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ORIGINAL RESEARCH

The Mayo Leadership Impact Index Adapted for Matrix Leadership Structures: Initial Validity Evidence

Jamile A Ashmore[1,2], Anthony C Waddimba[2–4], Megan E Douglas[5], Stacey V Coombes[6], Tait D Shanafelt[7], J Michael DiMaio[2,4,8]

[1]Office of Professionalism and Well-Being, Baylor Scott & White-The Heart Hospital, Plano, TX, USA; [2]College of Medicine, Texas A&M University, Dallas, TX, USA; [3]Division of Surgical Research, Department of Surgery, Baylor University Medical Center, Dallas, TX, USA; [4]Research Development & Analytics Core, Baylor Scott and White Research Institute, Dallas, TX, USA; [5]Trauma Research Consortium, Baylor Scott and White Research Institute, Dallas, TX, USA; [6]OrganizationRx, Los Angeles, CA, USA; [7]Department of Medicine, Stanford University School of Medicine, Stanford, CA, USA; [8]Division of Cardiothoracic Surgery, Baylor Scott & White-The Heart Hospital, Plano, TX, USA

Correspondence: Jamile A Ashmore, Office of Professionalism and Well-being, Baylor Scott & White-The Heart Hospital, 1100 Allied Drive, Plano, TX, 75093, Tel +1469814-4289, Email Jamile.Ashmore@BSWHealth.org

Importance: Physician burnout has reached crisis levels. Supportive leadership is one of the strongest drivers of physician well-being, and monitoring supervisor support is key to developing well-being focused leadership skills. Existing measures of leader support were designed within "direct report" supervision structures limiting their applicability to matrixed leadership reporting structures where direct reports are not the predominant norm. Antecedently, no measure of leadership support is validated specifically for implementation in matrixed leadership structures.

Objective: Adapt and validate the Mayo Leadership Impact Index (MLII) for settings with matrixed leadership structures.

Design: A psychometric validation study utilizing classical test theory and item response theory.

Setting: A tripartite hospital system in the southwestern US.

Participants: Physician-respondents to a 2023 cross-sectional survey.

Main Outcomes and Measures: After pilot testing, the adapted MLII was examined using a unidimensional graded response model and confirmatory factor analyses. Convergent validity was investigated via correlations with professional fulfillment, perceived autonomy support, self-valuation, and peer connectedness/respect. Divergent validity was tested via correlations with burnout.

Results: Of the three candidate revisions of the MLII, the 9-item adaptation was selected for its superior validity/reliability indices. Standardized Cronbach's and Ordinal alpha coefficients were 0.958 and 0.973, respectively. CFA loadings exceeded 0.70 ($p < 0.001$), and coefficients of variation (R^2) exceeded 0.60 for all items. GRM slope parameters indicated "high" to "very high" item discrimination. Items 2, 5, and 8 were the most informative. Positive correlations of the adapted MLII with professional fulfillment, perceived autonomy support, and peer connectedness/respect were observed, supporting convergent validity. Negative correlation with overall burnout supports divergent validity.

Conclusions and Relevance: The findings provide evidence of the adapted MLII's validity, reliability, and appropriateness for implementation within matrixed leadership settings. Prior to this study, no leadership support measure had been validated for use among the growing number of healthcare systems with matrixed leadership reporting structures.

Plain Language Summary:

Question: What is the validity and reliability of a well-being centered leadership measure adapted for use in healthcare systems with matrixed, multiform reporting structures?

Findings: Classical test theory and item response theory analyses of cross-sectional survey data from 158 physician-respondents supported the adapted measure's construct validity. All reliability coefficients were strong. Leadership ratings positively correlated with professional fulfillment, autonomy support, self-valuation, and peer connectedness/respect, and negatively correlated with burnout.

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Meaning: Findings support the adapted measure's validity and reliability. This study is the first to demonstrate a valid empirical measure of well-being centered leadership behaviors in settings with multiform, matrixed leadership structures.

Keywords: physician, psychometrics, well-being, burnout, leader support

Introduction

Physician well-being influences quality, safety, satisfactoriness and cost of patient care,[1–4] workforce retention,[5,6] risk of malpractice lawsuits,[7] and healthcare organization performance.[8,9] Support from an immediate supervisor is one of the biggest drivers of physicians' satisfaction within healthcare organizations.[10,11] One study found that every unit increase in ratings of one's leader was associated with a 9% increase in physician satisfaction and a 3% decrease in burnout.[12] Interdisciplinary and longitudinal studies replicate these findings.[13,14] In a multi-site study, physicians who rated their supervisor's performance within the topmost tertile reported 48% lower risk of burnout, 66% lower intent to leave their organization within 2 years, and 5.8 times greater odds of high professional fulfillment.[15] However, physician training typically includes little to no formal leadership development.[16] Recent initiatives are incorporating leadership development into residency/fellowship training and specialists' continuing medical education.[17–22] Such initiatives necessitate the accurate assessment and periodic tracking of targeted and beneficial leadership behaviors.[23–25]

The Mayo Leadership Impact Index© (MLII), formerly known as the Mayo Clinic Participatory Management Leadership Index, is a self-report scale that assesses healthcare workers' "direct report" supervisors across dimensions of supportive behavior such as: inclusion, keeping people informed, empowering team members, nurturing professional development, soliciting input, and providing feedback and recognition.[12,26] One of the most widely utilized measures of well-being centered leadership in healthcare organizations, the MLII was first developed and validated at Mayo Clinic, where each physician is led by a single "direct report" supervisor.[27] "Direct report" leadership structures exist in healthcare organizations whose administrative hierarchy assigns an immediate "front-line" supervisor to each physician. In contrast, organizations with "matrixed" leadership reporting structures have flexible hierarchies that link each physician to leaders at multiple levels such that a physician can flexibly obtain support, supervision, or mentorship from any of the potential alternative sources, based on the specific need or context. Most studies that link leadership support ratings with burnout and professional fulfillment were conducted in "direct report" settings,[13–15,25] except for graduate medical education studies where residents/fellows rate overall "program leadership" rather than a single leader.[28,29] The generalizability of these study findings to more flexible multiform leadership structures is unknown.[15]

Escalating consolidation of practice groups and hospitals within healthcare delivery systems in the private and academic settings has created organizational leadership structures with heterogeneous degrees of vertical and horizontal integration.[30–33] Many physicians work in loosely integrated settings with flexible, matrixed reporting structures that enable multiple and optional sources of leadership support.[34,35] This calls for an adaptation of the MLII for use in flexible, matrixed leadership structures, which then necessitates an investigation of the adapted measure's construct validity and reliability in these settings.[36] The present study applied classical test theory (CTT) and item response theory (IRT) to validate an adaptation of the MLII. This is the first adaptation of the MLII for the empirical assessment of leadership performance within organizations with matrixed leadership reporting structures.

Methods and Materials

Study Design

The study was nested within a cross-sectional anonymized "quality improvement" survey. The Baylor Scott & White Research Institute Institutional Review Board waived written informed consent requirements and approved the study (# 023–171). The study adhered to STROBE[37] and CHERRIES[38] guidelines.

Participants

The study included credentialed physicians from various specialties (see Table 1) providing care to in- or out-patients across three enterprise hospitals plus associated ambulatory clinics who responded to an annual "Physician Well-being Survey". Excluded were physicians with less than one year of organizational tenure, those with no patient-care encounters in the preceding year, and residency/fellowship trainees.

Table 1 Social Demographics and Clinical Work Characteristics of the Study Sample

Covariate / Characteristic	Overall Study Sample (n=158)	Derivation Subsample (n=79)	Validation Subsample (N=79)	Significance (p)
Gender, n (%)				
a. Male	120 (75.95)	60 (75.95)	60 (75.95)	**0.0002**[a]
a. Female	27 (17.09)	9 (11.39)	18 (22.78)	
a. Missing/Did not answer	11 (6.96)	10 (12.66)	1 (1.27)	
Age group, n (%)				
a. 18–30 years	1 (0.63)	1 (1.27)	0 (0.00)	**0.0320**[a]
a. 31–40 years	24 (15.19)	9 (11.39)	15 (18.99)	
a. 41–50 years	56 (35.44)	22 (27.85)	34 (43.04)	
a. 51–64 years	44 (27.85)	27 (34.18)	17 (21.52)	
a. ≥65 years	21 (13.29)	10 (12.66)	11 (13.92)	
a. Missing/Did not answer	12 (7.59)	10 (12.66)	2 (2.53)	
Race/Ethnicity, n (%)				
a. White/Non-Hispanic	68 (43.04)	32 (40.51)	36 (45.57)	0.5204[b]
a. Asian or Asian Indian/Indian American	51 (32.28)	23 (29.11)	28 (35.44)	0.3949[b]
a. Hispanic or Latinx/Latino/Latina	9 (5.70)	5 (6.33)	4 (5.06)	1.000[a]
a. Black/African American	7 (4.43)	5 (6.33)	2 (2.53)	0.4425[a]
a. Middle Eastern or North African	5 (3.42)	2 (2.53)	3 (3.80)	1.000[a]
a. American Indian/Alaskan Native	0 (0.00)	0 (0.00)	0 (0.00)	—
a. Native Hawaiian/Pacific Islander	0 (0.00)	0 (0.00)	0 (0.00)	—
a. Missing/Did not answer	19 (12.03)	11 (13.92)	8 (10.13)	0.4631[b]
Specialty/Department, n (%)				
a. Non-invasive Cardiology	27 (17.09)	11 (13.92)	16 (20.25)	0.3590[b]
a. Interventional Cardiology	24 (15.19)	15 (18.99)	9 (11.39)	0.2383[b]
a. Cardiovascular Surgery	15 (9.49)	7 (8.86)	8 (10.13)	0.5866[b]
a. Vascular Surgery	7 (4.43)	3 (3.80)	4 (5.06)	0.1403[b]
a. Anesthesia	15 (9.49)	10 (12.66)	5 (6.33)	0.2322[b]
a. EP	9 (5.70)	4 (5.06)	5 (6.33)	0.5738[b]
a. Hospitalist	8 (5.06)	6 (7.59)	2 (2.53)	0.0518[b]
a. Other	52 (32.91)	22 (27.85)	30 (37.97)	0.2596[b]
a. Missing/No response	1 (0.63)	1 (1.27)	0 (0.00)	1.000[a]
Clinical service location, n (%)				
a. Plano, Texas	120 (75.95)	61 (77.22)	59 (74.68)	0.9010[b]
a. Denton, Texas	17 (10.76)	8 (10.13)	9 (11.39)	0.8907[b]
a. McKinney, Texas	14 (8.86)	7 (8.86)	7 (8.86)	0.9277[b]
a. Did not answer	7 (4.43)	3 (3.80)	4 (5.06)	1.000[a]
Organization subsidiary, n (%)				
a. The Heart Hospital	32 (20.25)	20 (25.32)	12 (15.19)	0.0502[b]
a. Health Texas Providers Network	56 (35.44)	25 (31.65)	31 (39.24)	0.1546[b]
a. Other	67 (42.41)	31 (39.24)	36 (45.57)	0.1810[b]
a. Missing/Did not answer	3 (1.90)	3 (3.80)	0 (0.00)	0.2452[a]

(*Continued*)

Table 1 (Continued).

Covariate / Characteristic	Overall Study Sample (n=158)	Derivation Subsample (n=79)	Validation Subsample (N=79)	Significance (p)
Clinical practice experience, n (%)				
a. 1–5 years	21 (13.29)	9 (11.39)	12 (15.19)	0.1801[b]
a. 6–10 years	30 (18.99)	11 (13.92)	19 (24.05)	0.0695[b]
a. 11–15 years	27 (17.09)	14 (17.72)	13 (16.46)	0.2058[b]
a. 16–20 years	19 (12.03)	12 (15.19)	7 (8.86)	0.0913[b]
a. >20 years	58 (36.71)	30 (37.97)	28 (35.44)	0.1895[b]
a. Missing/Did not answer	3 (1.90)	3 (3.80)	0 (0.00)	0.2452[a]
Patient case volume, median (Q_1, Q_3)				
a. Count of patient encounters per year	200 (50, 520)	157 (50, 400)	300 (60, 750)	0.0674[c]

Notes: a=Fisher's exact test; b=Pearson's Chi-squared test; c= Kruskal–Wallis test;

Data Collection

A hyperlink to the online questionnaire was e-mailed to eligible physicians between January 24th 2023 and February 10th 2023. Data were managed via the Research Electronic Data Capture (REDCap™)[39] platform. REDCap has a proven track record as a secure and reliable web-based application for building and managing online surveys and databases specifically for research studies.

Survey Measures

Contextual Variables

Physicians' demographics (eg, age, gender, and race/ethnicity), service location (city), department/unit, clinical experience (years in practice), and annual caseload were surveyed.

Psychosocial Variables

Standardized measures included:

Mayo Clinic Leadership Impact Index (adapted): Factor analytic studies of the original 12-item MLII version found that three items contributed minimally to the construct, and the scale was shortened to 9 items.[13,14] The Mayo Leadership Impact Index (MLII) remains proprietary to the Mayo Clinic organization and was adapted with permission. Three co-authors collaboratively proposed changes to this pre-existing 9-item revised MLII. Proposed changes were piloted among a 10-member advisory panel of physicians whose input was incorporated. Ten candidate items (adaptations of the original 9 plus a newly crafted 10th item) were subjected to psychometric testing. eTable 1 compares the 10 candidate items with the original 9 items in the pre-existing scale.

The Stanford Professional Fulfillment Index (PFI):[40] is comprised of the Professional Fulfillment Scale (PFS; 6 items) and Overall Burnout Scale (OBS; 10 items). The OBS combines the 4-item Work Exhaustion and 6-item Interpersonal Disengagement subscales. Each item has five response options: from 0 ("not at all true") to 4 ("completely true") for the PFS and 0 ("not at all") to 4 ("extremely") for the OBS. Scale scores are derived by averaging scores on constituent items, with averages ranging from 0 to 4. Some studies normalize scores to a 10-point scale, by transforming scores from a 0–4 to a 0–10 range.[25,41–44] However, we applied cut-off thresholds on the 0–4 spectrum in the original validation study.[40] Thus, respondents whose PFS scores ≥ 3.0 are likely professionally fulfilled. Those whose OBS scores ≥ 1.33 are likely burned out.

The Six-item Physician Perceptions of Autonomy Support (PPAS-6) scale:[45] assesses physicians' perceived support towards their clinical autonomy (ie, volition to use one's best judgment in applying scientific evidence and clinical expertise during patient care). Each PPAS-6 item is rated on a five-point Likert-style spectrum from 1 ("None of the time") to 5 ("All of the time"). The PPAS-6 is scored by summing up items (after reverse coding a negatively worded

"interference" item) such that higher total scores (minimum = 6; maximum = 30) indicate higher autonomy support. One standard deviation above the mean[46] PPAS-6 score in the original validation study,[45] rounded to the nearest whole number, was the threshold for "high" ratings on the PPAS-6. Thus, PPAS-6 scores ≥22 (ie, 22–30) indicated perceptions of "high" support towards clinical autonomy; scores between 17 and 21 "moderate" support; and scores ≤17 (ie, between 6 and 16) "low" support.

The Self-Valuation Scale (SVS):[47] comprises two items assessing deferment of self-care to prioritize work demands (eg, "I put off taking care of my own health due to time pressure"), and two items assessing harsh responses to personal imperfections/errors (eg, "When I made a mistake, I felt more self-condemnation than self-encouragement to learn from the experience"). Items are scored via 5-point Likert response options from 0 ("Never") to 4 ("Always"). Total SVS scores ≥ 9 are the threshold for moderate-to-high self-valuation, suggesting a respondent is likely to prioritize personal well-being over work and to have a growth mindset. SVS scores <9 indicate low self-valuation suggesting a respondent is likely to defer self-care to prioritize work demands and to respond harshly to personal imperfections or errors.

Organizational retention: Four items assessing intentions to leave the organization in the next 24 months, reduce work hours in the next year, or to voluntarily retire,[48–51] were included. The first item ("What is the likelihood that you will leave your current organization within two years?") was scored via five response options: 1 "none", 2 "slight", 3 "moderate", 4 "likely", 5 "definitely". Two items ("Are you considering leaving or retiring altogether?" and "Are you retiring earlier than you had anticipated retiring?") had a binary Yes/No response option. A fourth item, "What is the likelihood that you will reduce the number of hours you devote to clinical care over the next 12 months?" had five response options: 5 "none", 4 "slight", 3 "moderate", 2 "likely", 1 "definitely".

Peer relationships: Two new items originated by the authors solicited respondents' self-reported connectedness to peers ("I feel connected to my peers at work") and respect by peers ("I feel respected by my peers at work"), respectively, via one of five responses: "strongly disagree", "disagree", "neither agree nor disagree", "agree", or "strongly agree".

Statistical Analysis Strategy

The study dataset was randomly and equitably split 50:50 into development and validation sub-samples to facilitate a split-sample internal validation strategy. Equitable distribution of contextual variables between derivation and validation subsamples was tested to confirm successful random partitioning. Three alternative formulations of the adapted MLII were compared: a 10-item versus a 9-item versus an 8-item format. Internal consistency of the scale was assessed using ordinal coefficient alpha[52] and Cronbach's coefficient alpha.[53] Reliability of individual items was tested via inter-item plus item-to-scale polychoric correlations.[54] The Spearman correlations (ρ) with the OBS assessed divergent validity. Convergent validity was evaluated using correlations (ρ) with the PFS, PPAS-6, SVS, and Peer Connectedness/Respect. Construct validity was tested via single-factor diagonally weighted least squares (WLSMV) confirmatory factor analysis (CFA)[55] and Samejima's polytomous graded response item response theory (IRT)[56] models. Statistical analyses were performed using SAS version 9.4 (SAS Inc., Cary, NC), Mplus® version 8.6 (Muthen & Muthen, Los Angeles, CA), IBM SPSS® Statistics version 29.0.0.0 (IBM Inc., New York, NY), and R version 4.2.1 for Windows (R Development Core Team, Vienna, Austria).

Results

Sample Characteristics

Of 500 eligible physicians, 158 submitted survey responses (response rate = 31.6%). Respondents were predominantly male (76.0%), aged 41 to 65 years (63.3%), and White (43.0%) or Asian (30.4%). A plurality (48.74%) had practiced for ≥15 years. Median (Q1, Q3) annual caseload was 200 (50, 520) patient-care encounters per year. Almost one of three (32.3%) were (non-invasive/interventional) cardiologists, with cardiovascular surgeons (9.5%) and anesthesiologists (9.5%) as the next two most self-reported specialties. Table 1 further outlines the sample characteristics. The 50:50 split-sample randomization distributed most demographics and service attributes equitably between derivation (n = 79) and validation (n = 79) subsamples, except for female gender and the middle age groups (41–50 and 51–64 years). However,

psychometric indices were identical between derivation and validation subsamples despite the observed differences in distribution of sexes and middle age groups.

Item-Level Scores and Item/Scale Reliability

Of three candidates (10-item, 9-item, and 8-item) adaptations, the 9-item version was selected due to superior psychometric indices. Specifically, the final 9-item adaptation of the MLII excluded the brand-new candidate item and reframed some of the original items of the pre-existing 9-item MLII. Mean (± standard deviation) scores on nine individual items of the adapted MLII, in the derivation subsample, ranged from a low of 3.43 (1.26) on item 1 ("holds career development conversations with me") to a high of 4.17 (0.84) on item 4 ("ensures I am treated with respect and dignity"). "Strongly disagree" or "Disagree" responses were less frequently endorsed than "Strongly agree" or "Agree" responses on all items (see eTable 2). Scale reliability coefficients if an item is deleted ranged from 0.950 for item 5 to 0.956 for both items 7 and 9 (see eTable 2). eTable 3 illustrates the inter-item and item-to-scale correlation matrix. Inter-item polychoric correlations (standard errors) ranged from a low of 0.68 (0.06) between items 1 and 7 to a high of 0.90 (0.02) between items 5 and 8, indicating moderate to high item reliability. Item-to-scale Spearman correlation coefficients ranged from 0.80 for item 7 to 0.90 for item 6 ($p < 0.0001$), indicating high reliability of all items. Standardized Cronbach's alpha coefficient was 0.958, indicating high internal consistency of the composite scale. eFigure 1 illustrates a polychoric correlation *heat map* of the 10 candidate items initially considered. eTable 4 compares reliability indexes for 8-, 9-, and 10-item candidate adaptations of the revised MLII among the derivation subsample.

Table 2 illustrates the single-factor CFA of the 9-item adaptation based on the WLSMV estimator. The CFA excellently fit the derivation subsample data (SRMR = 0.035; CFI = 0.999; TLI = 0.997), providing evidence of unidimensionality. Standardized loadings ($\lambda_{standardized}$) for all items exceeded 0.700 ($p < 0.001$). Items 5, 6, and 8 had the highest, second, and third highest factor loadings ($\lambda_{standardized}$ = 0.905, 0.894, and 0.890) plus proportions of variance in item scores (R^2 = 0.819, 0.800, and 0.791) accounted for by the latent factor. Items 9 and 4 had the lowest and second

Table 2 Diagonal Weighted Least Squares (DWLS) Confirmatory Factor Analysis – Item Loadings and Global Fit Indices

#	Item	Standardized βeta Coefficient / Factor Loading	Squared Multiple Correlation (R^2)	Standardized Error Variance of R^2
1	Holds career development conversations with me	0.827	0.684	0.316
2	Empowers me to do my job	0.869	0.756	0.244
3	Encourages employees to suggest ideas for improvement	0.850	0.722	0.278
4	Ensures that I am treated with respect and dignity	0.779	0.606	0.394
5	Provides helpful feedback and coaching on my performance	0.905	0.819	0.181
6	Recognizes me for a job well done	0.894	0.800	0.200
7	Keeps me informed about changes taking place in my clinic, work unit, or hospital	0.806	0.650	0.350
8	Encourages me to develop my talents and skills	0.890	0.791	0.209
9	Overall, I am satisfied with the person or people who provide (or should be providing) the support listed above	0.777	0.604	0.396
Global Goodness of Fit Indexes		**Standardized Root Mean Square Residual (SRMR)**	**Goodness of Fit Index (GFI)**	**Tucker-Lewis Index (TLI)**
		0.0354	0.9999	0.9972

lowest factor loadings ($\lambda_{standardized}$ = 0.777 and 0.779) and R^2 values (0.604, 0.606), respectively. eTable 5 compares CFA goodness-of-fit indexes among the derivation subsample for 8-, 9-, and 10-item candidate adaptations.

Calibration with the Unidimensional Graded Response Model

Parameter estimates from the unidimensional GRM of the 9-item adaptation are listed in Table 3. Items that more efficiently discriminate among respondents' leadership ratings have higher/steeper slope (α) parameters. Conventionally, slopes of 0.65–1.34 indicate "moderate", 1.35–1.75 "high", and >1.76 "very high" discrimination.[57] Items 7 and 9 had "high" discrimination; the other seven items "very high" discrimination. Items 5, 2, and 8 most efficiently discriminate between respondents' ratings of their leaders. Each threshold or difficulty (Ь) parameter is the point at which the probability of respondents endorsing a specific response versus another (eg, "strongly disagree" vs "disagree") is approximately equal (50:50). Higher Ь values indicate more difficult response options for respondents to endorse. Response category thresholds ranged from −2.570 for Ь1 on item 4 to 0.796 for Ь4 on item 1. Item-level goodness-of-fit was assessed by the generalized S-$\sum^2$ index, which indicated good overall fit (ie, $p \geq 0.001$) for all items, with no item showing poor fit (ie, $p < 0.001$). Response option characteristic curves in Figure 1 show that respondents endorsed a wide spectrum of responses on all items of the adapted MLII. Thus, the scale validly captures a diverse range of respondents' ratings of their leaders. Figure 2 shows information function curve plots for individual items and the adapted measure as a whole. Items 5, 8, and 2 captured the highest amount of psychometric information across the entire breadth of variability in leaders' ratings. Items 7, 9, 4, and 1, in contrast, had the flattest information curves. eFigure 2A and eFigure 2B depict item characteristic and item information curve plots for the 10th candidate item. eFigure 3 compares test information curve plots for 8-, 9-, and 10-item candidate adaptations.

Table 3 Unidimensional Graded Response Model of the Nine-Item Adaptation of the Revised MLII in the Derivation Subsample – Item Scalability, Slope (Discrimination), and Response Category Threshold (Difficulty) Parameters

Item		Slope ∫	Response Category Thresholds ∫				Item Goodness of Fit	
		α (SE)	b_1 (SE)	b_2 (SE)	b_3 (SE)	b_4 (SE)	S-Σ^2 Index	p
1	"Holds career development conversations with me"	1.902 (0.357)	−1.423 (0.259)	−0.924 (0.207)	−0.019 (0.161)	0.796 (0.203)	8.897	0.064
2	"Empowers me to do my job"	2.614 (0.558)	−2.095 (0.361)	−1.618 (0.271)	−0.637 (0.166)	0.580 (0.178)	7.582	0.023
3	"Encourages employees to suggest ideas for improvement"	2.025 (0.391)	−1.876 (0.343)	−1.388 (0.250)	−0.687 (0.179)	0.554 (0.184)	4.195	0.123
4	"Ensures that I am treated with respect and dignity"	1.900 (0.398)	−2.570 (0.494)	−0.840 (0.196)	−1.031 (0.149)	0.374 (0.178)	5.480	0.360
5	"Provides helpful feedback and coaching on my performance"	3.256 (0.737)	−1.344 (0.235)	−0.884 (0.177)	−0.216 (0.148)	0.772 (0.183)	2.515	0.473
6	"Recognizes me for a job well done"	2.274 (0.432)	−1.311 (0.240)	−0.925 (0.196)	−0.324 (0.158)	0.580 (0.182)	4.826	0.306
7	"Keeps me informed about changes taking place in my clinic, work unit, or hospital"	1.487 (0.280)	−2.100 (0.377)	−1.384 (0.275)	−0.567 (0.190)	0.445 (0.195)	6.702	0.244
8	"Encourages me to develop my talents and skills"	2.479 (0.494)	−1.291 (0.235)	−1.103 (0.210)	−0.351 (0.158)	0.738 (0.185)	1.414	0.493
9	"Overall, I am satisfied with the person or people who provide (or should be providing) the support listed above"	1.481 (0.277)	−1.973 (0.349)	−1.556 (0.282)	−0.728 (0.202)	0.433 (0.194)	13.887	0.016

Notes: α is the item slope (discrimination) parameter; b_1 to b_4 are item response category threshold (difficulty) parameters; ∫ indicates that $p<0.0001$ for all the slope (α) and threshold (b) parameters, S- Σ^2 is the generalized item-level goodness-of-fit index (based on 68 observations in the derivation subsample with complete responses to all items); p is significance level for the S- Σ^2 index.
Abbreviation: SE, standard error.

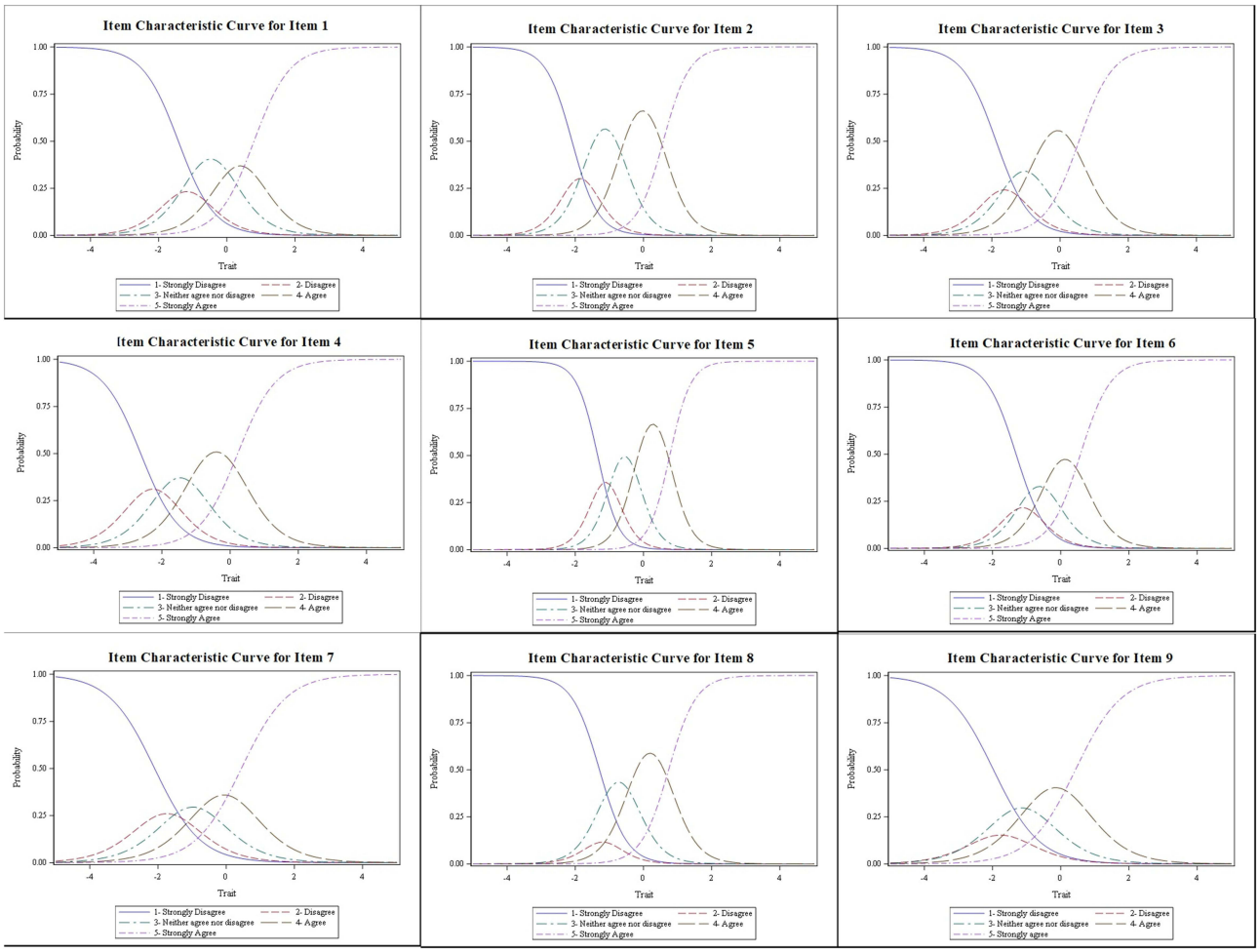

Figure 1 Unidimensional Graded Response IRT Model of the Nine-item Adaptation of the Revised MLII – Item Characteristic Curve Plots.

Convergent and Divergent Validity

A strong positive unadjusted association ($\rho = 0.567$; $p < 0.001$) was observed between leadership behavior and perceived autonomy support. The adapted MLII had moderate positive associations with professional fulfillment ($\rho = 0.470$; $p < 0.0001$), respect from peers ($\rho = 0.496$; $p < 0.0001$), connectedness to peers ($\rho = 0.411$; $p < 0.0001$), and a moderate negative association ($\rho = -0.303$; $p = 0.0004$) with burnout. A small positive association with self-valuation ($\rho = 0.286$; $p = 0.0009$) was observed (see eTable 6).

Discussion

We tested the psychometric validity and reliability of an adapted version of the MLII designed to assess ratings of leaders' behaviors by physicians embedded in organizations with a multiform, flexible leadership structure. We confirmed the unidimensional factor structure of the nine-item adaptation via CTT and IRT analyses. Its construct validity, convergent and divergent validity, and internal consistency reliability satisfied established criteria.

This study yields evidence that the adapted MLII validly and reliably assesses leadership behaviors experienced by physicians who are neither exclusively supported nor supervised by a single direct-report leader. Furthermore, perceptions of leadership support positively correlated with professional fulfillment, perceived autonomy, self-valuation, and connectedness to peers. Lower scores on the adapted measure correlated with higher levels of burnout. By standard criteria,[58] correlation coefficients were mostly moderate to high.

Our findings replicate studies of the standard 9-item MLII designed for use in settings with traditional, hierarchical leadership structures. Mete et al found Pearson correlation coefficients (r) of –0.34 with overall burnout and 0.44 with professional fulfillment.[15] Dyrbye et al observed correlations (r) of –0.247 with burnout and 0.444 with satisfaction with one's organization.[13] Shanafelt et al found a correlation (r) of 0.53 with values alignment at the work unit level.[25] Kang et al observed correlations (r) of 0.72 with psychological safety, 0.67 with excellence/innovation, 0.48 with engagement, and 0.44 with well-being.[59] Likewise, the reliability coefficients are consistent with studies of previous MLII versions.[59]

Despite a proven association of leadership behaviors with clinicians' well-being plus values alignment with their organization in settings with traditional, hierarchical leadership structures,[12–15,25,26] organizations with matrixed leadership reporting structures justifiably question the applicability of such findings to their contexts. Our study demonstrates that leadership behavior remains an important driver of burnout and professional fulfillment even for physicians embedded in settings with no singularly exclusive direct-report leader. This emphasizes the importance of assessing, developing, and fostering well-being centered leadership in such organizations.

One model posits that well-being centered leadership has, at its core, three elements: (1) genuine demonstration of caring about the individuals they lead, (2) cultivation and nurturing of individual relationships and interrelationships among team members, and (3) inspiring work-unit level change by fostering creativity and autonomy as well as supporting change efforts.[24] Leadership training programs aimed at teaching skills within these foundational domains may be insufficient to

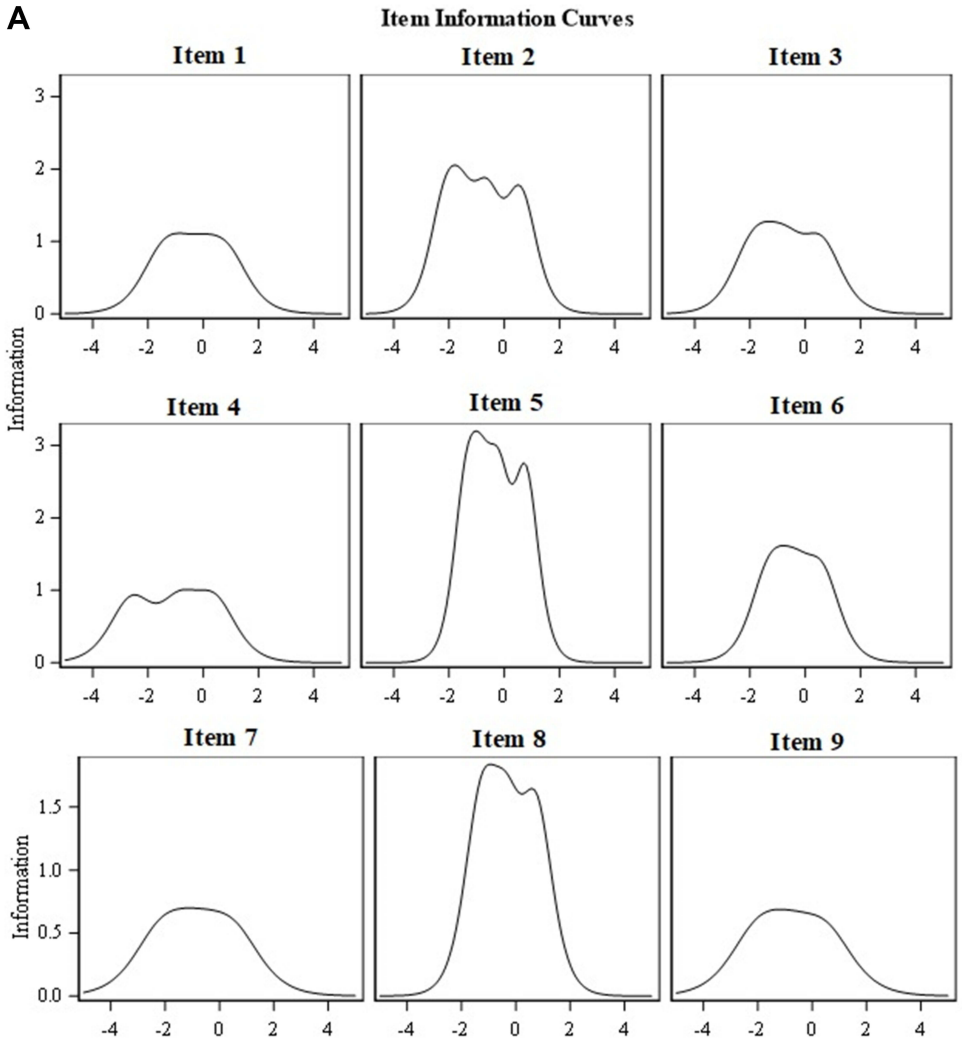

Figure 2 (**A**) Unidimensional Graded Response IRT Model - Item Information Curve Plots.

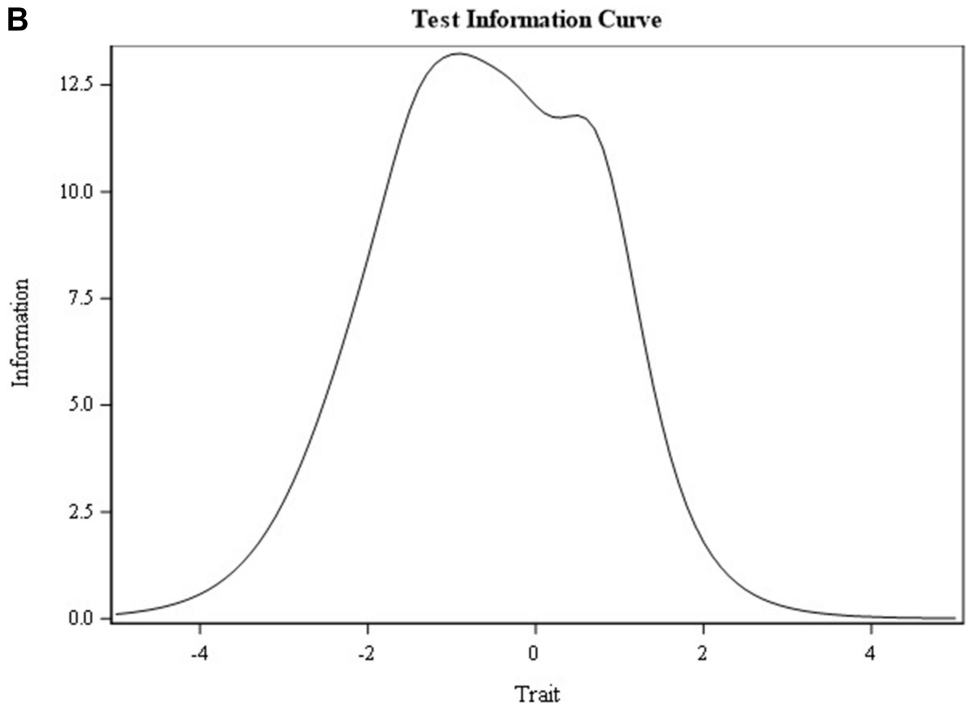

Figure 2 (**B**) Unidimensional Graded Response IRT Model – Test Information Curve Plot.

generate long-term improvement. Factors such as leaders' personality traits, unique needs and expertise, plus the organization's supportive structures and processes must also be considered to effectively optimize performance.[60]

Limitations and Strengths

This study has limitations. Respondents were from a single healthcare system, likely limiting generalizability. Although comparable to many physician studies,[61,62] our response rate underperforms averages for online surveys of specialist physicians.[63,64] As a sensitivity analysis, we tested CTT and IRT models on an expanded simulated dataset generated via 100 multiple imputations[65] of the respondents' sample and observed identical psychometric indexes. The expanded, simulated dataset was generated by using a multiple imputation method to draw an unrestricted random sample from the study dataset 100 successive times with replacement. Thus, the modest sample size was likely not a significant threat to statistical conclusion validity. Authors had no data on non-respondents and could not quantify non-response bias. However, studies conducting robust analyses of survey non-responders show that respondents typically are representative of target subpopulations.[66] The cross-sectional nature of the study precluded test–retest reliability assessment. Additionally, acquiescence response bias was not assessed in this study. Notable strengths of the study were the robust validity and reliability indices, plus the split-sample internal validation strategy that minimized overfitting.

Implications of the Study

Our findings imply that physicians in organizations with matrixed leadership reporting structures receive "well-being centered" leadership support from diverse sources (eg, direct report leaders, indirect leaders, professional colleagues, and peer groups) and that this multi-sourced support is associated with professional fulfillment and burnout levels.[67] Future studies might extend the single-factor, uni-dimensional model via a multi-dimensional conceptual framework that unearths distinct (eg, emotional, tangible, and informational)[68,69] domains, not just the "overall" or composite construct, of leadership support. In addition, this study offers a measure that can help identify individuals or workgroups experiencing low levels of well-being focused leadership support. Tailored interventions to improve support can then be developed and implemented.

Conclusion

An adapted version of the MLII validly and reliably assesses well-being centered leadership support in organizations with matrixed leadership reporting structures not dependent on a single direct-report leader. The adapted measure's validity and reliability indices resemble those of the traditional MLII designed for settings with exclusive, direct-report leaders. Scores on the adapted measure correlate negatively with burnout and positively with professional fulfillment indicating that wellness-centered leadership behaviors are important both for systems with hierarchical leadership structures and matrixed leadership reporting structures. Prior to this study, no equivalent measure had been validated for use among the growing number of healthcare systems with matrixed leadership reporting structures.

Disclosure

Tait Shanafelt is co-inventor of the Mayo Leadership Impact Index. Mayo Clinic holds the copyright to this measure and has licensed it for use outside of the Mayo Clinic. Mayo Clinic shares a portion of the royalties with Dr. Shanafelt. As an international expert in clinician well-being, Dr. Shanafelt frequently presents grand rounds/keynote lectures and advises healthcare organizations on how to improve their practice environments. He receives honorarium for some of these engagements. Other authors have no potential conflicts of interest to disclose in this work.

References

1. Haas JS, Cook EF, Puopolo AL, Burstin HR, Cleary PD, Brennan TA. Is the professional satisfaction of general internists associated with patient satisfaction? *J Gen Intern Med*. 2000;15(2):122–128. doi:10.1046/j.1525-1497.2000.02219.x
2. Panagioti M, Geraghty K, Johnson J, et al. association between physician burnout and patient safety, professionalism, and patient satisfaction: a systematic review and meta-analysis. *JAMA Intern Med*. 2018;178(10):1317–1330. doi:10.1001/jamainternmed.2018.3713
3. Tawfik DS, Scheid A, Profit J, et al. Evidence relating health care provider burnout and quality of care: a systematic review and meta-analysis. *Ann Internal Med*. 2019;171(8):555–567. doi:10.7326/m19-1152
4. Hodkinson A, Zhou A, Johnson J, et al. Associations of physician burnout with career engagement and quality of patient care: systematic review and meta-analysis. *Br Med J*. 2022;378:e070442. doi:10.1136/bmj-2022-070442
5. Shanafelt TD, Mungo M, Schmitgen J, et al. Longitudinal study evaluating the association between physician burnout and changes in professional work effort. *Mayo Clin Proc*. 2016;91(4):422–431. doi:10.1016/j.mayocp.2016.02.001
6. Hamidi MS, Bohman B, Sandborg C, et al. Estimating institutional physician turnover attributable to self-reported burnout and associated financial burden: a case study. *BMC Health Serv Res*. 2018;18(1):851. doi:10.1186/s12913-018-3663-z
7. Balch CM, Oreskovich MR, Dyrbye LN, et al. Personal consequences of malpractice lawsuits on American surgeons. *J Am Coll Surg*. 2011;213(5):657–667. doi:10.1016/j.jamcollsurg.2011.08.005
8. Shanafelt T, Goh J, Sinsky C. The business case for investing in physician well-being. *JAMA Intern Med*. 2017;177(12):1826–1832. doi:10.1001/jamainternmed.2017.4340
9. Han S, Shanafelt TD, Sinsky CA, et al. Estimating the attributable cost of physician burnout in the United States. *Ann Internal Med*. 2019;170(11):784–790. doi:10.7326/m18-1422
10. Swensen S, Shanafelt TD *Cultivating leadership: measure and assess leader behaviors to improve professional well-being*. American Medical Association (AMA), Professional Satisfaction and Practice Sustainability Group; 2021. Available from: https://edhub.ama-assn.org/steps-forward/module/2774089. Accessed August 06, 2024.
11. Demmy TL, Kivlahan C, Stone TT, Teague L, Sapienza P. Physicians' perceptions of institutional and leadership factors influencing their job satisfaction at one academic medical center. *Acad Med*. 2002;77(12):1235–1240. doi:10.1097/00001888-200212000-00020
12. Shanafelt TD, Gorringe G, Menaker R, et al. impact of organizational leadership on physician burnout and satisfaction. *Mayo Clin Proc*. 2015;90(4):432–440. doi:10.1016/j.mayocp.2015.01.012
13. Dyrbye LN, Major-Elechi B, Hays JT, Fraser CH, Buskirk SJ, West CP. Relationship between organizational leadership and health care employee burnout and satisfaction. *Mayo Clin Proc*. 2020;95(4):698–708. doi:10.1016/j.mayocp.2019.10.041
14. Dyrbye LN, Major-Elechi B, Hays JT, Fraser CH, Buskirk SJ, West CP. Physicians' ratings of their supervisor's leadership behaviors and their subsequent burnout and satisfaction: a longitudinal study. *Mayo Clin Proc*. 2021;96(10):2598–2605. doi:10.1016/j.mayocp.2021.01.035
15. Mete M, Goldman C, Shanafelt T, Marchalik D. Impact of leadership behaviour on physician well-being, burnout, professional fulfilment and intent to leave: a multicentre cross-sectional survey study. *BMJ Open*. 2022;12(6):e057554. doi:10.1136/bmjopen-2021-057554
16. Stoller JK. Help wanted: developing clinician leaders. *Perspect Med Educ*. 2014;3(3):233–237. doi:10.1007/s40037-014-0119-y
17. Blumenthal DM, Bernard K, Bohnen J, Bohmer R. Addressing the leadership gap in medicine: residents' need for systematic leadership development training. *Acad Med*. 2012;87(4):513–522. doi:10.1097/ACM.0b013e31824a0c47
18. Frich JC, Brewster AL, Cherlin EJ, Bradley EH. Leadership development programs for physicians: a systematic review. *J Gen Intern Med*. 2015;30(5):656–674. doi:10.1007/s11606-014-3141-1
19. Sadowski B, Cantrell S, Barelski A, O'Malley PG, Hartzell JD. Leadership training in graduate medical education: a systematic review. *J Grad Med Educ*. 2018;10(2):134–148. doi:10.4300/jgme-d-17-00194.1
20. Onyura B, Crann S, Tannenbaum D, Whittaker MK, Murdoch S, Freeman R. Is postgraduate leadership education a match for the wicked problems of health systems leadership? a critical systematic review. *Perspect Med Educ*. 2019;8(3):133–142. doi:10.1007/s40037-019-0517-2
21. Mustafa S, Stoller JK, Bierer SB, Farver CF. Effectiveness of a leadership development course for chief residents: a longitudinal evaluation. *J Grad Med Educ*. 2020;12(2):193–202. doi:10.4300/jgme-d-19-00542.1

22. Geerts JM, Goodall AH, Agius S. Evidence-based leadership development for physicians: a systematic literature review. *Soc sci med*. 2020;246:112709. doi:10.1016/j.socscimed.2019.112709
23. Shanafelt T, Stolz S, Springer J, Murphy D, Bohman B, Trockel M. A blueprint for organizational strategies to promote the well-being of health care professionals. *NEJM Catal*. 2020;1(6). doi:10.1056/CAT.20.0266
24. Shanafelt TD, Trockel M, Rodriguez A, Logan D. Wellness-centered leadership: equipping health care leaders to cultivate physician well-being and professional fulfillment. *Acad Med*. 2021;96(5):641–651. doi:10.1097/acm.0000000000003907
25. Shanafelt TD, Wang H, Leonard M, et al. Assessment of the association of leadership behaviors of supervising physicians with personal-organizational values alignment among staff physicians. *JAMA Network Open*. 2021;4(2):e2035622. doi:10.1001/jamanetworkopen.2020.35622
26. Swensen SJ, Shanafelt TD. *Agency Action: Measuring Leader Behaviors. In: Mayo Clinic Strategies to Reduce Burnout: 12 Actions to Create the Ideal Workplace (Mayo Clinic Scientific Press)*. New York, NY: Oxford University Press; 2020. 105–120. doi:10.1093/med/9780190848965.003.0015
27. American Hospital Association, American Medical Association. Integrated leadership for hospitals and health systems: principles for success. *American Hospital Association (AHA) and American Medical Association*; 2015.Available from: https://www.aha.org/guidesreports/2015-06-03-integrated-leadership-hospitals-and-health-systems. Accessed August 06, 2024
28. Dyrbye LN, Leep Hunderfund AN, Winters RC, et al. The relationship between residents' perceptions of residency program leadership team behaviors and resident burnout and satisfaction. *Acad Med*. 2020;95(9):1428–1434. doi:10.1097/acm.0000000000003538
29. Leep Hunderfund AN, West CP, Rackley SJ, et al. Social support, social isolation, and burnout: cross-sectional study of U.S. residents exploring associations with individual, interpersonal, program, and work-related factors. *Acad Med*. 2022;97(8):1184–1194. doi:10.1097/acm.0000000000004709
30. Furukawa MF, Machta RM, Barrett KA, et al. Landscape of Health Systems in the United States. *Med Care Res Rev*. 2020;77(4):357–366. doi:10.1177/1077558718823130
31. Heeringa J, Mutti A, Furukawa MF, Lechner A, Maurer KA, Rich E. Horizontal and vertical integration of health care providers: a framework for understanding various provider organizational structures. *Int J Integr Care*. 2020;20(1):1–10. doi:10.5334/ijic.4635
32. Machta RM, Reschovsky JD, Jones DJ, Kimmey L, Furukawa MF, Rich EC. Health system integration with physician specialties varies across markets and system types. *Health Serv Res*. 2020;55(Supplement 3):1062–1072. doi:10.1111/1475-6773.13584
33. Kimmey L, Furukawa MF, Jones DJ, Machta RM, Guo J, Rich EC. Geographic variation in the consolidation of physicians into health systems, 2016-18. *Health Affairs*. 2021;40(1):165–169. doi:10.1377/hlthaff.2020.00812
34. Allcorn S.Using matrix organization to manage health care delivery organizations. *Hospital & Health Services Administration*. 1990;35(4):575–590.
35. Bhalla V, Gandarilla D, Watkins M. How to make your matrix organization really work. *MIT Sloan Manage Rev*. 2022;64(1):1–6.
36. Nunnally JC, Bernstein IH. *Psychometric Theory. 3rd* ed. New York, NY: Tata McGraw-Hill Education; 1994.
37. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *Int j Surg*. 2014;12(12):1495–1499. doi:10.1016/j.ijsu.2014.07.013
38. Eysenbach G. Improving the quality of web surveys: the checklist for reporting results of internet e-surveys (CHERRIES). *J Med Internet Res*. 2004;6(3):e34. doi:10.2196/jmir.6.3.e34
39. Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: building an international community of software platform partners. *J biomed informat*. 2019;95:103208. doi:10.1016/j.jbi.2019.103208
40. Trockel M, Bohman B, Lesure E, et al. A brief instrument to assess both burnout and professional fulfillment in physicians: reliability and validity, including correlation with self-reported medical errors, in a sample of resident and practicing physicians. *Acad Psychiatry*. 2018;42(1):11–24. doi:10.1007/s40596-017-0849-3
41. Shanafelt TD, Makowski MS, Wang H, et al. Association of burnout, professional fulfillment, and self-care practices of physician leaders with their independently rated leadership effectiveness. *JAMA Network Open*. 2020;3(6):e207961. doi:10.1001/jamanetworkopen.2020.7961
42. Shanafelt TD, Trockel M, Wang H, Mayer T, Athey L. Assessing professional fulfillment and burnout among CEOs and other healthcare administrative leaders in the United States. *J Healthc Manag*. 2022;67(5):317–338. doi:10.1097/jhm-d-22-00012
43. Rowe SG, Stewart MT, Van Horne S, et al. Mistreatment experiences, protective workplace systems and occupational distress in physicians. *JAMA Netw Open*. 2022;5(5):e2210768. doi:10.1001/jamanetworkopen.2022.10768
44. Makowski MS, Trockel M, Paganoni S, et al. Occupational characteristics associated with professional fulfillment and burnout among US physiatrists. *Am J Phys Med Rehabil*. 2023;102(5):379–388. doi:10.1097/phm.0000000000002216
45. Waddimba AC, Mohr DC, Beckman HB, Meterko MM. Physicians' perceptions of autonomy support during transition to value-based reimbursement: a multi-center psychometric evaluation of six-item and three-item measures. *PLoS One*. 2020;15(4):e0230907. doi:10.1371/journal.pone.0230907
46. Holmbeck GN. Toward terminological, conceptual, and statistical clarity in the study of mediators and moderators: examples from the child-clinical and pediatric psychology literatures. *J Consult Clin Psychol*. 1997;65(4):599–610. doi:10.1037//0022-006x.65.4.599
47. Trockel MT, Hamidi MS, Menon NK, et al. Self-valuation: attending to the most important instrument in the practice of medicine. *Mayo Clin Proc*. 2019;94(10):2022–2031. doi:10.1016/j.mayocp.2019.04.040
48. Shanafelt TD, Sloan J, Satele DV, Balch C. Why do surgeons consider leaving practice? *J Am Coll Surg*. 2011;212(3):421–422. doi:10.1016/j.jamcollsurg.2010.11.006
49. Shanafelt TD, Raymond M, Kosty M, et al. Satisfaction with work-life balance and the career and retirement plans of U.S. oncologists. *J Clin Oncol*. 2014;32(11):1127–1135. doi:10.1200/jco.2013.53.4560
50. Sinsky CA, Dyrbye LN, West CP, Satele DV, Tutty M, Shanafelt TD. Professional satisfaction and the career plans of US physicians. *Mayo Clin Proc*. 2017;92(11):1625–1635. doi:10.1016/j.mayocp.2017.08.017
51. Sinsky CA, Brown RL, Stillman MJ, Linzer M. COVID-related stress and work intentions in a sample of U.S. health care workers. *Mayo Clin Proc*. 2021;5(6):1165–1173. doi:10.1016/j.mayocpiqo.2021.08.007

52. Zumbo B, Gadermann A, Zeisser C. Ordinal versions of coefficients alpha and theta for likert rating scales. *J Mod Appl Stat Methods*. 2007;6 (1):21–29. doi:10.22237/jmasm/1177992180
53. Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika*. 1951;16(3):297–334. doi:10.1007/BF02310555
54. Price LR. *Psychometric Methods: Theory into Practice*. 1st ed. New York, NY: © The Guilford Press; Division of Guilford Publications, Inc.; 2017.
55. Flora DB, Curran PJ. An empirical evaluation of alternative methods of estimation for confirmatory factor analysis with ordinal data. *Psychological Methods*. 2004;9(4):466–491. doi:10.1037/1082-989x.9.4.466
56. Samejima F. Graded Response Models. In: van der Linden WJ, editor. *Handbook of Item Response Theory, Volume One: Models*. Boca Raton, FL: Chapman & Hall/CRC Press, Taylor & Francis Group; 2016:95–108.
57. Baker FB. *The Basics of Item Response Theory. 2nd* ed. College Park, MD: ERIC Clearinghouse on Assessment and Evaluation; 2001.
58. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. *2nd* ed. Mahwah, NJ: Lawrence Erlbaum Associates; 1988.
59. Kang JY, Lee MK, Fairchild EM, et al. Do organizational values and leadership impact staff engagement, wellbeing, and patient satisfaction? *J Healthc Leadersh*. 2023;15:209–219. doi:10.2147/jhl.S421692
60. Debets M, Jansen I, Lombarts K, et al. Linking leadership development programs for physicians with organization-level outcomes: a realist review. *BMC Health Serv Res*. 2023;23(783). doi:10.1186/s12913-023-09811-y
61. Kuerer HM, Eberlein TJ, Pollock RE, et al. Career satisfaction, practice patterns and burnout among surgical oncologists: report on the quality of life of members of the society of surgical oncology. *Ann Surg Oncol*. 2007;14(11):3043–3053. doi:10.1245/s10434-007-9579-1
62. Shanafelt TD, Balch CM, Bechamps GJ, et al. Burnout and career satisfaction among American surgeons. *Ann Surg*. 2009;250(3):463–471. doi:10.1097/SLA.0b013e3181ac4dfd
63. Cunningham CT, Quan H, Hemmelgarn B, et al. Exploring physician specialist response rates to web-based surveys. *BMC Med Res Method*. 2015;15(32). doi:10.1186/s12874-015-0016-z
64. Meyer VM, Benjamens S, Moumni ME, Lange JFM, Pol RA. Global overview of response rates in patient and health care professional surveys in surgery: a systematic review. *Ann Surg*. 2022;275(1):e75–e81. doi:10.1097/sla.0000000000004078
65. Graham JW, Schafer JL. On the performance of multiple imputation for multivariate data with small sample size. In: Hoyle RH, editor. *Statistical Strategies for Small Sample Research*. 1st ed. Thousand Oaks, California, USA: SAGE Publications, Inc; 1999:1–29.
66. Shanafelt TD, West CP, Sinsky C, et al. Changes in burnout and satisfaction with work-life integration in physicians and the general US working population between 2011 and 2020. *Mayo Clin Proc*. 2022;97(3):491–506. doi:10.1016/j.mayocp.2021.11.021
67. Haber MG, Cohen JL, Lucas T, Baltes BB. The relationship between self-reported received and perceived social support: a meta-analytic review. *Am J Community Psychol*. 2007;39(1–2):133–144. doi:10.1007/s10464-007-9100-9
68. Cohen S, Mermelstein R, Kamarck T, Hoberman HM. Measuring the functional components of social support. In: Sarason IG, Sarason BR, editors. *Social Support: Theory, Research and Applications*. Dordrecht: Springer Netherlands; 1985:73–94. doi:10.1007/978-94-009-5115-0_5
69. Lakey B, Cohen S. Social support theory and measurement. In: Cohen S, Underwood LG, Gottlieb BH, editors. *Social Support Measurement and Intervention: A Guide for Health and Social Scientists*. New York, NY: Oxford University Press; 2000:29–52. doi:10.1093/med:psych/9780195126709.003.0002