ORIGINAL RESEARCH

Development of the Perceived Challenges in Disaster Response Scale (PCDRS): Validity and Reliability Study

Ahmet Doğan Kuday, MSc, PhDc;[1] Cüneyt Çalışkan, MSc, MEds, PhD;[2] Kerem Kınık, MD, PhD;[2] Nihal Dağ, MSc, PhDc;[2] Hüseyin Koçak, MSc, PhD[2]

1. Department of First and Emergency Aid, Vocational School of Health Services, Bezmialem Vakıf University, Istanbul, Türkiye
2. Department of Emergency Aid and Disaster Management, Hamidiye Faculty of Health Sciences, University of Health Sciences, Istanbul, Türkiye

Correspondence:
Ahmet Doğan Kuday
Department of First and Emergency Aid
Vocational School of Health Services
Bezmialem Vakıf University
Istanbul, Türkiye
E-mail: dogankuday@gmail.com

Conflicts of interest/funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The author(s) declare no conflicts of interest.

Keywords: difficulties; disaster; obstacles; reliability; validity

Abbreviations:
AFAD: Disaster and Emergency Management Presidency [Afet ve Acil Durum Yönetimi Başkanlığı]
AGFI: Adjusted Goodness of Fit Index
AYAYDER: Association for Emergency Aid and Disaster Managers [Acil Yardım ve Afet Yöneticileri Derneği]
CBRN-e: chemical, biological, radiological, nuclear, and explosives
CFA: Confirmatory Factor Analysis
CFI: Comparative Fit Index
ECOLIO: Environmental and health, Communication and information, Organizational, Logistical, Individual, and Other factors
EFA: Exploratory Factor Analysis
GFI: Goodness of Fit Index
IFI: Incremental Fit Index
KMO: Kaiser-Meyer-Olkin
NFI: Normed Fit Index
NGO: nongovernmental organization
PCDRS: Perceived Challenges in Disaster Response Scale
RMSEA: Root Mean Square Error of Approximation
SRMR: Standardized Root Mean Squared Residual
TLI: Tucker-Lewis Index

Abstract

Objectives: This study aimed to design and validate a measurement tool in Turkish to assess the challenges perceived by individuals involved in the disaster response process, such as volunteers, health care personnel, firefighters, and members of nongovernmental organizations (NGOs).

Methods: This methodological study was conducted from November 2023 through March 2024. The scale development process comprised item development, expert reviews, and language control, followed by the creation of a draft survey, pilot testing, application of the final scale, and statistical analyses. All stages, including validity and reliability analyses, were conducted in Turkish. While reliability analysis used Cronbach's alpha, item-total correlations, intraclass correlation coefficients, test-retest reliability, Tukey's additivity, and Hotelling's T-squared tests, validity analysis included Exploratory and Confirmatory Factor Analyses (EFA/CFA). Software such as AMOS 22.0 and SPSS 22.0 were used to perform statistical analysis.

Results: Findings indicated six dimensions with 23 items, with factor loadings ranging from 0.478 to 0.881. The CFA demonstrated acceptable fit indices. Test-retest analysis showed a robust positive correlation ($r = 0.962$) between the measurements. The scale's total Cronbach's alpha coefficient was 0.913. Sub-dimension reliability scores were calculated as follows: 0.865 for environmental and health, 0.802 for communication and information, 0.738 for organizational, 0.728 for logistical, 0.725 for individual, and 0.809 for other factors.

Conclusions: This study showed that the Perceived Challenges in Disaster Response Scale (PCDRS), developed and validated in Turkish, is a reliable and valid measurement tool. It offers a foundation for understanding the challenges faced by disaster response teams and for formulating improvement strategies.

Kuday AD, Çalışkan C, Kınık K, Dağ N, Koçak H. Development of the Perceived Challenges in Disaster Response Scale (PCDRS): validity and reliability study. *Prehosp Disaster Med.* 2025;40(2):86–93.

Introduction

Disasters are occurrences that interrupt the normal functioning of communities, resulting in significant economic and physical damages that surpass the capacity of local resources to handle effectively.[1] These events can lead to material damage, physical injuries, and even loss of life. Disaster response requires effective planning, coordination, and proper utilization of resources. Strengthening the local-level medical response capacity is crucial for achieving the priority outlined in the International Sendai Framework 2015-2030, which emphasizes

Received: April 14, 2024
Revised: January 13, 2025
Accepted: February 13, 2025

doi:10.1017/S1049023X25000263

enhancing preparedness for effective response to the impacts of disasters at all regional, local, and national levels.[2,3]

Disasters pose significant threats to public health and safety, often resulting in an urgent need for response efforts to mitigate their impact. Preparedness and timely responses are crucial in minimizing disease outbreaks and mortality rates associated with such events.[4] However, during disaster response, there are various challenges that organizations and individuals may encounter.[5] Language differences and cultural norms can hinder effective communication between response teams and disaster victims, potentially delaying or complicating relief efforts.[6] Although various initiatives have been undertaken to standardize or improve various triage systems, difficulties can still arise in conducting disaster triage and making ethical decisions.[7,8] Coordination among response teams is another critical aspect of effective disaster management. Altıntaş and Delooz reported that the most significant problem faced by teams in the 1999 Marmara Earthquake was coordination.[9] In subsequent disasters like the 2023 Kahramanmaraş Earthquake, the same problem persisted, with coordination remaining the primary challenge once again.[10] Lack of coordination can result in inefficient use of resources, duplication of efforts, and delays in providing assistance to those in need. Despite intensive efforts to transport patients to health care facilities or due to disagreements regarding transportation, delays in patient transfer are frequently emphasized in the literature.[11,12] Additionally, these teams may face abduction, arrest, or detention in certain disaster situations, which can hinder the delivery of health services.[13]

Generally, the challenges encountered in disaster response are multi-faceted, and overcoming these challenges requires a comprehensive approach. Hugelius, et al summarized the challenges in disaster management by categorizing them into five key areas: managing uncertainty, aligning emergency plans with reality, establishing a functional crisis organization, adapting medical interventions, and ensuring resilience in response efforts.[14] However, this study primarily focused on operational aspects of disaster management. On the other hand, Sorani, et al have categorized them into six categories: people-related issues, infrastructural deficiencies, mismanagement of information, management barriers, shortage of paramedics and safety concerns, and medical services challenges.[15] However, this study has revealed a deficiency in addressing challenges related to personnel. Differing from these approaches, Kuday, et al provided an in-depth analysis of disaster response challenges and categorized them into six domains: environmental and health, communication and information, organizational, logistical, individual, and other factors.[16]

Measuring the perceived challenges of individuals involved in disaster response is important for evaluating the effectiveness of developed strategies and improving disaster response processes. However, there is limited information in the existing literature regarding the development of a specific scale for perceived challenges in disaster response. Therefore, this study aimed to develop a scale for perceived challenges in disaster response based on the systematic review by Kuday, et al.[16] The scale developed in this study (Perceived Challenges in Disaster Response Scale; PCDRS) can serve as a practical tool for identifying critical barriers faced by response teams, informing training programs, guiding policy decisions, and enhancing disaster preparedness and response strategies. By systematically measuring perceived challenges, the scale allows organizations to pinpoint specific operational obstacles, such as coordination inefficiencies, logistical shortcomings, or communication gaps, which can hinder effective disaster response. In addition to these practical applications, the scale provides a data-driven foundation for developing tailored interventions aimed at specific groups, such as volunteers, health care workers, or firefighters. Policymakers can leverage insights gained from the PCDRS to allocate resources more effectively and address systemic issues that may not be immediately apparent in qualitative evaluations. Ultimately, this scale supports a proactive approach to disaster management by identifying and mitigating challenges before they escalate into critical failures during actual response efforts.

Methods

This study aimed to create a measurement tool that is both valid and reliable for evaluating the perceived challenges faced by individuals participating in disaster response activities, including volunteers, health care workers, firefighters, and nongovernmental organization (NGO) members. This study was carried out from November 2023 through March 2024 and was conducted as a methodological study. Research efforts aimed at proving the validity and reliability of instruments or procedures used to measure constructs acting as variables in scientific investigations are known as methodological studies.[17] In this regard, the research questions addressed in this study are:

1. Is the PCDRS a valid measurement tool? And,
2. Is the PCDRS a reliable measurement tool?

Conceptual Validity

The conceptual framework and design process of the PCDRS is based on the ECOLIO approach derived from the systematic review of challenges faced by medical rescue teams during disaster response by Kuday, et al. The ECOLIO approach comprises six challenge factors: Environmental and health, Communication and information, Organizational, Logistical, Individual, and Other factors. These factors were metaphorically likened to gears in a mechanism where one problem can trigger other problems:

> A problem in the logistics of aid supplies can further disrupt coordination, burden medical rescue teams with heavy workloads, cause fatigue among medical rescue teams due to the heavy workload, and lead to errors in information sharing due to mental exhaustion.[16]

This approach has emphasized that addressing challenges in disaster response requires more than just an operational perspective and underscores the necessity of adopting a broader perspective.

Scale Development Process

This study used a systematic and structured approach to develop a scale, following a conceptual framework. The scale development process included item development, expert reviews and language control, creation of a draft survey, pilot test, application of the final scale and field test, and statistical analyses.

Item Development—The item development process was based on the systematic review conducted by Kuday, et al. In this review, 94 main findings summarizing challenges faced during disaster response were presented in their first table. These findings formed the foundation for the item pool creation. Each of these 94 challenges was carefully reviewed and converted into item statements to reflect specific situations experienced by participants. For example, one of the challenges identified as "inadequate sanitation and hygiene" was transformed from the item: "When working in a disaster area, I encounter poor hygiene conditions." Based on this process, 94

https://doi.org/10.1017/S1049023X25000263 Published online by Cambridge University Press

challenges were systematically examined, and 70 items were developed to represent the six factors identified in the study (Appendix 1; available online only). This ensured that all significant findings from Kuday, et al were effectively translated into measurable scale items. The distribution of the terms that formed the basis of the item development process is provided below:

- Environmental and Health: Inadequate sanitation and hygiene, lack of vector protection and vaccination, absence of shower and handwashing facilities, insufficient toilet facilities, bad weather conditions (ie, darkness, cold weather), infectious disease and epidemics, illness and injury, and improper waste disposal.
- Communication and Information: Communication network disruptions, insufficient communication, failure in patient tracking and documentation, lack of data collection, and uncertain and erroneous information sharing.
- Organizational: Lack of coordination, ambiguity in personnel roles and responsibilities, authorization issues, inadequate leadership, delays and late response due to formal procedures, and lack of integration among teams.
- Logistical: Inadequate equipment and materials, mismatched machinery, insufficient vehicles and personnel, shortage of health care facilities, and transportation issues (ie, traffic, congestion).
- Individual: Lack of personal items, inadequate accommodation and tents, irregular shift periods, high workload and exhaustion, lack of sleep, afraid of getting hurt, insufficient training and experience, being away from home, lack of motivation, difficulty coping with anxiety, and lack of sufficient information about families.
- Other Factors: Power outages, media relations, organization and distribution of donations, geographical location and terrain, cultural and local norms, lack of a common language or interpreters, diverse emergency plans of other international NGOs, absence of safety and security briefings, and record keeping.

Expert Reviews and Language Control—The item pool was evaluated in terms of necessity, clarity, and specificity by a total of ten experts, including four experts in disaster management, two experts in disaster medicine, two experts in public health, one expert in Turkish language, and one expert in psychometrics. The geographical distribution of these experts was limited to Türkiye and varied among various universities and institutions. The selection of experts was based on the criterion that they have academic and practical experience in relevant fields. Thirteen items were removed following expert assessments of the 70 draft items because they did not fit the scale's conceptual model and were not directly nor indirectly related to any of the six categories. A linguist examined and edited the draft items before the pilot research started to make sure they adhered to grammatical and semantic criteria. The scale developed in this study was designed and validated exclusively in Turkish. All stages of the development, including pilot testing and validity and reliability analyses, were conducted with Turkish-speaking participants. An English version of the scale has not been developed.

Creation of Draft Survey—The initial version of the scale included 57 items (Appendix 1). Each item in the draft PCDRS used a five-point Likert scale, from "strongly agree" to "strongly disagree." This structure allowed participants to express different levels of agreement or disagreement, providing detailed responses for comprehensive data collection. There were no reverse-coded items in the scale. Higher total scores, obtained by adding up all points, indicate a stronger perception of challenges in responding to disasters.

Pilot Test—A pilot study with 50 participants was carried out to evaluate the draft scale's readability and comprehensibility following expert assessments. The main study did not include these participants. Data were collected through face-to-face interactions to ensure detailed feedback on the scale items during the pilot phase. The final survey was conducted with the main participants after adjusting based on feedback received during the pilot test.

Application of the Final Scale and Field Test—The study population consisted of volunteers, health care personnel, firefighters, Disaster and Emergency Management Presidency (AFAD [Afet ve Acil Durum Yönetimi Başkanlığı]; Ankara, Türkiye) personnel, and members of NGOs involved in disaster response. For validity and reliability studies, several guidelines regarding sample size have been proposed, such as requiring at least five-times the number of items on the scale,[18] a sample size exceeding 100,[19] or a range of 100-200 participants.[20,21] In addition, Tabachnik and Fidell reported that if high factor loadings are obtained in the analysis, a sample size of 150 individuals may be sufficient.[22] Therefore, since there are 57 items on the scale, a minimum of 285 participants were targeted to be reached. The inclusion criteria were determined as follows: (1) being a volunteer, health care personnel, firefighter, or NGO member; and (2) having previously participated in national disaster response efforts. The volunteers in the study consisted of individuals working in various institutions and organizations operating in Türkiye. The fact that the participants were experienced in disaster response processes was determined as an important criterion for them to evaluate the challenges they perceived more accurately and comprehensively. In addition, the diversity of the participants from various disciplines and organizations enabled the data obtained to be evaluated from a broad perspective. As a result of the study, data were collected from 342 individuals, and 328 individuals met the inclusion criteria. Among the 328 participants, 32 were excluded from the analysis due to unreliable responses, such as missing responses, giving the same response to all items, and completing the questionnaire in an unusually short time. These criteria were applied to ensure the accuracy and reliability of the data. Additionally, a sub-sample of the total respondents ($n = 50$) was randomly selected, and they were asked to complete the same PCDRS again after 21 days to examine the test-retest reliability.

Statistical Analyses

The study's data were analyzed using SPSS version 22.0 (IBM Corp.; Armonk, New York USA) and AMOS version 22.0 (IBM Corp.; Armonk, New York USA) software. The normal distribution of the data was checked by examining the histogram graph and the skewness and kurtosis values. A range of ± 2.00 was taken as the criterion for skewness and kurtosis values.[23] Descriptive findings were presented with numbers, percentages, mean, and standard deviation (SD) values. Items were revised based on the Lawshe technique and feedback from ten experts. Items meeting a Content Validity Ratio (CVR) ≥ 0.62 and a

https://doi.org/10.1017/S1049023X25000263 Published online by Cambridge University Press

Content Validity Index (CVI) > 0.75 were retained in the survey draft.[24,25]

To determine the adequacy of the samples for factor analysis, thresholds were established with a Kaiser-Meyer-Olkin (KMO) value exceeding 0.5 and a Bartlett's Test significance level below 0.05.[26] Exploratory Factor Analysis (EFA) was conducted to reveal the structures of the items. Firstly, six separate EFA studies were conducted, each focusing on different factors: environmental and health, communication and information, organizational, logistical, individual, and other factors. The Principal Component Analysis (PCA) method was employed for factor extraction during the EFA process. In order to achieve better results, items with correlations above 0.5 and factor loading values above 0.50 were accepted in the conducted factor analyses for each of the six factors. Items with correlation matrix and factor loading values under 0.50 were excluded, and the analysis was conducted again. After completing the initial six EFA analyses, the number of factors was fixed at six in the "Factor Analysis: Extraction" stage, and the allocation of items across these factors was revisited. Direct Oblimin rotation method was preferred because it is considered that the factors are correlated with each other. This time, items showing correlations of at least 0.3 in the correlation matrix, items with values above 0.5 in the anti-image matrix, and items with factor loadings of at least 0.3 were accepted.[27] Additionally, factor loadings were deemed acceptable if they were at least 0.1 higher than the second-highest loading for the same item. Furthermore, items were allowed to load exclusively onto the constructs they were theoretically designed to represent, ensuring consistency with the theory underlying the scale development.

The same sample was used to conduct Confirmatory Factor Analysis (CFA) in order to assess the suitability of the model previously examined and determined through EFA. Fit indices including $\chi 2/df$, Standardized Root Mean Squared Residual (SRMR), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Incremental Fit Index (IFI), Tucker-Lewis Index (TLI), and Normed Fit Index (NFI) values were considered as acceptance criteria and examined.[28] In addition, the item-total correlations, Cronbach's alpha, intraclass correlation coefficient, test-retest reliability, Tukey's Additivity, and Hotelling's T-squared tests were used for scale's reliability analysis. Reliability calculations were made for both the general and sub-dimensions of the scale. For the item analysis, Cronbach's alpha values greater than 0.70 and total item correlation coefficients exceeding 0.30 were used as benchmarks.[27] A threshold of $P < .05$ was established as the criterion for statistical significance in all analyses.

Ethical Considerations

The study received approval from the University of Health Sciences Ethics Committee (Istanbul, Türkiye) with reference number 23528 on December 8, 2023. Considering the challenge of obtaining permissions from multiple institutions and organizations due to data collection involving diverse stakeholders, the data gathering process was facilitated through members of the Association for Emergency Aid and Disaster Managers (AYAYDER; Çanakkale, Türkiye); AYAYDER is a civil society organization in Türkiye where disaster professionals from various private, governmental, and/or civil society organizations are members on a voluntary basis, operating in the field of disaster. Among the members of the association are followers from different disciplines, primarily including health, fire brigade, disaster and emergency management personnel, and academia.[29]

Variables	n	%
Gender		
Male	158	53.4
Female	138	46.6
Age		
18 – 25	56	18.9
26 – 33	100	33.8
34 – 41	76	25.7
≥ 42	64	21.6
Education Level		
High School	24	8.1
Associate's Degree	58	19.6
Bachelor's Degree	118	39.9
Postgraduate Degree	96	32.4
Department		
Health Care Personnel	91	30.7
Volunteers	76	25.7
Members of NGOs	49	16.6
Firefighters	43	14.5
AFAD Personnel	37	12.5
Previous Disaster Experiences		
Earthquakes	226	37.8
CBRN-e	140	23.4
Floods	108	18.1
Forest Fires	92	15.4
Lanslides	32	5.4

Table 1. Demographic Information of Participants

Abbreviations: AFAD, Disaster and Emergency Management Presidency; CBRN-e, chemical, biological, radiological, nuclear, and explosives; NGO: nongovernmental organization.

Results

The development of the final version of the PCDRS was outlined in three stages: characteristics of the participants, validity analysis of the PCDRS, and reliability analysis of the PCDRS.

Characteristics of the Participants

Out of all participants, 53.4% were male and 46.6% were female. The average age was 34.10 (SD = 9.02) years, ranging from 19 to 59 years old among the participants. Individuals aged 26-33 years constituted 33.8% of the total participants. According to their educational background, 39.9% had a bachelor's degree and 32.4% had completed postgraduate studies. Regarding profession, 30.7% of the participants were health care personnel, 25.7% were volunteers, 16.6% were NGO members, 14.5% were firefighters, and 12.5% were AFAD personnel. When participants' disaster experiences were examined, 37.8% had previously participated in earthquakes, 23.4% in chemical, biological, radiological, nuclear, and explosives (CBRN-e) incidents, 18.1% in floods, 15.4% in forest fires, and 5.4% in landslides (Table 1).

https://doi.org/10.1017/S1049023X25000263 Published online by Cambridge University Press

Items	Factors						Eigen Values	% of Variance	% Cumulative
	1	2	3	4	5	6			
m34	0.875						8.174	35.54	35.54
m35	0.765								
m33	0.759								
m31	0.745								
m32	0.644								
m25		0.847					1.733	7.53	43.07
m26		0.809							
m55		0.622							
m24		0.478							
m14			0.835				1.652	7.18	50.25
m15			0.671						
m17			0.663						
m13			0.634						
m1				0.754			1.281	5.57	55.82
m7				0.743					
m2				0.719					
m6				0.610					
m51					0.880		1.131	4.91	60.74
m52					0.830				
m50					0.707				
m42						0.881	1.095	4.76	65.50
m41						0.752			
m46						0.653			

Table 2. Factors and Factor Loadings of Items

Validity Analysis of the PCDRS

In each of the six separate EFAs conducted, the KMO value exceeded 0.5, indicating adequacy. Additionally, the Bartlett's Test of Sphericity showed statistically significant results ($P < .001$), confirming the dataset's suitability for factor analysis each time. As stated in the methods, items with correlations below 0.5 and factor loading values below 0.5 were removed in the initial six EFA analyses. Thus, a total of 34 items were removed, with five in the first EFA, seven in the second EFA, nine in the third EFA, four in the fourth EFA, three in the fifth EFA, and six in the sixth EFA. After this stage, the "Factor Analysis: Extraction" section was set to six, and the Direct Oblimin method was selected as the factor rotation method to re-examine the distributions of the remaining items. The KMO value was found to be 0.880, and Bartlett's sphericity test was found to be significant ($P < .001$). When the rotated component matrix table of the final analysis was examined, it was determined that the items were appropriately distributed and a structure with six factors emerged. The total variance explained by these six factors was found to be 65.50% (Table 2).

After conducting the EFA, CFA was performed using the same sample. The path diagram of the PCDRS is shown in Figure 1. This diagram demonstrates the relationships between the six sub-dimensions and their respective items. Arrows within the diagram represent the strength of these relationships, while the numerical values reflect the factor loadings obtained through CFA. During the CFA, variables that negatively impacted model fit were identified, and new shared variables were generated for those with high residual covariances (eg, e3-e4, e4-e5, e7-e8, e11-e12). The all-fit indices obtained are shown in Table 3.[30–33] Specifically, the $\chi 2/df$ value of 2.127 and RMSEA of 0.062 indicated that the fit indices were at an acceptable level. The results of the CFA confirmed the structural validity of the scale with statistically significant outcomes at the level of $P < .05$. The 23 items and six sub-dimensions included in the scale were found to be consistent with its theoretical framework.

Reliability Analysis of the PCDRS

The item-total correlations of the scale ranged from 0.342 to 0.653. Therefore, correlations above 0.30 for all items indicated that the items in the scale were associated with the measured concept and that the scale was reliable.[34] The Cronbach's alpha value of the scale was 0.913, which is quite high. The Cronbach's alpha values of sub-dimensions were as follows: 0.865 for the environmental and health factor, 0.802 for the communication and information factor, 0.738 for the organizational factor, 0.728 for the logistical factor, 0.725 for the individual factor, and 0.809 for the other factor (Table 4). These values indicated good reliability in terms of internal consistency among the six sub-scales of the scale.[35]

Responses of participants to draft items were evaluated for differences using the Hotelling T2 test. As a result of the test, the Hotelling's T-square value was found as $T2 = 1953.1774$, $P < .001$ and there was no response bias. In addition, a Tukey's test of scale summability was conducted to obtain a total score for the scale. Upon reviewing the results, it could be concluded that the questions comprising the scale were homogeneous and correlated with each other ($P < .05$). According to the Intraclass Correlation

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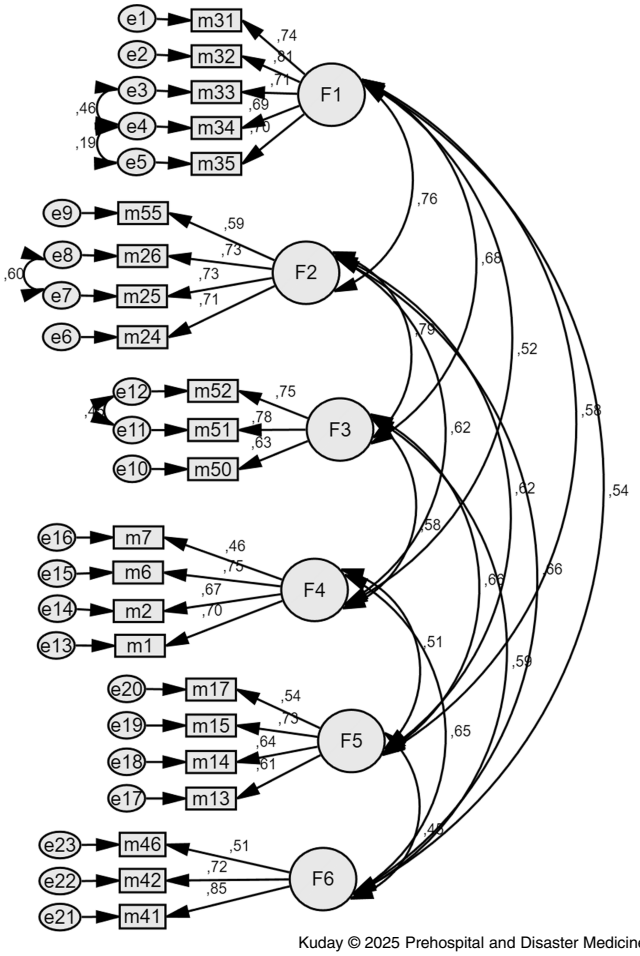

Figure 1. Path Diagram of PCDRS.

Abbreviation: PCDRS, Perceived Challenges in Disaster Response Scale.

Coefficient test, it had been determined that the scale was reliable both in terms of individual items and in terms of average measurements ($P < .05$). Lastly, 21 days after the initial data collection process, 50 individuals took the test again.[36] The analysis showed a very strong positive correlation ($r = 0.962$) between the two measurements ($P < .001$), indicating that the scale demonstrated time invariance.

Discussion

There is limited research in the literature regarding perceived challenges in disaster response. This indicates a lack of understanding and addressing the complexity of response processes, emphasizing the importance of increasing knowledge and experience in this field. Especially, private and public institutions, as well as civil society organizations operating in the disaster field, need tools to measure these challenges for effective and efficient use of resources. Meeting this need can lead to improvements in the response perspectives of first responders or disaster professionals. Therefore, in this study, the PCDRS was developed to determine the perceived challenge levels of individuals involved in disaster response, and validity and reliability analyses were conducted.

The factors compiled by Kuday, et al by examining the challenges faced by disaster response teams during the response process, and the subsequently developed ECOLIO approach, were utilized as the basis for the development phase of the PCDRS.[16] In this regard, expert opinions were obtained from professionals with backgrounds and experience in public health, disaster medicine, emergency health services, and disaster science for the developed pool of 70 items. Following expert opinions and a pilot test, 13 items were eliminated, and the main application was conducted with 53 items. Subsequently, data analysis was performed. The study revealed that the factor loadings of the scale items ranged from 0.478 to 0.881, resulting in the emergence of six dimensions consisting of 23 items.

In scale development studies, factor loading values should typically be above 0.30.[28] However, different sources suggest slightly varying thresholds for factor loading values. Tabachnick and Fidell propose a minimum loading of 0.32 as a rule of thumb for factor items, while Pett, et al suggest at least 0.40 factor loadings.[22,37] In the current study, the lowest factor loading was found to be 0.478. Therefore, it can be said that each item adequately or sufficiently measures the factor.

When examining the CFA studies in the literature, it can be observed that there are many studies where CFA has been conducted both with the same sample and with different samples.[38] Additionally, there are studies suggesting that one-half of the sample can be used for EFA while the other-half can be used for CFA.[39] However, it is generally recommended that EFA and CFA be conducted on different samples.[40] The reason for this is that using different samples increases the likelihood of obtaining more generalizable and reliable results. In this study, both EFA and CFA were conducted on the same sample. According to the results of CFA, the $\chi 2/df$ value was 2.127 and the RMSEA was 0.062. Additionally, all fit indices including CFI, GFI, AGFI, TLI, IFI, and NFI values were found to be above 0.80. Although conducting CFA with the same sample in this study is a limitation, it can still be said that the model is acceptable.[41]

In reliability analyses of scales, Cronbach's alpha is generally considered, and it is desired that this value be above 0.70.[42–44] Both the overall and sub-dimensions of PCDRS had Cronbach's alpha values above 0.70. Furthermore, the Tukey scale collectability value was $P < .05$, and Hotelling's T-square value was $P < .001$. A P value of less than .001 from Hotelling's T-squared test suggests that there is a statistically significant variance difference between the groups and that they are distinct from one another. On the other hand, the Tukey scale's collectability test with a P value of $< .05$ indicates that the scale is collectable and that the measured characteristics exhibit sufficient diversity.[45] Consequently, the validity and reliability of the 23-item PCDRS have been established. The scale is quick to complete because it has few items and brief texts. In addition, the PCDRS encompass all individuals involved in disaster response and, as its fundamental aim is to improve the response process, it refers to the "build back better" doctrine of the Sendai Framework.[46]

In summary, the PCDRS can be implemented in disaster response training programs by identifying the most challenging aspects faced by specific groups, such as volunteers or health care workers, and tailoring training sessions accordingly. For example, if communication barriers are identified as a significant issue, training programs can focus on improving communication skills and implementing tools like standardized communication protocols or mobile applications. In policy development, the PCDRS can provide evidence-based insights to guide resource allocation. For instance, if logistical challenges are consistently perceived as

https://doi.org/10.1017/S1049023X25000263 Published online by Cambridge University Press

Fit Index	$\chi 2$/df	AGFI	GFI	NFI	CFI	IFI	TLI	SRMR	RMSEA
Acceptable Fit	≤ 3	≥0.85	≥0.80	≥0.80	≥0.85	≥0.85	≥0.80	≤0.10	≤0.08
Good Fit	≤ 2	≥0.95	≥0.90	≥0.95	≥0.95	≥0.95	≥0.95	≤0.05	≤0.05
PCDRS	2.127	0.855	0.981	0.864	0.922	0.923	0.907	0.05	0.062

Table 3. Fit Measures of Confirmatory Factor Analysis[30–33]
Abbreviations: PCDRS, Perceived Challenges in Disaster Response Scale; AGFI, Adjusted Goodness of Fit Index; GFI, Goodness of Fit Index; NFI, Normed Fit Index; CFI, Comparative Fit Index; IFI, Incremental Fit Index; TLI, Tucker-Lewis Index; SRMR, Standardized Root Mean Squared Residual; RMSEA, Root Mean Square Error of Approximation.

Scale	Number of Items	Item Total Correlation	$\bar{X} \pm SD$	Skewness Kurtosis	Cronbach's Alpha
PCDRS	23	0.342 – 0.653	ā3.56 (SD = 0.59)	-0.77/1.89	0.913
Environmental & Health	5	0.570 – 0.641	3.68 (SD = 0.76)	-0.68/0.80	0.865
Communication & Information	3	0.531 – 0.634	3.31 (SD = 0.94)	-0.16/-0.37	0.802
Organizational	4	0.342 – 0.557	4.27 (SD = 0.75)	-1.56/1.94	0.738
Logistical	3	0.396 – 0.603	3.88 (SD = 0.77)	-1.02/1.40	0.728
Individual	4	0.384 – 0.527	2.45 (SD = 0.80)	0.27/-0.22	0.725
Other	4	0.509 – 0.653	3.78 (SD = 0.75)	-0.59/0.61	0.809

Table 4. Reliability Values of the PCDRS
Abbreviation: PCDRS, Perceived Challenges in Disaster Response Scale.

critical, policymakers can prioritize investments in transportation infrastructure, equipment, or emergency supply chains. By systematically addressing the key challenges highlighted by the PCDRS, both training and policy interventions can be more targeted and effective in enhancing disaster response capabilities.

Limitations

The main limitation of the study is that EFA and CFA were conducted on the same sample. This approach, while commonly used in scale development studies, may limit the generalizability of the findings, as the results might be specific to the sample used. Future research should consider using separate samples for exploratory and confirmatory analyses to validate the scale across different populations and to ensure its broader applicability. Another limitation is the geographical and cultural context of the study, as the participants were from Türkiye. This focus may limit the generalizability of the results to other cultural or geographical settings where disaster response challenges and organizational structures might differ significantly. For future research, it is important to re-evaluate and confirm the validity and reliability of the scale with a larger and more diverse sample to contribute to the enhancement of the scale's development. Additionally, conducting post-implementation studies to assess the practical impact of utilizing the PCDRS could aid in understanding changes in attitudes and behaviors related to perceived challenges in disaster response.

Conclusion

The PCDRS serves as a comprehensive measurement tool designed to assess perceived challenges encountered during disaster response. The findings from the study indicate that the PCDRS is both a reliable and valid instrument for evaluating these difficulties. There are 23 items on the scale, divided into six dimensions. There are no reverse-scored questions on the five-point Likert scale, which goes from "strongly agree" to "strongly disagree." Higher scores on the PCDRS denote a higher perception of challenges in disaster response.

Author Contributions

ADK: Conceptualization, Methodology, Resources, Formal Analyses, Writing - Review & Editing, Writing - Original Draft. CC: Conceptualization, Methodology, Project Administration, Supervision, Formal Analyses, Writing - Review & Editing, Writing - Original Draft. KK: Investigation, Project Administration, Supervision, Writing - Review & Editing, Writing - Original Draft. ND: Investigation, Writing - Review & Editing, Writing - Original Draft. HK: Investigation, Writing - Review & Editing, Writing - Original Draft.

Supplementary Materials

To view supplementary material for this article, please visit https://doi.org/10.1017/S1049023X25000263

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