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Introducing the TDM-20: A Validated 20-Item Instrument to Measure Team Development

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ABSTRACT

Background and Objectives: Research has shown that effective team functioning increases patient satisfaction and reduces medical errors and burnout. The Team Development Measure (TDM), a 31-item instrument, was validated to assess four areas of team development: cohesion, communication, roles and goals, and team priorities. Despite its high reliability and psychometric validity, the large number of items in the TDM may be a barrier to its use in busy health care settings.

Methods: Using the original dataset of 1,194 participants from 120 primary care teams, we conducted an exploratory factor analysis. We used principal component analysis with varimax rotation and Kaiser normalization to validate a 20-item shortened version (TDM-20). We also performed a scree test as a parallel analysis.

Results: Our exploratory factor analysis identified two domains in the TDM-20. The first was communication and engagement, which we defined as team members' ability to respectfully interact toward accomplishing goals. The second domain was shared values and cohesion, which we defined as core beliefs that guide the behaviors of a group from an empathetic and psychologically safe position. Each domain comprised 10 items. The eigenvalues for the two domains were 10.9 and 1.10, accounting for 54.5% and 5.5% of the variance, respectively. Both domains demonstrated high internal consistency (Cronbach's α were 0.92 and 0.93, respectively).

Conclusions: The TDM-20 demonstrated high validity and is suitable for measuring team development in primary care medical settings. Further research is needed to examine whether the pandemic affected the results of the instrument in various cultural backgrounds and current medical environments.

INTRODUCTION

Primary care clinicians frequently encounter complex and challenging situations while caring for patients.[1,2] Thus, multidisciplinary teams often are used to optimize patient care.[3] Evidence has suggested that superior team dynamics are associated with enhanced clinical outcomes,[4,5] reductions in medical errors,[6] and improved patient satisfaction,[7,8] while also mitigating burnout among health care clinicians.[9] While these findings are important, further research is needed to understand how effective teams are formed and to explore the characteristics of teams in health care settings. An instrument designed to measure team development that can be easily and efficiently used in primary care and other health care settings would be of great value.

Numerous teamwork or team-related instruments have been developed, but considerable variability exists in what they measure and the types of teams studied.[10,11] Any robust instrument designed to accurately measure a cognitive or behavioral domain requires an assessment of its psychometric properties.[12] This assessment process also can reduce the number of items needed to measure selected constructs and the time and effort required, given that response rates often decrease as the effort needed to complete surveys increases.[13,14]

Stock et al published a 31-item Team Development Measure (TDM-31) in 2013,[15] which characterized the instrument's psychometric properties. The tool was initially validated using data from 1,194 individuals representing 120 different primary care teams and produced a Cronbach's α of 0.97 and a Rasch person reliability coefficient of 0.95. Our exploratory factor analysis indicated that the four domains of team development that were measured included (a) cohesion, (b) communication, (c) roles and goals, and (d) team primacy.

Since the TDM-31 was published, we found eight studies that have used it.[16–23] Four of these assessed the impact of clin-

ical work interventions on team development.[16–19] The other four studies used the TDM to measure the effect of educational or workspace change aimed at improving teamwork; one of these used data from the TDM to facilitate team learning.[20–23] Appendix A includes a supplemental table that outlines these studies.[16–23] We also found a review conducted by Marlow et al, published in 2018,[11] that compared 70 scales designed to measure teamwork. That review found that the TDM is highly reliable, and the domain components of the constructs measured were considered adequate. The TDM-31 also was examined for validity and was found to be an appropriate instrument for measuring team development in the primary care setting.[10–12]

While the original TDM is psychometrically sound, the number of published studies using it is small, possibly related to its length and time needed to complete it.[13,14] To examine the impact of the shortened scale, we reran the factor analysis, which resulted in a validated 20-item instrument. Here, we report on methods and findings from these analyses.

METHODS

The shortened 20-item TDM (TDM-20) was derived from the dataset that produced the original 31-item instrument.[15] We requested access to the de-identified dataset from the study team, which was shared along with a list of items the original team thought should be included in the TDM-20 (Table 1). Briefly, the original dataset was a compilation of data gathered from 120 teams regarding how their respective teams were functioning. That dataset included team sizes ranging between 3 and 39 members and represented both rural and urban, as well as inpatient and outpatient health care settings.[15]

Using the original dataset, we dropped 11 variables the original study team determined were not needed based on the Rasch measurement assessment of item fit, item calibration, and person reliability. The TDM-20 items have a person reliability of .94 compared to .95 for the original 31 items (personal communication, R. Stock, 2024). We began by running a correlation matrix for all variables to assess the extent that individual items were correlated and found that only 3 of the 20 variables (15%) had correlations above .32. We ran the principal component analysis (PCA) using two approaches—one using Promax rotation without Kaiser normalization and one using varimax rotation and Kaiser normalization—and the findings were essentially identical. Here, we present the PCA that used varimax rotation and Kaiser normalization. We pilot-tested the TDM-31 and TDM-20 with 10 diverse clinic team members to assess how much time was needed to complete each one. We found that the TDM-20 took a mean of 2.0 minutes to complete compared to the mean of 4.1 minutes to complete the TDM-31.

We conducted analyses using SPSS version 29 (IBM). The rotation converged in three iterations. We also performed a scree test as a parallel analysis (Appendix B). We report the factor loadings (domains measured), eigenvalues, percent of total variance, scale means and standard deviations, number of items, and Cronbach's α for reliability coefficients. Oregon

Health & Science University's Institutional Review Board determined these study activities were exempt from review (IRB #26904).

RESULTS

We measured two components in this updated factor analysis (Table 2). We named the first one communication and engagement, which we defined as team members' ability to respectfully interact toward accomplishing goals. This component had 10 items with an eigenvalue of 10.9, accounting for 54.5% of the variance. The mean score for this domain was 27.95 (SD=5.50), and Cronbach's α was 0.92.

We named the second component shared values and cohesion, which we defined as core beliefs that guide the behaviors of a group from an empathetic and psychologically safe position. This component also had 10 items with an eigenvalue of 1.10, and 5.5% of the variance was accounted for. This domain had a mean score of 30.36 (SD=5.25), and Cronbach's α was 0.93. The overall Cronbach's α with all items included was 0.96.

Scoring the TDM-20 mirrors the TDM-31, in which a summary score at the level of the team is calculated; using a Rasch conversion, the team development score would range from 0 to 100 from "initial development" (0–33) to "in place" (34–67) to "firmly in place" (68–100). A higher score indicates a more developed team. With the revised 20-item TDM, the pattern development suggests that the communication and engagement component develops first, followed by shared values and cohesion.

DISCUSSION

Analyses from this study found that the TDM-20 also has strong psychometric properties and is a valid instrument for measuring team development. Because the number of questions has been reduced to 20, survey completion will be faster and less burdensome for respondents. While the original TDM-31 psychometric testing revealed four domains (ie, communication, roles and goals, cohesiveness, and team primacy), the reduced item analysis of the TDM-20 resulted in these four domains collapsing into two (ie, communication and engagement, and shared values and cohesion), which we defined in the Results section. Importantly, communication and engagement loaded with an eigenvalue over 10 that accounted for more than half the variance, suggesting that the items in this component likely rise strongly together. The component shared values and cohesion had an eigenvalue just over 1 (1.11) and accounted for just over 5% of the variance, suggesting that these items would be less likely to rise together during team development.

In addition to being easy to use, the TDM-20 is unique in that it was explicitly designed to measure team development and has been validated in the medical field. Many studies measure team characteristics, most often measuring team performance, psychological safety, and leadership skills. Given the complexities and number of instruments designed to measure teamwork, providing context for the TDM-20 is essential. In Valentine et al's scoping review,[11] only 10 of 39 teamwork

TABLE 1. Team Development Measure—20 Items

TDM 20 items
1. Team members say what they really mean.
2. Team members say what they really think.
3. All team members feel free to share their ideas with the team.
4. The team practices tolerance, flexibility, and appreciation of the unique differences between team members.
5. The team handles conflicts in a calm, caring, and healing manner.
6. Regardless of the topic, communication between the people on this team is direct, truthful, respectful, and positive.
7. The team openly discusses decisions that affect the work of the team before they are made.
8. In this team, members support, nurture, and care for each other.
9. The team has agreed upon clear criteria for evaluating the outcomes of the team's effort.
10. In the team there is more of a WE feeling than a ME feeling.
11. All team members place the accomplishments of the team ahead of their own individual accomplishments.
12. The goals of the team are clearly understood by all team members.
13. All team members define the goals of the team as more important than their own personal goals.
14. I am happy with the outcomes of the team's work so far.
15. I enjoy being in the company of the other members of the team.
16. The work I do on this team is valued by the other team members.
17. I am allowed to use my unique personal skills and abilities for the benefit of the team.
18. Information that is important for the team to have is openly shared by and with all team members.
19. All individuals on this team feel free to suggest ways to improve how the team functions.
20. When team problems arise, the team openly explores options to solve them.

Abbreviation: TDM, team development measure

scales met basic psychometric criteria, and just 4 were validated with outcomes beyond self-report in medical contexts.[24–31] For example, the Team Emergency Assessment Measure (TEAM)[32] evaluates emergency team performance in 12 items related to leadership, teamwork, and task management. Similarly, TeamSTEPPS includes instruments such as the Teamwork Attitudes Questionnaire (T-TAQ),[33] the Teamwork Perceptions Questionnaire (T-TPQ),[34] and the Team Performance Observation Tool (TPOT),[35] which assess attitudes, perceptions, and observed behaviors related to teamwork. However, these tools focus on individual-level constructs and momentary performance rather than capture a team's developmental process. In contrast, the TDM-20 assesses team-level maturity by aggregating individual responses and is grounded in both theoretical and empirical foundations relevant to health care teams. Few published reports exist in medicine on instruments that measure team development. The Group Development Questionnaire (GDQ), published in 1994 by Wheelan et al[36], assesses team development across five theoretical stages: dependency and inclusion, counter-dependency and fight, trust and structure, work and productivity, and termination. Although conceptually rich, the GDQ was validated using a small sample—164 individuals from three US health care facilities and 168 from the financial sector. As such, its ability to capture shared team dynamics remains limited. Moreover, with 60 items, the scale may be too lengthy for practical use in time-constrained clinical settings.[13,14]

One of the benefits of measuring team development is that it enables an objective understanding of a team's status and informs strategies for growth. The average TDM-20 score reflects the team's developmental stage. Understanding the characteristics of the team development stage will support the team's maturity. One widely cited framework for understanding team development is the Tuckman model, which outlines five stages (ie, forming, storming, norming, performing, and adjourning) through which teams are thought to mature.[37] Although these stages offer useful guidance for identifying developmental needs and appropriate interventions, empirical studies have suggested that team progression is often nonlinear and dynamic.[38,39] Therefore, continuously measuring team dynamics can help determine whether a team is advancing or stagnating. The TDM-20's factor structure aligns with this model: communication and engagement reflects the early stages of team formation, where interaction and participation begin to emerge; while shared values and cohesion corresponds to later stages characterized by trust, alignment, and collective identity. This alignment supports the construct validity of the TDM-20 and underscores the foundational role of communication in team development.

Team developmental stages are likely to shift in response to factors such as staff turnover or new member assignments. Although such changes can complicate communication and temporarily destabilize dynamics, they may also introduce new knowledge and relationships that ultimately strengthen the team. Conducting a survey using the TDM-20 offers the

TABLE 2. Team Development 20-Factor Analysis Findings

Team development items	Domains identified	
	Communication and engagement	Shared values and cohesion
The team has agreed upon clear criteria for evaluating the outcomes of the team's effort.	.771	.121
The goals of the team are clearly understood by all team members.	.743	.174
When team problems arise, the team openly explores options to solve them.	.679	.461
All team members define the goals of the team as more important than their own personal goals.	.675	.341
The team openly discusses decisions that affect the work of the team before they are made.	.656	.363
All team members place the accomplishments of the team ahead of their own individual accomplishments.	.642	.376
All individuals on this team feel free to suggest ways to improve how the team functions.	.622	.484
Information that is important for the team to have is openly shared by and with all team members.	.605	.417
I am happy with the outcomes of the team's work so far.	.583	.526
All team members feel free to share their ideas with the team.	.533	.530
I enjoy being in the company of the other members of the team.	.123	.775
I am allowed to use my unique personal skills and abilities for the benefit of the team.	.236	.735
The work I do on this team is valued by the other team members.	.252	.735
In this team, members support, nurture, and care for each other.	.411	.670
Team members say what they really mean.	.413	.640
The team practices tolerance, flexibility, and appreciation of the unique differences between team members.	.443	.635
Team members say what they really think.	.431	.611
In the team, there is more of a WE feeling than a ME feeling.	.562	.603
Regardless of the topic, communication between the people on this team is direct, truthful, respectful, and positive.	.547	.594
The team handles conflicts in a calm, caring, and healing manner.	.541	.565
Eigenvalues	10.90	1.11
Percentage of total variance	54.50	5.55
Scale mean (SD)	27.95 (5.50)	30.36 (5.25)
Number of items	10	10
Cronbach's α coefficients	.92	.93

Rotated factor matrix[a]
Extraction method: principal component analysis
Rotation method: varimax with Kaiser normalization
[a] Rotation converged in three iterations.
Abbreviation: SD, standard deviation

possibility of capturing the dynamic process through which medical teams mature and regress. Collecting longitudinal data using the same instrument may help identify typical patterns of team maturation. Furthermore, comparing the maturation process of a typical medical team with that of the target team may help determine whether a team is in a critical phase that requires timely intervention. The TDM-20 also may be used to evaluate interventions aimed at facilitating team development. Specific examples of such interventions include the frequency of team meetings, the impact of social gatherings, and adjustments in team composition.

Although team training and leadership are widely recognized as important for team development and functioning, these domains are not included in the TDM-20.[40] This intentional omission reflects the instrument's primary aim—to evaluate the overall maturity of health care teams rather than to assess individual leadership traits or training effectiveness. As often occurs in family medicine, teams typically comprise professionals from multiple disciplines, such as physicians, advanced practice providers, nurses, pharmacists, and social workers,[41] which makes measuring team function especially important. In these interdisciplinary teams, the individual taking on the leadership role often changes depending on the clinical situation, which can be more effective than relying on a fixed, hierarchical structure.[42] Reflecting this, the original TDM-31 excluded leadership-related items due to difficulties in reliably identifying a team leader. Only one item—"On this team, the person who takes the lead differs depending on

who is best suited for the task"—was retained, but was later removed during item reduction using Winsteps (M. Linacre). This decision is consistent with the view that mature, well-functioning teams can sustain their performance not because of a fixed leader, but because leadership responsibilities are flexibly shared among members according to the situation.[43]

Limitations of this study included that the original dataset was collected in 2010 and may not reflect current issues in team development. Another limitation was that the study was conducted in the Northern Pacific region of the United States (Oregon, Washington, and Alaska), which would be considered less ethnically diverse and therefore not able to produce generalizable findings. Future research should examine TDM-20's validity in diverse cultural contexts. Future studies are planned to assess the use of the TDM-20 in Japan, which may contribute valuable insights regarding its cross-cultural applicability. Lastly, the team ID variable was lacking in this updated analysis, so we were unable to conduct psychometric analyses of team clustering. Furthermore, due to several factors, including the COVID-19 pandemic, changes in team composition have become necessary in the medical field, and remote work is one of them. Team development will likely differ from what we observed before the pandemic.[44]

CONCLUSIONS

In conclusion, the TDM 20 is a valid instrument for measuring team development. Future research should explore its use across diverse clinical and cultural contexts and examine whether sharing TDM-20 feedback within teams facilitates improved team function over time.

PRESENTATIONS

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