96	0.80
	47	I avoid excessive consumption of dates and honey.	4.23	0.96	1
	48	I will increase fluid intake in case of COVID-19.	4.8	1	1
	49	I use green leafy vegetables more than three times a day.	4.23	1	0.80
	50	If the skin is dry, I use emollient creams to soften between the toes.	4.23	0.96	0.80
	51	Before washing my feet, I check the temperature of the water with my fingers.	4.05	0.96	1
	52	I check my feet daily for blisters, cuts, scrapes, or lesions between the toes.	4.14	0.96	1
	53	If I have a fever, I check my blood sugar more often.	3.44	0.96	0.80
	54	In the COVID-19 conditions, I continue to do my sports activities, taking into account the health instructions.	2.94	0.90	0.80
	55	I refrain from smoking.	5	0.93	0.80
	56	I pay attention to the recommendations of the Ministry of Health regarding the injection of the COVID-19 vaccine.	3.68	1	1
Mean			3.95	0.97	0.93

CVI, content validity index; CVR, content validity ratio.

COVID-19) to investigate the level of awareness, attitude, and performance of diabetic patients toward COVID-19. The mentioned questionnaire with 46 items and 3 areas of awareness, attitude, and self-care performance, while having good validity and reliability; however, it was not specific to diabetic patients and was designed for the general public (29,30). There are differences between the present study and Ehsani and colleagues' study in terms of the questionnaire used. Although Honarvar and colleagues' study, similar to the present study, has dealt with important areas, such as individuals' awareness and performance regarding COVID-19, the questionnaire was not specific to diabetic patients, while in the present study, in addition to the items addressed by Ehsani et al, care items specific for diabetic patients in the COVID-19 period, such as the effect of consuming high-fat foods in diabetic patients in the COVID-19 period, the effect of COVID-19 on the blood sugar level of diabetic patients, and the effect of the COVID-19 vaccine on the blood sugar level of diabetic patients, have also been mentioned (31).

Mohammadian et al used a researcher-made questionnaire aiming to determine the awareness, attitude, and performance of individuals with type 2 diabetes in the city of Izeh regarding COVID-19 in 2021. The questionnaire contained four parts: Demographic characteristics, measuring the awareness of patients with type 2 diabetes regarding COVID-19, measuring the attitude and performance of patients toward COVID-19. The results of the mentioned study revealed that despite the individuals' acceptable levels of awareness, attitude, and performance toward COVID-19, in some cases,

there were responses based on poor knowledge, incorrect beliefs and attitudes, and insufficient performance regarding various aspects of COVID-19 in the study. Although the questionnaire used in Mohammadian and colleagues' study has good validity and reliability, with 31 items in the awareness section, 8 items in the attitude section, and 11 items regarding the self-care performance, this questionnaire evaluates the general performance of diabetic patients in the COVID-19 conditions (30). In the present research, the Awareness and Self-Care Performance Questionnaire regarding COVID-19, besides the items mentioned in Mohammadi and colleagues' questionnaire regarding general care during the COVID-19 era, assesses more specialized items, such as the effect of the COVID-19 vaccine on the severity of diabetes, the consumption of various vitamins such as vitamin C and Vitamin A on the severity of diabetes, the effect of COVID-19 on blood sugar increase, and how to use blood sugar lowering drugs during COVID-19 vaccine injection. The questionnaire used in Mohammadian and colleagues' study, like the present study, had good face validity, content validity, and reliability.

Consistent with the present study, Pal et al conducted a web-based cross-sectional study to assess the knowledge, attitude, and performance of patients with type 1 diabetes regarding COVID-19 during quarantine in India. The researcher-made questionnaire in the mentioned research contained 15 questions about knowledge, 5 questions about attitude, and 8 questions about performance. The result of their study demonstrated that young patients with type 1 diabetes had moderate knowledge about COVID-19, reflected in their positive attitude and

healthy preventive measures toward COVID-19. The questionnaire used in Pal and colleagues' study, similar to the current study, besides the general knowledge about diabetes, also deals with the specific knowledge of diabetic patients at the time of COVID-19, such as "Do patients with diabetes have higher odds of contracting COVID-19 than normal individuals?" and "Is more likely for diabetic patients to die due to COVID-19 compared to normal individuals?" (32).

Alsaleh et al conducted a study to evaluate the level of knowledge, attitude, performance, and fear about the infection of COVID-19 among patients with diabetes mellitus in primary healthcare centers in Kuwait. The data collection tool was a researcher-made questionnaire in four areas, including knowledge (28 items), attitude (7 items), performance (15 items), and fear (7 items), about COVID-19. The results demonstrated that most of the patients had moderate awareness (71.1%), positive attitudes (90.9%), and good preventive measures (83.6%) toward COVID-19. The patients' fear total score was 21.6 ± 6.5 (61.7%). Regardless of patients' positive attitudes and good preventive measures, they had a moderate level of awareness regarding COVID-19, indicating the presence of significant knowledge gaps in the diabetic patients' knowledge in the mentioned study (33). Alsaleh and colleagues' study, aligned with the current study, contains appropriate questions about general information about COVID-19 and compliance with the issues that all society members should consider in the face of COVID-19. In Alsaleh and colleagues' research, similar to the current research, diabetes patients' knowledge and information about prevention methods, ways of disease transmission, disease symptoms, disease risk factors, diet, and care methods against COVID-19 have been evaluated. However, unlike the present study and aligned with other mentioned studies, Alsaleh and colleagues' study has addressed the necessary general information about COVID-19, and has not addressed those questions that diabetic patients have to deal with diabetes according to their disease and should have been asked. Moreover, the questionnaire used in Alsaleh and colleagues' study lacks validity and reliability reports.

De Lima Filho et al conducted a cross-sectional descriptive study entitled "Investigating the Level of Knowledge among the Elderly with Diabetes about COVID-19 in Brazil" by phone. Data were collected through a structured questionnaire in the form of an interview, and data related to socio-economic variables and participants' awareness of COVID-19 were collected using the checklist of the Brazilian Ministry of Health guidelines. The total points obtained by the participants ranged from zero to 24. A higher score denoted a greater level of knowledge of COVID-19. This questionnaire did not have a specific cut-off point because the checklist of the Brazilian Ministry of Health was used.

This questionnaire contains 24 items regarding disease symptoms (5 items), ways of transmission (6 items), and preventive measures (13 items) concerning COVID-19. The mentioned research indicated that participants had no in-depth knowledge about COVID-19 because out of 24 questions, on average, only 7.73 ± 1.61 correct answers were obtained. This finding indicates that the knowledge sources of the elderly participants may have been incomplete or their capacity to retain information was insufficient (13). The questionnaire used in de Lima Filho and colleagues' study, similar to the current research, evaluated the disease symptoms, ways of transmission, and preventive measures regarding COVID-19. Moreover, the mentioned questionnaire assessed the preventive measures considering the different levels of COVID-19 and the occurred symptoms. This is one of the strengths of de Lima Filho and colleagues' study compared to the present study, which measured the preventive methods for each of the symptoms of COVID-19 separately. Furthermore, de Lima Filho and colleagues' research did not refer to the items of the knowledge about the COVID-19 diagnosis, the required information for travelers, or what to do if someone gets COVID-19 because, as quoted by the author, the information regarding these cases has been mentioned to people in previous studies, and they know what to do when dealing with COVID-19. Another point is that the questionnaire used in de Lima Filho and colleagues' study lacked validity and reliability reports.

Aligned with the present study, Lim et al analyzed the psychometrics of the diabetic patients' awareness questionnaire regarding diabetes during the COVID-19 era in Malaysia. In the mentioned study, as in the present study, the dimensions of diabetes, the disease treatment, nutrition, detrimental effects of diabetes, disease control, risk factors, and physical activity of diabetes individuals were discussed (21). A difference between the present study and Lim and colleagues' study includes the item "how to store insulin," which was not mentioned in the present study. Although this issue has been addressed in Lim and colleagues' study, according to the author, many respondents did not respond to this question correctly, and the lack of correct answers may have been due to the lack of clarity in the concept of using insulin because the insulin can be stored in a refrigerator at a temperature of 2-8 °C and at a room temperature lower than 28 °C away from sunlight for 4 weeks (34). Hence, probably the lack of correct perception of the item had provided the ground for incorrect answers by the respondents in the mentioned study.

Legese et al conducted a cross-sectional study to evaluate knowledge, attitude, and performance toward COVID-19 among patients with chronic diseases referred to public hospitals. This study was conducted on 319 patients with chronic diseases referred to public hospitals in Mekele, Tigray, Ethiopia, from April to June 2021. The samples

were systematically selected, and a researcher-made questionnaire was used to collect data. The questionnaire contained socio-demographic characteristics, knowledge (16 items), attitude (14 items), and performance (16 items) toward COVID-19. The results of the mentioned study demonstrated that 51.1% of patients had good knowledge, 59.9% had positive attitudes, and 49.2% had good performance regarding COVID-19. Legese and colleagues' study, similar to the current research, has explained the operational concepts of awareness, attitude, and self-care performance in diabetic patients based on a literature review as the basis for designing questionnaire items. However, unlike the present study, it has not referred to the questionnaire's validity and reliability (12).

The present research, like other studies, has limitations. One of its limitations is the researcher's limited access to other internal and external databases to review the literature related to diabetes in the COVID-19 era, which could impact the accurate explanation of the awareness and self-care performance concepts among diabetic patients during the COVID-19 pandemic. Also, since this study has been extracted from a master's thesis, due to time constraints, it was not possible to conduct the construct validity to precisely express the areas of awareness and self-care performance of diabetic patients during COVID-19 in the student's period of education. Therefore, to resolve this limitation, it is suggested that other qualitative studies be conducted to explain more precisely the concepts of awareness and self-care performance of diabetic patients to collect more complete items in developing the Awareness and Self-Care Performance Questionnaire of diabetic patients in infectious pandemics. It is also suggested that the construct validity be conducted to determine the exact dimensions of the questionnaire and other psychometric items after construct validity, such as stability, responsiveness, ceiling effect, and floor effect.

Conclusion

The research results reveal that the designed questionnaire has good psychometric properties, the required strength and validity to measure the awareness and self-care performance in diabetic patients during the COVID-19 pandemic, and the applicability in similar studies. The current questionnaire is by Iranian culture, convenient, and understandable to measure awareness and self-care performance in diabetic patients during the COVID-19 pandemic. Since this research is part of a more extended study by a master's student, it was not possible to conduct the questionnaire's construct validity in the student's short period of education. Therefore, conducting the construct validity is suggested as a supplemental part of the questionnaire's construct validity.

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Formal analysis: Niloofar Motamed.

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Methodology: Niloofar Motamed, shahnaz Pouladi.

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Competing Interests

No conflict of interest.

Ethical Approval

The current research was conducted after obtaining permission from the Vice-Chancellor of Research and Technology of the university, and obtaining the code of ethics (IR.BPUMS.REC.1401.098).

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