Ability of a 9-Item Well-Being Index to Identify Distress and Stratify Quality of Life in US Workers

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Objective: To determine whether the well-being index (WBI) can identify US workers in distress and stratify quality of life (QOL). **Methods:** We used data from 5392 US workers and 6880 physicians to evaluate the efficacy of the WBI and an expanded version of the WBI (eWBI) to identify individuals with distress (high fatigue, burnout, low QOL, and suicidal ideation) and high QOL. **Results:** Individuals with distress were more likely to endorse each of the WBI items as well as a greater number of total items (all $P < 0.001$). The eWBI improved stratification among individuals with low scores and also identified individuals with high QOL in both samples. **Conclusions:** The eWBI appears to be a useful screening tool to identify individuals in distress across a variety of domains and identify individuals with high well-being.

High workplace stress and mental health disorders are common among US workers.[1–3] Workers with mental health problems cost US employers $31 to $51 billion in lost productivity.[4,5] Mental health disorders are the leading cause for disability among working-aged US adults,[6] and among the most costly of all health conditions.[7] Although worksite wellness programs are becoming increasingly common[8,9] most are primarily aimed at physical health (exercise, nutrition, health risk assessments, tobacco-free campus, weight management, chronic disease management) with few formally addressing stress or mental health[8–10] despite an estimated 30%[11] of the approximate 130 million US workers[9] are likely to experience a mental health disorder over 12 months[11] with less than half seeking treatment.[11,12]

Mental health is indispensable to well-being and in need of immediate attention.[13] Health assessments offered as part of workplace wellness programs should include mental health screenings with feedback of results to workers. A simple screening tool that evaluates multiple relevant dimensions of distress could be used by individual workers at regular intervals to assess their current level of distress, indicate when the level of distress places the individual at increased risk for adverse consequences, identify those who may benefit most from individual support, and guide individuals toward resources. Mental health assessment could also help organizations gain a more complete understanding of the health of an organization[9] and guide prioritization of wellness programming and offerings. Existing mental health screening tools, however, are long, typically only measure one form of distress (eg, depression, anxiety, stress, fatigue, burnout), and are cumbersome to analyze.

To address this gap, we evaluated the ability of the 7-item well-being index (WBI), originally designed to be used in medical students and physicians,[14–16] to identify distress in a variety of dimensions (fatigue, burnout, low overall quality of life [QOL], and suicidal ideation) in the general US working population to see if this short instrument may have utility for evaluating distress in workers more broadly. In an effort to enhance the ability of the tool to identify individuals who are thriving, we also evaluated the efficacy of a 9-item WBI that included items exploring satisfaction with work life integration and meaning in work. Evidence suggests that work life integration and meaning in work may mitigate the relationship between job-related stress and psychological distress.[17–20] Accordingly, we hypothesized inclusion of work life integration and meaning in work would improve the ability of the WBI to stratify the risk of distress and better identify those with high QOL.

METHODS

Participants

Population Sample

To evaluate the utility of the WBI to identify distress in non-physicians, we surveyed a probability-based sample of working US adults aged 22 to 65 years in October 2014. As previously reported,[21] we conducted the survey using a probability-based panel (KnowledgePanel; Knowledge Networks) developed to be representative of the US population. Individuals in the panel were initially chosen scientifically by a random selection of addresses and telephone numbers. Then, they were invited to participate by mail or phone. Those who agreed to participate completed an online survey using their own computer or a computer provided by Knowledge Networks. Additional technical and process information is available at http://www.knowledgenetworks.com/ganp/reviewer-info.html. Demographic information collected on participants included age, sex, occupation, relationship status, current employment, hours worked per week, and highest level of education completed. Physicians (M.D. or D.O.) were excluded from the population sample. Participation was voluntary and all responses were anonymous.

Physician Sample

As previously described,[21] we also surveyed a sample of US physicians between August and September 2014 using the Physician Masterfile (PMF). The PMF is a nearly complete record of all US physicians independent of American Medical Association (AMA) membership. Participation was voluntary and all responses were anonymous.

Study Measures

The population and physician samples provided information on demographics and on overall QOL, fatigue, burnout, suicidal ideation, meaning in work, and satisfaction with work/life balance.

Well-Being Index

Previously, (1) we identified the domains of burnout, mental and physical QOL, depression, fatigue, and stress with input from

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experts; (2) derived items from standardized instruments to measure these dimensions using a brief 7-item screening tool; and (3) developed a 7-item screening instrument, the Medical Student WBI for use in medical students.[22,23] This instrument was then reviewed by an independent group and judged to be clear, relevant, and representative of the intended domain.[23] The ability of the instrument to identify each dimension of distress relative to gold-standard instruments was then evaluated in two separate samples of US medical students (2007: $n = 2248$; 2009: $n = 2682$).[22] As the dimensions of distress (ie, fatigue, depression, burnout, anxiety/stress, and mental/physical QOL) are also commonly experienced by physicians, a modified version of the 7-item WBI was subsequently validated in a sample of over 7000 US physicians and separate sample of 1701 residents.[14,15] Pooled analysis in over 13,000 medical students, residents/fellows, and physicians indicate that the WBI can identify individuals in distress, as well as identify those individuals whose degree of distress places them at risk for adverse professional consequences (eg, making medical error, low career satisfaction, intent to leave current position/medical school).[14,15,22] The sensitivity, specificity, positive predictive value, and negative predictive value of the WBI in samples of medical students, residents, and physicians for these outcomes have been published.[14–16] Use of an electronic version of the WBI has been shown to improve self-calibration and promote behavioral change to improve personal well-being in a national sample of US surgeons.[24] During the original development process the focus was on identifying those in distress. More recent data has suggested that high well-being may actually enhance care.[25–27] Although evidence suggests that individuals with more favorable scores on the WBI have higher professional satisfaction,[15] the index was not originally designed to distinguish between those with average well-being and those who are thriving.

Each of the original 7-item WBI items is answered ''yes/no'' with 1 point assigned for each ''yes'' response.[14–16,23,24] A total score (0–7) is calculated by adding the number of ''yes'' responses. In samples of physicians and medical students, every one point increase in score results in a step-wise increased probability of distress and risk for adverse personal or professional consequences.[14,15,22] For example, in a sample of 7288 US physicians the post-test probability of suicidal ideation is 0.6%, 5.7%, 10.3%, and 27.4% for those with WBI scores of 0, 3, 4, and 7, respectively.[14] Threshold scores (ie, ≥ 3) estimate the risk of distress in a group scoring at or above a specific value and can be used to identify a subset of individuals who may benefit from further evaluation. As with all screening tools, there are inherent trade-offs in sensitivity and specificity when applying a screening instrument to a population at risk. Our previous studies suggest the optimal threshold score to identify individuals in distress is ≥ 4 for medical students,[16] ≥ 4 for practicing physicians,[28] and ≥ 5 for residents.[15]

In the present study, in addition to evaluating the original 7-item WBI and scoring system (0–7 range with higher score indicative of worse well-being) in the general US working population we also evaluated an expanded 9-item version of the WBI (eWBI) that included two additional items assessing meaning in work and satisfaction with work life integration. For the eWBI, the first 7-items were scored in the traditional manner. To evaluate meaning in work, participants were asked to indicate the degree of meaning they derived from work using a question (''The work I do is meaningful to me'') from the Empowerment at Work Scale (7-point Likert scale; anchor ''very strongly disagree'' at the 1 end of the scale and ''very strongly agree'' at the 7 end of the scale).[29] Individuals who indicated a low level of meaning in work (response option of a 1 or 2 on the 7-point Likert scale) had 1 point added to their score while those who answered favorably (response option of a 6 or 7 on the 7-point Likert scale) had 1 point subtracted from their score. No adjustment to the total score was made for those who indicated neutral level of meaning in work (response option of 3 to 5 on the 7-point Likert scale). The second new item assessed satisfaction with work life balance by asking participants to indicate their level of agreement, with the statement ''My work schedule leaves me enough time for my personal/family life,'' (response options: strongly agree; agree; neutral; disagree; strongly disagree). This item has been used in numerous previous studies of both physicians and non-physicians.[30–35] Individuals who indicated lower satisfaction with work life integration (eg, disagree; strongly disagree) had 1 point added to their score while those who indicated higher satisfaction (agree, strongly agree) had 1 point subtracted from their score. Accordingly, the total score for the eWBI ranged from -2 to 9.

Other Study Measures

Overall QOL over the past week was measured on a standardized linear analog scale (0 = ''As bad as it can be''; 10 = ''As good as it can be''). This item has established validity for measuring overall QOL in a variety of medical conditions and populations.[36–38] A score $\geq 1/2$ standard deviation above or below the mean has been shown to have clinical relevance.[38] Participants also rated their level of fatigue during the previous week on a similarly validated 0 to 10-point linear analogue scale with response anchors ranging from ''as bad as it can be'' (0 points) to ''as good as it can be'' (10 points), consistent with previously published approach.[15,39–44] Greater fatigue is indicated by lower scores on this scale.

Burnout was measured using two single-item measures from the Maslach Burnout Inventory (MBI): ''I feel burned out from my work'' and ''I have become more callous toward people since I took this job''.[45] These two items correlate strongly with the emotional exhaustion and depersonalization domains of burnout, as measured by the full MBI in a sample of over 10,000 individuals.[46,47] The area under the receiver operating characteristic (ROC) curve for these single items relative to the full MBI is 0.94 and 0.93 for emotional exhaustion and depersonalization, respectively.[46,47] Individuals endorsing either symptom as occurring weekly or more often were considered to have symptoms of burnout.[46,47] This approach to measuring burnout has also been used in prior large scale national studies.[48,31]

Recent suicidal ideation was evaluated by asking, ''During the past 12 months, have you had thoughts of taking your own life?'' The item is similar to questions used in large US epidemiologic studies.[49,50]

Relationship to Other Variables

Given the various manifestations of distress (eg, depression, burnout, fatigue, QOL), we evaluated the ability of the WBI to detect distress in a variety of dimensions including its ability to:

1. identify individuals with low overall QOL as defined by a score $\geq 1/2$ standard deviation (SD) *below* the mean for the general population norm[30] (a clinically meaningful effect size[38])
2. identify individuals who had high fatigue (ie, an unfavorable level of fatigue) as defined by a score $\geq 1/2$ standard deviation (SD) *worse than* the mean for general population norm[30] (lower scores indicate higher fatigue)[51]
3. identify individuals who had high levels of burnout in either the emotional exhaustion and/or depersonalization domains as defined by endorsing symptoms of burnout weekly or more often on either of the single item MBI measures[46,47]
4. identify individuals who reported suicidal ideation within the last 12 months, a clinically relevant outcome that warrants individualized counseling.

The ability of the 9-item eWBI to stratify risk across these outcomes (low QOL, high fatigue, burnout, suicidal ideation) was also determined. In addition, to evaluate the ability of the 7-item

WBI and the 9-item eWBI to identify individuals who were thriving, we also assessed the ability of WBI and eWBI score to identify those with high overall QOL as defined by an overall QOL score $\geq$1/2 standard deviation (SD) *above* the mean for the general population norm (a clinically meaningful effect size[38]). The Mayo Clinic Institutional Review Board reviewed and approved the study.

Statistical Analysis

We used basic descriptive statistics and the Fisher exact test or chi-square test, as appropriate. We used a 5% type I error rate and a two-sided alternative. We calculated the univariate odds ratio (OR), post-test probabilities, and likelihood ratios (LRs) associated with WBI scores for outcomes of interest. Analysis was repeated using the eWBI and the new scoring algorithm in the population and physician samples. To compare the performance of the WBI and eWBI, we constructed ROC curves for the main outcomes of interest. We conducted all analysis using SAS version 9 (SAS Institute, Cary, NC).

RESULTS

Demographic and Work Characteristics of the General US Working Population Sample

Demographics of responders are shown in Table 1. As previously reported,[21] 54.4% (2934/5392) of responders were men, the median age was 52, 67.5% (3642/5392) were married, and the median hours worked/week was 40 (mean = 40; standard deviation $\pm$11.3). Forty-four percent (2348/5392) had a Bachelors degree or advanced degree (Master's or Professional/Doctorate degree).

The mean overall QOL score was 7.15 with 18.21% of men and 16.95% of women having low overall QOL (score less than 5.54 for men and less than 5.77 for women) and with 45.31% of men and 51.99% of women having high QOL (score greater than 7.74 for men and greater than 7.93 for women). The mean fatigue score was 5.57 and with 28.82% of men and 31.71% of women having high fatigue (score less than 4.46 for men and less than 4.30 for women). Twenty-eight percent (1503/5319 [28.3%]) had symptoms of burnout. Feelings of suicidal ideation in the last 12 months were reported by 4.0% (211/5332).

7-Item Well-Being Index

Respondents with low overall QOL were more likely to endorse each WBI item (Table 2) as well as a greater total number of items ($P < 0.0001$). As the number of WBI items endorsed increased so did the odds of having low overall QOL. Using exact WBI scores, the OR of low overall QOL ranged from 0.24 to 7.7 (Table 2). Assuming a 27% prevalence of low overall QOL (ie, the approximate prevalence for the general population norm[30]) as the pretest probability, the WBI exact score can lower the posttest probability to 10.6%, or raise it to 73.3% (Table 3).

Respondents with high levels of fatigue, burnout, or recent suicidal ideation were also more likely to endorse each WBI item and a greater number of total items (all $P < 0.001$). As the number of WBI items endorsed increased, so did the odds of high fatigue (OR, 0.48 to 4.0), burnout (OR, 0.06 to 7.50), and suicidal ideation (OR, 0.10 to 9.1). Assuming a prevalence of 31% for high fatigue as the pretest probability (ie, the approximate prevalence for the general population norm[30]), the WBI exact score can lower the posttest probability to 20.6% or raise it to 63.7% (Table 3). Assuming a prevalence of 28% for burnout as the pretest probability (ie, the approximate prevalence for the general population norm[30]), the WBI exact score can lower the posttest probability to 3.2% or raise it to 73.6%. Similarly, using a prevalence of 3.7% for recent suicidal ideation as the pretest probability (ie, the approximate prevalence for the general population[52]), the exact score can lower the posttest probability 0.5%, or raise it to 24.5%.

For low overall QOL, high level of fatigue, and recent suicidal ideation, the likelihood ratio was less than 1 for those with an exact score of less than 3 and greater than 1 for those with exact scores of 3 or higher. For burnout, the likelihood ratio was less than 1 for those with an exact score less than 2 and greater than 1 for those with exact scores of 2 or higher. Together, these findings suggest a score of 2 or 3 may be the optimal threshold score to identify an at risk population.

TABLE 1. Demographics of the Probability-Based Sample of the Employed US Population Aged 29 to 65 years

	Population $N = 5392$
Gender	
Male	2934 (54.4%)
Female	2458 (45.6%)
Age	
Median	52
29–34	526 (9.8%)
35–44	1076 (20.0%)
45–54	1550 (28.7%)
55–65	2240 (41.5%)
Relationship status	
Single	1300 (24.1%)
Married	3642 (67.5%)
Partnered	354 (6.6%)
Widowed/widower	96 (1.8%)
Missing	0
Hours worked/week	
Mean (SD)	40 (11.3)
Median	40
<40 hrs	1412 (26.2%)
40–49 hrs	2927 (54.4%)
50–59 hrs	702 (13.0%)
60–69 hrs	268 (5.0%)
70–79 hrs	36 (0.7%)
≥80 hrs	39 (0.7%)
Missing	8
Highest level of education completed	
Less than high school graduate	174 (3.2%)
High school graduate	1159 (21.5%)
Some college, no degree	1054 (19.5%)
Associate degree	657 (12.2%)
Bachelor's degree	1341 (24.9%)
Master's degree	745 (13.8%)
Professional or doctorate	262 (4.9%)
Missing	0
Occupation	
Professional*	2787 (52.3%)
Service†	342 (6.4%)
Sales‡	414 (7.8%)
Office and administrative support	428 (8.0%)
Farming, forestry fishing	22 (0.4%)
Precision production, craft and repair§	341 (6.4%)
Transportation and material	158 (3.0%)
Armed services	26 (0.5%)
Other	804 (15.1%)
Missing	107

SD, standard deviation.

*Business/financial, management, health care, computer/mathematical, architecture/engineering, lawyer/judge, life/physical/social sciences, community/social services, teacher non-university, teacher college/university, other.

†Protective service, food preparation/service, building cleaning/maintenance, personal care/service.

‡Sales representative, retails sales, other sales.

§Construction and extraction, installation/maintenance/repair, precision production (machinist, welder, backer, printer, tailor).

TABLE 2. 7-Item Well-Being Index (WBI) Items Endorsed by 5373 Individuals With and Without Low Overall Quality of Life (QOL), 2014*

Item	No. (%) Endorsing Item†		OR (95% CI)‡
	Individuals With Low Overall QOL ($n = 941$)	Individuals Without Low Overall QOL ($n = 4396$)	
During the past month:			
1. Have you felt burned out from you work?	706 (75.0%)	2348 (53.4%)	2.62 (2.24, 3.07)§
2. Have you worried that your work is hardening you emotionally?	439 (46.7%)	974 (22.2%)	3.07 (2.65, 3.56)§
3. Have you often been bothered by feeling down, depressed, or hopeless?	556 (59.1%)	927 (21.1%)	5.40 (4.66, 6.27)§
4. Have you fallen asleep while stopped in traffic or driving?	103 (10.9%)	226 (5.1%)	2.27 (1.78, 2.90)§
5. Have you felt that all things you had to do were piling up so high that you could not overcome them?	486 (51.6%)	1076 (24.5%)	3.30 (2.85, 3.81)§
6. Have you been bothered by emotional problems (such as feeling anxious, depressed, or irritable)?	598 (63.5%)	1365 (31.1%)	3.87 (3.34, 4.49)§
7. Has your physical health interfered with your ability to do your daily work at home and/or away from home?	338 (35.9%)	534 (12.1%)	4.05 (3.45, 4.76)§
No. of items endorsed			
0	99 (10.5%)	1445 (32.9%)	0.24 (0.19, 0.30)§
1	93 (9.9%)	985 (22.4%)	0.38 (0.30, 0.48)§
2	109 (11.6%)	725 (16.5%)	0.66 (0.545, 0.82)‖
3	164 (17.4%)	489 (11.1%)	1.69 (1.39, 2.05)§
4	162 (17.2%)	357 (8.1%)	2.35 (1.93, 2.88)§
5	147 (15.6%)	274 (6.2%)	2.79 (2.25, 3.45)§
6	129 (13.7%)	97 (2.2%)	7.04 (5.35, 9.26)§
7	38 (4.0%)	24 (0.5%)	7.66 (4.58, 12.84)§

CI, confidence interval; OR, odds ratio; QOL, quality of life.
*For the purposes of this study, low overall QOL was defined as having a mental standardized linear analog QOL score ≥1/2 standard deviation below 2010 normative group.[6]
†All WBI questions are answered "yes" or "no." One point is assigned for each "yes" response.
‡Odds ratio represents risk of low overall QOL in group of individuals that endorsed the item or the number of items relative to the referent group.
The WBI is copyrighted, and permission for use must be obtained by the author.
§$P < 0.0001$.
‖$P = 0.0002$.

TABLE 3. Efficacy of the Well-Being Index (WBI) for Identifying Low Overall Quality of Life (QOL), Unfavorable Fatigue, Recent Suicidal Ideation, and Burnout Among Individuals in the Population*

WBI Exact Score†	Low Overall QOL ($n = 941$)		High Fatigue ($n = 1620$)		Suicidal Ideation ($n = 211$)		Burnout ($n = 1503$)	
	LR‡	Post-Test Prob.§ %	LR	Post-Test Prob. %	LR	Post-Test Prob. %	LR	Post-Test Prob. %
0	0.32	10.6	0.58	20.6	0.14	0.6	0.09	3.2
1	0.44	14.1	0.66	22.8	0.25	1.0	0.55	17.4
2	0.70	20.7	0.81	26.6	0.63	2.4	1.10	29.5
3	1.57	36.8	1.32	37.0	1.58	5.7	1.71	39.5
4	2.12	44.1	1.50	40.1	1.6	5.8	2.72	50.9
5	2.51	48.2	2.85	55.9	3.04	10.5	4.92	65.2
6	6.21	69.8	3.25	59.2	4.47	14.7	5.90	69.2
7	7.4	73.3	3.93	63.7	8.44	24.5	7.30	73.6

LR, likelihood ratio; QOL, quality of life; WBI, well-being index.
*We defined (1) low overall QOL as having as mental standardized linear analog QOL score ≥1/2 standard deviation below that of the sex-matched general population, (2) high fatigue as having a fatigue standardized linear analog score ≥1/2 standard deviation below that of the sex-matched general population (high score is favorable), (3) recent suicidal ideation as endorsing experiencing suicidal ideation within the previous 12 months, and (4) burnout as answering "a few times a week or more" to either of the single item MBI measures.
†The WBI exact score is the number of the seven WBI items endorsed.
‡LR indicates the likelihood ratio associated with the exact score.
§Posttest probability was calculated using an estimated prevalence of 27.11% for low overall QOL, 30.84% for high fatigue, 3.7% for suicidal ideation, and 27.6% for burnout as the pretest probability.

TABLE 4. Efficacy of the Expanded 9-Item Well-Being Index (eWBI) for Identifying Low Overall Quality of Life (QOL), High Fatigue, Recent Suicidal Ideation, and Burnout Among Individuals in the Population*

	Low Overall QOL ($n = 941$)		High Fatigue ($n = 1620$)		Suicidal Ideation ($n = 211$)		Burnout ($n = 1503$)	
9-Item e WBI Exact Score†	LR‡	Post-Test Prob. %§	LR	Post-Test Prob. %	LR	Post-Test Prob. %	LR	Post-Test Prob. %
−2	0.12	4.3	0.61	21.3	0.17	0.6	0.06	2.1
−1	0.32	10.8	0.55	19.8	0.08	0.3	0.21	7.4
0	0.46	14.6	0.59	20.9	0.50	1.9	0.41	13.5
1	0.74	21.6	0.78	25.7	0.56	2.1	0.93	26.2
2	1.24	31.6	1.21	35.1	1.34	4.9	1.33	33.7
3	1.35	33.4	1.36	37.8	1.34	4.9	2.22	45.9
4	2.41	47.3	1.71	43.2	1.48	5.4	3.06	53.9
5	2.91	52.0	2.31	50.7	3.15	10.8	5.71	68.5
6	5.19	65.9	3.39	60.2	3.61	12.2	7.66	74.5
7	8.88	76.8	4.1	64.6	5.63	17.8	9.33	78.1
≥8‖	10.09	79.0	6.98	75.7	5.46	17.3	16.49	86.3

LR, likelihood ratio; MBI, Maslach Burnout Inventory; QOL, quality of life; WBI, well-being index.

*We defined (1) low overall QOL as having as mental standardized linear analog QOL score ≥1/2 standard deviation below that of the sex-matched general population, (2) high as having a fatigue standardized linear analog score ≥1/2 standard deviation below that of the sex-matched general population (high score is favorable), (3) recent suicidal ideation as endorsing experiencing suicidal ideation within the previous 12 months, and (4) burnout as answering "a few times a week or more" to either of the single item MBI measures.

†The WBI exact score is the number of the seven WBI items endorsed.

‡LR indicates the likelihood ratio associated with the exact score.

§Posttest probability was calculated using an estimated prevalence of 27.11% for low overall QOL, 30.84% for high fatigue, 3.7% for suicidal ideation, and 27.6% for burnout as the pretest probability.

‖These categories were pooled because of the very small number of individuals with a score of 9 ($n = 12$).

9-Item Expanded Well-Being Index

A total of 2617 individuals had a score for both the 7-item and 9-item instruments. The greatest redistribution occurred in stratification of respondents with the two most favorable scores on the 7-item instrument (scores of 0 and 1) into six categories (scores of −2, −1, 0, 1, 2, and 3) on the eWBI, consistent with the intent for the 9-item instrument to stratify individuals with low levels of distress on the 7-item tool into different categories well-being (eg, neutral vs. thriving/flourishing). Among the 2617 individuals who had a score of 0 or 1 on the 7-item instrument 871 (33.3%) had a −2 score on the 9-item instrument, 881 (33.7%) a score of −1, 554 (21.2%) a score of 0, 226 (8.6%) a score of 1, 68 (2.6%) a score of 2, and 17 (0.7%) a score of 3.

Next, we examined the ability of the eWBI to both stratify individuals with distress as well as identify those with high well-being (Table 4). Overall, the ability to stratify risk of distress appeared similar to that of the 7-item instrument.

We next evaluated the ability of the 9-item instrument to identify those with high QOL. Respondents with high overall QOL endorsed fewer eWBI items ($P < 0.0001$). Using a 42% prevalence of high overall QOL (ie, the approximate prevalence of high QOL in a previously published sample of the general population[30]) as the pretest probability, the eWBI exact score raised the posttest probability to as high as 73.8% or as low as 4.6% (Table 5).

Validation Cohort Evaluation of the Expanded WBI

Based on the performance of the eWBI in the population cohort, we next evaluated the ability of the eWBI to both improve stratification of distress as well as identify well-being in an independent cohort of 6880 physicians. The ability of the eWBI to identify physicians with low overall QOL, high fatigue, suicidal ideation, and burnout is shown in Supplement Digital Content eTable 1 (http://links.lww.com/JOM/A292). Respondents with low overall QOL, high fatigue, suicidal ideation, and burnout were more likely to endorse each eWBI item as well as have a higher mean score ($P < 0.0001$). Using pretest probabilities based on prevalence rates in a separate national sample of physicians,[30] the range of posttest probabilities was 0.9% to 80.3% for low QOL, 8.8% to 79.2% for high fatigue, 0.3% to 29.7% for recent suicidal ideation, and 5.4% to 96.8% for burnout. The eWBI also stratified high QOL (Supplemental Digital Content eTable 2, http://links.lww.com/JOM/A292). With a pretest probability of 29.01%,[30] the eWBI can lower the posttest probability of having a high QOL to 2.0% or raise it to 69%.

Comparison of 7-Item and 9-Item Expanded WBI

Next we constructed ROC curves for main outcomes of interest to determine which version of the WBI better predicts high QOL, low QOL, burnout, and high fatigue (Table 6). In both the population and the physician cohort the eWBI resulted in higher area under the curve (AUC) for high QOL, low QOL, burnout, and high fatigue, suggesting the 9-item eWBI may be better at predicting these outcomes than the 7-item PWBI.

DISCUSSION

In this national cohort of 5392 working US adults the 7-item WBI stratified individual's well-being and identified those at risk for low QOL, high fatigue, suicidal ideation, and burnout. This study expands existing validity data published in medical students, residents, and physicians,[14,15,22] and suggests this simple 7-item index has utility for identifying fatigue, burnout, depression, and suicidal ideation in workers broadly. We also found that expanding the WBI to include two additional items assessing work life integration and meaning in work improved the ability of the index to stratify individuals in distress and stratify individuals with more positive well-being, a finding true in both the training and validation cohort.

The eWBI has a number of characteristics that lends itself well to a screening instrument. Even in its expanded form of nine

TABLE 5. Ability of the Expanded 9-Item Well-Being Index (eWBI) and 7-Item Well-Being Index (WBI) to Identify Individuals With High Overall Quality of Life (QOL)*

9-Item eWBI Exact Score†	LR‡	Post-Test Probability§	7-Item Exact Score†	LR‡	Post-Test Probability§
−2	3.79	73.8	–	–	–
−1	2.02	60.0	–	–	–
0	1.28	48.8	0	2.4	64.2
1	0.99	42.5	1	1.43	51.7
2	0.66	32.8	2	0.99	42.5
3	0.53	28.2	3	0.55	28.9
4	0.33	19.8	4	0.4	22.9
5	0.28	17.2	5	0.29	18.0
6	0.17	11.0	6	0.16	10.9
≥7‖	0.06	4.6	7	0.18	11.9

LR, likelihood ratio; WBI, well-being index.
*We defined high overall QOL as having as mental standardized linear analog QOL score ≥1/2 standard deviation above that of the general population.
†The eWBI exact score is the number of the seven WBI items endorsed and responses to the meaning in work and work life balance items. The WBI exact score is the number of the seven WBI items endorsed (see methods).
‡LR indicates the likelihood ratio associated with the exact score.
§Posttest probability was calculated using an estimated prevalence of 42.7% for high overall QOL.
‖These categories were pooled because of very small number of individuals with high QOL and a score of 7 ($n=5$), 8 ($n=3$), or 9 ($n=2$).

items, the eWBI is brief, takes a short time to complete (less than 1 minute), is simple to score, and has national benchmark data. In this regard, the eWBI may be easier to use than other screening instruments which tend to be long, more complicated to score/analyze, and typically assess only one form of distress (eg, depression or burnout).[14–16] Given these features, the eWBI could be used by individuals wishing to assess their current level of well-being, learn how their well-being compares to others, and gain an insight into whether their current level of distress is placing them at risk for potentially serious consequences. Receiving such information has been shown in a study of US surgeons to prompt consideration of behavioral change to promote well-being across a number of dimensions.[24] In sum, these findings suggest that either the 7-item or the 9-item WBI may be used in other health care workers (nurses, pharmacists, etc).

The eWBI could also be useful for organization to encourage help-seeking behaviors before distress places individuals at higher risk for an adverse personal or costly professional consequence. In addition, employee scores could be aggregated and de-identified by a third party to allow for reports of scores being used to explore well-being of employees by a variety of demographic factors (years employed, age, sex, job category) and track well-being over time to gain insight into potential ramifications of new organization strategy on employee satisfaction, retention, and well-being. Data suggests workplace-based interventions for workers with common mental health conditions can improve work disability outcomes, work function and productivity, and reduce cost.[10,53]

TABLE 6. Area Under the Curve for Efficacy of the 7-Item and Expanded 9-Item Well-Being Index (eWBI) for Identifying High Overall Quality of Life (QOL), Low Overall QOL, Fatigue, Burnout, and Recent Suicidal Ideation

	Area Under Curve	
	7-Item PWBI	9-Item ePWBI
Population sample		
High QOL	0.7050	0.7343
Low QOL	0.7411	0.7767
High fatigue	0.6499	0.6560
Burnout	0.8034	0.8245
Physician sample		
High QOL	0.7804	0.8009
Low QOL	0.8086	0.8376
High fatigue	0.7285	0.7406
Burnout	0.8408	0.8509

QOL, quality of life.

This study has several limitations. First, the 7-item WBI was developed specifically for medical students, and later modified for physicians. Other domains of distress than those assessed by the WBI may be important for others who work in different careers, particularly if outside of health care. Second, distress is a multi-dimensional construct without a gold standard. We chose to evaluate four clinically relevant dimensions of distress (QOL, fatigue, suicidal ideation, and burnout) with potentially serious personal and professional consequences. While this study suggests the 7-item WBI and 9-item eWBI stratify risk across these important dimensions, the ability of the WBI/eWBI to do so in other dimensions of distress in unknown. Third, the WBI/eWBI is a screening and not a diagnostic tool. As such individuals who score unfavorably warrant further evaluation to best guide appropriate allocation of existing resources. Fourth, given the cross-sectional design of this study additional research is needed to determine the WBI/eWBI's predictive validity. Despite these limitations, our methodological approach included validated metrics to measure QOL, fatigue, and burnout and explored relationship between WBI scores and relevant personal and professional outcomes in two separate cohorts to establish construct and criterion validity of the WBI/eWBI in both the general working population and physicians. Fifth, the standard tools to assess QOL, fatigue, suicidal ideation, and burnout measures asked about the presence of symptoms over variable time intervals (''during the past week'', ''last 12 months'', etc). In contrast, the WBI/eWBI items intentionally use a consistent time interval (eg, the last month) to assess current well-being. Despite the differences in the interval assessed for the various full length instruments, our findings suggest the WBI/eWBI items are strongly associated with each outcome (QOL, fatigue, suicidal ideation, and burnout) evaluated. Although the differences in time periods might contribute to contamination of each health outcome in term of duration of symptom the relationships and areas under the curve were strong.

In summary, results from this study suggest the WBI/eWBI is a useful screening tool to identify distress across a variety of

domains in the general population. The addition of two items evaluating work life integration and meaning in work improves the ability of the eWBI to stratify individuals in both the general population and physician sample with more positive well-being, and to predict low QOL, high QOL, and burnout. Additional studies are needed to determine employees willingness to participate in a screening process, how best to provide individualized feedback, and ultimately determine if screening encourages appropriate help-seeking behaviors and improves the well-being and career satisfaction of working adults.

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