Flourishing as a Measure of Global Well-being in First Year Residents: A Pilot Longitudinal Cohort Study

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Journal of Medical Education and Curricular Development
Volume 8: 1–8

DOI: 10.1177/23821205211020758
SAGE

ABSTRACT

BACKGROUND: Physician well-being is critical to optimal learning and performance, yet we remain without validated measures to gauge the efficacy of well-being curricula for trainees. This study evaluates initial evidence of flourishing as a valid measure of global well-being in postgraduate-year-1 residents (PGY-1s), providing a means of assessing well-being intervention efficacy.

STUDY DESIGN: In this single-site study of PGY-1s participating in Enhanced Stress Resilience Training (ESRT), an online questionnaire of published measures was administered at baseline (T1, just before PGY-1), post-ESRT (T2, 7 weeks later), and at PGY-1 end (T3, 11 months later). The Mental Health Continuum (MHC) was used to assess our primary outcome variable, flourishing, a well-established metric of psychosocial thriving in non-physicians that can be treated continuously or categorically. Correlation between flourishing and both resilience (mindfulness and workplace support) and risk (emotional exhaustion, depersonalization, stress, depressive symptoms, anxiety, and workplace demand) factors was assessed at each time-point and longitudinally.

RESULTS: Forty-five interns completed the survey at T1, 37 at T2, and 21 at T3; 21 responded at all time points. MHC score was significantly positively correlated with mindfulness ($\beta = 1.47$, SE = 0.35, $P < .001$) and workplace support ($\beta = 2.02$, SE = 1.01, $P = .05$) longitudinally, and at all time points. Flourishing was significantly negatively correlated with depressive symptoms ($\beta = -7.48$, SE = 1.68, $P < .001$), stress ($\beta = -1.28$, SE = 0.29, $P < .001$), and anxiety ($\beta = -1.74$, SE = 0.38, $P < .001$) longitudinally and at all time points, and significantly negatively correlated with emotional exhaustion ($\beta = -2.65$, SE = 0.89, $P = .003$) longitudinally and at T1 ($\beta = -3.36$, SE = 1.06, $P = .003$).

CONCLUSION: Flourishing showed appropriate correlation with established resilience and risk factors, thus supporting its concurrent validity as a measure of global well-being in this population. As such, the MHC may provide a simple, meaningful assay of well-being and an effective tool for evaluating the efficacy of well-being interventions. Further validation requires a larger, multi-center study.

KEYWORDS: Surgical resident well-being, mindfulness for surgeons, flourishing, job strain, distress, surgical education

RECEIVED: March 24, 2021. **ACCEPTED:** May 10, 2021.

TYPE: Original Research

FUNDING: The author(s) received no financial support for the research, authorship, and/or publication of this article.

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Background

Physician well-being is a critical component of sustainable healthcare,[1] yet burnout,[2] depression,[3] and attrition[4] remain alarmingly high. Due to the COVID-19 pandemic, the stressors of clinical training were exacerbated by social isolation, risk of COVID-19 exposure, and increased workplace uncertainty.[5] Increasing evidence suggests that both individual- and workplace-level interventions are necessary to both promote and sustain physician well-being,[2,6,7] and to minimize pathology. This is exemplified by the recent Accreditation Council for Graduate Medical Education (ACGME) mandate for accredited programs to implement and evaluate well-being interventions for all trainees and faculty. However, within this realm of study we remain without a validated measure of well-being for physicians (or trainees), much less one which accounts for individual differences, or the modern conceptualization of well-being as a complex state of positive affect, belonging, and purpose.[8] This limits our ability to evaluate individual needs, assess intervention efficacy, and target precious resources.

To address this gap, we hypothesized that flourishing is an appropriate measure of global (i.e. multi-faceted) well-being that can be used over time to assess changes in individual well-being and thereby evaluate the efficacy of interventions. Flourishing as measured by the Mental Health Continuum (MHC), is defined as positive social, emotional, and psychological functioning (3 related but distinct domains of mental health)[9] which acknowledges the complex construct that is global individual well-being. Furthermore, there exists a rich and long-standing body of evidence demonstrating occupational and clinical relevance, with flourishing positively associated with greater job satisfaction,[10-12] and negatively associated with the risk of future mental illness,[13] healthcare utilization,[14] suicidality,[15] and mortality[16] in large studies of non-physicians. Validity of the MHC has been demonstrated in a more rigorous

and faceted way than arguably any extant assay of well-being, to date. Such a well contextualized, vetted, and succinct measure is perfect for evaluating the critical asset of well-being in time-compressed surgeons. In a longitudinal study of mixed-specialty post-graduate-year 1 (PGY-1s) medical trainees, individuals who were flourishing were found to have lower depressive symptom scores throughout the year than those who were not.[17] Our prior work suggests flourishing as a potential measure of individual global well-being within surgery,[18] as evidenced by cross-sectional association with high resilience factors and low risk factors in mixed PGY-level surgical trainees. Additionally, we found higher mindfulness to be correlated with higher flourishing. This suggests that Enhanced Stress Resilience Training (ESRT), a mindfulness-based curricular intervention tailored to surgeons and shown to increase mindfulness,[19] might serve as an individual-level intervention effective at promoting global, that is, multi-domain, well-being.

In this pilot longitudinal cohort study of mixed-specialty PGY-1 trainees in 3 procedural-based specialties (i.e. General Surgery (GS), Emergency Medicine (EM), and Obstetrics & Gynecology (Ob/Gyn)) who received ESRT, we evaluated initial evidence of the validity of flourishing as a measure of well-being in these populations. Further, we explored the association of flourishing with modifiable individual- and workplace-level factors. Our goal was to provide early data on targets and metrics to guide the design and evaluation of future curricular well-being interventions.

Methods

Study design

A longitudinal, single-institution, cohort study of mixed-specialty PGY-1 trainees was conducted from 2019 to 2020. An online survey instrument was administered at baseline (T1, prior to initiation of PGY-1), immediately after ESRT completion (T2, 7 weeks later) and end of PGY-1 (T3, 11 months later). The study was approved by UCSF's institutional review board and informed consent was obtained for all participants.

Study population

Forty-six incoming interns participated in ESRT, with a 77% attendance rate across all 5 sessions of the class. Most cited reasons for non-attendance were being with an unstable patient post-call or holding the team pager. The study was limited to PGY-1 trainees (1) to allow the largest possible single-institution sample of surgical trainees with a highly similar 12-month experience and (2) to capture the effect of new exposure to residency stressors on our metrics of interest. The study population included only individuals who were exposed to ESRT, which is an individual-level mental skills training program tailored to surgeons and described in detail elsewhere.[19-21] Briefly, ESRT is comprised of 5 weekly 60-minute classes, centered on the development of 3 key cognitive skills: interoception (i.e. moment-to-moment situational awareness of thoughts, emotions, and sensations), emotional regulation (i.e. learned nonreactivity in response to these stimuli), and meta-cognition (i.e. awareness of non-reactivity and utilization under stress). Skills are taught through experiential training in various contemplative practices (mindful sitting, walking, and standing meditation, breath awareness, body-scan, qi gong), and scaffolded onto a conceptual framework explaining the relationship to cognitive training and stress resilience in physicians. Skills are explicitly applied to surgery, hospital-based work, and the challenges of maintaining well-being during demanding training. Focus is on informal (i.e. "throughout the day") practice. ESRT has proven to be feasible, acceptable, and effective in small randomized trials of surgical trainees, showing increased mindfulness and improvements in burnout, cognition, and physiologic markers of stress.[19-21] While the effects of ESRT have been shown to persist over time, the skills taught can and likely should be reinforced by intermittent "booster sessions" after course completion.

Survey instrument

An online survey was used to collect basic demographic information (Table 1) and to measure the presence of resilience (characterized by high positive emotions, acceptance/nonreactivity to stressors, and connectedness/high social support, as defined by seminal works in the field of resilience science[22-27]) and presence of distress (characterized by high burnout, stress, anxiety or depressive symptoms, as defined by multiple works exploring distress and burnout in surgery).[2-4] These Likert scale-based measures have been found reliable in our prior work and were scored according to published methods.

Our primary outcome variable, flourishing, was assessed through the *Mental Health Continuum-Short Form (MHC-SF)*, a 14-item measure of individual social, emotional, and psychological mental health domains, with strong internal consistency (>0.80)[28] and strong literature base of clinical relevance.[29] Similar to standard diagnostic criteria for depression, the MHC-SF items are scored according to the frequency with which respondents experience each symptom of positive mental health. Per convention, scores can be treated categorically to identify flourishing (i.e. experiencing high positive functioning and high positive emotions 'every day' or 'almost every day') or languishing (i.e. 'never' experiencing, or only experiencing 'once or twice in the past month' high positive functioning and high positive emotions). Scores can also be treated continuously.[30] In our work, we use both the categorical (i.e. 'flourishing') and continuous (i.e. 'MHC score') forms of this measure.

To assess individual-level risk and resilience factors, we used the *Cognitive Affective Mindfulness Scale-Revised (CAMS-R)* a 10-item measure of both dispositional and trained mindfulness in the form of attention, present-focus, awareness, and acceptance,[3] with good reliability (0.7-0.74)[31] and a calculated global score, shown to increase with mindfulness training.[17] Higher scores

Table 1. Participant characteristics and scores at each time point.

PARTICIPANT CHARACTERISTICS	TIME 1 (N=45)	TIME 2 (N=37)	TIME 3 (N=21)
Specialty, % (n)			
EM	20.0 (9)	21.6 (8)	14.3 (3)
GS	57.8 (26)	51.4 (19)	57.1 (12)
Ob/Gyn	22.2 (10)	27.0 (10)	28.6 (6)
Gender identity, % (n)			
Female	66.7 (30)	65.7 (23)	76.2 (16)
Male	31.1 (14)	31.4 (11)	23.8 (5)
Other	2.1 (1)	2.9 (1)	0 (0)
SCORES OF ALL RESPONDENTS AT EACH TIME POINT	**TIME 1 (N=45)**	**TIME 2 (N=37)**	**TIME 3 (N=21)**
Wellbeing			
MHC total score, mean (SD)	49.89 (11.29)	51.95 (9.51)	48.76 (14.16)
Flourishing, % (n)	73.3 (33)	70.3 (26)	71.4 (15)
Resilience, mean (SD)			
CAMS-R	26.16 (4.22)	27.22 (3.77)	27.76 (5.02)
DCSQ-Support	17.33 (2.07)	17.70 (1.82)	16.67 (2.35)
Risk, mean (SD)			
PHQ	0.84 (0.95)	0.49 (0.73)	1.05 (1.02)
MBI-EE	2.18 (1.47)	2.24 (1.16)	2.90 (1.34)
MBI-DP patients	1.29 (1.34)	1.70 (1.68)	2.10 (1.45)
MBI-DP colleagues	1.09 (1.28)	1.32 (1.16)	1.76 (1.41)
PSS	17.38 (6.41)	16.68 (4.63)	17.95 (5.90)
STAI	13.04 (3.57)	11.08 (2.88)	11.67 (3.79)
DCSQ-Demand	15.82 (1.28)	16.38 (1.44)	16.14 (2.31)
SCORES OF RESPONDENTS WHO COMPLETED SURVEY AT ALL 3 TIME POINTS	**TIME 1 (N=21)**	**TIME 2 (N=21)**	**TIME 3 (N=21)**
Wellbeing			
MHC total score, mean (SD)	49.29 (13.29)	53.90 (10.09)	48.76 (14.16)
Flourishing, % (n)	71.4 (15)	85.7 (18)	71.4 (15)
Resilience, mean (SD)			
CAMS-R	25.56 (3.97)	27.33 (3.93)	27.76 (5.02)
DCSQ-Support	17.76 (1.81)	17.76 (1.87)	16.67 (2.35)
Risk, mean (SD)			
PHQ	0.90 (1.04)	0.62 (0.74)	1.05 (1.02)
MBI-EE	2.52 (1.36)	2.24 (0.89)	2.90 (1.34)
MBI-DP patients	1.52 (1.50)	1.76 (1.48)	2.10 (1.45)
MBI-DP colleagues	1.05 (1.36)	1.19 (1.03)	1.76 (1.41)
PSS	17.90 (5.89)	16.81 (5.53)	17.95 (5.90)
STAI	13.67 (3.55)	10.10 (2.79)	11.67 (3.79)
DCSQ-Demand	16.14 (1.01)	16.38 (1.47)	16.14 (2.31)

Abbreviations: CAMS-R, Cognitive Affective Mindfulness Scale Revised; DCSQ, Demand-Control-Support Questionnaire; DP, depersonalization; EE, emotional exhaustion; EM, emergency medicine; GS, general surgery; MBI, Maslach Burnout Inventory; MHC, mental health sontinuum-short form; Ob/Gyn, obstetrics & gynecology; PHQ, Patient Health Questionnaire; PSS, Perceived Stress Scale; SD, standard deviation; STAI, State Trait Anxiety Index.

associated with lower odds of distress in surgical trainees[3,31]; *modified Maslach Burnout Inventory (MBI)*, a 1-item validated screen for high emotional exhaustion (EE)[32] and a 2-item screen for depersonalization (DP) toward patients and colleagues, each associated with multiple negative sequelae in surgical trainees; *Cohen's Perceived Stress Scale (PSS)*, a 10-item widely-used measure of stress, with good internal consistency (>0.80),[33,34] normative data for men and women aged 18 to 34, and high scores correlated with cognitive impairment, missed work and disability[35]; and *Spielberger's State Trait Anxiety Index (STAI)*, a 6-item measure of subjective feelings (e.g. apprehension, tension) and autonomic arousal[36-40] correlated with state anxiety, used with surgical trainees in real-life and simulated trauma scenarios, with good internal consistency (0.92)[41] and a cutoff of ⩾40 used in other studies to denote high anxiety[39,40]; and *Patient Health Questionnaire-2 (PHQ-2)*, a 2-item rigorously evaluated and validated depression screening tool,[42] with a total score of ⩾3 correlated with increased use of clinical resources.[29]

Finally, we explored the influence of workplace risk and resilience factors through use of the *Swedish Demand-Control-Support Questionnaire (DCSQ)*, a 16-item measure of job strain, with good internal consistency (0.7-0.85)[43] rooted in Job Demand-Resource theory, with sub-domains for risk factors (psychological demand) and resilience factors (control and social support),[44,45] and 'High' and 'Low' subdomain cut-offs respectively defined by convention as scores in the upper or lower tertile of possible scores.[43] Only demand and social support (12 items) were assessed here.

Data analysis

At each of the 3 time points, all measures of interest were described overall and by flourishing status. Correlation was assessed between total MHC score and each continuous variable using linear regression. Logistic regression was used to test for differences in each measure by the binary flourishing variable.

Longitudinally, repeated measures generalized estimating equation (GEE) linear regression models,[46] which account for within-person correlation, were used to assess trends in continuous measures over time, along with the associations between continuous measures. The Cochran-Armitage exact test for trend was used for the binary flourishing variable. Hypothesis tests were two-sided, and the significance threshold was set to 0.05. Statistical analyses were performed using SAS version 9.4.

Results

Respondents

Forty-five of the 46 ESRT participants completed the online survey at T1 (baseline, prior to start of PGY-1), 37 at T2 (post-ESRT) and 21 at T3 (12-month follow-up) (Table 1). Twenty-one participants (3 EM, 12 GS, and 6 Ob/Gyn; 76% female-identifying, 24% male-identifying) had survey responses at all 3 time-points (Table 1).

Flourishing over time

Among the 21 participants who responded to the survey at all 3 time points, the MHC score increased from T1 (49.29) to T2 (53.90), and then decreased below the T1 level at T3 (48.76). Among the 21 participants who responded to the survey at all 3 time points, the prevalence of flourishing increased from T1 (76.2%) to T2 (85.7%), and then returned to the T1 level at T3 (76.2%). Neither trend was significant (respectively, $P = .84$ and $P = .99$).

Mindfulness over time

Among the 21 participants who responded to the survey at all 3 time points, the raw CAMS-R scores increased from T1 (25.56) to T2 (27.33) and then again from T2 to T3 (27.76). This trend was significant (slope = 0.69, SE = 0.30, $P = .02$).

Validity of flourishing as a measure of well-being

In terms of the resilience factors, total MHC score was significantly and positively correlated with mindfulness at T1 (CAMS-R, β = 1.29, SE = 0.36, $P = .001$), T2 (β = 1.51, SE = 0.34, $P < .0001$), and T3 (β = 1.79, SE = 0.50, $P = .002$) and with workplace support at T1 (DCSQ-Support, β = 1.65, SE = 0.79, $P = .04$), T2 (β = 2.72, SE = 0.75, $P = .001$) and T3 (β = 3.11, SE = 1.18, $P = .02$, Table 2). At T1 and T2, flourishing was significantly and positively correlated with CAMS-R (T1 OR = 1.28, CI 1.04-1.59, $P = .02$; T2 OR = 1.94, CI 1.25-3.00, $P = .003$) and DCSQ-Support (T1 OR = 1.84, CI 1.16-2.93, $P = .01$; T2 OR = 1.85, CI 1.12-3.07, $P = .02$). At T3, the correlation between flourishing and CAMS-R (T3 OR = 1.21, CI 0.95-1.54, $P = 0.12$) and DCSQ-Support (T3 OR = 1.57, CI 0.87-2.85, $P = .13$) did not reach significance.

From the repeated measures models, total MHC score was significantly positively correlated with CAMS-R (β = 1.47, SE = 0.35, $P < .001$) and DCSQ-Support (β = 2.02, SE = 1.01, $P = .05$) (Table 3). Flourishing was significantly positively correlated with CAMS-R (OR = 1.37, CI 1.15-1.64, $P = .001$) but the correlation between flourishing and DCSQ-Support did not reach significance (OR = 1.43, CI 0.95-2.17, $P = .09$).

In terms of the risk factors, at T1, total MHC score was significantly negatively correlated with emotional exhaustion (MBI-EE, β = −3.36, SE = 1.06, $P = .003$), depersonalization (MBI-DP patients, β = −2.86, SE = 1.21, $P = .02$), stress (PSS, β = −0.98, SE = 0.22, $P < .0001$), anxiety (STAI β = −2.02, SE = 0.37, $P < .0001$), and depression (PHQ, β = −5.38, SE = 1.61, $P = .002$). At T2 and T3, MHC score was significantly negatively correlated with PSS (T2 β = −0.86, SE = 0.32, $P = .01$; T3 β = −1.61, SE = 0.41, $P = .001$), STAI (T2 β = −1.70, SE = 0.48, $P = .001$; T3 β = −2.94, SE = 0.53, $P < .0001$), and PHQ (T2 β = −5.66, SE = 1.99, $P = .01$; T3 β = −11.35, SE = 1.82, $P < .0001$).

At T1, flourishing was significantly negatively correlated with MBI-EE (OR = 0.56, CI 0.33-0.95, $P = .03$), PSS (OR = 0.72,

Table 2. Cross-sectional associations between dependent and independent variables.

DEPENDENT VARIABLE	INDEPENDENT VARIABLE					
	FLOURISHING			MHC SCORE		
	OR	95% CI	*P*-VALUE	β	SE	*P*-VALUE
	TIME 1 (N=45)					
Resilience						
CAMS-R	1.28	1.04-1.59	.02	1.29	0.36	.001
DCSQ-Support	1.84	1.16-2.93	.01	1.65	0.79	.04
Risk						
MBI-EE	0.56	0.33-0.95	.03	−3.36	1.06	.003
MBI-DP patients	0.71	0.43-1.17	.18	−2.86	1.21	.02
MBI-DP colleagues	0.79	0.47-1.34	.38	−1.61	1.33	.23
PSS	0.72	0.59-0.89	.003	−0.98	0.22	<.0001
STAI	0.60	0.43-0.84	.003	−2.02	0.37	<.0001
PHQ	0.39	0.17-0.89	.03	−5.38	1.61	.002
DCSQ-Demand	0.80	0.45-1.41	.44	−1.86	1.31	.16
	TIME 2 (N=37)					
Resilience						
CAMS-R	1.94	1.25-3.00	.003	1.51	0.34	<.0001
DCSQ-Support	1.85	1.12-3.07	.02	2.72	0.75	.001
Risk						
MBI-EE	0.57	0.28-1.17	.12	−1.81	1.37	.39
MBI-DP patients	0.87	0.56-1.35	.54	0.13	0.96	.89
MBI-DP colleagues	0.79	0.41-1.52	.49	1.20	1.38	.39
PSS	0.88	0.73-1.06	.17	−0.86	0.32	.01
STAI	0.72	0.53-0.99	.04	−1.70	0.48	.001
PHQ	0.39	0.14-1.07	.07	−5.56	1.99	.01
DCSQ-Demand	1.38	0.80-2.37	.24	−0.12	1.12	.91
	TIME 3 (N=21)					
Resilience						
CAMS-R	1.21	0.95-1.54	.12	1.79	0.50	.002
DCSQ-Support	1.57	0.87-2.85	.13	3.11	1.18	.02
Risk						
MBI-EE	1.08	0.50-2.36	.84	−0.10	2.43	.97
MBI-DP patients	1.23	0.58-2.60	.59	1.78	2.21	.43
MBI-DP colleagues	1.55	0.66-3.65	.31	−0.03	2.30	.99
PSS	0.80	0.64-1.00	.06	−1.61	0.41	.001
STAI	0.69	0.45-1.04	.08	−2.94	0.53	<.0001
PHQ-2	0.08	0.01-0.87	.04	−11.35	1.82	<.0001
DCSQ-Demand	1.35	0.84-2.18	.21	0.48	1.40	.74

Abbreviations: β, linear regression coefficient; CAMS-R, Cognitive Affective Mindfulness Scale Revised; CI, confidence interval; DCSQ, Demand-Control-Support Questionnaire; DP, depersonalization; EE, emotional exhaustion; MBI, Maslach Burnout Inventory; MHC, mental health continuum-short form; OR, odds ratio; PHQ, Patient Health Questionnaire; PSS, Perceived Stress Scale; SE, standard error; STAI, State Trait Anxiety Index.

Table 3. Results from repeated measures models.*

INDEPENDENT VARIABLE	DEPENDENT VARIABLE					
	FLOURISHING			MHC SCORE		
	OR	CI	*P*-VALUE	β	SE	*P*-VALUE
Resilience						
Mindfulness	1.37	1.15-1.64	.001	1.47	0.35	<.001
DCSQ-Support	1.43	0.95-2.17	.09	2.02	1.01	.05
Risk						
MBI-EE	0.82	0.57-1.17	.27	−2.65	0.89	.003
MBI-DP patients	1.00	0.61-1.66	.99	−1.53	1.29	.23
MBI-DP colleagues	0.86	0.59-1.25	.43	−2.06	1.46	.16
PSS	0.71	0.58-0.88	.002	−1.28	0.29	<.001
STAI	0.71	0.55-0.92	.01	−1.74	0.38	<.001
PHQ-2	0.35	0.15-0.82	.02	−7.48	1.68	<.001
DCSQ-Demand	1.08	0.88-1.32	.48	−0.33	0.45	.47

Abbreviations: β, repeated measures model regression coefficient; CAMS-R, Cognitive Affective Mindfulness Scale Revised; DCSQ, Demand-Control-Support Questionnaire; DP, depersonalization; EE, emotional exhaustion; MBI, Maslach Burnout Inventory; MHC, mental health continuum-short form; PHQ, Patient Health Questionnaire; PSS, Perceived Stress Scale; SE, standard error; STAI, State Trait Anxiety Index.
*Data from 21 respondents who answered survey at all 3 time points; the number of respondents in the non-flourishing category were n = 5 at time 1, n = 3 at time 2, and n = 5 at time 3.

CI 0.59-0.89, *P* = .003), STAI (OR = 0.60, CI 0.43-0.84, *P* = .003) and PHQ (OR = 0.39, CI 0.17-0.89, *P* = .03). At T2, flourishing was significantly negatively correlated with STAI (OR = 0.72, CI 0.53-0.99, *P* = .04). At T3, flourishing was significantly negatively correlated PHQ (OR = 0.08, CI 0.01-0.87, *P* = .04). No significant correlation was seen between flourishing or total MHC score and workplace demand in our population at any time point.

From the repeated measures model, total MHC score was significantly negatively correlated with MBI-EE (β = −2.65, SE = 0.89, *P* = .003), PSS (β = −1.28, SE = 0.29, *P* < .001), STAI (β = −1.74, SE = 0.38, *P* < .001), and PHQ (β = −7.48, SE = 1.68, *P* < .001). Flourishing was significantly negatively correlated with PSS (OR = 0.71, CI 0.58-0.88, *P* = .002), STAI (OR = 0.71, CI 0.55-0.92, *P* = .01), and PHQ (OR = 0.35, CI 0.15-0.82, *P* = .02).

Discussion

The results of this longitudinal pilot study in procedural-focused PGY-1 trainees revealed 4 key findings within this population. First, flourishing is a promising measure of individual global well-being; second, flourishing is positively associated with individual mindfulness; third, flourishing is positively associated with workplace support; and fourth, flourishing is not associated with workplace demand.

Our first finding, that the categorical designation of flourishing accurately reflects high individual well-being in this population, is evidenced by the positive correlation between flourishing and resilience factors such as high coping skills (e.g. mindfulness) and low negative emotions (e.g. stress, anxiety), both cross-sectionally and modeled over time. Moreover, when we analyze the total MHC score as a continuous variable, the same relationships are reiterated and even expanded to reveal a relationship between higher MHC score and lower EE. By definition, flourishing represents the presence of high social, emotional and psychological functioning, all fundamental components of the resilient phenotype, as demonstrated in multiple high-stress populations.[47,48] As such, our data suggest that these ascribed attributes also hold true among flourishing, procedurally-oriented, highly time-compressed graduate medical trainees. Thus, the MHC may serve as a screening instrument for well-being in this population of trainees and as a means for measuring the efficacy of curricular initiatives to address well-being.

Our second finding, that flourishing is positively associated with individual mindfulness, is supported by the significant positive correlation between MHC score and CAMS-R, further seen when modeled longitudinally. This is reinforced by the significant positive association between flourishing and CAMS-R at the first 2 time points. This is not surprising, as both theory and empirical evidence support a strong positive relationship between flourishing and both inherent and trained mindfulness skills.[49,50] Broaden and Build theory describes how positive emotions (cultivated through

the practice of mindfulness[26,51]) expand one's thought-action repertoire,[52,53] which in turn enhances individual capability and attracts collaborative outside support.[54,55] This so-called "upward spiral of positive emotions" reciprocates with flourishing, as reflected in prior studies[56,57] and as suggested by our pilot data here. This is an important finding precisely because mindfulness can be trained, as evidenced by multiple studies in our target population,[18-20] providing a promising target for well-being program resources.

Our third finding, that flourishing is positively associated with workplace support, is suggested by the significant positive correlation between MHC score and DCSQ-Support at all 3 time points, including when modeled longitudinally. Job Demand-Resource theory suggests that job strain (which includes burnout) develops in settings where workplace demands outstrip resources[58,59] resulting in job dissatisfaction and even pathology.[43,60,61] A large body of empirical work has shown that the negative effects of demanding work can be mitigated through increased workplace control (i.e. decision-making latitude) and support (i.e. internal resources such as coping skills, and external resources such as acknowledgment and appreciation).[43] Our finding here appears to reflect this very relationship and moreover suggests that workplace support is a second promising target for well-being program resources, one whose impact might be evaluated by measuring MHC score/flourishing.

Our fourth finding, that flourishing is not directly associated with workplace demand, is evidenced by lack of significant correlation between flourishing or MHC score and DCSQ-Demand at any of the 3 time points or longitudinally. Interestingly, studies of job strain have shown that workplace demand is not homogeneous, and can promote or diminish work engagement depending, respectively, on perceived challenge vs. hindrance.[46] Perhaps relatedly, observations from our prior work suggest work quality may be more important than quantity among surgical trainees, thus affecting how workplace demand is perceived.[18] Similarly, findings from the FIRST trial showed that duty hour restrictions were not associated with higher well-being.[62] Taken together, these findings underscore our lack of clarity regarding the difference between type of work and amount of work, and how the difference may influence perceived workplace strain in this population. In other words, *how* time is spent may be more important than *how much time* is spent in the workplace. Another possible explanation is that while workplace demand is not directly associated with flourishing, the effect of workplace demand may be mediated by other factors (e.g. depression or anxiety). These concepts warrant further refinement and exploration.

While our findings show promise in terms of identifying a valid measure of trainee well-being, as well as promising individual-level and systems-level targets for intervention, our study should be viewed in the context of several limitations. First, due to the pilot nature of this work, our sample size is small and our cohort limited to a single institution. This suggests caution in interpreting our results, although their potential impact on the design and evaluation of future well-being interventions warrants a larger, multi-center study focused on a more homogeneous population (e.g. just surgeons). Second, given the small sample size, we were unable to explore effects such as the ability of ESRT to increase the prevalence of flourishing or relationships and trends that may vary by gender and race/ethnicity. Given findings in our and others' work showing well-being, training experience, and risk and resilience factors to differ by gender identity and race18, it will be critical to examine these sub-populations in a larger study. Finally, our study population included only individuals who were exposed to ESRT, precluding a comparative control group and potentially influencing the magnitude of scores.

Conclusions

Our results suggest that flourishing, as measured by the MHC, has concurrent validity for assessing global well-being in surgical and non-surgical trainees. Moreover, flourishing, as a composite score of social, emotional, and psychological well-being, may account for variability in what comprises well-being across different individuals and contexts. Having such a measure would provide a simple, meaningful, individualized assay of well-being; and provide a foundation for more effective design and assessment of well-being intervention curricula. Next steps include conducting a multi-center study to confirm the findings in this pilot and the development of guidelines to inform impactful, cost-effective, multi-level well-being curricula nationally.

Author Contributions

CCL was responsible for concept and design; CCL, CB, ALG, and AS were responsible for acquisition, analysis, or interpretation of data; CCL and ALG were responsible for drafting of the manuscript; CCL, ALG, CB, and MS were responsible for critical revision of the manuscript.

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