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Development and Validation of an Instrument for Assessing Nurses' Control Sources of Resilience in the COVID-19 Pandemic

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Abstract

Background: Nurses' resilience in the care of patients with Coronavirus Disease 2019 (COVID-19) is essential. This study aimed to develop and validate an instrument for assessing nurses' resilience control resources in the COVID-19 pandemic.

Methods: In this qualitative study, with a conventional content analysis based on a literature review and semi-structured interviews conducted with 20 nurses, the initial draft of the instrument was prepared in different aspects based on a 5-point scale. The instrument's face validity and content validity were examined in 15 nurses and 15 experts, and construct validity was obtained in 482 nurses using the available sampling method. Data were analyzed in SPSS software Version 24 using indexes and analytic tests.

Results: Out of 54 items, 18 items were confirmed by the expert panel and the items had content validity ratio and content validity index scores higher than 0.79. According to the results of an exploratory factor analysis, this tool has 4 dimensions: God, chance, internal locus of control, and powerful others. They accounted for 48.06% of the total variance. CFA showed the indices confirmed the model fit ($\chi 2/df = 1.846$, comparative fit index = 0.921, incremental fit index = 0.923, root mean square approximation error = 059, goodness of fit index = 0.905). The reliability of the instrument was acceptable ($\Omega > 0.70$, $\alpha > 0.7$, CR >0.60, and intra-class correlation coefficients > 0.70).

Conclusion: The developed tool is used to measure the control resources of nurses' resilience in caring for COVID-19 patients. It can help recognize the focus areas for developing appropriate interventions.

Keywords: Health Locus of Control, Resilience, COVID-19, Measurement tools

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Introduction

In late December 2019, the coronavirus spread from China to all continents. On March 11, 2020, the World Health Organization (WHO) declared it a pandemic health crisis (1). With the continuation of the pandemic Up until July 21, 2022, 6 million fatalities and 537 million confirmed cases of the illness were documented (2).

An entirely new and difficult work environment, including fear of infection, stress from the deaths of patients and coworkers, and changes to everyday work experiences, are experienced by nurses at the forefront of the fight against this disease (3). A systematic study found the prevalence of anxiety, depression, stress, post-traumatic stress syndrome,

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↑What is "already known" in this topic:
A decrease in the level of nurse's resilience was reported in the COVID-19 pandemic. Locus of control is a predictive factor of resilience, but there is no instrument specifically for measuring locus of control in nurses' resilience.

→What this article adds:
An instrument was designed to measure nurses' sources of control in resilience during the COVID-19 pandemic, and its validity and reliability were confirmed. The instrument can be used in interventions to improve nurses' resilience when providing care to patients with COVID-19.

insomnia, mental distress, and burnout in health workers at 34.4%, 31.8%, 40.3%, 11.4%, 27.8%, 46.1% and 37.4%, respectively. Based on this study, the prevalence of anxiety and depression in nurses was higher than other health workers (4). Caregivers in the Middle East had the highest prevalence of anxiety and depression (28.9%, 34.6%) and moderate levels of posttraumatic stress disorder (21.5%) during the COVID-19 epidemic. The most commonly reported reasons were dissatisfaction with preventive measures, lack of education, different socioeconomic characteristics, specific social norms, long working hours (5), decreased personal protective equipment in the hospital, fear of not having enough equipment and contracting COVID-19, and passing the virus to their loved ones (6). However, the lowest rates of depression and anxiety (18.7%, 14.8%) were reported in North America (7).

Resilience is the process of coping with stressful or challenging life events that provide a person with more coping and supportive skills than before (8).

The ability of nurses to bounce back from stress is a crucial psychological trait. Their low level of resilience leads to a decrease in work commitment, performance level, job satisfaction, and increased absenteeism (9). Various factors have been investigated in the field of increasing nurses' resilience. Some of them include the role of nursing leaders as an accelerator of resilience (10), teaching emotional intelligence skills (11), and learning to use positive coping strategies in the face of stress (12).

The source of control is also one of the important predictors of resilience (13). It is one of the constructs of the theory of attribution. According to this theory, a person attributes the causes of good and bad events to internal, powerful others, and chance, stable and unstable, controllable and uncontrollable factors (14).

People that experience chronic stress do not attempt to cope with stressful experiences, attributing the events' origins to outside forces, and do not employ helpful resilience characteristics (15). People who attribute events more to internal sources of control are actively looking for constructive solutions to solve problems (16). These people have less job stress and more job satisfaction even in unfavorable conditions (15).

As the COVID-19 crisis continues, paying attention to the psychological health and job performance of nurses is more important than ever (9). The sources of control for building the resilience of health care workers during the COVID-19 pandemic are largely unknown (17). There are several locus of control scales in Walston's physical health (18), adolescent pain (19), pregnant women's health (20), self-efficacy (21), and defense and well-being (22). Nevertheless, none of them are specifically about the axis of control in the field of nurses' resilience.

Therefore, it is necessary to have a instrument for measuring control resources in the field of nurses' resilience. The purpose of this study was to design and psychometrically assess an instrument to measure nurses' resilience control resources during the COVID-19 pandemic.

Methods

Study Design

The study was designed to develop and validate an instrument for assessing nurses' sources of resilience control during the pandemic. It was performed in hospitals of Iran University of Medical Sciences from January 21, 2022, and February 19, 2022. The study was done in 3 phases, which are explained below (23).

Phase 1: Item Development

To define the theoretical framework of the nurses' resilience control resources, a broad literature review was conducted based on national and international databases, including SID, PubMed, Scopus, and Web of Science, with the following keywords: resilience, nurses, source of control, and COVID-19. It led to an initial item set. They were revised several times during consensus discussions between the study researchers. Then, semi-structured interviews were done with 20 nurses about their control sources of resilience in the pandemic based on the theoretical framework of the dimensions of Form A of Walston's health locus of control measurement tools (24).

The duration of each interview was about 30 to 60 minutes. Questions were asked about their opinion about the source dimension of powerful others (Which people and factors are influenced by your resilience in the conditions of the COVID-19 epidemic? And how can these people provide the conditions of resilience?).

Sampling continued until data saturation. All interviews were typed word by word. Data were analyzed using content analysis. An initial set of 54 items was created. After the detailed review of the items by the research team, similar and overlapping items were merged. The initial version of the instrument with 28 items in 4 dimensions was approved.

Phase 2: Scale Development

Population: The population were nurses in hospitals of Iran University of Medical Sciences.

Sampling: The sample size included 15 nurses to ensure face validity and 15 experts to ensure content validity. Comrey and Lee suggest a graded scale of sample sizes for scale development: 100 = poor, 200 = fair, 300 = good, 500 =very good, ≥1000 = excellent (25). In their study, 482 nurses participated for construct validity.

Their sampling method was available sampling. Inclusion criteria included (1) at least 2 years of work experience, (2) caring for COVID-19 patients for at least 6 months, and (3) having a bachelor's degree or higher. Exclusion criteria included not suffering from psychological diseases leading to drug use and unwillingness to participate in the study.

Phase 3: Scale Evaluation

Face Validity: To quantitatively measure face validity, the initial draft of the instrument was sent to 15 nurses to rate the importance of each item based on a 5-point Likert scale from 1 (not important) to 5 (extremely important). The impact score of each item was calculated by multiplying the importance by the percentage of frequency. Items

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with an impact score >1.5 were considered suitable (26).

Also, for the qualitative assessment of face validity, 10 nurses expressed their opinions about the relevance, ambiguity, and difficulty of the items. After that, the necessary corrections were made.

Content Validity: To qualitatively measure content validity, 15 experts in the fields of health education, nursing, and psychiatry were asked to examine the items of the instrument in terms of the use of appropriate expressions, compliance with grammar, and the correct placement of words.

Quantitative content validity was measured by calculating the Content Validity Ratio (CVR) and Content Validity Index (CVI). In the CVR stage, the above 15 experts were asked to evaluate the importance of the items on a 3-point scale (not necessary, useful but not necessary, and not necessary). Based on Lausche table (1975), items with a CVR <0.49 were excluded (27).

Also, to check the CVI, the same 15 experts were asked to rate the simplicity and relevance of the items on a 4-point Likert scale (irrelevant, slightly relevant, relevant, and very relevant). By counting the number of experts who evaluated each item as 3 or 4 and dividing it by the total number of experts (28), items whose CVI was ≥0.79 were considered acceptable (29).

Normality Tests and Outliers: In the present study, because of the use of an online instrument, there were no missing data. Univariate distribution was examined for outliers, skewness, and kurtosis. The cutoff values for skewness and kurtosis were considered as ±3 and ±7, respectively. Cases that were multivariate outliers were evaluated with Mahalanobis distance P < 0.001(30).

Construct Validity: Construct validity was evaluated using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). During the 2-month period of January and February 2022, an EFA link to the PORSLINE-created instrument was posted on the nurses' social network. A total of 241 nurses completed the instrument based on a 5-point Likert scale.

The way of scoring in the dimensions of internal locus of control and powerful others locus of control was from completely disagree (1) to agree (5) and for the dimensions of chance locus of control and God locus of control, it was reversed from completely disagree (5) and completely agree (1).

Data analysis was done using SPSS software Version 24. The adequacy and appropriateness of the sample size were checked with the KMO and Bartlett test. The acceptable value for the KMO is >0.70 (31). The minimum factor load of each item in a hidden factor was determined to be ≥0.33 based on the following formula: $CV = 5.152 \div \sqrt{(n-2)}$. An eigenvalue >1 was also considered to extract the main factors of the instrument (32).

Then, the factor structure obtained from EFA entered the CFA stage. The data collected from 241 other nurses were evaluated based on model fit indices in AMOS software Version 24. Model fit shows how a theoretical model is compatible with an experimental model. It is evaluated with several indices, including chi-square, residual Root Mean Square Error Approximation (RMSEA), chi-square value divided by degree of freedom ($\chi 2/df$), and indices of Incremental Fit Index (IFI), Tucker-Lewis index (TLI), Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Normed Fit Index (NFI), Adjusted Goodness Fit Index (AGFI) (33).

Reliability: The reliability of the scale was determined using internal consistency and stability tests. To determine the internal consistency of the items of each dimension, the Cronbach alpha (α), MacDonald's Omega (Ω), and average inter-item correlation (AIC) were calculated (29).

Intra-class Correlation Coefficients (ICC) were used to establish the test–retest reliability of the instrument for absolute agreement at the level of individual items. A sample of 30 nurses completed the developed instrument for this purpose in two stages with a 2-week interval between each stage. Good stability is regarded as occurring between 0.61 and 0.80 (34, 35).

Omega MacDonald values >0.70 can be interpreted as good internal reliability (34, 36). An AIC of factors should be between 0.2 and 0.4, and values between 0.1 and 0.5 are acceptable (37).

Convergent and Discriminant Validity: Convergent and divergent validity of the construct were measured by Average Variance Extracted (AVE), Maximum common Square Variance (MSV), and Average common Square Variance (ASV). To establish convergent validity, the constructs of AVE should exceed 0.50 and be less than CR (38). When a construct is related to other theoretically relevant constructs, it is said to have convergent validity (35). Also, for confirming the differential validity of the instrument, the following conditions were considered: ASV< AVE and MSV <AVE (38). The convergent and discriminant validity of the instrument was measured using the Excel macro of Professor James Gaskin in the Excel software (39).

Ethical Considerations

The study was approved by the Ethics Committee of Iran University of Medical Sciences, Tehran, Iran (Code NO. IR.IUMS.REC.1400.431). Participants provided written consent. They voluntarily participated in the study.

Results

In the stage of quantitative face validity assessment, 4 items were removed because of an impact score of <1.5. Based on qualitative face validity, several items were rewritten, and the remaining items will be carried forward for the next steps of the study.

In the content validity stage, two items with a CVR less than 0.49 were removed. One item had a CVI between 0.79 and 0.70, which was revised based on feedback from five nurses. The items that scored above 0.79 were kept for further analysis.

In the present study, 54.8%*of the participants* were women, 52.3% were single, 88% had a bachelor's degree, and had an average number of years of work experience (10.22±7.01). The demographic characteristics of the participants in the EFA and CFA stages are reported in Table 1.

In EFA, the KMO index = 0.763 and Bartlett's test was significant (chi-square = 1629.708, P < 0.001, df =153). It

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Table 1. Characteristics of Participants in 2 Exploratory (EFA) and Confirmatory Factor Analysis (CFA) (N = 482)

Variable		EFA (No (%) N = 241	CFA (No (%) N = 241
Age (years) (Mean ± SD)		31.20 ± 11.30	38.07 ± 10.24
Gender	Male	109 (%45.2)	160 (%66.4)
	Female	132 (%54.8)	81 (%33.6)
Marital status	Single	126 (%52.3)	137 (%56.8)
	Married	114 (%47.3)	103 (%42.7)
Education level	Bachelor's degree	212 (%88)	235 (%97.5)
	Master's degree	27 (%11.2)	6 (%2.5)

Table 2. The Results of Performing Exploratory Factor Analysis on the Tool of the Nurses' Resilience Control Resources in the COVID-19 Pandemic

Factors	Items	Factor Loading	h2	Eigenvalue	%Variance
God locus of control	God is directly responsible for the improvement or deterioration of my resilience to care for patients with COVID-19	0.695	0.482	3.688	20.491
	Increasing my resilience to take care of patients with COVID-19 depends on God's will	0.828	0.686		
	Improving my endurance to take care of patients with COVID-19 is under God's will	0.890	0.792		
	The level of my resilience to take care of patients with COVID-19 is under God's control	0.885	0.782		
Chance locus of control	Whatever is going to happen in my resilience to take care of patients with COVID-19, it will eventually happen	0.406	0.164	2.469	13.718
	Issues that affect my resilience to care for patients with COVID-19 occur randomly	0.565	0.319		
	My resilience in continuing to care for patients with COVID-19 is a function of my chance	0.864	0.747		
	My resilience to take care of patients with COVID-19 depends on my destiny	0.678	0.460		

shows the adequacy of the sample size and the appropriateness of continuing the factor analysis. Data extraction was done by the principal axis factoring (PAF) method. With Promax rotation, 4 factors were extracted according to the eigenvalues >1, which explained 48.06% of the total variance. The factors, in the order of the most variance, included God locus of control, chance locus of control, internal locus of control, and powerful others locus of control. Four items were removed because of cross-loading and 18 items remained in the model because of factor loading >0.33, whose value varied from 0.387 to 0.890. The eigenvalues, h2, and factor loading values of the items and the variance percentage of each factor are listed in Table 2.

Since the assumption of normality of the data was not established to perform the CFA, the Bootstrapping method was used (40, 41). Therefore, the number of Bootstrap data was set to 2000 and the confidence interval was considered 95%. Then, the model was run again in AMOS software.

In the CFA stage, the results of EFA were plotted in AMOS software. The appropriateness of the factor structure was evaluated through fit indices. Then, by drawing correlations between measurement errors, the model was modified (Figure 1) and the obtained indices showed a good fit ([$\chi2 = 234.40$, df = 127, N = 241, P < 0.001, $\chi2/d = 1.84$], CFI = 0.92, IFI = 0.92, GFI = 0.90, TLI = 0.90, AGFI = 0.87, and RMSEA = 0.59) (90% CI = 0.47–0.71).

Therefore, the 18-item scale with 4 dimensions of chance locus of control (4 items), internal locus of control (5 items), powerful others locus of control (5 items) and God locus of control (4 items) was approved.

Since the factor load of one of the items of the structure of chance locus of control and the powerful others locus of control were 0.21 and 0.37, respectively, we removed these 2 items from the smallest factor load and ran the model after removing each step. The fit indices of the model in the 16-item scale showed a better fit than the 18-item scale ($\chi2 = 149.996$, df = 83, N = 241, P <0.001, $\chi2/d = 1.807$) (CFI = 0.946, IFI = 0.947, GFI = 0.926, TLI = 0.932, AGFI = 0.87,

[DOI: 10.47176/mjiri.38.22]

Table 2. Continued

Internal locus of control	When I do things like relaxation, exercise, and appropriate entertainment, it affects my resilience in caring for patients with COVID-19.	0.624	0.513	1.015	8.221
	I am proud of myself when I see that I have the resilience to take care of patients with COVID-19.	0.716	0.443		
	My personality traits are effective in taking care of patients with COVID-19	0.666	0.359		
	My resilience in caring for patients with COVID-19 depends on the application of my patient care skills	0.599	0.197		
	No matter how long the duration of the COVID-19 epidemic is, if I try, I can maintain my resilience to care for infected patients	0.444	0.389		
Powerful others locus of control	People play a big role in improving, stabilizing, or decreasing my resilience to care for patients with COVID-19	0.621	0.386	1.480	5.638
	Improving my resilience to care for patients with COVID-19 depends on others seeing the good results of my work	0.738	0.544		
	The support of others plays a role in my resilience to care for patients with COVID-19	0.700	0.490		
	The quality of management of hospital officials has a role in my resilience to care for patients with COVID-19	0.540	0.292		
	If my endurance to take care of patients with COVID-19 decreases, it is because of the prolongation of this disease	0.387	0.149		

and RMSEA = 0.58) (90% CI = 0.43–0.73). Nevertheless, these changes were not significant. Both models were confirmed.

Finally, we reported the 18-item scale, which is measured based on the Likert scale. Each item is scored from 1 to 5 (from completely disagree to completely agree). The range of the total score was 18– 90.

Convergent and discriminant validity were measured using the Excel macro of Professor James Gaskin in Excel software. The convergent validity of the tool was considered acceptable (CR >0.60 and AVE >0.5) (42). In addition, the conditions ASV< AVE and MSV <AVE were established for all factors; thus, divergent validity was confirmed. The details are reported in Table 3.

The reliability of this instrument was acceptable and showed good internal consistency for all factors (Ω > 0.70, α > 0.70, AIC > 0.70) and good construct validity (CR >0.60 and ICC >0.70). Details of reliability are listed in Table 3.

Also, the ICC for each factor was calculated. Results were substantial and the instrument has good stability for God locus of control (ICC = 0.900; F (30); 95% CI: 0.803 to 0.951), for chance locus of control (ICC= 0.759; 95% CI: 0.557 to 0.876), internal locus of control (ICC= 0.804; 95% CI: 0.633 to 0.901), and powerful others locus of control (ICC= 0.645; 95% CI: 0.382 to 0.811). The P. value for all factors was significant ($P < 0.001$).

Discussion

To help nurses cope with the stress of the COVID-19 pandemic in a positive way, it is crucial to understand the sources of control they have over their resilience to COVID-19. In this study, first, a literature review was done. In the next step, semi-structured interviews were conducted

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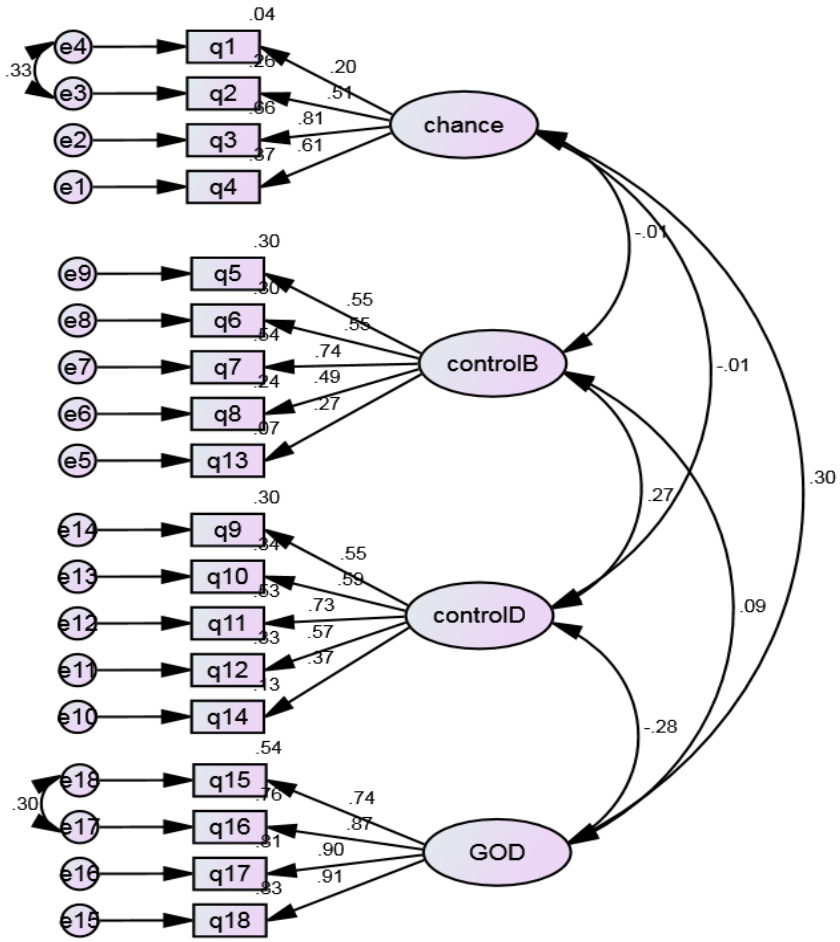

Figure 1. Evaluation structures of the tool of the nurses' resilience control resources in the COVID-19 pandemic: a factor analysis model

Table 3. Convergent and Divergent Validity, Internal Consistency and Construct Reliability on the Tool of the Nurses' Resilience Control Resources in the COVID-19 Pandemic

Factors	ASV	Ω	α	AVE	CR	MSV	AIC	CI%95
God locus of control	0.059	0.829	0.893	0.736	0.917	0.091	0.893	0.870-0.914
Chance locus of control	0.030	0.717	0.726	0.333	0.630	0.091	0.726[c]	0.664-0.778
Internal locus of control	0.051	0.729	0.725[c]	0.329	0.701	0.080	0.725[c]	0.666-0.776
Powerful others locus of control	0.027	0.741	0.726	0.293	0.657	0.074	0.726[c]	0.664-0.778

with nurses. Then, the initial draft of the instrument was prepared and its face, content, and structural validity were obtained.

The results of the present study showed God locus of control domain is one of the predictors of nurses' resilience. This dimension includes 4 items: God's desire, will, control, and direct responsibility for improving their resilience.

For many people, belief in a higher power can have powerful effects. Thus, in designing health improvement programs, attention should be paid to the role and influence of God for some people (43). The results of a study by Wilcox et al showed that the source of external control, chance, and God are the predictors of people's health control. The role of these 2 sources in controlling health was different based on race and sex *as it* was stronger in men and non-White races (44). Olagoke et al reported a significantly negative association between religiosity and COVID-19 vaccination intention. Such that the crisis may be viewed as an act of God. Also, an external source of health control was a mediating variable for vaccination intention. Therefore, the joint efforts of health professionals and religious institutions were suggested to increase the intention of vaccination in people (45). According to the results of Welton et al 's study, the ideal control source of a person should be a combination of internal source and God. Many religious teachings emphasize both God's control and human responsibility (41).

The findings of the present study showed that God locus of control should be considered as one of the influential factors in interventions to improve the resilience of nurses in the COVID-19 pandemic.

In this study, nurses took into account how chance, coincidence, destiny, and fate affected their resilience. Previous

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studies have shown Asians, especially those living in the Middle East, have a stronger belief in chance, destiny, and fate based on cultural, ethnic, and religious beliefs (20). This was also true for the participants in this study and the subscale of the control source had the most variance after God locus of control domain. Musik et al found that those people who believed their pain and health were the result of chance and fate had the least preventive behavior (46). The results of Crump et al 's study showed that belief in chance and powerful others decreased self-control in disease prevention (47). In this study, nurses who believed in the role of chance in facing the COVID-19 crisis had less resilience, and this should be considered in interventions to improve nurses' resilience.

The internal locus of control consists of 5 items about personality traits, individual efforts, skill level, and pride of one's performance. Studies showed internal locus of control is useful in various areas of life. People with a higher internal locus of control have higher self-efficacy, resilience, and effective interpersonal relationships (13). Internal locus of control is associated with greater control over one's health, better quality of life (48), good work ethic, and hard work (49). Nurses who have a high internal locus of control were more motivated to fulfill organizational commitments (50). In the present study, people with a higher internal locus of control had a higher level of resilience during the pandemic. Therefore, in designing interventions to improve nurses' resilience, attention should be paid to internal sources.

Based on the findings of this study, nurses' resilience is influenced by powerful others. It includes the support of relatives and the quality of management in the hospital. A study by Haybatollahi et al showed that nurses who considered nursing managers as an external source were less inclined to use their resources in controlling events (51). Social support and internal locus of control play an important role in the effectiveness of employee performance. Organizations should strengthen social support among supervisors and employees by creating a convenient work environment and adopting appropriate policies (52). In the present study, those who had greater support from others had lower pandemic resilience. Conducting the study during the COVID-19 pandemic and the direct involvement of nurses in this crisis is considered one of the strong points of the study.

Limitation

The limitations were convenience sampling and a lack of generalizability. The comparison and discussion of results are hindered by the absence of comparable studies.

Conclusion

The developed tool has acceptable content and structural validity, convergent and divergent validity, and reliability. It is used to measure the resources of control of nurses' resilience in caring for COVID-19 patients. This tool can assist in identifying the key areas for developing effective interventions to support nurses' resilience during the COVID-19 crisis.

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Conflict of Interests

The authors declare that they have no competing interests.

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