Psychometric Properties of the Team STEPPS Teamwork Perceptions Questionnaire Among Iranian Nurses: A Cross-Sectional Study

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Abstract- Teamwork is the important principle of safety in healthcare. Evaluating the teamwork manners is vital to promote the functioning of a medical teams. So this research aimed to evaluate the psychometric properties of the Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS®). Teamwork Perception Questionnaire (T-TPQ) among Iranian nurses. This scale may help assess teamwork in hospital settings, ultimately facilitating the improvement of care quality. This cross-sectional research was conducted in two phases from April 2019 to March 2020. The first phase involved the translation and cultural adaptation of the English version of the TeamSTEPPS questionnaire. The second phase focused on validating the Persian language version of the TeamSTEPPS questionnaire, which included assessments for face validity, content validity, construct validity, and reliability. For validation purposes, 360 native Persian nurses working in educational hospitals at Jahrom University of Medical Sciences participated in the study. The content validity index was found to be 0.92, indicating high validity of the Persian language version of the TeamSTEPPS questionnaire. The content validity ratio was deemed acceptable at 0.77. The results of the confirmatory factor analysis demonstrated that the construct validity of the Persian IR-TPQ was also acceptable (RMSEA=0.061; CFI=0.960; NFI=0.927; TLI=0.957). The factor loadings of all items fell within the range of 0.47-0.90, indicating an acceptable level of validity. The first and second questions related to the Team Structure dimension were as follows: "The skills of nurses overlap sufficiently so that work can be shared when necessary (0.472)" and "Nurses are held accountable for their actions (0.531)". The Cronbach's α coefficient of the Persian T-TPQ was calculated to be 0.942. Based on our findings, the psychometric characteristics of the Persian version of the T-TPQ are suitable, suggesting its potential for use in future research.

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Introduction

Background/rational

Teamwork is one of the most important principles of quality assurance and safety in hospitals and medical centers. In the past decade, the growing complexity of healthcare systems has led to an emphasis on the need for teamwork in healthcare practice to improve quality care and it has been understood to be a key factor that contributes to reductions in adverse events (1). Teamwork is a close collaboration between healthcare professionals who pursue common goals such as mental and physical care of patients (2,3). In global health systems, there is a strong emphasis on the advantages of

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effective teamwork in practice for both patients and healthcare professionals, especially for nurses. The benefits of nurses' teamwork for patients include improving patient safety during service delivery, preventing adverse events by increasing error reporting rates and ultimately reducing mortality (4).

A team environment allows individuals to bring their diverse perspectives to problem-solving, which in turn increases their success in arriving at solutions more efficiently and effectively. Teamwork enables better problem-solving, unlocks potential for innovation, leads to happier employees, enhances personal growth, lowers the risk of burnout, provides opportunities for growth, boosts productivity and allows for smarter risk-taking (1,3,5). Nowadays, nursing service consists of different talents, generations, educational levels and cultures. So, working as a team is more important. Effective collaboration among nurses facilitates nursing care, increases job satisfaction and causes better outcomes not only for patients but also for nurses (6). The lack of teamwork manners causes inefficiently nursing care outcomes due to duplicated efforts, waste of time and energy subsequently have a negative impact on patient satisfaction (7).

A good understanding and perception of teamwork can facilitate it to reduce burnout among healthcare teams (5). Therefore, the Department of Defense and the Agency for Healthcare Research and Quality (AHRQ) developed the Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS®) approach to facilitate and integrate teamwork in clinical practice (8). In a review of 54 malpractice incidents in an emergency department, 8 out of 12 deaths were judged to have been preventable if appropriate teamwork had occurred (9). Medical errors in Iranian hospitals are reported to range 0.06% to 42% (4). The prevalence of burnout among nurses in Iran has been reported between 23% to 72%. One of the important causes of such disorders in health systems is the lack of culture of teamwork (10). Medical errors are also moderately reported. Additionally, the relationship between nurses and other members of the medical team in Iran requires attention and constructive action (2,5,10,11). The results of assessments have shown that teamwork is a fundamental priority for the healthcare team. As healthcare in Iran continues to evolve, the need for teamwork skills becomes more apparent. Studies have indicated that teamwork within the clinical care team in Iran needs to be enhanced (11). One of the key foundations for strengthening the concept of teamwork is the development of measurement tools that can be utilized in research and education (12).

The review of studies has shown that there are multiple questionnaires available for evaluating teamwork knowledge and attitude (13,14). One example is the Safety Attitudes Questionnaire (SAQ), which measures the attitudes of hospital caregivers towards teamwork, safety, managerial understanding, job satisfaction, working conditions, and recognition of stress (15). Another important tool is the Hospital Survey on Patient Safety (HSOPS), which measures twelve sections related to the culture of patient safety. Among the different sections of this questionnaire, only two scales focus on intra-departmental and inter-departmental teamwork (16). Team members need good interpersonal skills because effective communication and collaboration are vital for success in the workplace. These skills enable them to build strong relationships, to resolve conflicts, and to work well with others, ultimately contributing to a positive work environment and improved productivity (10). Therefore, evaluating the teamwork situation is very important and vital.

The mentioned questionnaire primarily focused on organizational aspects, neglecting individual and behavioral dimensions. Therefore, it is essential to utilize a questionnaire that assesses individual dimensions and skills related to teamwork. The TeamSTEPPS Teamwork Perception Questionnaire (T-TPQ) serves as a tool to evaluate personal perceptions of skills and teamwork behaviors. This questionnaire is renowned worldwide for its effectiveness and practicality in measuring individuals' understanding of teamwork skills and behaviors.

The validity and reliability of this scale were assessed in different languages such as Japanese, Norwegian, Chinese, Swedish, and French and recently were assessed among Turkish nurses in 2024 (5,6,9,17-19).

Since there is no tool in Persian to assess teamwork among Iranian nurses and given the cultural differences between societies, the translation and cultural compatibility of this tool is essential. Therefore, this study was designed aiming at translation and psychometric analysis of Team Strategies and Tools to Enhance Performance and Patient Safety (TeamSTEPPS®) among Iranian nurses.

Materials and Methods

Design and setting

The present study is a cross-sectional study that aimed to translate the T-TPQ into Persian and evaluate its validity and reliability across cultures using COSMIN criteria. The TeamSTEPPS Teamwork Perception

Questionnaire (T-TPQ) serves as a tool to evaluate personal perceptions of skills and teamwork behaviors. The T-TPQ consists of 35 items, with five dimensions: Team Structure, Leadership, Situation Monitoring, Mutual Support, and Communication. Each dimension includes seven items rated on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The sum or average of each dimension of the T-TPQ is used for assessment (20).

The present study is a cross-sectional study that was conducted in two phases. The first phase involved the translation and cultural adaptation of the English version of the Team STEPPS teamwork perceptions questionnaire. The second phase focused on the validation (including face validity, content validity, and construct validity) and reliability of the Persian version of the Team STEPPS teamwork perceptions questionnaire. Samples in the translation phase were two fluent translators to Persian and English languages for forward and backward translation.

During the psychometric phase, the study samples consisted of six PhD in medical surgical nursing and four specialists in instrument development and four nurses in face validity. Content validity was assessed by eight PhDs in medical surgical nursing and four specialists in instrument development.

The inclusion criteria for construct validity included nurses who are willingness to participate in research, a minimum of two years of clinical experience, at least a bachelor's degree in nursing, and no history of mental disorders, so the total number of 360 nurses participated in the research.

Phase I: Translation and cultural adaptation

Initially, the instrument was translated and culturally adapted. This translation followed the approach proposed by Wild et al. (Forward translation, synthesis, Back-translation, Reconciliation, Pre-testing and cognitive interviewing, Final version) (21).

Forward translation

First, the original English version of the questionnaire was translated into Persian by two translators independently. Both translators were faculty members and fluent in medical sciences.

Combination of early translations (synthesis)

The different translations were reviewed in face-to-face meetings, item by item, with the goal of reaching a consensus on the best possible translation. Two translators then compared the versions, and the final version was prepared after making a few adjustments. The attendees at the meeting were members of the research team who reached an agreement through negotiation.

Back-translation

A faculty member and English teacher at the university with adequate knowledge of healthcare terminology translated the T-TPQ from Persian to English, without having seen the original version (different from the previous translators). The translation team (research team) then conducted a Focus Group Discussion (FGD) to compare all versions of the T-TPQ and evaluate its clarity and understandability. Finally, the team of experts agreed on the pre-final version.

Reconciliation

In this step, a final reconciliation was conducted with two translators and the original developer of the instrument by examining the differences and similarities between the Persian and English versions. The objective of this step is to consolidate all the information from the translations, to assess the degree to which the meaning of the words and conceptual equivalence has been attained, and to create a "pre-final" version of the Persian T-TPQ for additional testing.

Pre-testing and cognitive interviewing

In order to examine the tentative final version, 10 nurses (who did not participate in the final study) were randomly selected. The nurses provided us with their opinions regarding the difficulty, irrelevancy, and ambiguity of each item (qualitative face validity).

Final version

After incorporating some minor revisions, the final version of the instrument was completed.

Phase II: Validation of persian version of T-TPQ

For assessing the qualitative face validity of the questionnaire ten nurses and PhDs in medical surgical nursing were interviewed face to face to express their ideas about difficulty level, relevance, and ambiguity of each item. After the faulty items were revised, to confirm the quantitative face validity of the questionnaire, (item impact method), ten experts (six PhDs in medical surgical nursing and four specialists in instrument development) were asked to score each item on a 5-point Likert scale ((It is very important:5, it is important:4, it is relatively important:3, it is a little important:2, it is not important at all:1) and the item impact score of each item was

calculated.

Content validity was measured both quantitatively and qualitatively. In the qualitative stage, ten experts (eight PhDs in medical surgical nursing and four specialists in instrument development) who were familiar with the development of the instruments and nursing were asked if the items measured the desired attribute and if the questions covered the entire content of the test. There was complete agreement among the experts regarding the quality content validity of the Persian version of IR-TPQ.

The Content Validity Ratio (CVR) and Content Validity Index (CVI) were used for quantitative assessment of the content validity (20).

The proposed Lawshe model was used to evaluate the questionnaire (CVR=0.56). Twelve experts were asked to answer each question and provide corrective comments. The Waltz & Bausell method was used to evaluate the questionnaire (CVI=0.79) based on relevance, clarity, and simplicity. The selected experts were faculty members of Jahrom University of Medical Sciences with at least five years of clinical experience and six years of education as faculty members.

Assessment of the reliability

Data collection

The survey was conducted between April 2019 and March 2020.

Statistical analysis

Our analysis was performed in two main steps. First, we described the demographics of the participants and the scores of each item in the TPQ questionnaire.

Median and interquartile range (IQR), item to total correlation and, Cronbach's alpha was calculated for each item. Then Reliability was assessed using Cronbach's α, Intraclass correlation (ICC), composite reliability (CR), and McDonald’s omega (McDonald, 1999) for internal consistency. Values greater than 0.7 for these indicators are acceptable for interpreting the findings (1,2).

in the second step, confirmatory factor analysis (CFA) for the hypothesized five-factor model, was used for the construct validity of the Iranian version of the TPQ. The items of the TPQ were rated on five Likert points as ordinal responses (strongly disagree, disagree, neutral, agree, and strongly agree). Thus, ordinal variables were analyzed with diagonal weighted least squares (DWLS). The Root-mean-square error of approximation (RMSEA; <0.08 good, 0.08–0.10 reasonable), Standard Root Mean Square Residual (SRMR; <0.08), Tucker–Lewis index (TLI; ≥.95), comparative fit index (CFI; ≥0.90), and Normed fit index (NFI; ≥.95) were used to measure the overall goodness of fit of the model.Thereafter, discriminant validity was assessed by analyzing inter-factor correlations (IFC) with Spearman rank correlation and average variance extracted (AVE) to represent the average amount of variance that a construct explains in its indicators relative to the overall variance of its indicators. Value greater than 0.5 and lower than 0.8 for AVE and IFC, respectively demonstrates an acceptable level of discriminant validity (3,4). All the analysis of this study were done with the help of following packages in R version 4.0 programming language: "Lavaan" and "Semptools"(5,8).

The lavaan and Semptools package are developed to provide users, researchers and teachers a free open-source, but commercial-quality package for latent variable modeling. You can use lavaan to estimate a large variety of multivariate statistical models, including path analysis, confirmatory factor analysis, structural equation modeling and growth curve models (22). Semptools is a very useful function for visualizing structural equation models (23).

Results

Characteristics of the participants

A total of 309 out of 360 questionnaires were completed and collected by nurses (Response rate=84.7%). 223 of the participants were married (73.8%) and 241 of them were female (79.8%), and the mean age was 32.9±6.95 with 57.6% having more than 5 years of work experience. Additionally, 92.4% of the participants held a bachelor's degree (Table 1).

Psychometric properties

Reliability

The Overall IR-TPQ questionnaire demonstrated excellent internal consistency with a Cronbach's alpha coefficient of 0.942. Additionally, all five factors showed satisfactory internal consistency, with the exception of the communication dimension which had a slightly lower internal consistency coefficient (0.654) as shown in Table 2. Table 3 displays the Cronbach's α, ICC (CI 95%), CR, and Omega, all indicating excellent internal consistency for both the Overall IR-TPQ and its dimensions

Content validity

The total CVR obtained was 0.77. CVR in each dimension was calculated as follows: team structure=0.71, leadership=0.67, situation monitoring=0.80, mutual support=0.83,

communication=0.76. The total CVI obtained was 0.92. (Relevancy=0.92, Simplicity=0.92, Clarity=0.91).

Construct validity

Iranian version of TPQ was analyzed using 5-factor model in confirmatory factor analysis (CFA), with Chi-Square value ($\chi 2$=932; P<0.001). CFA results showed that IR-TPQ had a good fit (RMSEA=0.061; CFI=0.960; NFI=0.927; TLI=0.957). As shown in Table 2, standardized factor loadings for all items, except items S1 and S2, were above 0.65 and were statistically significant (P<0.001). The path diagram displayed measurement model of IR_TPQ in Figure 1.

The AVE for dimensions of IR-TPQ shown in Table 3 demonstrates values greater than 0.5 for dimensions (Team Structure, Team Leadership, Situation Monitoring, Mutual Support, and Communication). Furthermore, Table 4 showed inter-factor correlations that all coefficients are lower or close to 0.8. These results suggest a potentially good discriminant validity of the IR-TPQ.

Table 1. Characteristics of participants (n=302)*

Variables	Categories	Count (%)
Gender	Male	61(20.2)
	Female	241(79.8)
Age	20-24	13(4.3)
	25-29	107(35.4)
	30-34	66(21.9)
	35-39	56(18.54)
	>40	60(19.9)
Marital status	Married	223(73.8)
	Single	79(26.2)
Work Experience	< 5	128(42.4)
	5-10	54(17.9)
	10-20	92(30.5)
	>20	28(9.3)
Education	Associate	6(2)
	Bachelor	279(92.4)
	Master	17(5.6)

*missing data:7

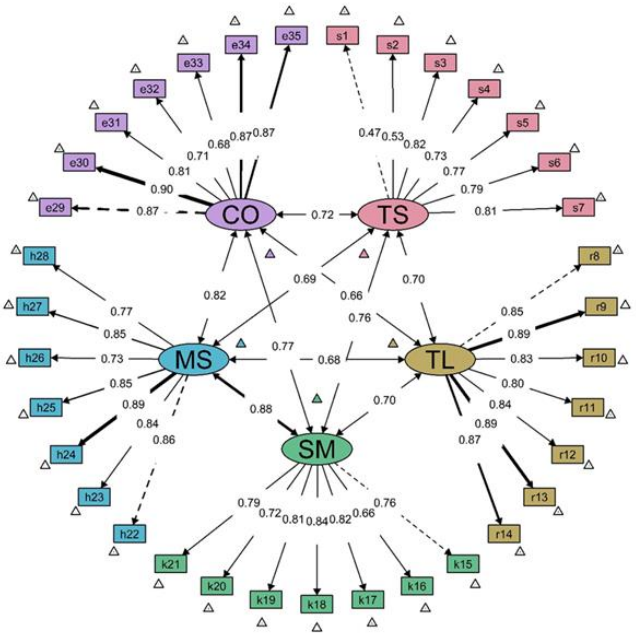

Figure 1. Confirmatory factor analysis for IR-TPQ-persian language

Table 2. Summary of median (IQR), corrected item-total correlation and cronbach's alpha if item deleted, for T-TPQ items (n=302)

Item (No. of items)	Corrected item-total correlation	Cronbach's alpha if item deleted	Cronbach's alpha	Mean (SD)	Factor loading
Team Structure (7)			**0.821**	**3.97(0.88)**	
The skills of nurses overlap sufficiently so that the work can be shared when necessary. (S1)	0.385	0.830		3.83(0.93)	0.472
Nurses are held accountable for their actions. (S2)	0.415	0.819		4.28(0.7)	0.531
Nurses within my unit share information that enables timely decision making by the patient care team. (S3)	0.620	0.790		4.00(0.75)	0.822
My unit makes efficient use of resources (e.g., staff, supplies, equipment, and information). (S4)	0.614	0.789		3.77(0.91)	0.728
Nurses understand their roles and responsibilities. (S5)	0.643	0.785		3.99(0.81)	0.776
My unit has clearly articulated goals. (S6)	0.648	0.783		3.98(0.84)	0.788
My unit operates at a high level of efficiency. (S7)	0.650	0.782		3.91(0.94)	0.810
Team Leadership (7)			0.925	3.73(0.97)	
My head nurse considers nurses input when making decisions about patient care. (r1)	0.756	0.915		3.85(0.89)	0.848
My head nurse provides opportunities to discuss the unit's performance after an event. (r2)	0.794	0.910		3.68(1)	0.890
My head nurse takes time to meet with nurses to develop a plan for patient care. (r3)	0.765	0.913		3.72(0.98)	0.830
My head nurse ensures that adequate resources (e.g., staff, supplies, equipment, and information) are available. (r4)	0.691	0.921		3.66(1.02)	0.798
My head nurse resolves conflicts successfully. (r5)	0.793	0.911		3.62(0.99)	0.843
My head nurse models appropriate team behavior. (r6)	0.818	0.908		3.73(1)	0.888
My head nurse ensures that nurses are aware of situations or changes that may affect patient. (r7)	0.737	0.916		3.86(0.89)	0.869
Situational Monitoring (7)			0.878	3.64(0.94)	
Nurses effectively anticipate each other's needs. (k1)	0.668	0.859		3.43(0.97)	0.761
Nurses monitor each other's performance. (k2)	0.611	0.867		3.61(0.9)	0.662
Nurses exchange relevant information as it becomes available. (k3)	0.736	0.851		3.71(0.89)	0.822
Nurses continuously scan the environment for important information. (k4)	0.736	0.850		3.56(0.97)	0.839
Nurses share information regarding potential complications (e.g., patient changes, bed availability). (k5)	0.633	0.864		3.92(0.82)	0.815
Nurses meet to re-evaluate patient care goals when aspects of the situation have changed. (k6)	0.594	0.871		3.46(1.05)	0.723
Nurses correct each other's mistakes to ensure that procedures are followed properly. (k7)	0.666	0.860		3.78(0.93)	0.794
Mutual Support (7)			0.891	3.87(0.87)	
Nurses assist colleagues during high workload. (h1)	0.734	0.872		3.77(1.09)	0.855
Nurses request assistance from colleagues when they feel overwhelmed. (h2)	0.667	0.878		3.97(0.79)	0.840
Nurses caution each other about potentially dangerous situations. (h3)	0.749	0.870		4.05(0.74)	0.895
Feedback between nurses is delivered in a way that promotes positive interactions and future change. (h4)	0.764	0.866		3.85(0.87)	0.852
Nurses advocate for patients even when their opinions conflict with that of a senior member of the unit. (h5)	0.607	0.884		3.89(0.79)	0.726
When nurses have a concern about patient safety, they challenge others until they are sure that the concern has been heard. (h6)	0.717	0.872		3.94(0.8)	0.850
Nurses resolve their conflicts, even when the conflicts have become personal. (h7)	0.633	0.883		3.58(0.99)	0.767
Communication (7)			0.654	3.99(1.36)	
Information regarding patient care is explained to patients and their families in lay terms. (e1)	0.628	0.576		4.01(0.86)	0.873
Nurses relay relevant information in a timely manner. (e2)	0.639	0.580		4(0.81)	0.900
When communicating with patients, nurses allow enough time for questions. (e3)	0.585	0.584		3.87(0.87)	0.814
Nurses use common terminology when communicating with each other. (e4)	0.198	0.892		4.22(2.99)	0.706
Nurses verbally verify information that they receive from one another. (e5)	0.456	0.615		3.88(0.77)	0.677
Nurses follow a standardized method of sharing information when handing over patients. (e6)	0.572	0.597		4.06(0.75)	0.875
Nurses seek information from all available sources. (e7)	0.620	0.577		3.89(0.87)	0.868
IR-T-TPQ -Total scale			0.942	3.84(1.01)	

Table 3. Internal consistency and discriminant validity

Dimensions	Cronbach`s alpha	ICC (95% CI)	Composite reliability	Convergent-discriminant validity	
				Omega	AVE
Team structure	0.821	0.812(0.78-0.84) ***	0.704	0.833	0.513
Team leadership	0.925	0.92(0.91-0.94) ***	0.861	0.926	0.727
Situation monitoring	0.878	0.87(0.85-0.89) ***	0.778	0.882	0.602
Mutual support	0.891	0.88(0.86-0.9) ***	0.836	0.904	0.686
Communication	0.654	0.65(0.59-0.71) ***	0.826	0.902	0.673
TPQ	0.942	0.94(0.93-0.95) *	-	-	-

Table 4. Inter-factor correlations

Dimensions	Team structure	Team leadership	Situation monitoring	Mutual support	Communication
Team structure		0.701	0.764	0.694	0.725
Team leadership			0.698	0.676	0.660
Situation monitoring				0.879	0.771
Mutual support					0.815
Communication					

Discussion

The TPQ is an instrument that has been translated into multiple languages worldwide, currently including Persian, to measure teamwork within a unit or a department (2). In the present study, the Persian version of the T-TPQ was developed by a multistep forward–back translation protocol, and psychometric validity evidence was presented. We applied a Five-factor confirmatory factor analysis and found that all items loaded strongly on their hypothesized factor. The findings of this study confirm the reliability and validity of the Persian-translated TPQ among health workers.

Cronbach's alpha in general was equal to 0.942 and for all constructs except communication (a=0.654) ranging from 0.821 to 0.925, which confirmed excellent and approved internal consistency for these constructs. Similar results have been obtained for other versions of this questionnaire such as Greek (20), French, etc. (24). The Iranian version of this questionnaire has been examined in two separate studies in the past years. In the first study conducted in 2014 by Najafi M et al., the total Cronbach's alpha was equal to 0.8 and the items Mutual support and communication were the weakest items in terms of internal consistency with 0.36 and 0.46 respectively (11). Meanwhile, in the study by Kakemam E *et al*., conducted in 2021, Cronbach's alpha in general was 0.96 and the two items mentioned above obtained values of 0.84 and 0.89, respectively, for this index (2). Our study also calculated composite reliability for the constructs beyond the study of the Iranian version, whose values indicated acceptable to excellent convergent validity for all constructs (25).

We consider the construct validity of the Persian version of the T-TPQ to be acceptable. The RMSEA was 0.06, indicating a good fit to the hypothesized structure, and the RMSEA of our study comparable to those reported in previous studies that translated the T-TPQ into other languages (5,20,18-19,24-25).

Since the questionnaire questions are 5-step Likert type, we were faced with ordinal answers to the questions. Therefore, we used the DWLS method to estimate the parameters of the CFA model, which is more suitable for ordinal data (26). Meanwhile, the previous Iranian version and most other versions have used the traditional method, the use of normal approximation and the maximum likelihood estimation method, which are designed for quantitative data.

In this study, CFI and TLI were calculated at 0.96 and 0.957 respectively, which indicate good fit. The values of these indices for some translated versions such as Iranian (2), Chinese (9), French (19), Japanese (5), and Swedish (18) were smaller and for others such as the USA and Greek versions (CFI, TLI=0.994) (20,24). They were comparable or larger than the values of our study. These results provide a generally satisfactory fit for our research data, and the result was in lines with the previous validation study of T-TPQ.

In this study, the forward-backward method was used for translation to ensure an accurate understanding of items by health care providers. Samples were collected from two hospitals and the number of participants in the study (n=302) and the rate of answering questions was 60%, which was better than some studies such as the Norwegian study (17).

In the present study, all items of the questionnaire had

good factor loadings (above 0.6) except for the two team structure items which had relatively good factor loadings and were not weak. In the Japanese article (5), the factor loading value of the first item of the questionnaire, similar to our finding, is lower than its logical value and may be due to cultural compatibility problems that should be further investigated in the future.

The important point about teamwork is that the term has different meanings among medical staff, and not everyone has a common understanding of team structure, team roles, and tasks to the patient care team, which may have an impact on the answer of the participants (17). The perceptions of interprofessional teamwork may be influenced by professional role identities. For example, Aase *et al.*, (27) found nursing students were more likely to share the responsibility than medical students who regarded taking responsibility at an individual level. By validation of Iranian version in nurses, it is possible to measure their teamwork perception. In this study, only nurses were sampled. Teamwork for different healthcare professional has different meaning so the result of this study cannot be generalized for other group in healthcare system. Therefore, it is suggested sampling in other care and health groups in the future studies.

The Persian version of T-TPQ has suitable psychometric characteristics that can be used in other research. This study can be a basis for further studies focusing on teamwork in health care in Iran with a larger sample size and participants from different professions. So, researchers in the field of medical education can use this questionnaire to study teamwork in different care and health settings.

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