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RESEARCH ARTICLE

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Development and validation of knowledge of caring for COVID-19 tool

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Abstract

Aim: We aimed to examine the validity and reliability of a newly developed tool that measures nursing and allied health students' knowledge of caring for patients with COVID-19.

Method: We developed in five phases (literature review, item development, expert evaluation using content validity index, revisions based on a pilot test, and exploratory factor and reliability analyses on the data from the main study). We administered online surveys (the pilot test & the main study using a cross-sectional design) to students in a governmental health sciences college in Oman.

Results: The pilot test had 43 participants, and the main study had 507. The item content validity index scores ranged from 0.81–1.00, and the scale content validity index for 20 items was 0.95. The factor analysis revealed a three-factor solution. The overall Cronbach's alpha for the final (19-item) version of the tool after item deletion was 0.76. The reliabilities for Subscales 1, 2, and 3 were 0.83, 0.67, and 0.51, respectively.

KEYWORDS
content validity index, COVID-19, exploratory factor analysis, knowledge of caring, reliability, tool development

1 | INTRODUCTION

The rise in morbidity and mortality rates from the COVID-19 pandemic has raised some questions regarding the effectiveness of the strategies for preventing COVID-19 infection. One of the most effective strategies being used globally is increasing the awareness of people regarding proper preventive measures. Doctors, nurses, and allied health teams are on the front line managing COVID-19 cases. Similarly, nursing and allied health students can play a major role in fighting this pandemic. They can be called on to supplement the shortage of health care professionals due to the highly contagious nature of the disease, which may place extreme pressure on frontline health care workers. Therefore, these students must be equipped with proper knowledge about the effective management of COVID-19 and the necessary personal safety and preventive measures before making clinical contact to care for patients with COVID-19. Most importantly, exploring students' knowledge of care for COVID-19 patients is a vital step during this pandemic.

1.1 | Background

The COVID-19 pandemic has forced many health care organizations and services to implement strategies to overcome the consequences

of the outbreak, such as a shortage of nurses and lack of resources. Some of those strategies include asking recently retired clinical staff to return to practice to support the rapidly rising demand for health care workers and recruiting nursing and allied health students, especially those in the final years of study, to supplement the number of health care staff available (Rosychuk et al., 2008; Yonge et al., 2010).

Recruitment of nursing and allied health students is a crucial part of preparedness for a pandemic due to the unique skills that those students have in terms of caring for sick people (Rosychuk et al., 2008). Students can play a major role in helping frontline nurses who are fighting COVID-19 by performing noncritical nursing tasks such as feeding patients, checking vital signs, and performing clerical tasks. In addition, students can provide many services in the community, such as administering health education and conducting community visits with sick patients. Nevertheless, students must be equipped with the necessary skills and knowledge of prevention strategies. They also need to be provided with the required personal protective equipment since even caring for patients in regular wards could be risky due to the asymptomatic nature of COVID-19 in some patients (CDC, 2020; Qasim et al., 2018; Tavan et al., 2016). Consequently, some researchers have emphasized the significance of supervising the students during their work, claiming that sending students to clinical areas without any supervision may produce more catastrophic results than benefits; for example they could get infected or infect others (Swift et al., 2020).

Nursing education was one of the first professional health care education offered in Oman. In 1959, nursing education started with an in-hospital training course that lasted 6–9 months (Al Maqbali et al., 2019) In 1970, the American Missionary Association started a 2-year training program for nurses. Later, in 1991, the program was expanded as the nursing workforce grew, with 12 nursing institutes teaching a 3-year diploma program under the supervision of the Ministry of Health. The first baccalaureate program in Oman was offered by Sultan Qaboos University (Al Maqbali et al., 2019).

Recently, the Ministry of Health's educational institutions were combined under one health sciences college. The existing certificate was upgraded to a bachelor of science degree. The college has nine branches with six nursing and allied health specialities: pharmacy, medical imaging, physiotherapy, medical information records, medical laboratories, and oral health and hygiene. College programs include the foundation program, a noncredit preparatory course to start academic studies. The foundation program's main focus is to develop the students' English skills, and it includes courses in mathematics and information technology. The bachelor of science programs includes theory and practicum courses that prepare students in the various health care professions. In 2018, the college produced 530 graduates from different specialties (Ministry of Health, 2018), making it one of the largest contributors of health care professionals in the country.

Various colleges in Oman did not permit their students to volunteer in hospitals during the pandemic. Some colleges allowed students supervised volunteering opportunities, which were preceded by preparatory workshops on infection control. The fear that students might be infected with COVID-19 and the fear of sending students without prior preparation to care for patients are examples of the limitations of employing nursing students during the COVID-19 pandemic.

There is a growing concern that nursing curricula focus little on caring for patients in disaster events or pandemics (e.g. COVID-19); therefore, it is important to examine the knowledge of nursing and allied health students empirically regarding caring for such patients.

Although some instruments measure nurses' and allied health personnel's knowledge regarding pandemic diseases, very few instruments focus on nursing and allied health students. Most of those instruments focus on previous pandemic diseases (e.g. influenza, SARS, and H1N1) and were tested mainly in Western countries and a few Eastern countries. To our knowledge, this study is the first to measure nursing and allied health students' knowledge of caring for patients with COVID-19 in Oman, which has a unique demographical and cultural context. As an Arabic Muslim country, Oman has a unique cultural background that influences individuals' relationships within society. Many of these concepts influence students' knowledge and subsequently their attitudes towards COVID-19 in regard to caring for patients and adhering to precautionary measures. These measures include maintaining physical distance and avoiding handshakes and social gatherings, which are contradictory to the students' societal graces, customs, and behaviours.

The development of an instrument that measures nursing and allied health students' knowledge of COVID-19 is important to understand the extent of their awareness about the precautionary measures and to determine the sources of their information. Consequently, conducting psychometric measurements for the newly developed instrument is an essential step. Developing and validating such instruments may help academic institutions assess students' knowledge of caring for patients with COVID-19. Moreover, a validated instrument may add to the understanding of students' preparedness and contribute to supporting health care systems in safely overcoming the issue of workforce shortages.

1.2 | Research aims

The aims were to (a) describe the process of developing a tool for assessing nursing and allied health students' knowledge of caring for patients with COVID-19, the Knowledge of COVID-19 (KCOVID-19) tool, and (b) examine the validity, reliability, and factor analysis of the newly developed tool.

2 | METHOD

The current tool was developed in five phases: Phase 1, reviewing relevant literature; Phase 2, developing items that suit the study's purposes; Phase 3, sending the first draft of the tool to expert reviewers to evaluate the content and construct validity and then modifying the tool items based on the experts' revisions; Phase 4,

piloting the modified tool with a group of nursing and allied health students to test the tool's internal consistency reliability (Huyuh et al., 2020; Qasim et al., 2018); and Phase 5, modifying the tool based on the results of exploratory factor analysis and assessing the internal consistency of the final version of the tool (Figure 1).

2.1 | Phase 1: Literature review

The first step was searching the literature for instruments that measure the knowledge of health care workers and/or students regarding the COVID-19 pandemic. The literature search was conducted through different databases such as PubMed and Google Scholar to identify all relevant instruments.

2.2 | Phase 2: Item development

The second step was to draft an item pool that meets the definition of the construct of interest (DeVon et al., 2007). We defined knowledge of care during the pandemic based on the students' level of awareness of three areas of COVID-19: (a) transmission, symptoms, prognosis, and treatment; (b) self-protection measures, and (c) the sources of their knowledge. Accordingly, we generated 23 items by examining the literature and relevant instruments and obtained the authors' permission (Modi et al., 2020) to adapt the instrument's items. We also reviewed the latest updates from the WHO and the CDC.

2.3 | Phase 3: Expert Reviewers

We developed a content validity index (CVI) tool (Table 1) to determine if the tool content is valid regarding the addressed topic (Lynn, 1986). We adapted the CVI published by Squires et al. (2013). We aimed to obtain a large number of experts to allow for disagreements between experts. Lynn (1986) suggested a minimum of six participants to allow for at least one disagreement between them. We sent the CVI tool to 25 expert reviewers with various expertise in academia and with experience in instrument development. The expert reviewers were also health care providers in the areas of communicable diseases and/or nurse specialists. Two reminders were sent, and 16 forms were returned within 1 month. The reviewers were asked to judge the degree of relevancy of the instrument items to the definition of knowledge stated earlier and to rate the items on their relevancy to the proposed concepts using a 4-point Likert-type format (1 = *not relevant*, 2 = *somewhat relevant*, 3 = *quite relevant*, 4 = *highly relevant*; Davis, 1992).

We assessed the content validity of the tool using the CVI (Squires et al., 2013). The CVI adds clarity when judging the degree to which tool items are relevant to the concept being assessed (Lynn, 1986). We used the 16 forms collected from the experts to evaluative the CVI of the tool. Lynn (1986) suggested using a minimum of five experts when conducting a CVI.

We calculated the item content validity index (Item-CVI) and the scale content validity index (Scale-CVI). We computed the Item-CVI and Scale-CVI using averages (Polit et al., 2007). We calculated the Item-CVI by adding the number of evaluators who provided a rating of either 3 or 4 on the 4-point scale and dividing by the total number of evaluators (Polit et al., 2007). We calculated the Scale-CVI by averaging the items (Item-CVI; Polit et al., 2007).

2.4 | Phase 4: Pilot test

The purpose of the pilot test was to obtain feedback from participants on the newly developed tool and to assess the feasibility of

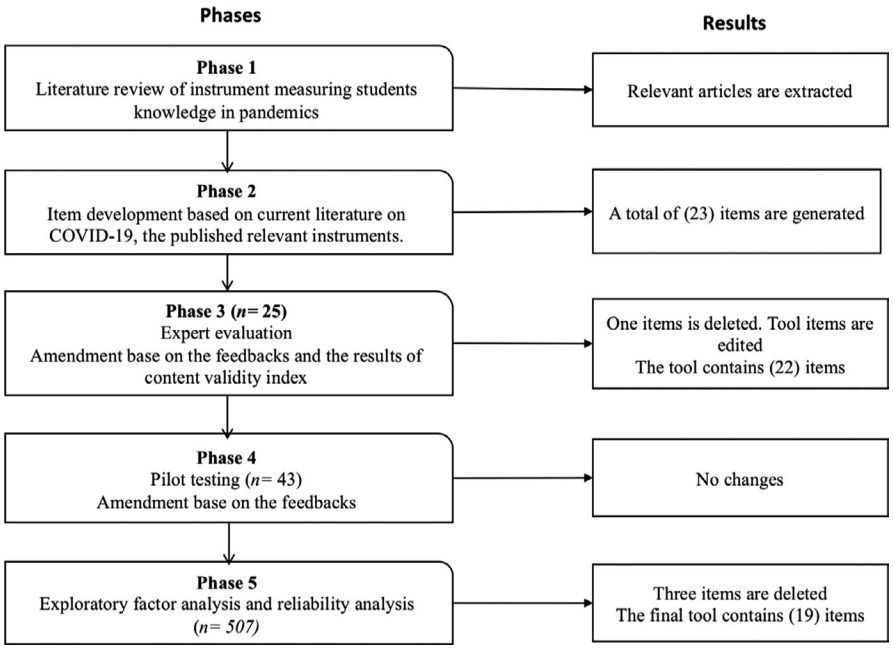

FIGURE 1 Validation process of the Knowledge of caring for COVID-19 tool (KCOVID-19)

TABLE 1 Results of the 16 experts' feedback on Content Validity Index (CVI) rating[a] for the Knowledge of caring for COVID-19 (KCOVID-19) tool. Phase III of the tool development

Item[b]	Expert agreement	I-CVI	Action base on experts' feedback	Item after modifications
Subscale: The student's level of awareness on COVID-19 sources, transmission, symptoms, prognosis, and treatment				
1. The virus causing COVID-19 infection is called 2019-nCoV	14/16	0.88	*Deleted* Similar to (item 2)	Item is deleted
2. Another name for the virus of COVID-19 is SARS-CoV-2	15/16	0.94	*Rephrased* based on experts' suggestions	The for the virus of COVID-19 is SARS-CoV-2
3. The most common symptoms of COVID-19 are fever, dry cough, and tiredness	16/16	1	*Rephrased* for clarity based on members of the research team suggestion	*According to the World Health Organization (WHO)*, the most common symptoms of COVID-19 are fever, dry cough, and tiredness
4. Chest pain or pressure, and loss of speech or movement are not symptoms of COVID-19	15/16	0.94	*Deleted* wrong and correct statements are within the same item	Item is deleted
5. The main mode of transmission of the virus from person to person is via personal contact with an infected person	15/16	0.94	*Rephrased* based on experts' suggestions	The main mode of transmission of the virus from person to person is via close personal contact with an infected person
6. Small droplets from coughing, sneezing, or speaking can spread the disease	16/16	1	Nil	No changes
7. Patients with chronic diseases are at a higher risk of infection and death	16/16	1	Nil	No changes
8. Children and young adults have a lower risk of infection	15/16	0.94	Nil	No changes
9. Using of face mask and gloves are not essential in the prevention of COVID-19	14/16	0.88	*Rephrased* based on experts' suggestions	Using of face mask and gloves are essential in the prevention of COVID-19
10. Hand hygiene and hand rub with soap for at least 20 s is important to kill the virus	16/16	1	Nil	No changes
11. The isolation period for COVID-19 is a minimum of two (2) weeks	16/16	1	Nil	The isolation period for COVID-19 is a minimum of fourteen (14) days
12. Antibiotics are the first-line treatment for COVID-19	13/15	0.87	Nil	No changes
Subscale: The level of awareness towards self-protection during the pandemic crises				
13. I believe washing hands with soap more frequently is essential to avoid infection	16/16	1	*Rephrased* based on experts' suggestions	I believe washing hands with soap more frequently is essential
14. I think it is wise to avoid crowded places during such a crisis	16/16	1	*Rephrased* based on experts' suggestions	I think it is wise to avoid crowded places
15. I would stop shaking hands with family members and keep a physical distance to avoid infection	15/16	0.94	*Rephrased* based on experts' suggestions	I would stop shaking hands with family members and keep a physical distance
16. I think social events such as iftar in Ramadan, Eid celebration can be practiced within the family group.	16/16	1	*Rephrased* based on experts' suggestions	I will celebrate social events such as Eid within my extended family members only
17. I believe ordering foods from restaurants is a safe practice	13/16	0.81	*Rephrased* based on experts' suggestions	I believe ordering food online from restaurants and groceries is a safe practice
Subscale: The student's awareness of COVID-19 resources to keep themselves updated				

(Continues)

TABLE 1 (Continued)

Item[b]	Expert agreement	I-CVI	Action base on experts' feedback	Item after modifications
18. I feel the present resources available are adequate to keep me updated with current information about COVID-19	15/15	1	*Rephrased* based on experts' suggestions	I feel the available official accounts in Oman are adequate to keep me updated with current information about COVID-19
19. I know there is an available hotline/ call center to answer any of my concerns or questions about COVID-19	16/16	1	Nil	No changes
20. I am aware of the "Tarassud" application	14/15	0.93	Nil	No changes
21. I am aware of the Oman official Twitter account "Oman vs. COVI-19"	14/15	0.93	Nil	No changes
22. I joined an online free workshop/course about COVID19 organized either by my college or other colleges in Oman	14/15	0.93	Nil	No changes
23. My college accounts in social media provide sufficient information on COVID-19 prevention	15/16	0.94	Nil	No changes

[a]Scale-level content validity index averaging method (I-CVI/Ave) = 0.95.

[b]Minor grammatical corrections were done on a few of the items' wording before the publication of the article.

administering the study's main survey. We implemented a cross-sectional design and collected data from students attending the governmental health care sciences college (using online survey administration by Google Surveys) from 15 to 24 June 2020. We included students from all academic years in the college's speciality programs. We excluded students who were not attending the college and students from the foundation program, the preparation program because they lack exposure to clinical practice. Due to social distancing restrictions forced by the COVID-19 pandemic, we obtained the assistance of a student affairs officer to email the survey link to the students.

2.5 | Phase 5: Factor analysis and reliability test

We conducted a study (main study) to examine the effect of the students' beliefs about and knowledge of COVID-19 on the intention to care for patients with COVID-19. We followed a similar study design, inclusion and exclusion criteria, and data collection method to those of the pilot test and added a criterion to exclude students who participated in the pilot test. We collected data for the main study from 11 to 30 July 2020. We used the results of the main study to conduct a factor analysis and reliability test. We conducted a principal component factor analysis using orthogonal (Varimax) rotation on the study sample. We followed these steps:

a. data screening: This step was conducted to determine the intercorrelation between variables. We used Field's (2015) recommendation to remove one of a pair of items with bivariate correlation scores ($r > .80$) to avoid or correct for multicollinearity (p. 807).
b. the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity: We conducted the KMO and Bartlett's Test of Sphericity to assess the suitability of conducting a factor analysis for the given data or the sampling adequacy. A KMO is >0.50 and a significant Bartlett's Test of Sphericity ($p < .05$) is needed to consider the tool suitable for factor analysis (Field, 2015, p. 817). We also looked at commonalities to examine the "proportion of common variance present in a variable" (Field, 2015, p. 795). As recommended by Child (2006), we removed any items with commonalities <0.2.
c. factor extraction: We used the principal components method of factor extraction. We used the scree plot test and parallel analysis value set established by Patil Vivek et al. (2017) to determine the number of factors to extract (Field, 2015). This was done by using Kaiser's criterion of an eigenvalue greater than 1 (Field, 2015).
d. the rotation method: We used Varimax rotation (Field, 2015). This method of rotation provides a clear and more interpretable structure because "the explained variances among the factors do not overlap and are therefore independent of each other" (Pett et al., 2003, p. 143). According to Field (2015), factor loading of at least 0.4 is considered "substantial". We suppressed the factor loading at less than 0.3; therefore, we did not lose value close to the cutoff, such as with loading of 0.39 (Field, 2015, p. 821).
e. factor labelling: Finally, we gave the extracted factors meaningful names after examining the actual items included in each factor to provide a useful description of the construct reported (Williams et al., 2010).
f. reliability analysis: We used Cronbach's alpha to measure the reliability of the factored tool.

2.6 | Statistical analysis

We used SPSS-27.0 -trial version- IBM® to conduct the exploratory factor analysis and the reliability analysis. We used Microsoft Excel to analyse the data from expert evaluation. We conducted the analysis based on the criteria set in the method section of this article.

3 | RESULTS

3.1 | Demographical characteristics

3.1.1 | Pilot test

The participants for the pilot test were 43 female students. The students' study programs were as follows: Nursing (*N* = 9, 20.9%), Pharmacy (*N* = 18, 41.9%), Radiography (*N* = 8, 18.6%), Medical Laboratory (*N* = 2, 4.7%), and Physiotherapy (*N* = 6, 14.0%). The mean age of respondents was 22.09 ± 1.09.7 years (range = 19–24 years), and most were third-year (*N* = 11, 25.6%) and fourth-year students (*N* = 17, 39.5%). The majority of participants had not previously volunteered in any disastrous situations (*N* = 34, 79.1%).

3.1.2 | Main study

The main study's participants comprised 507 students. The mean age of the participants was 21.2 ± 1.24 years (range = 18–25). The majority of respondents were female (*N* = 391, 77.1%) and were students in the nursing program (*N* = 458, 90.3%). The majority of students 81.3% (*N* = 412) had no experience in volunteer work; this study is under consideration for publication in a different journal.

3.2 | Phase 1: Literature review

We identified various tools, only one of which considered students' knowledge. This tool was developed by Modi et al. (2020) and aimed to "assess the awareness of COVID-19 disease and related infection-control practices among healthcare professionals and students in the Mumbai Metropolitan Region" (p. 1). The tool consisted of demographical questions: 17 questions based on knowledge and infection-control practices related to COVID-19 in the health care setting and a few questions related to hand hygiene techniques. The tool was not specifically developed for nursing and allied health students and was not created in the context of Arabic culture. This, too, was a good base for developing the KCOVID-19 tool that needed our concept definition stated earlier. A member of the research team contacted the original developers of the tool and obtained their permission to use the tool.

3.3 | Phase 2: Generation of items

We generated 23 items designed to measure the participants' knowledge of caring for COVID-19 patients. We organized the tool as a 5-point Likert scale (*strongly agree*, *agree*, *not sure*, *disagree*, and *strongly disagree*). All of the tool items were in English, as it is the formal instructional language of the college. Minor changes were made, such as rewording sentences and including updates based on WHO recommendations, before sending the tool off for expert evaluation.

3.4 | Phase 3: Content Validity Index

After collecting the CVI feedback forms from the 16 expert reviewers, we transferred the feedback to an Excel spreadsheet to calculate the Item-CVI and Scale-CVI for the 23 items (Scale-CVI was 0.95, indicating a high level of validity). The individual Item-CVIs are presented in Table 1. The reviewers' comments were evaluated, and some statements were rephrased and modified as suggested (Table 1). Two items were deleted: one because it overlapped with another item and another because it had incorrect statements about the symptoms of COVID-19, which might be confusing to participants (Table 1). After we considered the experts' feedback, the final edition of the tool about students' knowledge of caring for COVID-19 patients comprised 21 items. One item about quarantine—Item 10: "According to the WHO, quarantine means separating people who are ill with symptoms of COVID-19 and may be infectious to prevent the spread of the disease"—was added later. We added this item because quarantine is considered a major factor in the management of COVID-19 and health care providers need to have current information from the WHO's latest update about the strategies for managing COVID-19. This addition brought the total number of items to 22 at this stage of development. We rearranged the numbered items and the labels for each section of the tool to improve readability.

3.5 | Phase 4: Pilot test

Minor issues were reported during the administration of the KCOVID-19 tool. For instance, we revised Item 1 from "The virus of COVID-19 is SARS-CoV-2" to "Another name for the coronavirus of COVID-19 is SARS-CoV-2" for clarity. We also added the phrase "from COVID-19" was added to Item 5, making the item read "Patients with chronic diseases are at a higher risk of infection and death from COVID-19." Another change included adding the word "sanitizer" added to Item 8, "Hand hygiene and rubbing hands with *soap and sanitizer* for at least 20 s are important to prevent transmission of the virus," to cover the use of sanitizers in hand hygiene (Table 2).

TABLE 2 Rotated Component Matrix (Factor loadings) for the newly developed the Know of COVID-19 (KCOVID-19) tool[a]

Item number	Item description[b]	Factor I	Factor II	Factor III
1.	[c]Another name for the coronavirus of COVID 19 is SARS-CoV-2			
2.	According to the World Health Organization (WHO), the most common symptoms of COVID-19 are fever, dry cough, and tiredness	**0.631**		
3.	The main mode of transmission of the virus from person to person is via personal contact with an infected person	**0.467**		
4.	Small droplets from coughing, sneezing, or speaking can spread the disease	**0.644**		
5.	Patients with chronic diseases are at a higher risk of infection and death from COVID-19	**0.716**		
6.	Children and young adults have a lower risk of getting sick from COVID-19		−0.304	**0.531**
7.	Using of face mask, gloves and social distance are essential in the prevention of COVID-19	**0.690**		
8.	Hand hygiene and hand rub with soap and sanitizer for at least 20 s are important to prevent transmission of the virus	**0.736**		
9.	The isolation period for COVID-19 is a minimum of (14) days	**0.581**		
10.	According to the WHO, quarantine means separating people who are ill with symptoms of COVID-19 and may be infectious to prevent the spread of the disease	**0.402**		
11.	Antibiotics are the first-line treatment for COVID-19			**0.589**
12.	I believe washing hands with soap more frequently is essential	**0.593**		
13.	I think it is wise to avoid crowded places during the COVID-19 outbreak	**0.540**	0.319	
14.	I would stop shaking hands with family members and keep a physical distance to avoid infection	**0.468**		
15.	[c]I will celebrate social events such as Iftar in Ramadan and Eid with my immediate family members			−0.345
16.	I believe ordering foods from restaurants is a safe practice	−0.303		**0.536**
17.	I feel the available official accounts in Oman are adequate to keep me updated with current information about COVID-19		**0.712**	
18.	I know there is an available hotline/call center to answer any of my concerns or questions about COVID-19		**0.568**	
19.	I am aware of the "Tarassud" application		**0.690**	
20.	I am aware of the Oman official Twitter account (Oman vs. COVI-19)		**0.613**	
21.	I joined an online free workshop/course about COVID19 organized either by my college or other colleges in Oman			**0.645**
22.	My college accounts in social media provide sufficient information on COVID-19 prevention			**0.550**

[a]Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. All presented items have a loading cut-off of (>0.3). The highest loading values for each item are bolded.

[b]Minor grammatical corrections were done on a few of the items' wording before the publication of the article.

[c]Item 1 and item 15 are removed from the tool due to low loading (>0.4). Factor loading of at least 0.4 is considered substantial (Field, 2015).

3.6 | Phase 5: Factor analysis

The correlation matrix revealed an acceptable correlation lower than 0.80. The KMO measure (0.84) was within acceptable limits to verify the adequacy of the sample for the analysis (Field, 2015, p. 826). Bartlett's Test of Sphericity for the data was significant ($p < .0001$). The scree plot indicated three-factor solutions (Figure 2), and the parallel analysis (Patil Vivek et al., 2017) indicated three-factor solutions. All of the items' commonalities, prior to rotation, in the rotated factor solutions were above the acceptable limit (0.2).

The rotated component matrix indicated the three-factor solution had all items loading above the acceptable limit (0.4). The three-factor rotated solution explained 38.96% of the variance. The variance explained by Factors 1, 2, and 3 was 19.22%, 10.86%, and 8.89%, respectively. Factor 1 included Items 2, 3, 4, 5, 7, 8, 9, 10, 12, 13, and14), Factor 2 included items 17, 18, 19, and 20), and Factor 3 included Items 6, 11, 16, 21, and 22; Table 2). Items 1, "Another name for the coronavirus of COVID-19 is SARS-CoV-2," and 15, "I will celebrate social events such as Iftar in Ramadan and Eid within my immediate family members," had low loading; therefore, they

were removed from the tool, making the total number of items 20 at this stage of tool development.

We labelled the extracted factor to provide meaningful names after examining the actual items included for each factor (Williams et al., 2010). These labels were different from the original labels we included in the pilot test and the main study. We labelled the factors accordingly: Factor 1/Subscale 1: General knowledge about symptoms, transmission, and prevention, Factor 2/Subscale 2: Source of information knowledge, and Factor 3/Subscale 3: Health promotion and treatment knowledge.

3.7 | Reliability analysis (Cronbach's alpha)

The overall Cronbach's alpha for the 20-item tool was acceptable (α = 0.74). The Cronbach's alpha obtained for Factor 1 was good (α = 0.83), for Factor 2 was acceptable (α = 0.67). and for Factor 3 was poor (α = 0.49). We deleted one item—"Children and young adults have a lower risk of getting sick from COVID-19"—to increase the Cronbach's alpha to 0.51. The overall Cronbach's alpha for the tool increased to 0.76 after we deleted Item 6. The items comprising the tool were renumbered, and the final version of the tool contained 19 items (Appendix).

4 | DISCUSSION

After a review of the literature, we developed 23 items, which we subjected to various tests of validation, including acquiring expert evaluation of the tool content using CVI, performing exploratory factor analysis, administering a pilot test, and finally conducting an exploratory factor analysis and internal consistency reliability on a larger sample.

Based on the results of the CVI, we deleted one item because it overlapped with another item and one item since it contained incorrect statements that might be confusing to the participants. Furthermore, one item about the definition of quarantine was added because this is an important aspect in the management of COVID-19 and it had not previously been addressed in the tool. A total of 22 items was subjected to factor analysis. The exploratory factor analysis revealed a distribution of the items into three factors (subscales). Following the exploratory factor analysis, two items with low loadings were removed, making the total 20 items at this stage of development. Moreover, the tool's Cronbach's alpha coefficient was good (α = 0.76) after the deletion of one item to increase reliability. The final version of the KCOVID-19 tool has 19 items.

Overall, the instrument's development and implementation process helped in justifying its validity. We also believe this tool represents several cultural and behavioural patterns that match the study's context. For example, in Arab Muslim countries, shaking hands is considered part of the tradition for a polite greeting and part of normal behavioural patterns for people when they meet (Ajaaj, 2016). However, this cultural aspect is contrary to the recommended precautionary measures to reduce the likelihood of COVID-19 infection. In this tool, an item was included to assess if participants during the pandemic would agree to "stop shaking hands and keep their physical distance from their family members." Another example was an item that measured the participants' cultural values in gathering to celebrate holy events like Eid or breaking their Ramadan fast during the pandemic.

4.1 | Study limitations

We conveniently selected the participants from one health science college because the researchers involved in this study are faculty members at the college where the data were collected. This approach to data collection may not be representative of all nursing and allied health programs in the country. In addition, the study questionnaire

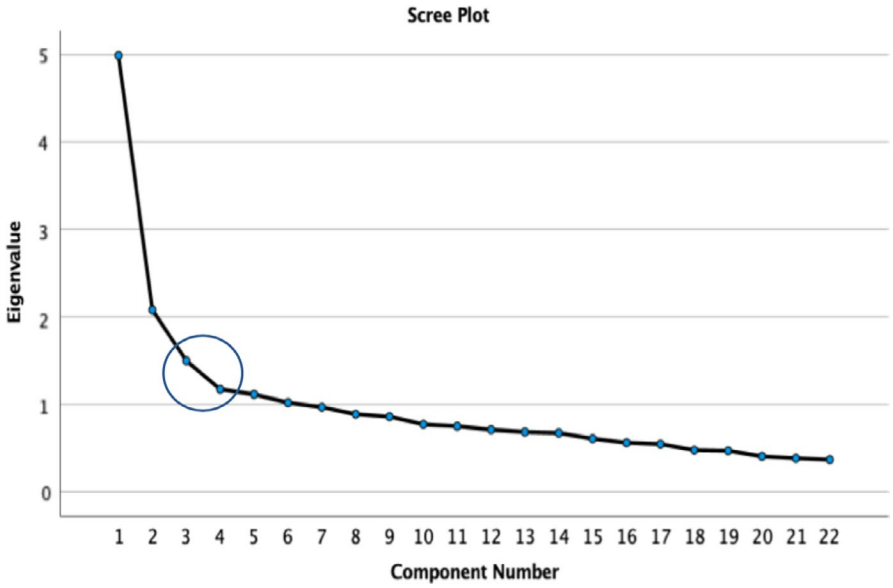

FIGURE 2 Screen plot indicating the cutoff for retained factors (*N* = 507)

was developed in English, and even though the language of instruction at the college included in this study is English, that might be a limitation for students with low English competency. Factor 3 had low reliability, indicating it might need to be re-examined. Further studies need to be conducted in various groups of nursing and allied health students to confirm the psychometrics of the newly developed instrument for generalizability.

4.2 | Conclusion

Strategies to assess nursing and allied health students' level of knowledge about caring for patients with COVID-19 need to consider the students' various needs. In this article, we explained the steps we took to develop a new instrument to measure the knowledge of caring for patients with COVID-19 and to report the process of validation and determining reliability. The validation approach we used—checking the content validity of the items, piloting the questionnaire, and factoring the tool using exploratory factor analysis—provided justification for the content validity of the newly developed tool.

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CONFLICT OF INTEREST

All authors declare no conflict of interest.

AUTHORS' CONTRIBUTIONS

MAA, SSA: responsible for writing the introduction, background, literature review and manuscript preparation. MAA, TSA, ASA, SA: Research design, Data collection, and Statistical analysis. MAA, TSA, SSA: Discussion and conclusion.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by Oman College of Health Sciences (OCHS) – Institutional Review Board (OCHS/REC/PROPOSAL_APPROVED/10/2020).

DATA AVAILABILITY STATEMENT

All data generated during this study are included in this published article.

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APPENDIX

Items included in the final version of the Know of COVID-19 (KCOVID-19) tool

SUBSCALE I: GENERAL KNOWLEDGE ABOUT SYMPTOMS, TRANSMISSION, & PREVENTION

Items
1. According to the World Health Organization (WHO), the most common symptoms of COVID-19 are fever, dry cough, and tiredness
2. The main mode of transmission of the virus from person to person is via personal contact with an infected person
3. Small droplets from coughing, sneezing, or speaking can spread the disease
4. Patients with chronic diseases are at a higher risk of infection and death from COVID-19
5. Using of face mask, gloves and social distance are essential in the prevention of COVID-19
6. Hand hygiene and hand rub with soap and sanitizer for at least 20 s are important to prevent transmission of the virus
7. The isolation period for COVID-19 is a minimum of fourteen (14) days
8. According to the WHO, quarantine means separating people who are ill with symptoms of COVID-19 and may be infectious to prevent the spread of the disease
9. I believe washing hands with soap more frequently is essential
10. I think it is wise to avoid crowded places during the COVID-19 outbreak
11. I would stop shaking hands with family members and keep a physical distance to avoid infection

SUBSCALE II: SOURCE OF INFORMATION KNOWLEDGE

Items
12. I feel the available official accounts in Oman are adequate to keep me updated with current information about COVID-19
13. I know there is an available hotline/call center to answer any of my concerns or questions about COVID-19
14. I am aware of the "Tarassud" application
15. I am aware of the Oman official Twitter account (Oman vs. COVI-19)

SUBSCALE III: HEALTH PROMOTION AND TREATMENT KNOWLEDGE

Items
16. Antibiotics are the first-line treatment for COVID-19
17. I believe ordering foods from restaurants is a safe practice
18. I joined an online free workshop/course about COVID-19 organized either by my college or other colleges in Oman
19. My college accounts in social media provide sufficient information on COVID-19 prevention