Uysal et al. BMC Psychology (2025) 13:1038
https://doi.org/10.1186/s40359-025-03399-0

BMC Psychology

RESEARCH

Open Access

Turkish adaptation, validity and reliability study of the "erlangen team cohesion at work scale": team cohesion of paramedics from healthcare professionals

Dilek Uysal[1*], Semra Altsoy[2], Mehmet Cinibulak[2] and Nilufer Demirsoy[3]

Abstract

Background The healthcare sector is a labor-intensive service domain that operates on the basis of multidisciplinary collaboration. Effective service delivery in this field is not solely dependent on individual expertise, but also closely linked to the cooperation and cohesion established among team members. Team cohesion plays a critical role in various aspects, including patient safety, quality of care, team performance, and the prevention of medical errors. Particularly in healthcare services, where human life is directly at stake, the importance of team cohesion becomes even more evident in ensuring effective and safe care delivery. In this context, the present study aimed to validate the Turkish version of the Erlangen Team Cohesion at Work Scale and to assess the level of team cohesion among paramedics.

Methods This methodological study was conducted between June 15 and July 15, 2024, with 219 paramedics who are members of the Association of Paramedics and Prehospital Emergency Medicine. To validate the Turkish version of the Erlangen Team Cohesion at Work Scale, the following procedures were carried out: For content validity: cultural adaptation, linguistic and content validation, and a pilot study. For construct validity: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). For reliability: Cronbach's alpha, item-total correlations, split-half reliability, and test-retest reliability analyses.

Results The Turkish version of the scale, consisting of 12 items under a single factor, demonstrated excellent psychometric properties: Cronbach's alpha = 0.93; KMO = 0.94; explained variance = 59.76%. The fit indices from CFA were: $\chi^2/df = 2.5$, RMSEA = 0.08, SRMR = 0.04, GFI = 0.90, NFI = 0.93, RFI = 0.90, IFI = 0.95, TLI = 0.94, and CFI = 0.95. These findings confirmed that the Turkish version of the Erlangen Team Cohesion at Work Scale has high content and construct validity as well as strong reliability. Additionally, the paramedics who participated in the study were found to have a high level of team cohesion, with a mean score of 2.86 ± 0.63.

Conclusion The Turkish version of the Erlangen Team Cohesion at Work Scale demonstrated robust validity and reliability, supporting its applicability among healthcare professionals in Turkey. Furthermore, the high cohesion levels

*Correspondence:
Dilek Uysal
dilekvuraluysal@gmail.com
Full list of author information is available at the end of the article

observed among paramedics highlight the presence of effective collaborative dynamics in prehospital emergency medical services.

Keywords Team Cohesion, Paramedics, Culture Adaptation, Validity, Reliability

Healthcare workers are frequently exposed to stressors such as heavy workloads, time pressure, and multi-functional roles [1]. Particularly in prehospital emergency care, paramedics are required to manage critically ill patients, communicate effectively with patients, and, when necessary, provide support to family members [2]. Paramedics, who serve at the frontline of the healthcare system, are professionals making high-risk decisions under time constraints and with limited resources [3]. Due to the life-threatening nature of prehospital interventions, team cohesion holds particular importance for paramedics. Under these challenging conditions, effective team cohesion becomes a critical factor not only for improving job performance but also for directly influencing patient survival [4]. The success of initial interventions in prehospital settings, where paramedics play a key role, is significantly affected by the level of team cohesion, making its assessment crucial.

Emergency medical service providers are among the professional groups where teamwork and time management are essential [5]. In Turkey, team cohesion in prehospital care is one of the primary elements that enhances the efficiency of care processes during field intervention, transport, and hospital admission, while also promoting patient safety and personnel resilience.

A team is defined as two or more individuals who work collaboratively toward a common goal, utilizing available resources, specializing in line with task requirements, and demonstrating the ability to coordinate, adapt, and communicate effectively [6]. Cohesion ranges from generalized social harmony among team members to task-specific commitment required for accomplishing complex responsibilities [7]. One of the most critical aspects for teams is the presence of shared values and interpersonal attraction that foster cooperation and the desire to work together [8]. Although cohesion has long been regarded as a vital contributor to team success, its role has become increasingly important in today's healthcare systems. As organizations strive to maintain a competitive edge, interest in team-based structures and team cohesion continues to grow as a means of enhancing knowledge sharing, motivation, and innovation [9].

Effective team cohesion is a fundamental factor that directly influences patient safety, quality of care, service efficiency, and employee satisfaction in healthcare [9, 10]. The ability of healthcare professionals to work in a coordinated, respectful, and trust-based environment enhances both individual and institutional performance. In this context, *team cohesion* is a multidimensional construct referring to mutual support, open communication, cooperation toward shared goals, and a sense of belonging among team members [8].

Team cohesion plays a central role in various outcomes, including intention to leave the profession [11] job satisfaction [12, 13], improved patient care outcomes and performance [4–14, 15], prevention of medical errors [16], time efficiency [17], cost control [18], perceived team performance, satisfaction, and vitality [19]. While team cohesion can be analyzed through various variables, its sustainability and consistency over time are of greater importance. Among the variables associated with cohesion, group performance has received the most scholarly attention [8]. High levels of cohesion have been shown to correlate with high team performance [20].

Although several instruments have been developed internationally to assess team cohesion, few have been directly adapted, validated, and tested for reliability within the Turkish healthcare context. Notably, the literature lacks a culturally adapted instrument specifically designed to measure team cohesion among prehospital healthcare professionals such as paramedics in Turkey. Existing scales are generally limited to nurses, physicians, or broader healthcare personnel, without accounting for the unique organizational structures, intervention conditions, and role definitions specific to paramedics [5–21].

Team cohesion is not solely determined by interpersonal dynamics but is also shaped by societal cultural norms, workplace dynamics, and the structural features of the healthcare system. In Turkey, the concept of teamwork in healthcare services is influenced by societal values, hierarchical organizational structures, and collectivist cultural orientations that differ from Western contexts [22]. This leads to an emphasis on collective responsibility and group loyalty rather than individual autonomy in team interactions. Therefore, any scale used to measure team cohesion must be adapted not only linguistically but also in terms of cultural norms and organizational realities.

In the Turkish healthcare system, task distribution, decision-making authority, and communication among team members are often shaped by vertical organizational principles [2]. Moreover, paramedics working in emergency medical services frequently encounter ambiguities in their job descriptions, and the distribution of authority and responsibilities may vary by region [5]. Consequently, the measurement of a context-sensitive construct such as team cohesion requires careful consideration of national healthcare policies, regulatory practices, and clinical workflows specific to Turkey.

In recent years, national health policies have increasingly focused on concepts such as “integrated care,” “patient safety,” and “quality management,” positioning team cohesion not merely as a workplace dynamic but as a key performance indicator that directly influences service quality [23]. In this context, the cultural adaptation of the Erlangen Team Cohesion at Work Scale to the Turkish healthcare system holds strategic value both for evaluating the quality of service delivery and for monitoring organizational development.

Materials and methods

Aim of the study

This study aimed to culturally adapt the *Erlangen Team Cohesion at Work Scale* (ETC), developed and psychometrically validated by Lieb et al. (2024), into Turkish and to evaluate its psychometric properties in a sample of paramedics [24]. The small number of items in the scale and its ease of application provide time efficiency during field data collection and enhance the motivation of healthcare professionals to participate. Thus, the scale contributes value as a practical and economical measurement tool that is sensitive to the time constraints frequently encountered in healthcare settings.

Population and sample

The target population of the study consisted of paramedics who are members of the Association of Paramedics and Prehospital Emergency Medicine. The sample comprised those members who agreed to participate in the study after being invited.The sample size was determined using a rough estimation method recommending a sample size of 5 to 10 times the number of variables. Given that the scale contains 13 variables, a sample size of 65 to 130 participants was deemed sufficient. Ultimately, 219 paramedics participated in the study [25, 26].

Data collection tools

The association’s board of directors delivered a Google form link to the association members between 15.06.2024 and 15.07.2024. The survey consists of two parts. The first part includes questions on socio-demographic characteristics (age, gender, education level, etc.), while the second part consists of questions related to the Erlangen Team Cohesion at Work Scale. The scale is a self-report questionnaire developed in 2024 by Lieb et al. to measure team climate in the workplace. It consists of 13 items and 2 factors [26].

Ethical considerations

Prior to data collection, ethical approval was obtained from the Non-Interventional Clinical Research Ethics Committee (Approval No: 2024/127, dated June 13, 2024), and written permission was granted by the association to contact its members. Additionally, authorization was received from the original developers of the scale. All participants were required to read and approve an informed consent statement before proceeding to the research questions.

Type of study

This study employed a methodological and cross-sectional research design.

Data analysis

The Turkish adaptation of the *Erlangen Team Cohesion at Work Scale*, originally developed by Lieb et al., followed the relevant validation procedures:

- For content validity: cultural adaptation into Turkish, linguistic-content validation, and pilot testing;
- For construct validity: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA);
- For reliability: Cronbach’s alpha, item-total correlations, split-half reliability, and test-retest reliability analyses.
- All analyses were conducted using SPSS 23 and AMOS 23 statistical software packages.

Content validity turkish adaptation stage

The translation–back translation method was employed to ensure the linguistic validity of the scale. Initially translated from English into Turkish by three experts fluent in both languages at a native level, the scale was reviewed and revised. Subsequently, it was back-translated into English by another set of three bilingual experts. Consensus was achieved among the translations, and the items were submitted for expert review to assess their linguistic and conceptual equivalence [22].

To ensure the linguistic and conceptual appropriateness of the Turkish version, expert opinions were obtained using the Davis method from a panel consisting of one healthcare management specialist, one nursing management expert, three paramedics, and two scholars in medical history and ethics. The Davis method is a technique used to evaluate the necessity, clarity, specificity, and face validity of measurement items or questions. It involves an expert evaluation form using a four-point Likert scale to determine whether each item is relevant, clear, and appropriate in relation to the study objectives. In this study, the following rating scale was used: 1 = not relevant; 2 = somewhat relevant; 3 = relevant; and 4 = highly relevant [27]. Based on the expert evaluations, the Content Validity Index (CVI) for each item ranged between 0.85 and 1.00.

Pilot application

As part of the cultural adaptation process, a pilot study was conducted with 60 healthcare professionals to assess whether the scale was appropriate and comprehensible. In the Exploratory Factor Analysis (EFA), the item "Everyone in the team has been left to work on their own" under the second factor had a factor loading below 0.30 and was therefore removed from further analysis. The Principal Component Analysis method, commonly used in social sciences, along with the Direct Oblimin rotation technique, was applied. As a result, a 12-item, single-factor scale was obtained. The lowest factor loading was 0.49, and the highest was 0.70. The Kaiser-Meyer-Olkin (KMO) value was 0.88, the Cronbach's alpha coefficient was 0.93, and the total variance explained was 58.62%. Since the scale demonstrated sufficient reliability in the preliminary study, the reverse-coded sixth item was retained in the instrument and included in the version administered to the main sample.

Construct validity

In order to test the construct validity of the scale, Exploratory Factor Analysis (EFA) was first conducted. This method was chosen because in adaptation studies, where the factor structure may differ due to cultural variations, EFA enables the exploration of factor loadings and the internal structure of the items within the Turkish sample [28]. In EFA, a Kaiser-Meyer-Olkin (KMO) coefficient ≥ 0.80 is considered "very good," and a significant result in Bartlett's Test of Sphericity ($p < 0.05$) indicates that the data are suitable for factor analysis [29, 30]. In this study, the KMO value was 0.94, and Bartlett's Test was found to be statistically significant, confirming the suitability of the data for EFA.

Following the EFA, Confirmatory Factor Analysis (CFA) was conducted to test the factor structure obtained. The main purpose of CFA is to examine the extent to which the theoretically assumed structure fits the observed data from the sample. To indirectly demonstrate the reliability of the scale and its items, a structural equation model was applied through CFA using the AMOS software. The goal of CFA is to test how well the proposed theoretical structure matches the empirical data. The model fit was assessed using indices such as CMIN/DF, RMSEA, GFI, SRMR, NFI, RFI, IFI, TLI, and CFI. Convergent validity was evaluated using the Average Variance Extracted (AVE) and Composite Reliability (CR) indices [29, 30].

Reliability

To assess internal consistency, Cronbach's alpha coefficient, item-total correlations, and split-half reliability were examined. For stability over time, test-retest analyses were conducted.

Results

The socio-demographic characteristics of the participating paramedics were evaluated as follows: 54.8% were married, 58.9% held a bachelor's degree, the mean age was 32 years, and the average duration of professional experience was 10 years. Furthermore, 88.6% reported that they chose their profession consciously, 92.2% stated that they practiced their profession with passion, and 83.1% were employed in public institutions.(see Table 1)

Table 1 Socio-Demographic / Descriptive characteristics

Characteristics	*n* (%)
Gender	
Female	120 (54.8)
Male	99 (45.2)
Marital Status	
Married	156 (71.2)
Single	63 (28.8)
Educational Status	
Associate Degree	42 (19.2)
Bachelor's Degree	129 (58.9)
Postgraduate Degree	48 (21.9)
Institution of Employment	
Public Sector	182 (83.1)
Private Sector	37 (16.9)
Intentional Career Choice	
Yes	194 (88.6)
No	25 (11.4)
Enjoying the Profession	
Yes	202 (92.2)
No	17 (7.8)
Age	32 ± 7.262
Years of Experience in Nursing	10 ± 7.503

Exploratory factor analysis

In the exploratory factor analysis conducted with a sample group of 219 participants, the sixth item—"Everyone in the team has been left to work on their own"—was excluded from the analysis because it formed a distinct single factor on its own (see Table 2). The Principal Components method and direct oblimin rotation technique were employed. A one-dimensional measurement tool consisting of 12 items was obtained. The scale was scored on a 5-point Likert scale ranging from 0 = strongly disagree to 4 = strongly agree.

As a result of the Exploratory Factor Analysis, the lowest factor loading was found to be 0.45 and the highest was 0.76. A KMO Bartlett's value greater than 0.50 indicates that the data structure is suitable for factor analysis. In this study, the KMO Bartlett's value was 0.94, indicating that the sample size was excellent. The total variance explained was 59.76%, the Cronbach's alpha coefficient

Table 2 First EFA analyzes

Pattern Matrix[a]		
	Component	
	1	2
ETC1	,602	
ETC2	,687	
ETC3	,748	
ETC4	,613	
ETC5	,699	
ETC6		,860
ETC7	,832	
ETC8	,869	
ETC9	,745	
ETC10	,851	
ETC11	,881	
ETC12	,843	
ETC13	,800	

was 0.94, and the mean score of the scale was 2.86 ± 0.63. (see Table 3)

Confirmatory factor analysis (CFA)

In the CFA, when examining the t-statistics for the items, all items were found to be statistically significant ($p < 0.001$). For the evaluation of factor loadings, 0.30 was accepted as the minimum threshold. Items with loadings below this value were assumed to have low contribution to the construct of the scale. This threshold is commonly used in the social sciences and indicates at least moderate significance of factor loadings [31]. Accordingly, based on the EFA results, only the 12 items with factor loadings above 0.30 were included in the analysis, and the item forming a standalone factor was excluded. In single-factor structures, a total variance explained of over 30% is generally considered sufficient; in this study, the variance explained was found to be 59.76%, indicating a high level [30]. (see Fig. 1) All fit indices obtained from the analyses were within acceptable ranges. These CFA results demonstrate that the scale possesses construct validity.

Additionally, the modification indices calculated after CFA provided suggestions for improving the measurement model. However, only modifications based on statistically significant and theoretically justifiable correlations (e.g., between ETC-ETC2 and ETC6-ETC7) were permitted [31].

To assess convergent validity following the confirmation of the structure, Average Variance Extracted (AVE > 0.50) and Composite Reliability (CR > 0.70) values were calculated. In convergent validity, the composite reliability (CR) values were found to be higher than the AVE values, and the AVE values were above the 0.50 threshold. These results indicate that the measurement model has an adequate level of convergent validity (CR > 0.70; AVE > 0.50; CR > AVE) [32]– [33].(see Table 4)

The primary indices and threshold values used to evaluate model fit are as follows: χ^2/df values below 5 indicate acceptable fit, while values below 2 indicate good fit [34]. RMSEA (Root Mean Square Error of Approximation) values ≤ 0.08 are considered acceptable, and values ≤ 0.05 indicate a perfect fit [35]. SRMR (Standardized Root Mean Square Residual) values ≤ 0.08 are within acceptable limits [36]. Incremental and comparative fit indices such as CFI, TLI, NFI, IFI, and GFI are considered acceptable when ≥ 0.90, and indicate good fit when ≥ 0.95 [37]– [38]. Based on these criteria, the fit indices obtained in this study indicate a good level of fit and demonstrate that the measurement tool is acceptable [29– [33–39].(see Table 5)

As a result of the EFA, only the 12 items with factor loadings above 0.30 were retained in the analysis, and the item that formed a standalone factor was excluded. In single-factor structures, a total explained variance of over 30% is generally considered sufficient. In this study, the explained variance was found to be 59.76%, which is considered high [30].

Table 3 Exploratory factor analysis (EFA) results of the finalized unidimensional scale

EFA	Items	Factor loading	KMO Barlett's	x2	*p*	Explained variance %	X ± SD
Erlangen Team Cohesion at Work Scale	ETC1	0,45	0,94	1786,802	0,000	59,76	2,86 – 0,63
	ETC2	0,55					
	ETC3	0,61					
	ETC4*	0,44					
	ETC5	0,50					
	ETC7	0,68					
	ETC8	0,72					
	ETC9	0,51					
	ETC10	0,68					
	ETC11	0,76					
	ETC12	0,68					
	ETC13	0,58					

* Reverse-coded item-

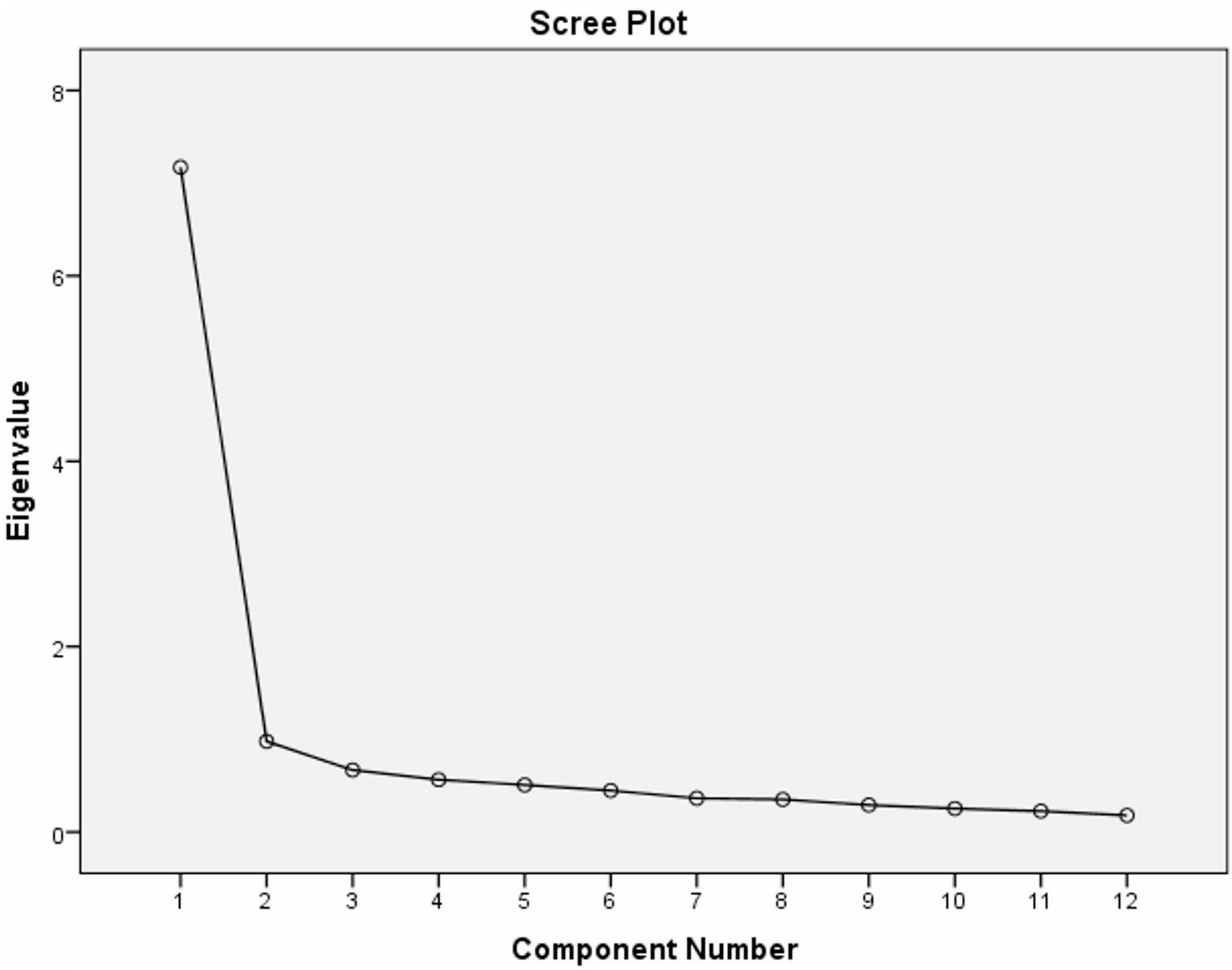

Fig. 1 Scree plot indicating unidimensionality

Table 4 CFA analyses

CFA	Items	Factor loading	S.D.	t	*p*	CR	AVE
Erlangen Team Cohesion at Work Scale	ETC1	0,60	--	--	0,000		
	ETC2	0,68	0,10	10,979	0,000	0,93	0,55
	ETC3	0,74	0,16	8,955	0,000		
	ETC4*	0,61	0,18	7,782	0,000		
	ETC5	0,68	0,21	8,307	0,000		
	ETC7	0,79	0,17	9,352	0,000		
	ETC8	0,83	0,18	9,617	0,000		
	ETC9	0,69	0,16	8,435	0,000		
	ETC10	0,83	0,16	9,552	0,000		
	ETC11	0,88	0,19	9,992	0,000		
	ETC12	0,83	0,16	9,597	0,000		
	ETC13	0,74	0,18	8,877	0,000		

* Reverse-coded item

Modifications were made between items ETC1–ETC2 and ETC6–ETC7, as these were found to contribute to the improvement of the model fit indices. (Fig. 2)

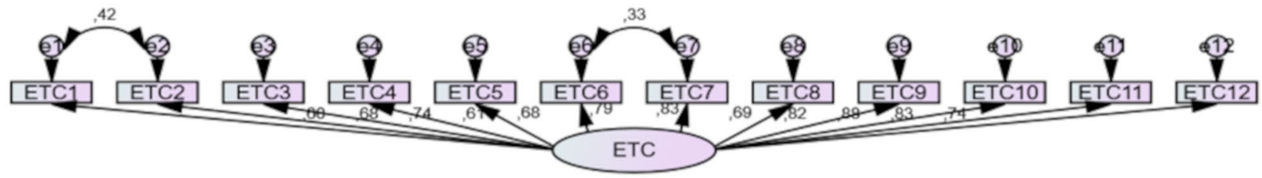

Fig. 2 Standardized path coefficients of the measurement tool

Table 5 Fit index values

Fit criteria	Appropriate	Acceptable	Working Values	Result
x^2/df	0–2	≤ 5	2,5	Acceptable fit
RMSEA	≤ 0.05	≤ 0.08	0,08	Acceptable fit
SRMR	≤ 0.05	≤ 0.08	0,04	Perfect fit
IFI	≥ 0.95	≥ 0.90	0,95	Perfect fit
CFI	≥ 0.95	≥ 0.90	0,95	Perfect fit
RFI	≥ 0.95	≥ 0.90	0,90	Acceptable fit
NFI	≥ 0.95	≥ 0.90	0,93	Acceptable fit
GFI	≥ 0.90	≥ 0.85	0,90	Perfect fit
TLI	≥ 0.90	≥ 0.85	0,94	Perfect fit

$χ^2$, Chi-square; df, Degrees of Freedom; RMSEA, Root Mean Square Error of Approximation; SRMR, Standardized Root Mean Square Residual; GFI, Goodness-of-Fit Index; NFI, Normed Fit Index; RFI, Relative Fit Index; IFI, Incremental Fit Index; TLI, Tucker-Lewis Index; CFI, Comparative Fit Index

Based on the item analysis following the EFA, none of the items had factor loadings below 0.30, and all loadings were within acceptable limits. Each item was found to sufficiently serve the overall purpose of the scale (see Tablo 6).

No statistically significant difference was found between the test-retest analyses conducted two weeks apart. The mean score of the measurement tool in the first test was 2.93 ± 0.505, while the mean score in the second test was 2.91 ± 0.40. This result indicates the stability of the measurement tool. The correlation between the test scores administered two weeks apart was found to be statistically significant ($p = 0.000$ / $r = 0.880$) (see Table 7).

Table 7 Test-retest analysis

Test	Re-Test	t*	*p*	*r***	*p***
2,93 ± 0,50	2,91 ± 0,40	0,500	0,621	0,88	0,000

*t test on dependent groups, degrees of freedom: 29

**pearson korelasyon

For the split-half reliability analysis, the data were divided into two parts. The Cronbach's alpha value was found to be 0.85 for the first part and 0.90 for the second part. The correlation coefficient between the two parts was calculated as 0.82 ($p < 0.05$). The Spearman-Brown coefficient was calculated as 0.90, and the Guttman split-half coefficient was also found to be 0.90. Hotelling's T-squared value was 382.822 and statistically significant ($p < 0.000$) (see Table 8).

Table 6 Item-Total correlation analysis

Item-Total Statistics	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
ETC1	31,24	51,78	0,61	0,51	0,93
ETC2	31,27	51,21	0,69	0,59	0,93
ETC3	31,42	49,35	0,73	0,61	0,93
ETC4*	32,09	49,02	0,61	0,41	0,94
ETC5	32,13	47,73	0,66	0,47	0,93
ETC7	31,52	48,51	0,78	0,69	0,93
ETC8	31,58	47,73	0,81	0,71	0,93
ETC9	31,43	50,19	0,66	0,53	0,93
ETC10	31,45	49,27	0,78	0,68	0,93
ETC11	31,57	47,10	0,83	0,74	0,93
ETC12	31,48	49,16	0,78	0,67	0,93
ETC13	31,58	48,61	0,71	0,57	0,93

Table 8 Reliability analysis results

	Cronbach's α	First half Cronbach's α	Second half Cronbach's α	Half the reliability	Spearman-Brown Coefficient	Guttman Split-Half Coefficient
ETC	0,93	0,85	0,90	0,82	0,90	0,90

Discussion

No Turkish scale study was found in the literature that directly assesses team cohesion. Therefore, the Erlangen Team Cohesion at Work Scale was culturally adapted into Turkish, and its psychometric properties were examined and discussed in light of the literature findings. The results indicate that the scale possesses strong psychometric properties in terms of both construct validity and reliability. Notably, the preservation of its unidimensional structure and the fact that all items demonstrated acceptable factor loadings support the conceptual consistency of the scale [31–33].

First, the Turkish cultural adaptation and translation of the scale were carried out [22], and content validity was evaluated based on expert opinions from seven professionals. The Content Validity Index (CVI) for each item ranged between 0.85 and 1.00, indicating that the scale demonstrated sufficient content validity [27]. In the pilot study, although the sixth item in the original instrument showed a low factor loading, it was retained and administered to the sample group.

In scale development or adaptation processes, Exploratory Factor Analysis (EFA) is typically used first to reveal the underlying factor structure [28]. EFA was conducted based on data collected from 219 paramedics. The Bartlett's Test of Sphericity value was 1786.802 and statistically significant ($p = 0.000$). The Kaiser-Meyer-Olkin (KMO) value was calculated as 0.94, compared to 0.91 in the original version of the scale [24]. These results indicate that the dataset and sample size are appropriate for factor analysis [40].

The Principal Components method and direct oblimin rotation technique were applied in the EFA. The direct oblimin method is preferred because it allows factors to be correlated and directly rotates the factor structure toward the final solution [41]. As a result of the EFA, the sixth item, which formed a standalone factor in the original scale, was excluded from the measurement tool. For a factor to be considered stable, it should ideally consist of at least three items [42].

Following the repeated EFA, the scale was found to have a unidimensional structure composed of 12 items. The factor loadings of all items ranged between 0.45 and 0.76, which is considered sufficient [29].In the original version of the instrument, factor loadings ranged from 0.50 to 0.78 [24]. The total explained variance was found to be 59.76%. In unidimensional structures, an explained variance above 30% is generally considered adequate [30]. These findings show that the construct validity of the scale is supported in line with the relevant literature.

It is emphasized that Confirmatory Factor Analysis (CFA) should be used to examine the structure revealed by Exploratory Factor Analysis [28]. In the CFA, all items were found to have factor loadings above 0.60. When examining the t-statistics for the items, all were found to be statistically significant ($p < 0.001$). The model fit indices were $\chi^2/df = 2.5$, RMSEA = 0.08, and SRMR = 0.04. Additionally, GFI, NFI, RFI, IFI, TLI, and CFI values were all above 0.90. These results indicate that the scale demonstrated good model fit, and the indices fall within the acceptable range reported in the literature [29–37].

Although the CFA results did not exactly replicate the original scale's structure, they provided adequate support for the structural validity of the instrument, indicating that it is a valid and usable tool. The convergent validity indices suggest no concerns regarding validity. The unidimensional structure yielded an Average Variance Extracted (AVE) value of 0.55 and a Composite Reliability (CR) value of 0.93. These results indicate that AVE was greater than 0.50 and less than CR, supporting the scale's convergent validity [43].

The reliability of the measurement instrument was assessed using Cronbach's alpha for internal consistency, item-total correlations, split-half reliability, and test-retest analyses to examine stability. In this study, the scale's Cronbach's alpha was 0.93, the split-half reliability coefficient was 0.82, and both the Spearman-Brown and Guttman split-half coefficients were 0.90. These reliability values indicate that the items sufficiently measure the intended construct, are appropriately related to the topic, and that the scale's unidimensional structure is highly [22–43]– [44]. Additionally, the Hotelling T-squared value was found to be F = 382.822 with $p < 0.000$. An analysis of the responses provided by the participating paramedics revealed that the responses were uniform, indicating no response bias in the instrument [44].

The results obtained are consistent with previous research which has demonstrated that team cohesion is significantly associated with outcomes such as job satisfaction [12], quality of patient care [14], and performance [19]. Moreover, as noted by Salas et al. (2015), team cohesion is a dynamic construct that not only influences interpersonal relationships but also impacts organizational success. In this context, the field application of the ETC scale could serve as a strategic tool, not only to enhance individual awareness, but also to provide valuable insights in managerial feedback processes [9].

Item-total correlation analysis reflects the relationship between the scores of individual items and the total scale score. In this study, item-total correlation coefficients were found to be greater than 0.30. These results indicate that all items on the scale are correlated with the total score, adequately measure the intended construct, and demonstrate item-level reliability [43]– [44]– [45].

Test-retest reliability refers to the ability of a test to yield consistent results over repeated administrations [46]. The expected outcome is that the measurement tool remains stable over time. It is recommended that the interval between the initial and follow-up tests be at least two weeks and no longer than four weeks, with a minimum sample of 30 participants [44]. In this study, the test-retest procedure was applied to 30 paramedics with a two-week interval, and no statistically significant difference was found between the two administrations ($p > 0.05$). Additionally, a strong correlation between the two sets of scores was observed, indicating that the measurement tool demonstrates high temporal reliability.

This study addresses a significant gap in the literature, as no valid team cohesion scale specifically developed for paramedics was previously available. While earlier studies have examined related concepts such as team attitudes, burnout, or leadership among paramedics [3–21], there is a notable lack of scales that directly assess team cohesion. This research thus contributes an important instrument to the field.

Teamwork is considered a dynamic process that involves two or more healthcare professionals who share a common background and skill set, pursue the same healthcare goals, and engage in joint physical and mental efforts to assess, plan, or evaluate patient care. This process is carried out through mutual coordination, open communication, and shared decision-making, and it supports high-quality patient care, the effective functioning of organizational processes, and positive staff outcomes [10].

In collaborative practice, especially in rapidly evolving healthcare systems where cost control is a major concern, teamwork involving multiple professional groups is of critical importance. Team cohesion is indispensable not only for achieving favorable clinical outcomes and patient satisfaction but also for meeting international standards of care quality [10–47].

The most essential feature of team cohesion is mutual collaboration, particularly in exerting collective effort and making shared decisions [10]. Experimental studies conducted in high-risk work environments have shown that collaboration and teamwork are reflected in the quality of the final product and the services delivered.

The number of studies focusing on interprofessional coordination and effective teamwork in healthcare delivery has been increasing [48]. In this study, paramedics—who are an integral part of pre-hospital emergency medical services—were found to have high levels of team cohesion. This finding suggests that paramedics in Türkiye demonstrate strong performance in patient-centered outcomes within collaborative team settings.

Study limitations

This study has several limitations. First, the sample consisted exclusively of healthcare professionals who are members of the Paramedic and Pre-Hospital Emergency Medicine Association. As a result, the findings may not fully represent the demographic, professional, or institutional diversity of all paramedics across Türkiye. This, combined with the voluntary nature of participation, may introduce volunteer bias.

Second, the data were collected primarily through an online survey, which may have limited both the response rate and the diversity of the sample. Particularly, healthcare professionals working in rural areas or with limited technological access may not have been able to participate, leading to potential regional imbalances in the sample. This limitation may affect the generalizability of the findings to the broader population of paramedics in Türkiye.

Third, the cross-sectional design of the study does not allow for the examination of changes in team cohesion over time or the establishment of causal relationships. Given that paramedics' team cohesion may be influenced by dynamic workloads, shift systems, or organizational changes, future longitudinal studies are recommended.

Finally, the study relied solely on a self-report measurement tool, which raises the possibility of social desirability bias. Participants may have been inclined to present themselves more positively regarding a construct like team cohesion, which is generally viewed favorably. Therefore, future research should incorporate observational data or third-party evaluations from supervisors to achieve data triangulation.

Conclusions and practical implications

The results of this study demonstrate that the Turkish version of the Erlangen Team Cohesion at Work Scale (ETC) is a valid and reliable measurement tool for use among paramedics. Its unidimensional structure and concise format—consisting of only 12 items—make the scale practical, time-efficient, and economically applicable in field settings. This facilitates its widespread use in routine healthcare practice.

Healthcare managers, quality improvement units, and training coordinators can use this tool to monitor intra-team dynamics and incorporate team cohesion data into evidence-based organizational improvement plans.

Furthermore, the scale may be utilized to identify needs for both individual performance development and team-based training or supervision. For example, in units where low team cohesion scores are observed, targeted interventions can be developed focusing on leadership, conflict resolution, and communication skills.

In clinical settings—particularly within pre-hospital emergency care environments characterized by high risk and the need for rapid decision-making—routine measurement of team cohesion can be regarded as a critical quality indicator for patient safety and service quality.

From a theoretical perspective, this study contributes to the literature by enhancing the understanding of how the concept of team cohesion is structured within the context of healthcare services in Türkiye. Considering the country's unique organizational structures, cultural values, and healthcare system dynamics, this adaptation study illustrates how team cohesion can be assessed with cultural sensitivity. In this regard, team cohesion is positioned not only as a psychosocial construct but also as an indicator of organizational functioning and ethical collaboration within healthcare services.

There is a need for further studies aimed at measuring team cohesion among other healthcare professionals. Longitudinal research is recommended to observe variations in team cohesion over time and to evaluate the effectiveness of intervention programs. Moreover, mixed-method approaches (qualitative + quantitative) may provide deeper insights into team members' perceptions of cohesion.

In this respect, the present study not only offers a valid measurement tool but also enables closer monitoring of team dynamics within the healthcare system. It thus provides a robust theoretical and practical foundation for researchers, administrators, and practitioners alike.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s40359-025-03399-0.

Supplementary Material 1

Author contributions

Conceptualization: DU, SA, MC, ND. Data curation: DU, SA, MC. Formal analysis: DU. Investigation: DU, SA, MC Methodology: DU, ND. Data collection: DU, SA, MC. Writing: DU, SA, MC. Writing reviewand editing: DU, ND.

Funding

Not applicable.

Data availability

All data generated or analysed during this study are available from the corresponding author upon request.

Declarations

Ethics approval and consent to participate

Ethics approval and consent to participate The ethical approval for the study was granted by the Eskisehir Osmangazi University Non-Interventional Clinical Research Ethics Committee (Approval no. 2024/127 dated 13.06.2024) The participants were informed about the research aim and methods before signing the informed consent form. The investigation conforms to the principles outlined in the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Eskisehir Osmangazi University Vocational School of Health Services, Eskisehir, Turkey
[2]Ankara Hacı Bayram Veli University Graduate Education Institute Health Management, Ankara, Turkey
[3]Eskisehir Osmangazi University, Faculty of Medicine Dep of History of Medicine and Medical Ethics, Eskisehir, Turkey

Received: 30 July 2024 / Accepted: 1 September 2025
Published online: 26 September 2025

References

1. Ağırkaya K, Erdem R. Psikolojik sağlamlık: Sağlık Çalışanları Açısından Bir değerlendirme. Pamukkale Üniversitesi İşletme. Araştırmaları Dergisi. 2023;10(2):656–78. https://doi.org/10.47097/piar.1254928.
2. Karaca BR, Oğuzhan G. Zihinsel iş Yükü Ile Tükenmişlik Arasındaki ilişki: Sağlık Çalışanları örneği. Bandırma Onyedi Eylül Üniversitesi Sağlık bilimleri ve Araştırmaları. Dergisi. 2023;5(2):100–9. https://doi.org/10.46413/boneyusbad.1161161.
3. Horrocks P, Hobbs L, Tippett V, Aitken P. Paramedic disaster health management competencies: A scoping review. Prehosp Disaster Med. 2019;34(03):322–9. https://doi.org/10.1017/S1049023X19004357.
4. Nosker JL, Lassen M, Cornelius A. Fatigue in aeromedicine: an exploration of team cohesion as a countermeasure against adverse events. Int J Aerosp Psychol. 2021;31(4):360–75. https://doi.org/10.1080/24721840.2021.1931227.
5. Ulaş S. Öncesi acil Sağlık hizmetleri Çalışanlarının Ekip Çalışmasını Etkileyen faktörler. Kastamonu Üniversitesi Sağlık Bilimleri Fakültesi Dergisi. 2023;2(1):11–23.
6. Brannick MT, Salas E, Prince C, editors. Team performance assessment and measurement: theory, methods, and applications. Lawrence Erlbaum Associates; 1997. https://doi.org/10.4324/9781410602053.
7. Carron AV, Widmeyer WN, Brawley LR. (1989). The measurement of cohesion in sports teams: the Group Environment Questionnaire. Canadian journal of sport sciences. Journal canadien des sciences du sport.1989; 14(1): 55–59.
8. Casey-Campbell M, Martens ML. Sticking it all together: A critical assessment of the group cohesion-performance literature. Int J Manage Reviews. 2009;11(2):223–46. https://doi.org/10.1111/j.1468-2370.2008.00239.x.
9. Salas E, Grossman R, Hughes AM, Coultas CW. Measuring team cohesion: observations from the science. Hum Factors. 2015;57(3):365–74. https://doi.org/10.1177/0018720815578267.
10. Xyrichis A, Ream E, Teamwork. A concept analysis. J Adv Nurs. 2008;61(2):232–41. https://doi.org/10.1111/j.1365-2648.2007.04496.x.
11. Jieun L, Jeonghyeon K, Haerang LA, Study on the Team Sharing Spirit Model, Team Effectiveness, Team Cohesion. Team reliability, and turnover intension among hospital nurses. J Korean Soc Integr Med. 2020;3121–31. https://doi.org/10.15268/ksim.2020.8.3.121.
12. Wang B, Zou G, Zheng M, Chen C, Teng W, Lu Q. Correlation between the quality of nursing handover, job satisfaction, and group cohesion among psychiatric nurses. BMC Nurs. 2022;21(1):1–7. https://doi.org/10.1186/s12912-022-00864-8.
13. Amos MA, Hu J, Herrick CA. The impact of team Building on communication and job satisfaction of nursing staff. J Nurses Prof Dev. 2005;21(1):10–6.
14. Bower P, Campbell S, Bojke C, Sibbald B. (2003). Team structure, team climate and the quality of care in primary care: An observational study. Quality and Safety in Health Care. 2003; 12(4): 273–279. https://doi.org/10.1136/qhc.12.4.273
15. Hall P, Weaver L. Interdisciplinary education and teamwork: A long and winding road. Med Educ. 2001;35(9):867–75. https://doi.org/10.1046/j.1365-2923.2001.00919.x.
16. Risser DT, Rice MM, Salisbury ML, Simon R, Jay GD, Berns SD. The potential for improved teamwork to reduce medical errors in the emergency department. Ann Emerg Med. 1999;34(3):373–83. https://doi.org/10.1016/S0196-0644(99)70134-4.
17. Tong HC, Haig AJ, Theisen ME, Smith C, Miller Q. Multidisciplinary team evaluation of upper extremity injuries in a single visit: the UPPER program. Occup Med. 2001;51(4):278–86. https://doi.org/10.1093/occmed/51.4.278.
18. Mickan SM. Evaluating the effectiveness of health care teams. Aust Health Rev. 2005;29(2):211. https://doi.org/10.1071/AH050211.
19. Tekleab AG, Quigley NR, Tesluk PE. A longitudinal study of team conflict, conflict management, cohesion, and team effectiveness. Group Organ Manage. 2009;34(2):170–205. https://doi.org/10.1177/1059601108331218.
20. Dorfman PW, Stephan WG. The effects of group performance on cognitions, satisfaction, and behavior: A process model. J Manag. 1984;10(2):173–92. https://doi.org/10.1177/014920638401000203.

21. Keklik B, Özgüneş Ö. Ambulans personeli acil Tıp teknisyenleri (ATT) ve paramediklerin Ekip Çalışması Tutumları Üzerine Bir araştırma. Giresun Üniversitesi İktisadi ve İdari. Bilimler Dergisi. 2022;8(2):311–30. https://doi.org/10.46849/guiibd.1184131.
22. Çapık C, Gözüm S, Aksayan S. Intercultural scale adaptation stages, Language and culture adaptation: updated guideline. Florence Nightingale Hemşirelik Dergisi. 2018;26(3):199–210. https://doi.org/10.26650/fnjn397481.
23. T.C. Sağlık Bakanlığı. (2021). *Sağlıkta Kalite Standartları (SKS) Hastane Seti*, Sürüm 6.
24. Lieb M, Erim Y, Morawa E. Development and validation of a questionnaire for measuring team cohesion: the Erlangen team cohesion at work scale (ETC). BMC Psychol. 2024;12(1):1–10. https://doi.org/10.1186/s40359-024-01583-2.
25. Hayat MJ. Understanding sample size determination in nursing research. West J Nurs Res. 2013;35(7):943–56.
26. Malone HE, Nicholl H, Coyne I. Fundamentals of estimating sample size. Nurse Res. 2016;23(5):21–5.
27. Davis LL. Instrument review: getting the most from a panel of experts. Appl Nurs Res. 1992;5(4):194–7. https://doi.org/10.1016/S0897-1897(05)80008-4.
28. Orçan F. Açımlayıcı ve Doğrulayıcı Faktör analizi: İlk Hangisi kullanılmalı. Eğitimde ve Psikolojide Ölçme ve Değerlendirme. Dergisi. 2018;9(4):413–21.
29. Seçer İ. Psikolojik test Geliştirme ve Uyarlama süreci: SPSS ve LISREL Uygulamaları. Anı yayıncılık; 2018.
30. Tavşancıl E. Tutumların ölçülmesi ve SPSS Ile veri analizi (4. Baskı). Nobel Yayın Dağıtım, Ankara; 2010.
31. Hair JF, Black WC, Babin BJ, Anderson RE. Multivariate data analysis. 7th ed. Pearson Education; 2010.
32. Fornell C, Larcker DF. Evaluating structural equation models with unobservable variables and measurement error. J Mark Res. 1981;18(1):39–50.
33. Yaşlıoğlu MM. Sosyal bilimlerde Faktör analizi ve geçerlilik: keşfedici ve Doğrulayıcı Faktör analizlerinin Kullanılması. İstanbul Üniversitesi İşletme Fakültesi Dergisi. 2017;46:74–85.
34. Kline RB. Principles and practice of structural equation modeling. 4th ed. Guilford Press; 2015.
35. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Equ Model. 1999;6(1):1–55.
36. Byrne BM. AMOS Ile Yapısal denklem modellemesi: Temel kavramlar, uygulamalar ve Programlama. New York: Routledge; 2010.
37. Çapık C. Geçerlik ve Güvenilirlik Çalışmalarında Doğrulayıcı Faktör analizinin Kullanımı. Anadolu Hemşirelik Ve Sağlık Bilimleri Dergisi. 2014;17(3):196–205.
38. Hooper D, Coughlan J, Mullen MR. Structural equation modelling: guidelines for determining model fit. Electron J Bus Res Methods. 2008;6(1):53–60.
39. Kartal M, Bardakçı S. Reliability and validity analysis with SPSS and AMOS applied examples. Ankara, Turkey: Akademisyen Publishing; 2018.
40. Boateng GO, Neilands TB, Frongillo EA, Melgar-Quiñonez HR, Young SL. Best practices for developing and validating scales for health, social, and behavioral research: A primer. Front Public Health. 2018;6:1–18. https://doi.org/10.3389/fpubh.2018.00149.
41. Fabrigar LR, Wegener DT, MacCallum RC, Strahan EJ. Evaluating the use of exploratory factor analysis in psychological research. Psychol Methods. 1999;4(3):272–99. https://doi.org/10.1037/1082-989X.4.3.27.
42. Velicer WF, Fava JL. Affects of variable and subject sampling on factor pattern recovery. Psychol Methods. 1998;3(2):231–51. https://doi.org/10.1037/1082-989x.3.2.231.
43. Özdamar K. Scale and test development structural equation modeling. Ankara: Nisan Kitabevi Publishing; 2016. pp. 6–286.
44. DeVellis RF, Thorpe CT. Scale development: theory and applications. Sage; 2021.
45. Eldevik MF, Flo E, Moen BE, Pallesen S, Bjorvatn B, Insomnia E, Sleepiness. Excessive fatigue, anxiety, depression and shift work disorder in nurses having less than 11 hours in-Between shifts. PLoS ONE. 2013;8(8):e70882. https://doi.org/10.1371/Journal. Pone.0070882.
46. Berchtold A. Test–retest: agreement or reliability? Methodological Innovations. 2016. https://doi.org/10.1177/2059799116672875. 9.
47. Schmitt MH. Collaboration improves the quality of care: methodological challenges and evidence from US health care research. J Interprof Care. 2001;15(1):47–66. https://doi.org/10.1080/13561820020022873.
48. Clements D, Dault M, Priest A. Effective teamwork in healthcare: research and reality. Healthc Pap. 2007;7:26–34.

Publisher's note