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# The prospective association between mindfulness and flourishing in mid-to-late life

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## ABSTRACT

**Objectives:** Policymakers are increasingly interested in positive factors that enhance people's holistic well-being, and mindfulness is one such positive psychological factor. This study examined the prospective association between mindfulness and flourishing in mid-to-late life.

**Method:** Three waves of data from the Midlife in the United States Study were used (1995–2014,  $N=2,496$ , mean age = 56 years). Generalized estimating equation models were used to examine the association between mindfulness in wave II and flourishing 10 years later in wave III, adjusting for various potential confounders and prior levels of flourishing assessed in wave I.

**Results:** The highest vs. lowest quartile of mindfulness was positively associated with composite flourishing ( $\beta=0.26$ , 95% CI = 0.17, 0.36) and all three of its key domains, including: emotional ( $\beta=0.22$ , 95% CI = 0.11, 0.33), psychological ( $\beta=0.23$ , 95% CI = 0.13, 0.34), and social well-being ( $\beta=0.20$ , 95% CI = 0.09, 0.31). When further evaluating the subdomains nested within the three primary domains, we observed that mindfulness displayed especially strong associations with personal growth and social contribution, but little associations with purpose in life or social actualization, and potentially an inverse association with social coherence.

**Conclusion:** This study suggests that cultivating mindfulness may be a meaningful avenue for promoting overall flourishing in middle-aged and older adults.

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Holistic well-being; mindfulness; flourishing; spirituality; aging


## Introduction

A holistic approach to promoting human development is important in policymaking (Vik & Carlquist, 2018). National surveys have increasingly incorporated measures of well-being to complement economic indicators in monitoring societal progress. A promising conceptual model to measure multi-dimensional well-being is flourishing, sometimes defined as 'a combination of feeling good and functioning effectively, and the experience that life is going well' (Huppert & So, 2013), or alternatively as 'a state in which all aspects of a person's life are good' (VanderWeele & Lomas, 2023). While most policy efforts have focused on reducing risk factors for illness, there is growing interest in fostering strengths and assets that promote holistic well-being (VanderWeele, 2017). Some longstanding spiritual and social science traditions have suggested that mindfulness may be one such asset.

The concept of mindfulness has its roots in Eastern philosophy and Buddhism, and has been operationalized in by Jon Kabat-Zinn (2003)—who above all is

credited with harnessing mindfulness in a modern therapeutic context with his creation of the Mindfulness-Based Stress Reduction program in the late 1970s—as 'paying attention on purpose, in the present moment, and non-judgmentally to the unfolding experience moment by moment.' In both its original Buddhist context and now its new embrace within contemporary research and clinical practice, mindfulness involves a deep inquiry into the nature of the mind and world, and is characterized by qualities of openness, acceptance, and compassion. Outside of its adoption within clinical settings, the concept of mindfulness has been further developed within empirical cognitive science, which placed an emphasis on its role in fostering attention and awareness. In this conception, mindfulness is understood as a cognitive style that involves self-regulation of attention, an open engagement with one's environment, and a process of formulating novel cognitive distinctions (Hart et al., 2013; Langer & Moldoveanu, 2000). Beyond its characterization as a cognitive skill, mindfulness is also considered to

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encompass psychological, philosophical, and spiritual dimensions (Phan et al., 2020). Given its multi-faceted nature, mindfulness may not be fully captured by any single operationalization. Across definitions, however, there is a consensus that mindfulness involves present-centered awareness, self-regulatory process, and openness to experiences. Several neurocognitive and psychosocial pathways through which mindfulness enhances well-being have been proposed. These include enhanced self-awareness (e.g. greater sensory clarity in current experiences), emotional and attentional regulation (e.g. equanimity, fewer habitual thoughts and emotions, more informed behavioral choices), self-transcendence (e.g. empathy, altruistic motivations and behaviors, interconnectedness), and self-integration (e.g. positive reappraisal, a greater sense of meaning and purpose) (Hölzel et al., 2011; Vago & Silbersweig, 2012).

Empirical literature generally suggests that mindfulness is positively associated with health and well-being. For instance, a recent review of randomized controlled trials found that mindfulness-based training programs, such as mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (MBCT), were associated with a range of improved outcomes (Creswell, 2017). These included reduced stress, chronic pain, and substance use, fewer depression symptoms, improved attention-related outcomes, and greater positive affect. However, some concerns have been raised regarding the mechanisms underlying mindfulness programs, because around half of prior studies did not find a meaningful increase in participants' self-reported mindfulness from pre- to post-intervention (Visted et al., 2015). Similarly, meditation programs that facilitate personal experiences of mindfulness were also associated with small to moderate reductions in multiple aspects of psychological distress (e.g. lower levels of anxiety, depression, and pain) and with other favorable health outcomes (e.g. lower levels of cognitive decline and better physical health outcomes) (Bhattacharyya et al., 2024; Goyal et al., 2014; Rose et al., 2020). In addition, recent reviews of observational studies also found that trait mindfulness was associated with better emotional and psychological health (Tomlinson et al., 2018), and greater interpersonal relationship quality (McGill et al., 2016). Other studies further suggested that mindfulness might be particularly meaningful for individuals transitioning into late adulthood, because it helps individuals actively cope with various changes associated with aging (Allen et al., 2017). These prior studies have significantly advanced our understanding of mindfulness and well-being, and they paved the way for further studies. Specifically, most observational studies on mindfulness and well-being are based on cross-sectional data with limited control for

confounding factors. Longitudinal studies with rigorous control for confounding would strengthen the evidence for causality. Moreover, most prior observational studies and randomized controlled trials are based on small samples of homogeneous participants (e.g. college students, clinic patients) with short follow-up periods. Studies with more diverse samples and longer follow-ups would help us better understand the generalizability of the results and the long-term effects of mindfulness. Next, mindfulness has often been studied with a single well-being outcome in each study separately. An alternative approach is to investigate mindfulness and multiple aspects of well-being simultaneously within the same sample, as this could provide a broad understanding of the dynamics at play.

To further strengthen the evidence base on mindfulness and well-being, this study examined the prospective association between mindfulness and various aspects of well-being (all unified under an integrated framework of flourishing) assessed 10 years later, using data from a U.S. national sample of middle-aged and older adults. We hypothesized that mindfulness would be positively associated with subsequent overall flourishing and each individual domains of flourishing.

## Methods

### Study sample

This study used data from the Midlife in the United States (MIDUS) study—a study aimed to understand psychosocial factors, health, and well-being in mid-life. MIDUS enrolled 7,108 non-institutionalized individuals aged 25 to 74 years (including 950 siblings and 957 twin pairs) from across U.S. through random digit dialing in 1995 to 1996 (wave I). Participants were invited to take a phone interview and were also mailed a self-administered questionnaire. The second wave of data collection (wave II) took place between 2004 and 2006, which followed 70% of the original participants ( $N=4,963$ ). Mindfulness was first assessed in wave II. The third wave (wave III) was conducted in 2013 and 2014 that followed 66% ( $N=3,294$ ) of wave II respondents. Because mindfulness, flourishing, and several important covariates were assessed only in self-administered questionnaires, the sample for the present study was drawn from respondents of the self-administered questionnaires in all three waves ( $N=2,656$ ). To examine the prospective association between mindfulness in wave II and subsequent flourishing in wave III, we excluded those with missing data on mindfulness in wave II or flourishing in wave III, yielding an analytic sample of 2,496 participants. Compared to those excluded from our analytic sample, participants included in the

sample were younger, healthier and had higher socioeconomic status, but were not different in other characteristics (Supplementary Table S1). Because it is difficult to discern confounders from potential mediators when covariates and mindfulness are assessed simultaneously (VanderWeele et al., 2020), in the primary analysis all data on covariates were taken from wave I (i.e. prior to the assessment of mindfulness). Data for this study are available through the Midlife in the United States Study website (<https://midus.wisc.edu/data/index.php>), and the analysis code is available upon request. Because we used publicly available and de-identified data, this study was exempted from additional review by the Institutional Review Board at Harvard T.H. Chan School of Public Health.

## Measures

### Mindfulness

Based on Langer and Moldoveanu's conception of mindfulness (Langer & Moldoveanu, 2000), MIDUS used a 9-item scale to assess the following aspects of dispositional mindfulness, including novelty seeking, novelty producing, flexibility, and engagement. The scale items were preceded by the prompt 'Because of your religion or spirituality, do you try to be...'. Some example items are 'more engaged in the present moment' and 'more sensitivity to the feelings or others' (see the full scale in Supplementary Table S2). Response options ranged from 1 (strongly agree) to 5 (strongly disagree). Responses were reverse coded and summed across all items to create an overall score (range: 9 to 45). A higher score indicated greater mindfulness. The scale has high reliability in this sample ( $\alpha=0.94$ ) and has also shown good psychometric properties in prior studies (Sesker et al., 2016). To evaluate potential threshold effects, we created quartiles of the mindfulness score based on its distribution in the sample.

### Flourishing

Based on Keyes' conception (Keyes, 2002), a composite flourishing score encompassing the domains of emotional, psychological, and social well-being was created. The same measure of flourishing was available in both wave I and wave III. To reduce potential reverse causation, this study considered flourishing in wave III as the dependent variable and adjusted for the prior level of flourishing assessed in wave I as a covariate.

### Emotional well-being

Two aspects of emotional well-being were assessed including positive affect and life satisfaction (Keyes & Simoes, 2012). First, a 6-item validated positive affect

scale (Mroczek & Kolarz, 1998) was used to measure the frequency of experiencing following positive feelings over past 30 days: cheerful, in good spirits, happy, calm and peaceful, satisfied, and full of life. Response options ranged from 1 (all the time) to 5 (none of the time). Responses were reverse coded, such that a higher score indicated greater positive feelings. An overall score of positive affect (range: 1 to 5) was derived by averaging responses across items. Second, life satisfaction was measured with the item 'How would you rate your life overall these days?'. Response options ranged from 0 (worst possible life overall) to 10 (best possible life overall). Because positive affect and life satisfaction were assessed on different scales, the scores were first standardized respectively (mean = 0, standard deviation [SD]=1), and then summed to create an overall score for emotional well-being ( $\alpha=0.71$ ).

### Psychological well-being

Ryff's Psychological Well-Being Scale (Ryff, 1989) was used to assess 6 subdomains (3 items for each subdomain). These included autonomy (e.g. 'I judge myself by what I think is important, not by the values of what others think is important'), environmental mastery (e.g. 'In general, I feel I am in charge of the situation in which I live'), personal growth (e.g. 'For me, life has been a continuous process of learning, changing, and growth'), positive relations with others (e.g. 'Maintaining close relationships has been difficult and frustrating for me'), purpose in life (e.g. 'I live life one day at a time and don't really think about the future'), and self-acceptance (e.g. 'I like most parts of my personality'). Response options ranged from 1 (strongly agree) to 7 (strongly disagree). Responses were reverse coded as necessary, such that a higher score represented greater well-being. A score for each subdomain was created by summing responses across the 3 items under the subdomain. An overall score of psychological well-being was derived by summing responses across all 6 subdomains ( $\alpha=0.79$ ).

### Social well-being

Keyes' validated 14-item scale (Keyes & Shapiro, 2004) was used to assess 5 subdomains of social well-being (3 items for each subdomain, except for social coherence which had 2 items). These included social coherence (e.g. 'the world is too complex for me'), social integration (e.g. 'I feel close to other people in my community'), acceptance of others (e.g. 'I believe that people are kind'), social contribution (e.g. 'I have something valuable to give to the world'), and social actualization (e.g. 'The world is becoming a better place for everyone'). Response options ranged from 1 (strongly agree) to 7 (strongly disagree). Responses

were reverse coded as necessary, so that higher scores indicated greater well-being. A score for each subdomain was created by summing responses across items under the subdomain. Because not all subdomains were measured on the same scale (i.e. social coherence was assessed with 2 items whereas others had 3 items), scores for each subdomain were standardized separately and then summed to derive an overall score of social well-being ( $\alpha=0.74$ ).

To provide a more complete picture of well-being on a continuum, this study used the continuous measure of flourishing as the primary dependent variable. Specifically, the domain scores of emotional, psychological, and social well-being were first standardized respectively (because they were assessed on different scales), and then summed to create a composite flourishing score (Chen et al., 2019). The unstandardized composite flourishing score and its domain and subdomain scores were reported in [Supplementary Table S3](#). As sensitivity analyses, we created a dichotomous indicator of flourishing following Keyes' approach (Keyes & Simoes, 2012): participants with high (i.e. in the top tertile) emotional well-being on at least one of its two subdomains (i.e. positive affect or life satisfaction) and with high psychological and social well-being on at least 6 out of the 11 subdomains (e.g. autonomy, social coherence, etc.) were considered as flourishing. To more fully capture well-being across subdomains, following prior work, we also created a count measure of flourishing by summing the number of subdomains (range: 0 to 13) in which the participant had a score in the top tertile (Chen et al., 2019).

*Covariates.* Covariates were assessed in wave I. Sociodemographic covariates included age, sex, race/ethnicity (because most participants were non-Hispanic White in this sample, to avoid collinearity we combined race and ethnicity into a composite variable rather than including them as separate variables), birthplace, marital status, education level, household income (ranged from \$0 to \$300,000+, quartiles created), and household wealth (assessed by subtracting liabilities from total financial assets, ranged from less than \$0 to \$1,000k+, quartiles created). Because childhood experiences may affect both mindfulness and flourishing (Chen et al., 2019; McKeen et al., 2023), we also adjusted for parents' highest educational level and parental warmth (measured with a 6-item Parental Support Scale (Rossi, 2001)). While the absence of mental illness does not necessarily imply the presence of flourishing, mental illness and flourishing are closely related concepts (Seligman, 2008). To address potential confounding by mental illness, we additionally adjusted for pre-baseline depressive and anxiety symptoms (measured with the Composite International Diagnostic Interview Short Form (Kessler et al., 1998)). Likewise,

prior evidence has suggested that personality is associated with both mindfulness and flourishing (Haliwa et al., 2021; Keyes, 2002). Therefore, we also accounted for the Big Five Personality Traits (Rossi, 2001) measured at pre-baseline. Moreover, spirituality and religious participation might enhance flourishing (VanderWeele, 2017), thus we adjusted for self-rated spirituality and religiosity, religious service attendance, prayer/other spiritual practice in past 12 months, and practice of relaxation or meditation in past 12 months. Next, because lifestyles, physical health, and well-being are interrelated (VanderWeele, 2017), we also adjusted for ever smoking, ever drinking, heart disease diagnosis, cancer diagnosis, and the number of chronic conditions (ranged from 0 to 12, those with  $\geq 4$  conditions were collapsed into one category to reduce data sparsity). Lastly, to reduce potential reverse causation, the composite flourishing score in wave I was also included as a covariate.

### **Statistical analysis**

All statistical analyses were conducted in SAS 9.4. The descriptive analyses examined the distribution of covariates by quartiles of the mindfulness score. We also examined the intercorrelation between the domains and subdomains of the flourishing measure.

The primary analyses used a set of generalized estimating equation models (with normal distribution) to regress the continuous scores of flourishing and its three domains (emotional, psychological, and social well-being, assessed in wave III) on quartiles of mindfulness (assessed in wave II) in separate models. The analyses adjusted for clustering by sibling status and all covariates (including the prior level of flourishing assessed in wave I). All continuous dependent variables were standardized (mean = 0, SD = 1), such that the effect estimates were reported in terms of per standard deviation change in the dependent variable. As a sensitivity analysis, we reanalyzed the models with the dichotomous indicator of flourishing (using modified Poisson regression) and the count measure of flourishing (with normal distribution, standardized) as the dependent variable separately. To investigate whether the observed associations (if any) were driven by specific subdomains of flourishing, as a secondary analysis, we reanalyzed the models with each of the 13 subdomains of flourishing as the dependent variable separately.

Among the participants included in our analytic sample, 166 participants had missing data on covariates. Because multiple imputation for missing data is often more flexible than other methods for handling missing data (Sterne et al., 2009), we used multiple imputation by chained equations (5 imputed datasets created) to impute missing data on covariates. We also performed complete-case analysis for comparison.

Three other sensitivity analyses were performed. First, we evaluated robustness of the results to potential unmeasured confounding by calculating E-values (VanderWeele & Ding, 2017). E-values assessed the minimum strength that an unmeasured confounder would need to have with both the independent and the dependent variable, above and beyond the adjusted covariates, on the risk ratio scale to fully explain away the observed association. Second, we reanalyzed the primary models with the continuous score of mindfulness (standardized) as the independent variable. Finally, we refit all models controlling for baseline flourishing and all covariates assessed in wave II, rather than in wave I, though this approach likely constitutes overadjustment as many of these variables are likely on the pathway from mindfulness to subsequent flourishing in wave III.

## Results

### Descriptive analyses

The sample had a mean age of 56 years in wave II when mindfulness was assessed, with approximately 25% of participants aged 65 or older and 1% younger than 35 years. The participants were slightly higher proportion female (56.17%), primarily non-Hispanic White (92.79%), mostly married (73.32%), had a college degree (40.79%), generally healthy, and were mostly spiritual or religious (e.g. 42.45% attended religious services weekly). The mean score of mindfulness was 34.01 (range: 9 to 45). Around 21.19% of participants met the criteria of the dichotomous measure of flourishing in wave III. The correlations between the 3 primary domains and the 13 subdomains of flourishing were small to moderate (Supplementary Table S4).

Table 1 showed the bivariate associations of mindfulness (wave II) with covariates (wave I). More mindful participants were generally older, more likely female, had certain personality traits (e.g. greater conscientiousness), were more spiritual or religious, and less likely to ever smoke or drink. Those with more chronic conditions and a history of cancer in wave I reported greater mindfulness in wave II.

### Mindfulness and subsequent flourishing

Mindfulness was positively associated with subsequent composite flourishing and its three domain scores, after adjusting for the pre-baseline level of flourishing and other covariates (Table 2). Specifically, the highest vs. lowest quartile of mindfulness was associated with greater subsequent composite flourishing ( $\beta=0.26$ , 95% Confidence interval [CI]: 0.17, 0.36), as well as greater emotional ( $\beta=0.22$ , 95% CI:

0.11, 0.33), psychological ( $\beta=0.23$ , 95% CI: 0.13, 0.34), and social well-being ( $\beta=0.20$ , 95% CI: 0.09, 0.31). Sensitivity analyses with the dichotomous indicator of flourishing (risk ratio = 1.35, 95% CI: 1.08, 1.68) and the count measure of flourishing ( $\beta=0.22$ , 95% CI: 0.12, 0.33) yielded similar results (Supplementary Table S5). There was, however, little difference in flourishing between the 2<sup>nd</sup> vs. the lowest quartile of mindfulness, suggesting some evidence for threshold effects.

Mindfulness was differentially associated with individual subdomains of flourishing (Table 2). When considering the subdomains under emotional well-being, the top two quartiles (vs. the lowest quartile) of mindfulness were both associated with greater life satisfaction, whereas only the top quartile of mindfulness was associated with greater positive affect. When considering the subdomains under psychological well-being, mindfulness was most strongly associated with personal growth, positive relations, and self-acceptance (e.g.  $\beta_{\text{highest vs. lowest quartile of mindfulness}}$  for personal growth = 0.43, 95% CI: 0.32, 0.55), whereas the associations with autonomy, environmental mastery, and purpose in life did not reach  $p<.05$ . Regarding the subdomains under social well-being, mindfulness was associated with greater subsequent social integration and social contribution (e.g.  $\beta_{\text{highest vs. lowest quartile of mindfulness}}$  for social contribution = 0.44, 95% CI: 0.33, 0.55), but was inversely associated with social coherence ( $\beta_{\text{third vs. lowest quartile of mindfulness}} = -0.16$ , 95% CI: -0.26, -0.06). There was little evidence that mindfulness was associated with subsequent social acceptance or social actualization.

Sensitivity analyses with the continuous score of mindfulness yielded similar results (Supplementary Table S6). Complete-case analyses also yielded similar results (Supplementary Table S7). When simultaneous adjustment was made for all covariates assessed in wave II rather than wave I, many associations became weaker (as would be expected from potential adjustment for mediators on the pathway from mindfulness to subsequent flourishing), but the associations with greater personal growth and social contribution remained robust (Supplementary Table S8).

### Sensitivity analyses for potential unmeasured confounding

Table 3 shows the E-values (VanderWeele & Ding, 2017) for evaluating the robustness of the observed associations to potential unmeasured confounding. For instance, an unmeasured confounder associated with both mindfulness and composite flourishing by risk ratios of 1.86 each, above and beyond all the covariates already adjusted for, would suffice to fully explain away the observed association between

**Table 1.** The distribution of participant characteristics by levels of mindfulness (the Midlife in the United States study wave I [1995–1996] and wave II [2004–2006],  $N=2,496$ ).

Participant Characteristics (assessed at wave I)	Mindfulness (assessed at wave II)			
	Lowest quartile ( $n=592$ )	2 <sup>nd</sup> quartile ( $n=596$ )	3 <sup>rd</sup> quartile ( $n=729$ )	Highest quartile ( $n=579$ )
Age (in years, range: 20 to 74), mean (SD)	44.21 (10.81)	46.20 (11.32)	46.68 (11.44)	46.95 (10.68)
Female, %	39.70	52.68	62.83	68.22
Race/ethnicity, %				
Non-Hispanic White	95.44	93.62	93.00	88.95
Non-Hispanic Black	1.01	1.68	3.70	5.18
Hispanic or Latino	2.20	2.85	2.47	2.76
Others	1.35	1.85	0.82	3.11
Born in U.S., %	96.28	96.64	96.97	94.30
Marital status, %				
Married or in partnership	70.95	74.83	76.54	70.12
Divorce/separated	13.51	11.74	12.07	16.58
Widowed	2.53	3.36	2.88	2.59
Never married	13.01	10.07	8.50	10.71
Education level, %				
Less than high school	3.21	4.53	6.04	5.18
High school	25.51	23.83	26.75	24.18
Some college	24.83	34.23	30.32	27.29
College or more	46.45	37.42	36.90	43.35
Household income, %				
Lowest quartile	21.54	24.36	25.32	27.72
2 <sup>nd</sup> quartile	22.22	27.43	25.04	24.56
3 <sup>rd</sup> quartile	27.86	26.41	24.19	23.68
Highest quartile	28.38	21.81	25.46	24.04
Household wealth, %				
Lowest quartile	23.14	25.67	27.30	31.43
2 <sup>nd</sup> quartile	27.36	26.17	27.71	24.35
3 <sup>rd</sup> quartile	21.45	20.64	21.26	19.34
Highest quartile	28.04	27.52	23.73	24.87
Parents' education level, %				
Less than high school	16.38	22.20	26.68	25.80
High school	39.31	36.44	34.78	33.04
Some college	14.48	18.47	16.20	18.55
College or more	29.83	22.88	22.35	22.61
Parental warmth in childhood (range: 0 to 4), mean (SD)	2.84 (0.59)	2.96 (0.61)	2.91 (0.64)	2.96 (0.66)
Depressive symptoms (range: 0 to 7), mean (SD)	0.64 (1.72)	0.64 (1.72)	0.59 (1.74)	0.77 (1.91)
Anxiety symptoms (range: 0 to 10), mean (SD)	0.13 (0.79)	0.13 (0.83)	0.10 (0.72)	0.18 (0.99)
Big Five personality traits				
Agreeableness (range: 1 to 4), mean (SD)	3.30 (0.53)	3.41 (0.49)	3.51 (0.46)	3.67 (0.40)
Extraversion (range: 1 to 4), mean (SD)	3.09 (0.56)	3.13 (0.56)	3.20 (0.54)	3.37 (0.50)
Neuroticism (range: 1 to 4), mean (SD)	2.28 (0.69)	2.28 (0.64)	2.23 (0.64)	2.14 (0.68)
Conscientiousness (range: 1 to 4), mean (SD)	3.42 (0.44)	3.45 (0.42)	3.47 (0.41)	3.55 (0.42)
Openness (range: 1 to 4), mean (SD)	2.94 (0.50)	2.95 (0.51)	3.02 (0.49)	3.19 (0.50)
Self-rated religiosity (range: 1 to 4), mean (SD)	2.45 (0.82)	2.90 (0.81)	3.00 (0.75)	3.14 (0.87)
Self-rated spirituality (range: 1 to 4), mean (SD)	2.53 (0.84)	2.99 (0.75)	3.14 (0.71)	3.44 (0.70)
Religious service attendance, %				
Never	31.18	16.36	12.45	11.48
Less than once/week	45.83	40.47	39.28	34.26
At least once/week	23.00	43.17	48.27	54.26
Prayer or other spiritual practice over past 12 months, %	16.35	33.78	37.93	47.06
Relaxation or meditation techniques over past 12 months, %	9.00	11.82	15.56	23.61
Ever smoke regularly, %	49.83	49.66	45.88	42.83
Ever drink regularly, %	50.17	39.39	36.54	35.06
Heart disease diagnosis, %	11.53	9.24	11.39	8.49
Cancer diagnosis, %	5.07	6.71	7.00	7.77
Number of chronic conditions (range: 0 to 4), mean (SD)	1.79 (1.43)	1.84 (1.49)	1.83 (1.48)	1.91 (1.52)
Flourishing score (range: -10.51 to 6.44), mean (SD)	-0.57 (2.59)	-0.26 (2.46)	0.11 (2.32)	0.80 (2.31)

Note: The mean levels (standard deviation) of the characteristic or proportion of individuals with that characteristic within each level of mindfulness were examined in this table. All participant characteristics were assessed at wave I, and mindfulness was assessed at wave II.

mindfulness and higher composite flourishing, but weaker joint confounder associations could not. Further, to shift the confidence interval to include the null value, an unmeasured confounder associated with both mindfulness and higher flourishing by risk ratio of 1.60 each would suffice, but weaker joint confounder associations could not. Similarly strong or even stronger E-values were found for the three flourishing domains and several subdomains (e.g. personal growth, social contribution, etc.).

## Discussion

Scholars and spiritual leaders have long recognized the importance of mindset in well-being (Kabat-Zinn, 2003). Congruent with prior evidence on trait mindfulness and well-being (most observational studies were cross-sectional), this study showed that mindfulness was positively associated with subsequent composite flourishing and all its primary domains (including emotional, psychological, and social well-being). This study extends the literature on

**Table 2.** Mindfulness and subsequent flourishing in mid-life (the Midlife in the United States study wave II [2004–2006] to wave III [2013–2014],  $N=2,496$ ).

Subsequent Flourishing (wave III)	Mindfulness (wave II)				<i>p</i> for trend
	Lowest quartile (reference)	2 <sup>nd</sup> quartile $\beta$ (95% CI)	3 <sup>rd</sup> quartile $\beta$ (95% CI)	Highest quartile $\beta$ (95% CI)	
Composite flourishing score (continuous, standardized)	0.00	0.04 (−0.05, 0.13)	0.12 (0.03, 0.21)**	0.26 (0.17, 0.36)***	<0.001
<i>Emotional well-being</i>	0.00	0.07 (−0.04, 0.17)	0.16 (0.07, 0.26)**	0.22 (0.11, 0.33)***	<0.001
Positive affect	0.00	0.02 (−0.08, 0.12)	0.09 (−0.01, 0.19)	0.19 (0.08, 0.30)***	<0.001
Life satisfaction	0.00	0.10 (−0.01, 0.20)	0.19 (0.09, 0.30)***	0.19 (0.08, 0.31)**	<0.001
<i>Psychological well-being</i>	0.00	0.02 (−0.07, 0.12)	0.10 (0.001, 0.19)*	0.23 (0.13, 0.34)***	<0.001
Autonomy	0.00	−0.05 (−0.16, 0.07)	−0.04 (−0.15, 0.07)	0.10 (−0.02, 0.22)	0.14
Environmental mastery	0.00	−0.03 (−0.13, 0.08)	−0.03 (−0.13, 0.07)	0.10 (−0.01, 0.21)	0.11
Personal growth	0.00	0.10 (−0.00, 0.21)	0.26 (0.16, 0.37)***	0.43 (0.32, 0.55)***	<0.001
Positive relations	0.00	0.05 (−0.05, 0.16)	0.14 (0.04, 0.24)**	0.16 (0.05, 0.27)**	<0.001
Purpose in life	0.00	−0.05 (−0.15, 0.05)	−0.06 (−0.15, 0.04)	0.02 (−0.09, 0.14)	0.75
Self-acceptance	0.00	0.05 (−0.05, 0.16)	0.11 (0.003, 0.21)*	0.17 (0.06, 0.28)**	0.002
<i>Social well-being</i>	0.00	0.002 (−0.09, 0.10)	0.04 (−0.06, 0.14)	0.20 (0.09, 0.31)***	<0.001
Social coherence	0.00	−0.14 (−0.24, −0.03)**	−0.16 (−0.26, −0.06)**	−0.10 (−0.22, 0.01)	0.07
Social integration	0.00	0.08 (−0.02, 0.18)	0.13 (0.02, 0.23)*	0.29 (0.17, 0.40)***	<0.001
Social acceptance	0.00	−0.04 (−0.15, 0.07)	0.04 (−0.07, 0.14)	0.06 (−0.06, 0.19)	0.18
Social contribution	0.00	0.16 (0.06, 0.26)**	0.18 (0.08, 0.28)***	0.44 (0.33, 0.55)***	<0.001
Social actualization	0.00	−0.06 (−0.16, 0.04)	−0.04 (−0.14, 0.07)	0.02 (−0.10, 0.15)	0.62

Note: The composite flourishing score and each of the flourishing domains and subdomain outcomes were examined in separate models. Generalized estimating equations (with normal distribution and identity link) were used to regress the standardized scores of subsequent flourishing (and its domains and subdomains) on baseline levels of mindfulness, adjusting for clustering by sibling status.  $\beta$  was the standardized effect estimate. All outcome variables were standardized (mean = 0, standard deviation = 1; all outcomes in this table are continuous variables). All models adjusted for age, sex, race/ethnicity, nativity status, marital status, education level, household income, household wealth, childhood socioeconomic status (assessed with parents' educational level), parental warmth in childhood, depressive symptoms, anxiety symptoms, personality traits (agreeableness, extraversion, neuroticism, conscientiousness, and openness), self-rated religiosity, self-rated spirituality, frequency of religious service attendance, engagement in prayer or other spiritual practice, use of relaxation or meditation techniques, ever smoking regularly, ever drinking regularly, history of heart disease diagnosis, history of cancer diagnosis, number of chronic conditions, and the pre-baseline level of flourishing score. All these covariates were assessed at wave I. The analyses were restricted to participants with complete data on mindfulness and subsequent flourishing outcomes. The multiple imputation procedure was used to impute missing data on covariates. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

**Table 3.** Robustness to potential unmeasured confounding (E-values) for the associations between mindfulness (highest vs. lowest quartile) and subsequent flourishing (the Midlife in the United States study wave II [2004 to 2006] to wave III [2013 to 2014],  $N=2,496$ )<sup>a</sup>.

	E-value for Effect Estimate <sup>b</sup> (highest vs. lowest quartile of mindfulness)	E-value for Confidence Interval Limit <sup>c</sup> (highest vs. lowest quartile of mindfulness)
Composite flourishing score (continuous)	1.86	1.60
<i>Emotional well-being</i>	1.74	1.45
Positive affect	1.66	1.36
Life satisfaction	1.67	1.35
<i>Psychological well-being</i>	1.78	1.51
Autonomy	1.42	1.00
Environmental mastery	1.42	1.00
Personal growth	2.33	2.02
Positive relations	1.58	1.26
Purpose in life	1.18	1.00
Self-acceptance	1.60	1.29
<i>Social well-being</i>	1.70	1.40
Social coherence	1.43	1.00
Social integration	1.92	1.62
Social acceptance	1.31	1.00
Social contribution	2.34	2.04
Social actualization	1.18	1.00

<sup>a</sup>See VanderWeele and Ding (2017) for the formula for calculating E-values.

<sup>b</sup>The E-values for effect estimates are the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome to fully explain away the observed association between the exposure and outcome, conditional on the measured covariates.

<sup>c</sup>The E-values for the limit of the 95% confidence interval (CI) closest to the null denote the minimum strength of association on the risk ratio scale that an unmeasured confounder would need to have with both the exposure and the outcome to shift the confidence interval to include the null value, conditional on the measured covariates.

mindfulness and well-being by adding prospective evidence with a large sample size, a long follow-up, and rigorous control for confounding.

When considering emotional well-being outcomes, there have been relevant randomized controlled trials and a limited number of prior longitudinal studies. They have generally shown positive associations of mindfulness with positive affect and life satisfaction (Enkema et al., 2020; Jislin-Goldberg et al., 2012). Researchers hypothesized that mindfulness enhances emotional well-being by adding clarity to current experience and reducing habitual emotional reactivity (Brown & Ryan, 2003).

Our results generally align with past research evaluating psychological well-being outcomes. For example, cross-sectional studies (Kim et al., 2021) and evidence from mindfulness-based programs (Eberth & Sedlmeier, 2012) found that mindfulness was positively associated with several aspects of psychological well-being such as personal growth, positive relations, and self-acceptance. The mindful-to-meaning theory posits that mindfulness helps individuals develop a decentered metacognitive perspective in stress appraisal, which facilitates the deployment of positive coping strategies and appreciation of even adverse experiences as opportunities for growth (Garland et al., 2015). Several qualities of mindfulness including non-judgment, openness, and compassion help cultivate empathy towards oneself and others, which further enhance self-acceptance, personal

growth, and interpersonal connection (Kabat-Zinn, 2003).

Our results also largely align with past evidence on social well-being outcomes. For instance, cross-sectional evidence at the interpersonal and societal level suggested positive associations of mindfulness with several aspects of social well-being such as social integration and social contribution (Kim et al., 2021). Indeed, some mindfulness-based practices are specifically 'other-oriented' (e.g. Loving Kindness Meditation), involving the cultivation of gratitude and kindness towards others (McGill et al., 2016). Recent review studies have also suggested effectiveness of mindfulness-based programs in improving interpersonal relationship quality (Winter et al., 2021). Moreover, informal practice of mindfulness in daily lives might also contribute to societal and environmental well-being (Thiermann & Sheate, 2021).

This study, however, found weaker associations of mindfulness with several aspects of psychological and social well-being, including autonomy, environmental mastery, purpose in life, social acceptance, and social actualization, when compared to prior evidence (Crego et al., 2021; Kim et al., 2021; Voci et al., 2019). This may be due to differences in study designs (e.g. prospective vs. cross-sectional) and methodologies (e.g. confounding control). Alternatively, it could be related to the measurements of mindfulness based on different conceptions. The measurement of mindfulness in this study focused on assessing one's sensitivity to external environment. Prior studies used measures such as the dispositional Mindful Attention Awareness Scale (MAAS) and the Five Facet Mindfulness Questionnaire (FFMQ), which additionally considered one's attention to inner experiences (Brown & Ryan, 2003). The awareness and acceptance of inner emotions, thoughts, and conflicts could play a key role in forming self-endorsed behavioral regulation (Brown & Ryan, 2003). Goals and actions that aligned with one's inner psychological needs might be the 'active ingredient' for generating a deep sense of autonomy, purpose, actualization, and connectedness (Crego et al., 2021). Such an 'inward orientation' of mindfulness is also characterized by qualities of non-judgement and self-compassion, which further enhance acceptance of oneself and might also translate into enhanced acceptance of others (Zhang et al., 2020). These above-mentioned processes related to attention to one's inner experiences might not be captured in this study. Somewhat contrary to our expectation, mindfulness was inversely associated with social coherence in this study. This might in part resonate with the 'dark night experiences' (e.g. increased confusion, anxiety, and agitation) that were sometimes observed in intensive mindfulness

training (Creswell, 2017). While mindfulness training helps heighten one's awareness of experience in the present moment, it can also lead to resurface of traumatic memories and deep feelings of fear, and more generally bring practitioners into contact with challenging mental material they may not be sufficiently-equipped to manage (Creswell, 2017; Lomas et al., 2015). However, these adverse consequences were sometimes mitigated when individuals developed the skills to understand and accept their reactions and to find coherence in separate aspects of their experiences (Creswell, 2017). It is also possible that the non-judgmental aspect of mindfulness renders it more difficult to in fact make cognitive judgements that may be critical in developing coherence or purpose. Moreover, the 'non-striving' aspect of mindfulness encourages practitioners to accept where one already is rather than striving to get somewhere (Kabat-Zinn, 2003). This focus on the present moment helps individuals to accept the complexity and uncertainty in life and may reduce one's desire to synthesize broader social patterns or to control things in life.

This study has some limitations. First, the measure of mindfulness might not capture the attention to one's inner experience, which is considered as an essential aspect of mindfulness in the Buddhist tradition (Kabat-Zinn, 2003). Studies that use other measures (e.g. MAAS, FFMQ), which additionally capture this inward orientation of mindfulness, could help us understand if mindful activities that resonate with one's inner psychological needs are most meaningful for flourishing. Second, while this study assessed multiple aspects of flourishing, some important dimensions that are highly valued by mindfulness practitioners such as equanimity, meaning, and compassion were not captured (Kabat-Zinn, 2003). Studies with measures that consider additional domains of flourishing (e.g. character and virtue) (VanderWeele, 2017), that are not included in Keyes' framework, would help us understand mindfulness and holistic well-being in a fuller sense. Next, MIDUS participants are predominantly non-Hispanic White and most are Christian (Schuurmans-Stekhoven, 2018), which limits generalizability of the findings to other ethnic and religious groups. In addition, the majority of the participants in this sample were in their middle adulthood at the time flourishing was assessed, with relatively few older adults and a very small proportion of young adults. Therefore, the study findings may not be applicable to all age groups. Studies that use more diverse samples would enhance our understanding of whether and how mindfulness contributes to flourishing across sociodemographic groups, spiritual traditions, and cultures.

Mindfulness is an inherent human capacity, and moreover is a skill that can be developed. To the

latter point, training programs (e.g. MBSR, MBCT) that help individuals further cultivate this capacity and practice it in all aspects of life are now widely available (Kabat-Zinn, 2003). Of note, such mindfulness-based programs may be particularly meaningful for individuals in transition to late adulthood. Aging is often accompanied by social, cognitive, and physical changes (e.g. retirement, health decline, and loss of loved ones) that require adaptation. Beyond its potential benefits for emotional, mental, cognitive, and physical health, mindfulness also supports older adults in cultivating a deeper sense of meaning and connection, as well as fostering present-moment awareness and emotional regulation, all of which may help them navigate life transitions more effectively (Fiocco & Meisner, 2020; Nilsson et al., 2015). Therefore, the skill of mindfulness could help individuals adapt to and accept aging-related changes non-judgmentally, rather than habitually perceiving them as deficits or threats to well-being (Allen et al., 2017). Further studies are warranted to develop a more nuanced understanding of the roles of mindfulness in promoting healthy aging and flourishing at different stages of life. This study also provides further evidence that mindfulness may provide long-term benefits on various aspects of psychosocial flourishing for middle-aged and older adults. However, this study, along with some prior evidence, suggests that mindfulness may not influence all aspects of well-being equally and sometimes may even lead to unexpected consequences. Therefore, further research that enhances nuanced understandings of how mindfulness shapes pathways to flourishing and how to mitigate unexpected consequences in mindfulness training is warranted. As evidence accumulates, we will have a better understanding of the potential of integrating mindfulness-based programs into public health practices and health policy aimed at enhancing well-being in mid- to late-life. Expanding access to mindfulness interventions in community, workplace, and clinical settings represents a promising strategy to promote long-term flourishing in middle-aged and older adults.

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### Authors' contributions

Y.C., E.S.K, J.S.N, T.L., and T.J.V. developed the study concept. Y.C. had full access to the data in the study and takes responsibility for the integrity of the data and accuracy of the data analysis. Y.C. drafted the manuscript. E.S.K, J.S.N,

T.L., and T.J.V. provided critical revisions, and approved the final submitted version of the manuscript.

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E.S.K has worked as a consultant with AARP and UnitedHealth Group. T.J.V. has received licensing fees from Flerish Inc. and Flourishing Metrics.

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