RESEARCH



Perceived stress during resuscitation: a scale development study



Asuman Şener¹, Tuğba Çınarlı^{1*} and Dilan Köse²

Abstract

Background Considering that resuscitation is a very stressful situation, it is very important to use a tool to determine perceived stress during resuscitation. There is no valid and reliable measurement tool to examine perceived stress during resuscitation in Türkiye. The objective of this study was to develop the Perceived Stress During Resuscitation Scale for healthcare professionals who have an important role in resuscitation and to validate its psychometric properties among emergency nurses.

Methods Based on the literature review and expert review, a four-point Likert-type 52-item scale was prepared. Item analyses, exploratory factor analysis, confirmatory factor analysis, concurrent and predictive validity and reliability studies were conducted to investigate the psychometric properties of the scale. Data were obtained from 348 emergency nurses registered in 11 hospitals in Turkey between August 2023 and October 2023.

Results After confirmatory factor analysis, the scale consisting of 7 sub-dimensions (inadequate working conditions, ethical difficulties, insufficient authority, failed resuscitation effort, difficulties caused by patient relatives, emotional pressure caused by patient/patient relatives, unexpected situations) was finalized with 27 items. The Cronbach's α reliability coefficient of the scale was 0.891 and the values for the sub-dimensions ranged between 0.672 and 0.863.

Conclusions The Perceived Stress During Resuscitation Scale is a valid and reliable measurement instrument for emergency nurses. The scale will enable the development of appropriate strategies by investigating the factors affecting perceived stress in nurses during resuscitation.

Clinical trial number Not applicable.

Keywords Cardiac arrest, Emergency care, Nursing, Reliability, Resuscitation, Stress, Scale development, Validity

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Background

Resuscitation is among the most important emergency response skills in healthcare settings. This practice should be performed efficiently and effectively for every individual [1]. Considering that the chance of life decreases by 10% for every minute that cardiopulmonary resuscitation is delayed, it is very important to start cardiopulmonary resuscitation (CPR) and defibrillation as soon as possible [2]. Nurses are often the first people to encounter these cases in various settings. Adequate preparedness and competent knowledge among nurses were reported to significantly affect the survival rates in a positive way [3].



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Stress is reported to be one of the most significant variables influencing resuscitation competence [1]. Although the literature acknowledges that resuscitation endeavors are highly stressful for all healthcare professionals, little is known about how nurses experience this situation [4].

Heart diseases are among the world's leading causes of death worldwide, especially from sudden cardiac arrest [3]. Cardiac arrest is a time-dependent acute event that requires the simultaneous coordination of various health professionals and any delay reduces the patient's chance of survival [5, 6]. Since nurses work in a wide variety of clinical settings, they assume important responsibilities in the initiation and administration of in-hospital resuscitation [4].

Nurses are health care professionals who identify the patients who need resuscitation, perform CPR, call the resuscitation team and spend most time with the patients. Considering that nurses are often with patients in every emergency situation rather than doctors, nurses should be aware when faced with an emergency. Nurses should also be able to reason, be skillfully competent, and most importantly, remain emotionally calm in the face of such emergencies [7]. However, performing CPR, basic and advanced resuscitation methods is accepted as one of the most stressful scenarios for nurses [8].

When work-related stress is spread over a long period of time and experienced intensely, people may develop disorders and chronic diseases. These can be physical, mental and cognitive. Physically, the individual may experience headache, hypertension and heart disease, mentally they may experience depression, fear and anxiety, and cognitively they may experience attention deficit and forgetfulness [9]. It was also reported that chronic stress caused by CPR can deplete nurses' empathic abilities and lead to compassion fatigue, resulting in a feeling of disconnection and decreased job satisfaction [10]. In addition, nurses who work in critical care areas such as intensive care and emergency departments encounter many more resuscitation incidences and working in these units is associated with higher burnout, compassion fatigue and post-traumatic stress [4].

CPR can result in significant mental stress for implementers, leading to a lack of focus and heightened distractibility. This can lead to incorrect assessment of priorities and a delay in CPR delivery, reducing the overall quality of CPR performance and further exacerbating mental stress [11]. One of the most crucial emergency skills in the healthcare setting is the effective delivery of resuscitation. It is reported that increased confidence in resuscitation skills results in better patient outcomes and patient survival rates [1].

As stated in the theme chosen by the International Council of Nurses for Nurses Day 2022, investment in nursing is necessary to secure global health. In order to provide quality care for patients, practices aimed at protecting the health of nurses and ensuring stress management are inevitable. In this way, it is very important to determine the stress perceived by nurses during resuscitation. However, there is currently no measurement tool to be used for this purpose in our country. Thus, this study aims to develop a measurement tool to identify the level of stress perceived by healthcare providers while performing resuscitation. This scale will enable the development of appropriate strategies by investigating the factors affecting stress perceived by nurses during resuscitation in future studies.

Methods

Design

The Perceived Stress During Resuscitation Scale (PSDRS) was developed and validated according to the scale development standards specified in the study by DeVellis [12]. In addition, the GRASS checklist [13] was utilized when reporting the study.

Methodology

The type of research design is a quantitative research based on methodological research techniques. The scale was developed and psychometrically tested in two stages. In the first stage, the creation of the scale items and content validity studies were carried out by experts. In the second stage, the scale was implemented on emergency nurses and psychometric tests were performed. The flow chart used in the development of the scale is shown in Fig. 1.

Composition of items

The initial item pool for the PSDRS scale was created by the researchers based on an extensive literature review. Each item of the PSDRS was rated on a 4-point Likert scale of 1 (never), 2 (sometimes), 3 (often) and 4 (always). Content validity was examined to determine whether each item in the measurement tool was sufficient to measure the construct to be measured. In this way, the scale items were first presented to 10 experts. The experts were asked to rate the scale items as "necessary", "useful but not sufficient" and "unnecessary".

Data collection

The study data were obtained from 348 emergency nurses registered in 11 hospitals in Turkey between August 2023 and October 2023 through a face-to-face survey. Participants were selected according to inclusion and exclusion criteria. The inclusion criteria were to have at least 6 months of clinical work experience and to be an emergency department nurse. Exclusion criteria were working in departments other than the emergency department. During scale improvement studies, the number of

Development stages of the Perceived Stress During Resuscitation Scale

Item construction and content validity

- Literature review
- Creating an item pool (Initial number of items 52)
- Content validity (10 expert opinions)
- ✤ 5 items were deleted due to low content validity index
- Preliminary survey (50 nurse)

Psychometric tests

Construct Validity

- Exploratory factor analysis (N = 348, 47 items)
- ✤ 27 items 7 factors and variance 63,598

Confirmatory factor analysis

The structure consisting of 27 items and 7 factors was validated with 2 modifications without removing any items

Reliability

- ✤ Internal consistency, RSASÖ a= 0.891, highly reliable
- Test-retest method, 65 randomly selected nurses (2 weeks apart)

Fig. 1 Development stages of the perceived stress during resuscitation scale

participants must be 5 to 10 times the number of items, taking into account a dropout rate of 25% [14]. The sample for this study consisted of 348 emergency nurses.

Data analysis

Within the context of the Turkish validity and reliability study of the PSDRS, firstly exploratory factor analysis (EFA) studies were conducted, then confirmatory factor analysis (CFA) studies were conducted and finally reliability analyses were conducted for the scale. EFA and reliability analyses were performed with SPSS 26.0 package program, while CFA were performed with AMOS 21.0 software. Descriptive statistical methods such as frequency, mean, standard deviation, median and minimum-maximum values were utilized for the evaluation of the study data. Significance levels were taken as 0.05 in all statistical analyses within the study.

Ethical considerations

Ethics approval for this study was received from Ondokuz Mayıs University Social and Human Sciences Research Ethics Committee (29.03.2023; No: 2023 – 165). Permission to conduct the study was obtained from 1 hospital affiliated to Ondokuz Mayıs University Rectorate Health Practice and Research Center Directorate (16.06.2023; E-15374210-108.99-2300025028) and 10 hospitals affiliated to Samsun Provincial Health Directorate (01.08.2023; E-26521195-604.02.02-221178709). The nurses were asked to sign a consent form indicating that they volunteered to be involved in the study. Nurses were also informed that they had the option to leave the study at any time. Participants were informed about the purpose and importance of the study that their participation was voluntary and their information would be kept confidential. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Results

Characteristics of the study participants

Descriptive characteristics of the nurses included in the study are presented in Table 1. It was determined that 68.4% of the nurses were female, 73.9% were university graduates, 69.0% of them chose to work in the emergency department willingly, and 94.3% of them worked in shifts. The mean duration of employment of the nurses in the emergency department in this study was 5.56 ± 4.24 years (Table 1).

Content validity

The data obtained based on the views of specialists were analyzed using the Lawshe [15] technique. The table created by Veneziano and Hooper [16] was used in determining the content validity criterion (CVR). Since the opinions of 10 experts were consulted in this study, CVR

Table 1 Distribution of nurses' Socio-demographic and working life characteristics (N = 348)

Characteristic	n	%
Age (31.47±6.00)		
22–30	198	56.9
> 30 years	150	43.1
Gender		
Female	238	68.4
Male	110	31.6
Marital status		
Married	219	62.9
Single	129	37.1
Child ownership		
Yes	159	45.7
No	189	54.3
Education status		
High school	6	1.7
Associate degree	63	18.1
License	257	73.9
Postgraduate	22	6.3
Duration of employment as a nurse (8.57 \pm 6.05)		
1–10 years	239	68.7
>10 years	109	31.3
Working time in the emergency department (5.56 \pm 4.24)		
1–5 years	199	57.2
>5 years	149	42.8
Status in the emergency department		
Service nurse	344	98.9
Service responsible nurse	4	1.1
Reason for working in the emergency department		
Willingly	240	69.0
Staff shortage	37	10.6
Coincidentally	65	18.7
Other	6	1.7
Mode of operation	20	5.7
Continuous daytime		
Shifts	328	94.3

was taken as 0.62. Accordingly, 5 items with a CVR of less than 0.62 were removed from the scale. The average of the CVR for the remaining 47 items was calculated and the content validity index (CVI) was determined as 0.94.

Pilot study

To evaluate the understandability of the PSDRS by nurses, a preliminary application of the scale was performed with a group of 50 nurses who were not included in the sample. The nurses stated that the descriptive data form and items on the PSDRS were understandable and that they had no difficulties in understanding them.

Construct validity

Exploratory factor analysis

Before determining the factor structure of PSDRS, the Kaiser-Meyer-Olkin (KMO) test was conducted to assess

 Table 2
 Fit index and goodness-of-fit values of the measurement model of the perceived stress during resuscitation scale

	Model fit	Good fit values	
	index values	(acceptable compliance)	
χ²/sd	2.132	≤3 (4–5)	
GFI	0.878	≥0,90 (0.89-0.85)	
AGFI	0.856	≥ 0.90 (0.89-0.85)	
IFI	0.906	≥ 0.95 (0.94 - 0.90)	
CFI	0.905	≥ 0.95 (0.94 - 0.90)	
RMSEA	0.057	≤0.05 (0.06-0.08)	
SRMR	0.063	≤0.05 (0.06-0.08)	

whether the data were appropriate for factor analysis and Bartlett's sphericity test was conducted to assess the significance of the correlation between the analyzed variables. The KMO value of PSDRS was 0.851. The KMO value is between 0 and 1, and the closer it is to 1, the more reliable the factor structure [17]. The sample size of the scale with a KMO value of 0.851 is sufficient and the results of Bartlett's test of sphericity show that the scale was eligible for factor analysis ($\chi 2 = 3832.201$, df = 351, p < .001).

The 47-item PSDRS was subjected to exploratory factor analysis utilizing principal component analysis and varimax rotation. As a result of the first analysis, the scale was divided into 12 sub-dimensions, but since some items were loaded strongly on more than 1 factor and some items formed a factor on their own, a total of 20 items were removed from the structure. As a result, it was statistically appropriate for the scale to consist of 27 items and 7 factors. Factor 1 (6 items) explains 12.716% of the overall structure, Factor 2 (3 items) explains 9.518%, Factor 3 (4 items) explains 9.402%, Factor 4 (4 items) explains 8.872%, Factor 5 (4 items) explains 8.231%, Factor 6 (3 items) explains 7.607% and Factor 7 (3 items) explains 7.253%. This 7-factor structure (27 items) explains 63.598% of the variance. In addition, the factor load values for each item on the scale were above 0.500.

Confirmatory factor analysis

The model composed of 27 items and 7 factors was analyzed with CFA. As a consequence of the analysis, some fit indices in the model did not have adequate fit. For this reason, 2 structurally appropriate modifications were made that caused the largest decrease in the chi-square value. No items were excluded. The model was confirmed as 27 item 7 factors and the fit index values are presented in Table 2. Item factor loadings after confirmatory factor analysis are shown in Table 3. In addition, the confirmed measurement model is shown in Fig. 2.

 Table 3
 Factor loadings for items on the perceived stress during resuscitation scale after confirmatory factor analysis

Items	Factor	Load Value
Insufficient number of personnel during resuscita- tion makes me nervous.	Factor 1	0.644
Insufficient material during resuscitation makes me anxious.		0.582
I feel uncomfortable when the resuscitation area is crowded.		0.452
The lack of a complete and ready resuscitation team during resuscitation makes me anxious.		0.796
The lack of knowledge and skills of team members during resuscitation worries me.		0.790
If the equipment used during resuscitation does not work, it causes me anxiety.		0.762
I am disturbed when ethical principles are not fol- lowed during resuscitation.	Factor 2	0.832
I feel uncomfortable if the patient's privacy is not respected during resuscitation.		0.725
Lack of respect for the patient during resuscitation disturbs me.		0.927
Not being supported to make independent decisions during resuscitation makes me uncomfortable.	Factor 3	0,444
Not having resuscitation training/not being up to date during resuscitation worries me.		0.865
Having little resuscitation experience worries me.		0.890
Not knowing my duties, authority and responsibili- ties during resuscitation worries me.		0.549
I worry about medical errors that may occur during resuscitation and the legal process that may follow.	Factor 4	0.540
I feel bad when resuscitation fails.		0.774
I worry about the reaction of the patient's relatives if resuscitation fails.		0.553
The thought that the patient cannot be revived during resuscitation makes me feel bad.		0.789
The presence of patient relatives during resuscita- tion makes me uneasy.	Factor 5	0.591
Threatening behaviors and discourses by patient relatives during resuscitation make me anxious.		0.685
During resuscitation, unrealistic expectations of the patient's relatives disturb me.		0.580
I would like to remove patient relatives from the environment during resuscitation.		0.615
The hopeful waiting of the patient's relatives dur- ing resuscitation causes me anxiety.	Factor 6	0.682
Recognizing the resuscitated patient and/or rela- tives makes me anxious.		0.650
During resuscitation, the cries of the patient's rela- tives distract me.		0.589
The thought that the care and treatment of other patients will be delayed when resuscitation time increases makes me uneasy.	Factor 7	0.738
The possibility of encountering complications dur- ing resuscitation worries me.		0.681
Resuscitation of more than one patient at the same time makes me nervous.		0.631

Reliability

Internal consistency

The 27-item PSDRS was found to be highly reliable ($\alpha = 0.891$). In addition, Factor 1 ($\alpha = 0.836$) and Factor 2 ($\alpha = 0.863$) were highly reliable, while Factor 3 ($\alpha = 0.777$), Factor 4 ($\alpha = 0.779$), Factor 5 ($\alpha = 0.678$), Factor 6 ($\alpha = 0.672$) and Factor 7 ($\alpha = 0.716$) were very reliable.

Test/retest method

The PSDRS, which was administered to 348 individuals, was administered again at a different time (2 weeks apart) to 65 randomly selected individuals. The relationship between the first and second application scores was then analyzed with intraclass correlation coefficients (ICC) and the agreement between the answers was very good (p < .001).

The average and standard deviation of the PSDRS scores for emergency nurses were 79.18 ± 12.03 , Factor 1 scores were 19.19 ± 3.57 , Factor 2 scores were 8.99 ± 2.34 , Factor 3 scores were 10.19 ± 3.00 , Factor 4 scores were 10.07 ± 2.83 , Factor 5 scores were 14.67 ± 1.76 , Factor 6 scores were 7.86 ± 2.39 and Factor 7 scores were 8.21 ± 2.20 (Table 4). Although there were no inversely scored items, a high score on the scale indicates a high level of perceived stress during resuscitation.

Discussion

The first step in developing a new scale is to conduct a literature review [18]. Accordingly, in this study, a pool of 65 items was developed through theoretical analysis and literature review. The final pool of 52 items was created through revision and integration by the authors.

Content validity, one of the most emphasized validity dimensions, is related to the extent to which the test as a whole and each item on the test serves the purpose. Accordingly, a test that adequately exemplifies the subject of measurement in a balanced way and where each item actually measures the behavior to be measured has content validity [19]. In this study, 10 experts were consulted to evaluate every item on the scale in order to assess understandability, whether it serves the goal, is distinctive and culturally appropriate (1 = not necessary, 2 = useful but not sufficient, 3 = necessary). The data obtained based on the opinions of the experts were analyzed with the Lawshe [15] technique. CVR was taken as 0.62 (10 experts) and 5 items with CVR below 0.62 were excluded from the scale. CVI was determined to be 0.94 for the remaining 47 items. As a result, the content validity of the 47-item structure was statistically significant since CVI (0.94) ≥ CVR (0.62).

Factor analysis, based on the relationships between a large number of variables, enables the discovery of new variables that are independent from each other with a smaller number of items in more expressive and





Fig. 2 Confirmatory factor analysis model of the perceived stress during resuscitation scale

 Table 4
 Descriptive statistics for the perceived stress during resuscitation scale and subscales

	Mean	SD	Min-Max
Perceived Stress During Resuscitation Scale	79.18	12.03	39–108
Inadequate working conditions	19.19	3.57	9–24
Ethical difficulties	8.99	2.34	3-12
Insufficient authority	10.19	3.00	4–16
Unsuccessful resuscitation effort	10.07	2.83	4–16
Difficulties caused by patient relatives	14.67	1.76	7–16
Emotional pressure caused by patient / patient relatives	7.86	2.39	3–12
Unexpected situations	8.21	2.20	3-12

summarized form [20]. The correlation matrix calculation, Bartlett's test and KMO test are used when investigating the suitability for factor analysis of the data. In this way, the suitability of the research data for factor analysis was examined with the KMO test and whether the correlation between the analyzed variables was significant or not was examined with Bartlett's test of sphericity. The KMO value of the scale was found to be 0.851. The KMO value was reported to be between 0 and 1 and as it approaches 1, it indicates a more reliable factor structure [17]. In this study, the correlation between the analyzed variables was significant after Bartlett's Test of Sphericity (χ 2 = 3832,201; *p* < .001).

EFA is a technique for specifying the number of subdimensions the items in a measurement tool can be grouped into and what type of a relationship exists among them [21]. In this study, after exploratory factor analysis, the scale was divided into 7 factors and this 7-factor structure (27 items) explained 63.598% of the total variance. The explained variance exceeding 50% was shown to be a sine qua non criterion of factor analysis. In addition, the factor structure cannot be said to be representative if it explains less than half of the total variable variance [22]. In this way, the rate of explanation of the total variance by the 7-factor structure is above the acceptable level.

CFA is commonly used in scale development and validity analyses and aims to verify the accuracy of a predetermined construct [20]. In this study, the measurement model defined as seven factors based on exploratory factor analysis was analyzed with CFA. After two modifications without item removal, some of the fit index values for the model indicated good fit ($\chi^2/sd = 2.132$, RMSEA = 0.057) and some fit index values indicated acceptable fit (GFI = 0.878, AGFI = 0.856, IFI = 0.906, CFI = 0.905, SRMR = 0.063). In addition, the factor loadings of the scale items were found to be higher than the minimum value of 0.40 [23].

Reliability is considered to be the responsiveness and consistency of a measurement tool. While a sensitive measurement tool refers to being able to measure the measured quality to the finest point, the consistency of a scale is defined as obtaining the same, similar, or close results in multiple measurements of a quality [24]. Accordingly, in this study, the reliability of the scale was analyzed using Cronbach's α internal consistency

coefficient and the test-retest method. The alpha coefficient is frequently used to calculate the reliability of a Likert-type scale based on total scores [25]. In the present study, the Cronbach's α coefficient of the PSDRS was found to be 0.891 and the scale dimensions ranged between $\alpha = 0.672$ and $\alpha = 0.863$. Cronbach's α coefficient has a value between 0 and 1. When Cronbach's α coefficient approaches 1, it indicates that the reliability of the scale increases.26 However, a Cronbach's α coefficient between 0.80 and 1 is considered highly reliable, while a value between 0.60 and 0.79 is considered to be very reliable.25.

Test-retest analysis results show whether the measurement maintains its stability over time [21]. For this purpose, the relationship between the results from the first and second applications of the scale was examined and PSDRS had appropriate measurement stability over time.

According to these results, it was determined that the Perceived Stress During Resuscitation Scale is a valid and reliable scale tool that can be used to reveal the stress perceived by nurses during resuscitation efforts. The average and standard deviation of the PSDRS scores for emergency nurses were 79.18 ± 12.03 . In a study investigating experiences of stress during resuscitation, nurses were reported to have moderate to high postcode stres (10). Another study measuring the stress levels of nurses with more than six months of clinical experience and serving as CPR team leaders reported that clinical experience in cardiac arrest and compliance was associated with acute stress during training (11).

These data show that it is necessary to determine the stress experienced during resuscitation and the factors that cause this stress and to develop appropriate strategies in order to increase the quality of resuscitation attempts and the chance of survival. Determining these stressors is also important for the health of nurses. It is thought that this scale developed in our study will make significant contributions to the field in this sense.

Limitations

A limitation of the study is that the study was conducted in a single city. It is recommended that more national or international studies be conducted with other practitioners who play an active role in the resuscitation team to test the generalizability of the PSDRS. In addition, the data obtained from this study are based on self-reporting by the participants. Although efforts were made to provide honest and accurate responses, this limitation should be taken into account when interpreting the results.

Conclusion

The stress experienced by health care professionals when initiating resuscitation, during resuscitation and at the end of resuscitation can potentially negatively affect both the individual and the team. Investigating these stresscausing factors and developing appropriate strategies are important for both the patient and the team. However, in our country, no measurement tool is available that allows the assessment of perceived stress during resuscitation. Accordingly, in this study, the PSDRS was developed and validity and reliability studies were conducted. The construct validity of the developed PSDRS was proved by analyzing it with EFA and CFA. The reliability of the PSDRS was analyzed with Cronbach's α and test-retest analysis and it was found to be a reliable measurement tool. Identifying the factors affecting perceived stress during resuscitation and developing appropriate strategies will be possible with the use of this scale.

Abbreviations

- CFAConfirmatory Factor AnalysisCPRCardiopulmonary ResuscitationCVIContent Validity IndexCVRContent Validity CriterionEFAExploratory Factor AnalysisKMOKaiser-Meyer-Olkin
- PSDRS Perceived Stress During Resuscitation Scale

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Author contributions

T.Ç., A.Ş.,D.K. wrote the main manuscript text and T.Ç., A.Ş.,D.K. prepared figures and tables. All authors reviewed the manuscript.

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Data availability

The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Ethics approval for this study was received from Ondokuz Mayıs University Social and Human Sciences Research Ethics Committee (29.03.2023; No: 2023 – 165). Permission to conduct the study was obtained from 1 hospital affiliated to Ondokuz Mayıs University Rectorate Health Practice and Research Center Directorate (16.06.2023; E-15374210-108.99-2300025028) and 10 hospitals affiliated to Samsun Provincial Health Directorate (01.08.2023; E-26521195-604.02.02-221178709). The nurses were asked to sign a consent form indicating that they volunteered to be involved in the study. Nurses were also informed that they had the option to leave the study at any time.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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