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RESEARCH PAPER

The Impact of Cardiovascular Health in the Association between mind-body Practice and Holistic well-being: Findings from a 20-year Study in US Adults

Kallol Kumar Bhattacharyya[1] · **Chitra Ghosh**[1] · **Shailpik Bhattacharyya**[2]

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Abstract

Mind-body practice can benefit various physical and mental health conditions. However, the exact role of cardiovascular health in the association between mind-body practice and holistic well-being, as often measured by flourishing, in mid- and late life, remains a growing field of research. This study examined respondents enrolled in waves 1–3 of the Midlife in the United States (MIDUS) study (N = 2,536; Mage = 65 ± 11, women 55%), merging data from the main self-administered questionnaire and biomarker projects. Holistic well-being was assessed by a composite flourishing score constructed from respondents' emotional, psychological, and social well-being status. Structural equation models examined whether persistent mind-body practice across two waves (1–2) or intermittent practice at one wave is associated with better flourishing over 20 years, compared to no practice, while controlling for covariates (baseline sociodemographic, health, and functional status). Furthermore, we evaluated whether better cardiovascular health, as assessed by the parameters of Life's Essential 8 defined by the American Heart Association, mediates the above associations. Only 18% of participants were identified using mind-body practice at any frequency. After controlling for covariates, findings revealed that persistent mind-body practice has a significant positive effect (b = 1.078; SE = 0.523; p < .05) on flourishing. Although cardiovascular health status has a significant positive effect (b = 0.325; SE = 0.125; p < .05) on flourishing, it does not mediate the association between persistent mind-body practice and flourishing. More research is necessary, considering other possible confounding factors, to support future policy and practice recommendations aimed at enhancing the overall well-being of middle-aged and older adults.

Keywords Mind-body practice · Cardiovascular health · Well-being · Flourishing

✉ Kallol Kumar Bhattacharyya
kkbhttch@memphis.edu

[1] School of Public Health, University of Memphis, 3825 Desoto Avenue, 136C Robison Hall, Memphis, TN 38152, USA

[2] Green Canyon High School, Logan, UT, USA

1 Introduction

Holistic well-being is a constantly evolving construct, still without any universally accepted definition (Östlund, 2024), and is commonly understood as the favorable state of being, encompassing "bio-psycho-social-ecological" prosperity (Kiknadze & Fowers, 2023). Earlier well-being evaluations emphasized traditional concepts of emotional health and included subjective measures, such as happiness and life satisfaction (Diener, 1984), restricting the perceptions and experience of well-being. However, a newer multidisciplinary perspective on holistic well-being encompasses multifaceted components, including several psychological and social dimensions, towards building a more comprehensive understanding of overall well-being (Eisele, 2020; Ryff et al., 2021; Keyes, 1998). Holistic well-being promotes a more comprehensive and effective strategy for improving overall health by emphasizing the interconnectedness of these dimensions (Paradisi et al., 2024), which also includes its associations with resilience and family functioning (An et al., 2023; Prasetyo et al., 2024). As the relevance of holistic well-being to health has grown, the concept of flourishing has emerged and been increasingly used in recent decades (Kiknadze & Fowers, 2023).

Flourishing is a psychological attribute of an individual's overall well-being that encompasses emotional, psychological, and social health, recognizing that each component contributes to an individual's overall health (Ryff et al., 2021). Flourishing is a key measure of holistic well-being that extends beyond the absence of illness to include positive states such as happiness, purpose, and life satisfaction (Huppert & So, 2013; Kelly-Hedrick et al., 2020; Symons & VanderWeele, 2024; VanderWeele, 2017). This critical comprehensive approach, rather than just treating isolated symptoms, addresses chronic disease and mental health issues by focusing on the whole person. It provides a comprehensive picture of health that links better outcomes with reduced risks of chronic disease, cognitive decline, and mental health disorders, enabling individuals to realize their potential and pursue meaningful goals and aspirations (Huppert, 2009; Seligman, 2011). On a more evolved level, it integrates two key perspectives: hedonic and eudemonic (Paradisi et al., 2024; Ryff et al., 2021; Symons & VanderWeele, 2024; Verhaeghen, 2024). The hedonic approach measures subjective well-being and assesses emotional health, i.e., happiness and life satisfaction. On the other hand, the eudemonic approach offers an objective assessment of psychological functioning, emphasizing self-actualization, i.e., purpose and pursuit of meaningful goals (Diener, 1984; Huppert & So, 2013; Keyes, 2002; Ryff, 1989).

In the context of well-being, mind-body practice, a common daily activity in Eastern culture since ancient times, is a growing trend in Western countries that provides an opportunity for individuals to engage themselves in meaningful activities promoting subjective well-being (Bhattacharyya et al., 2023; Younge et al., 2015). Recent data suggest that nearly two-fifths of the population in the United States engage in some form of mind-body practice at varying frequencies (Bhattacharyya et al., 2022). Mind-body practice refers to activities such as yoga, tai chi, and Pilates, which combine physical movement, breathing exercises, and meditation to enhance both mental and physical health (Bhattacharyya et al., 2023). These practices have a profound impact on holistic well-being, which has led to increased recognition. For example, research shows that yoga effectively improves cognitive function, reduces stress, and enhances emotional resilience, making it a valuable tool for promoting overall health, especially as individuals age (Bhattacharyya et al., 2022). Yoga supports both cognitive and emotional well-being by integrating physical movement with mindful-

ness and significantly enhances life satisfaction, emotional balance, and mindfulness (Bhattacharyya et al., 2023). It supports key elements of flourishing by helping people manage stress, build resilience, and boost self-awareness (Hagen & Hagen, 2024). These practices may help individuals lead a more balanced and fulfilling life, aligning with the greater goal of flourishing and living a life full of purpose and optimal health (Bhattacharyya et al., 2023). Evidence suggests that mind-body practices are effective and safe adjuncts to traditional medical management for several chronic conditions, including insomnia, chronic pain, depression, hypertension, and cardiovascular disease (Younge et al., 2015).

Cardiovascular health has been a global focus of public health (Cheng et al., 2024; Dong et al., 2025). Recent research suggests a projected 35.6 million deaths in 2050 due to cardiovascular disease, which is much higher than the current statistics, i.e., an estimated 20.5 million cardiovascular deaths in 2025 (Chong et al., 2024). Good cardiovascular health helps individuals' bodily systems operate effectively. Contextually, the American Heart Association (AHA) developed standardized metrics in 2010 based on clinical and population health studies and updated its framework from Life's Simple 7 to Life's Essential 8 in 2022, considering the prior framework's limitations. This new model includes the original seven metrics, such as smoking status, physical activity, diet, blood pressure, body mass index (BMI), blood glucose, and cholesterol, and adds sleep health as an additional component. This update reflects the growing recognition of sleep's role in cardiovascular well-being (Lloyd-Jones et al., 2022). Life's Essential 8 is recognized as a holistic approach and a comprehensive tool for improving long-term cardiovascular health by achieving the optimal level of these eight categories of lifestyle factors and health metrics. Each component of Life's Essential 8 is crucial for preventing cardiovascular disease. For example, regular physical activity, a healthy diet, and controlling blood pressure and glucose help reduce the risk of heart disease. Maintaining a healthy BMI and cholesterol level is another key to preventing plaque buildup in arteries, while sleep health is essential for overall heart health (Lloyd-Jones et al., 2022).

Earlier research has found that mind-body practice may improve psychological well-being due to its stress-relieving nature, bridging the mind and body, and adding value for individuals with cardiovascular disorders (Younge et al., 2015). Furthermore, a positive link was found between ideal cardiovascular health, as measured by Life's Essential 8, and flourishing, with scholars emphasizing the relationship between cardiac health and general well-being (Liu et al., 2022; Lloyd-Jones et al., 2022). Similarly, Kubzansky et al. (2018) found that individuals who experience better psychological well-being may also have a lower cardiovascular risk. Research also explained how cardiovascular health is connected with mind-body practice and flourishing. These practices boost well-being through more direct psychosocial pathways, rather than by solely improving heart health.

2 Literature Gap and Purpose of the Study

While many existing pieces of literature seek a direct relationship between various physical and mental health conditions and holistic well-being (AlNujaidi et al., 2025; Gheonea et al., 2023; Ryff et al., 2021), studies exploring relationships between mind-body practice and holistic well-being are limited, especially over a long period. To fill this gap, using Keyes' theoretical concepts of flourishing (Keyes, 2002) that combine hedonic/emotional

well-being with eudaimonic/functional dimensions of psychological and social well-being (Huppert & So, 2013), the current study aims to examine whether persistent mind-body practice predicts better flourishing scores, which covers emotional, psychological, and social well-being over 20 years. Moreover, it investigates whether cardiovascular health, as measured by Life's Essential 8, mediates the association between mind-body practice and flourishing. We hypothesized that (i) persistent mind-body practice would predict better flourishing scores and (ii) ideal cardiovascular health would mediate the association between mind-body practice and flourishing.

3 Methods

3.1 Study Design

The current study is a secondary analysis of data from the Midlife in the United States (MIDUS: https://midus.colectica.org/) survey, a large-scale longitudinal study spanning two decades. Wave 1 of this survey began in 1995, with 7,108 English-speaking participants (Mean age = 46 ± 13) across the United States (Hughes et al., 2018), followed by wave 2 in 2004 and wave 3 in 2013. The wave 2 survey included 75% of the wave 1 MIDUS respondents, and wave 3 included 77% of wave 2 participants (Bhattacharyya et al., 2022; Hughes et al., 2018). The surveys were conducted over the phone and by a mailed self-administered questionnaire. This study included participants enrolled in all MIDUS waves (waves 1–3, 1995–2015) and examined only those with no missing observations; data were merged from the main and biomarker projects. The IRB approval for this study was not requested as these analyses are based on a de-identified publicly available dataset through the Inter-University Consortium for Political and Social Research (Podber & Gruenewald, 2024).

4 Measures and Procedure

4.1 Dependent Variables

Flourishing. We used holistic well-being as the dependent variable, assessed by a composite flourishing score that included emotional, psychological, and social well-being, based on Keyes' conception (Keyes, 2002), at wave 3.

Emotional well-being. We measured life satisfaction and positive affect to assess emotional well-being (Keyes & Simoes, 2012). Life satisfaction was measured using a 5-item questionnaire. MIDUS asked participants to rate their life satisfaction based on overall life, work, health, relationship with spouse/partner, and relationship with children (Prenda & Lachman, 2001). Responses were coded on a scale from 0 (worst) to 10 (best). Next, the scores were averaged both for the relationship with spouse/partner and relationship with children to create one item. Then, this score was used along with the remaining three items (life overall, work, and health) to calculate an overall mean score; higher scores reflect better life satisfaction. Next, the score was computed for cases with valid values only for at least one item on the scale (range 1–10), otherwise considered missing data. Initially, we considered the average (mean) score provided in MIDUS for the entire range of responses

on life satisfaction. For positive affect, a 6-item validated scale (Mroczek & Kolarz, 1998) was used to evaluate how much the respondents felt cheerful, in good spirits, happy, calm and peaceful, satisfied, and full of life over the past 30 days. Responses were coded on a scale from 1 (all the time) to 5 (none of the time). Responses were reverse coded to indicate that higher scores reflect greater positive feelings. An overall positive affect score (range 1–5) was calculated, averaging responses across items. Because life satisfaction and positive affect were measured on different scales, their respective scores were standardized (mean = 0, standard deviation [SD] = 1) and then summed up to create an overall score for emotional well-being ($\alpha = 0.71$).

Psychological well-being. Psychological well-being was assessed based on an 18-item Ryff's Psychological Well-Being Scale (Ryff, 1989) that included six subdomains (three items in each subdomain). These consisted of 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., "The demands of everyday life often get me down"), personal growth (e.g., "I think it is important to have new experiences that challenge how you think about yourself and the world"), positive relations with others (e.g., "People would describe me as a giving person, willing to share my time with others"), purpose in life (e.g., "I sometimes feel as if I've done all there is to do in life"), and self-acceptance (e.g., "In many ways I feel disappointed about my achievements in life"). Responses were coded, ranging from 1 (strongly agree) to 7 (strongly disagree). Responses were reverse coded as necessary to reflect that a higher score corresponds to greater well-being. Individual subdomain scores were created by adding responses for the three items under that subdomain. An overall psychological well-being score was then created by summing the responses of all six subdomains ($\alpha = 0.79$).

Social well-being. We used a 14-item scale to assess five subdomains of social well-being: 3 items assigned to each subdomain except for the 2-item social coherence (Keyes & Shapiro, 2004). The subdomains were social coherence (e.g., "I cannot make sense of what's going on in the world"), social integration (e.g., "I feel close to other people in my community"), acceptance of others (e.g., "People who do a favor expect nothing in return"), social contribution (e.g., "My daily activities do not create anything worthwhile for my community"), and social actualization (e.g., "Society has stopped making progress"). Responses ranged from 1 (strongly agree) to 7 (strongly disagree). Responses were reverse coded as necessary to indicate that higher scores correspond to greater well-being. Subdomain scores were created by adding responses for items respective to each subdomain. As subdomains were assessed on different scales, their scores were standardized first and then summed up to create an overall social well-being score ($\alpha = 0.74$).

Finally, we standardized emotional, psychological, and social well-being scores as these scores were measured on different scales and then summed up to create a composite flourishing score (Chen et al., 2019), which we used as a continuous measure to assess holistic well-being.

4.2 Key Independent Variable

Mind-body practice was used as the key independent variable. Participants responded to the question, "In the past 12 months, either to treat a physical health problem, to treat an emotional or personal problem, to maintain or enhance your wellness, or to prevent the onset of

illness, how often did you use—exercise or movement therapy (yoga, pilates, tai chi, etc.)?" on a 5-point Likert scale ranging from 1 (practiced "a lot") to 5 ("never"). Responses were reverse coded reflecting higher values correspond to more frequent mind-body practice (i.e., "a lot" = 4, "often" = 3, "sometimes" = 2, and "rarely" = 1); responses indicating no practice (i.e., "never") were coded as 0. We further combined the responses indicating any frequencies of mind-body practice (1–4, i.e., "rarely" to "a lot") as 1 versus 0 (i.e., "never") based on distribution of the raw variable. To measure persistent mind-body practice, we further constructed the responses as a four-level practicing context variable using mind-body practice across waves 1 and 2: no practice either at wave 1 or 2 (reference) coded with a [0], practice at wave 1 only [= 1], practice at wave 2 only [= 2], and persistent practice at waves 1 and 2 [= 3].

4.3 Mediator Variable

We used individuals' cardiovascular health status in wave 2 as the mediator. Participants' cardiovascular health status was categorized based on the parameters of Life's Essential-8 defined by the AHA (Lloyd-Jones et al., 2022), which includes diet, physical activity, nicotine exposure, sleep health, body mass index, blood lipids, blood glucose, and blood pressure (see *Supplementary Table 1*). For each indicator, scores were coded as 1 (if respondents met the ideal AHA criterion) or 0 (otherwise). A composite cardiovascular health score was calculated by summing the parameters assessed, ranging from 0 (i.e., meeting no ideal cardiovascular health metric) to 8 (i.e., meeting all ideal cardiovascular health metrics). The current analysis used the continuous composite cardiovascular health score.

Briefly, regarding the percentile score for diet, the 2015 Healthy Eating Index score was measured from self-reported food frequency questionnaires from the National Health and Nutrition Examination Survey. Physical activity and sleep health were measured as self-reported minutes of moderate or vigorous activity per week and the average number of sleep hours per night, respectively. Systolic and diastolic blood pressure and BMI were measured at the clinics. Nicotine exposure scores were calculated from the original AHA scoring, measured based on self-report questionnaires, and categorized as never, previous, or current smoker in a prior study. Blood lipids (non-HDL cholesterol) and blood glucose were measured from Women's Health Initiative (WHI) data samples; for participants who self-reported taking lipid-lowering medications on the questionnaire, their blood lipid score was reduced by 20 points. Finally, as glycosylated hemoglobin was not recorded for many participants in the WHI dataset, the blood glucose score was calculated using data on fasting blood glucose and treatment for diabetes, similar to a previously published study (Wadden et al., 2024). Life's Essential 8 measures are summarized in *Supplementary Table 1*.

4.4 Covariates

Baseline (wave 1) sociodemographic, health, and functional factors were used as covariates. Sociodemographic variables included age, gender, race, marital status, education, and employment. While age (0 = < 65, 1 = ≥ 65) and gender (0 = *male*, 1 = *female*) were binary variables, and race (1 = *White*, 2 = *Black*, 3 = *other*) was measured in three categories. Marital status (1 = *married*, 2 = *separated/divorced*, 3 = *widowed*, 4 = *never married*) and educational level (1 = *no/some school*, 2 = *high school graduate/in college*, 3 = *graduated from college*,

4 = *having master's/professional degree*) were measured in four categories; employment status was measured in two categories (1 = *currently working*, 2 = *currently not working*).

Several variables were assessed to evaluate health and functional status. Respondents were asked, using a functional status questionnaire, if they had difficulty (i.e., functional limitations) in performing activities of daily living (ADLs) and instrumental activities of daily living (IADLs). We computed the sum using responses in MIDUS on functional limitations (ranging from "a lot" to "no difficulty"), reflecting higher values as greater difficulties. We also included additional health variables, including respondents' tobacco and alcohol use (1 = regular tobacco/alcohol user, or 0 = not) and their past 12 months' medication usage (sum of five indicators: tranquilizer, sedatives, stimulants, painkillers, and anti-depression medications). Lastly, because personality traits were established as significant correlates of emotional, psychological, and social well-being across adulthood (Alphenaar et al., 2025; Strickhouser & Sutin, 2021), we also considered these variables as potential confounders in our analysis. We included the big five personality traits, including agreeableness (helpful, warm, caring, softhearted, and sympathetic), conscientiousness (organized, responsible, hardworking, and careless [reverse coded]), extraversion (outgoing, friendly, lively, active, and talkative), openness (creative, imaginative, intelligent, curious, broadminded, sophisticated, and adventurous), and neuroticism (moody, worrying, nervous, and calm [reverse coded]) (Zimprich et al., 2012). Responses were measured on a 4-point Likert scale (1="a lot" to 4="not at all") and averaged for each trait. This study also adjusted for the baseline (wave 1) flourishing score, calculated in the same manner as for wave 3, as a covariate to minimize potential reverse causation.

5 Statistical Analysis

Our preliminary analyses examined participants' demographic characteristics, health, and functional status in the total sample and in the sample stratified by mind-body practice status at wave 3; we used multiple imputations to address missing data. We then used structural equation models to examine whether persistent mind-body practice across two waves (1–2) or intermittent practice at one wave is associated with better flourishing over 20 years (assessed at wave 3), compared to no practice, while controlling for baseline flourishing and covariates (sociodemographic, health, and functional status) assessed at wave 1. Additionally, we assessed whether better cardiovascular health (at wave 2), which was measured using the parameters of Life's Essential 8 defined by the AHA, mediates the above associations, controlling for baseline cardiovascular health. Statistical significance was evaluated at $p<.05$ (two-sided). Unstandardized regression coefficients (b) and standard errors (SE) are reported. We calculated structural equation models (SEMs), modeling the constructs as measured variables. We applied robust maximum likelihood estimation and adjusted the standard errors for repeated observations over time with bootstrapping. All statistical analyses were conducted with Stata 18.5 SE (College Station, TX) software.

6 Results

Table 1 shows the descriptive statistics of different variables, including participants' sociodemographic characteristics and health status at wave 3 for the total sample and the sample stratified by mind-body practice status, i.e., users versus non-users. A total of 2,536 individuals (who participated in all 1–3 waves of MIDUS) aged 42–92 years (*Mage* = 65 ± 11) in wave 3 were included in the analysis. Women comprised 55% of the sample, 59% were employed, and 90% were White. Three-fifths of the participants were alcohol users; four-fifths of the sample had difficulty with ADL. The findings revealed that only 18% of participants used mind-body practice at any frequency. Among mind-body practitioners, a

Table 1 Comparison of participant characteristics of US adults in MIDUS wave 3 (n=2,536)

Variables	Mind-Body Practice Status			
	Overall (*n* = 2,536)	Non-User (*n* = 2,046; 82%)	User (*n* = 449; 18%)	*p*-value
Age in year M (SD)	64.6 (11.0)	64.9 (11.0)	62.4 (10.5)	<0.001
≥65 (%)	49.1	51.2	39.4	
<65 (%)	50.9	48.8	60.6	
Women (%)	54.9	52.4	65.9	<0.001
Race/ethnicity (%)				0.093
White	90.3	90.0	91.9	
African American	2.9	2.8	3.6	
others	6.7	7.2	4.5	
Marital status (%)				0.496
married	67.9	68.5	65.2	
separated/divorced	14.1	13.7	16.0	
widowed	11.2	11.2	11.4	
unmarried	6.8	6.6	7.4	
Education (%)				<0.001
no/some school	5.3	5.8	2.9	
graduated from school	42.0	43.4	35.8	
graduated from college	34.4	33.8	37.4	
Master's/prof. degree	18.3	17.0	23.9	
Employment (%)				0.009
working	59.4	60.6	53.9	
not working	40.6	39.4	46.1	
Health and functional status				
Tobacco-user (%)	8.7	9.8	3.3	<0.001
Alcohol-user (%)	59.4	57.9	66.1	<0.001
Difficulty in ADL (%)	79.3	78.4	83.5	0.015
Sleep problem (%)	12.6	11.9	15.7	0.031
Medication (%)	9.7	9.2	11.8	0.096
Agreeableness M (SD)	3.4 (0.5)	3.4 (0.5)	3.5 (0.5)	0.594
Neuroticism M (SD)	2.1 (0.6)	2.1 (0.6)	2.1 (0.6)	0.968
Conscientiousness M (SD)	3.4 (0.5)	3.4 (0.5)	3.4 (0.5)	0.327
Openness M (SD)	2.9 (0.5)	2.9 (0.5)	3.0 (0.6)	0.005
Extraversion M (SD)	3.1 (0.6)	3.1 (0.6)	3.2 (0.6)	0.173
Composite Flourishing M (SD)	0.1 (8.6)	−0.2 (8.6)	1.7 (8.4)	<0.001

Note. values are in column percentage or in mean (M)/standard deviation (SD)

higher proportion were younger, women, White, highly educated, and non-smokers. The mean score of participants' composite flourishing was 0.1 ± 8.6 at wave 3, which is significantly higher among mind-body practitioners. Table 2 compares the characteristics of included participants based on their mind-body practice status, i.e., persistent, intermittent, or no practice, at waves 1 and 2. Only 6.5% of persistent mind-body practice users were included in the final analysis, whereas 70% of participants never used mind-body practice. Among the users of persistent mind-body practices, more were younger, women, White, and non-smokers.

Table 2 Comparison of participant characteristics of US adults in MIDUS wave 3 based on mind-body practice status at wave 1 and 2 (n=2,536)

Variables	Mind-Body Practice Status				
	No Practice (70.3%)	Intermittent Wave 1 Only (13.1%)	Intermittent Wave 2 Only (10.1%)	Persistent Both Waves (6.5%)	*p*-value
Age in year M (SD)	64.9 (11.0)	64.8 (11.6)	62.1 (11.1)	64.8 (10.1)	<0.001
≥65 (%)	50.5	47.0	56.4	47.1	0.135
<65 (%)	49.5	53.0	43.6	52.9	
Women (%)	51.9	55.0	73.4	70.6	<0.001
Race/ethnicity (%)					0.110
White	90.0	93.2	86.9	93.5	
African American	3.2	1.0	3.8	2.6	
others	6.8	5.8	9.3	3.2	
Marital status (%)					0.246
married	69.2	65.7	64.3	60.1	
separated/divorced	13.5	13.6	15.8	18.3	
widowed	11.6	12.6	11.2	12.4	
unmarried	6.8	6.6	7.4		
Education (%)					<0.001
no/some school	5.9	4.2	3.3	2.0	
graduated from school	44.1	42.2	32.9	29.4	
graduated from college	32.6	34.4	38.8	43.1	
Master's/prof. degree	17.3	19.2	25.0	25.5	
Employment (%)					0.754
working	40.6	37.9	42.3	39.9	
not working	59.4	62.1	57.7	60.1	
Health and functional status					
Tobacco-user (%)	8.3	11.6	8.3	3.3	0.025
Alcohol-user (%)	57.3	58.8	61.8	69.9	0.016
Difficulty in ADL (%)	80.4	74.6	81.3	77.8	0.106
Sleep problem (%)	11.5	12.7	13.8	17.8	0.127
Medication (%)	9.0	11.3	7.9	15.7	0.028
Agreeableness M (SD)	3.4 (0.5)	3.4 (0.5)	3.5 (0.5)	3.6 (0.5)	0.652
Neuroticism M (SD)	2.1 (0.6)	2.1 (0.6)	2.1 (0.6)	2.0 (0.6)	0.691
Conscientiousness M (SD)	3.5 (0.5)	3.4 (0.5)	3.5 (0.4)	3.5 (0.5)	0.073
Openness M (SD)	2.9 (0.6)	2.9 (0.5)	3.0 (0.5)	3.1 (0.5)	0.023
Extraversion M (SD)	3.0 (0.6)	3.1 (0.6)	3.2 (0.5)	3.2 (0.6)	0.546
Composite Flourishing M (SD)	−0.2 (8.6)	−0.1 (8.5)	1.2 (8.0)	2.3 (8.9)	<0.001

Note. values are in column percentage or in mean (M)/standard deviation (SD)

Table 3 presents parameter estimates from the SEM showing the direct effects of mind-body practice on flourishing over the twenty-year study period, without controlling for covariates, i.e., zero-order models. Findings revealed that individuals' persistent mind-body practice has a positive and significant effect ($b = 1.443$; $SE = 0.532$; $p = .007$) on the composite score of flourishing. Further, ideal cardiovascular health has a significant positive effect on the composite score of flourishing ($b = 0.446$; $SE = 0.125$; $p < .001$); however, no association between ideal cardiovascular health and persistent mind-body practice was found, indicating that ideal cardiovascular health does not mediate the association between persistent mind-body practice and flourishing over time.

Table 4 presents parameter estimates from the SEM showing the direct effects of mind-body practice on flourishing over the twenty-year study period, involving covariates (full model). After controlling for baseline (wave 1) sociodemographic and health factors and flourishing, the findings revealed that individuals' persistent mind-body practice has a positive and significant effect ($b = 1.078$; $SE = 0.523$; $p < .05$) on the composite score of flourishing. Although ideal cardiovascular health has a significant positive effect on the composite score of flourishing ($b = 0.325$; $SE = 0.125$; $p = .009$), no association was found between ideal cardiovascular health and persistent mind-body practice, indicating that ideal cardiovascular health does not mediate the association between persistent mind-body practice and flourishing over time. For a visual representation of the main findings from Table 4; Fig. 1 illustrates the schematic path diagram showing the pathways linking the key independent variable (mind-body practice), mediator (ideal cardiovascular health), and outcome (composite flourishing) for the SEM analysis. The model fit was good for the analyzed model (comparative fit index [CFI] = 0.999, root mean square error of approximation [RMSEA] = 0.024, and standardized root mean squared residual [SRMR] = 0.001).

Note. W1 = wave 1; W2 = wave 2; W3 = wave 3. Effects of covariates not shown in the diagram

Table 3 Zero-order structural equation model examining associations of mind-body practice, cardiovascular health, and flourishing in mid and later life, n=2,536

Variables	Ideal CVH W2 (Direct Effects)			Flourishing W3 (Direct Effects)		
	b	SE (bt)	*p*-value	b	SE (bt)	*p*-value
Intercept	0.562	0.157	<0.001	−6.534	1.212	<0.001
Key Independent Variable						
Mind-body practice						
Wave 1 only	0.135	0.062	0.029	−0.389	0.402	0.333
Wave 2 only	0.097	0.074	0.188	0.642	0.411	0.118
Both	0.126	0.097	0.196	1.443	0.532	0.007
Mediator						
Ideal CVH W2	-	-	-	0.446	0.125	<0.001
Flourishing W1	0.010	0.003	<0.001	0.743	0.018	<0.001
Ideal CVH W1	0.490	0.034	<0.001	0.969	0.262	<0.001

Note. CVH = cardiovascular health, W2 = wave 2, W3 = wave 3

Table 4 Structural equation model (full model) examining associations of mind-body practice, cardiovascular health, and flourishing in mid and later life, n=2,536

Variables	Ideal CVH W2 (Direct Effects)			Flourishing W3 (Direct Effects)		
	b	SE (bt)	*p*-value	b	SE (bt)	*p*-value
Intercept	1.470	0.321	<0.001	−13.671	2.346	<0.001
Key Independent Variable						
Mind-body practice						
Wave 1 only	0.117	0.060	0.053	−0.394	0.392	0.315
Wave 2 only	0.015	0.074	0.838	0.237	0.414	0.568
Both	0.032	0.098	0.746	1.078	0.523	0.039
Mediator						
Ideal CVH W2				0.325	0.125	0.009
Flourishing W1	0.008	0.004	0.038	0.627	0.025	<0.001
Ideal CVH W1	0.210	0.043	<0.001	0.263	0.313	0.400
Covariates at W1						
Age, *years*	−0.070	0.074	0.345	−2.555	0.473	<0.001
Female *(ref. male)*	0.228	0.042	<0.001	0.303	0.278	0.276
Race/ethnicity *(ref. other)*						
White	0.119	0.094	0.205	1.036	0.735	0.159
Black	0.042	0.138	0.764	2.297	1.007	0.023
Marital Status *(ref. never married)*						
Married	−0.071	0.060	0.239	0.895	0.435	0.040
Separated/divorced	−0.193	0.071	0.006	1.445	0.506	0.004
Widowed	−0.266	0.366	0.467	5.938	1.771	0.001
Education *(ref. no/some school)*						
Graduated from school	0.072	0.073	0.318	−0.028	0.627	0.964
Graduated from college	0.279	0.079	<0.001	0.775	0.651	0.234
Master's/prof. degree	0.362	0.091	<0.001	2.712	0.683	<0.001
Employment *(ref. not working)*						
Working	−0.012	0.045	0.792	0.372	0.266	0.162
Tobacco user	−0.454	0.060	<0.001	−1.048	0.477	0.028
Alcohol user	−0.063	0.090	0.485	0.509	0.544	0.350
Difficulty in ADL	0.103	0.070	0.143	1.104	0.665	0.097
Sleep problem	−0.001	0.064	0.991	−0.428	0.480	0.373
Medication	0.001	0.073	0.986	−0.695	0.495	0.161
Agreeableness	−0.045	0.050	0.370	−0.010	0.318	0.974
Neuroticism	0.010	0.037	0.776	−0.603	0.220	0.006
Conscientiousness	0.088	0.049	0.072	1.156	0.324	<0.001
Openness	−0.019	0.046	0.682	0.200	0.312	0.522
Extraversion	−0.009	0.050	0.854	1.269	0.315	<0.001

Note. CVH = cardiovascular health, W1 = wave 1, W3 = wave 3

7 Discussion

The current study illustrates a unique contribution to the existing literature, providing population-based longitudinal evidence that individuals who engage in persistent mind-body practices experience significantly higher levels of flourishing over time, thereby supporting our first hypothesis. Despite the positive impact of ideal cardiovascular health on achieving

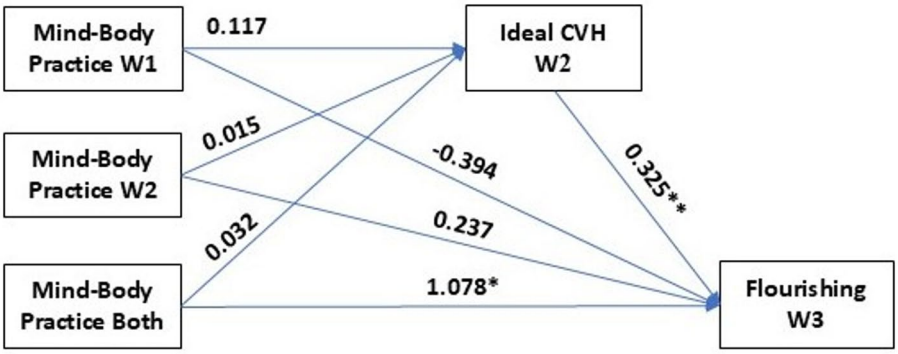

Fig. 1 Path diagram showing the pathways linking the key independent variable (mind-body practice), mediator (cardiovascular health), and outcome (flourishing) for the structural equation model (full model), n=1,736

better flourishing, the lack of an impact of ideal cardiovascular health on the association between persistent mind-body practice and flourishing, when applied with covariates, disproves our second hypothesis. The results suggest that an individual's overall well-being cannot be explained solely by sociodemographic and health factors that may coexist with various health promotional contexts; instead, some psychological and sociocultural factors may play a role in these associations (Nganje & Addey, 2019; Saenz et al., 2018).

In this context, Ren et al. (2023) found an association between Life's Essential 8 and Chronic Disease, implying that cardiovascular health has a crucial impact on overall health outcomes, including mental well-being, while Xu et al. (2024) emphasized a more direct link between cardiovascular metrics and mental health. These findings may reflect differences in study designs, such as the populations studied, how health was measured, or how long participants were followed. Wadden et al. (2024) observed that Life's Essential 8 was linked with cardiovascular disease and found a positive impact of behavioral practices on health outcomes. These results align with our current findings. Indeed, the complexity of mind-body practices encompasses elements such as mindfulness, stress reduction, and a sense of social connection, factors that can have powerful, direct effects on mental well-being without necessarily altering physical health markers (Slimmen et al., 2022). The benefits of these practices extend beyond the physical and impact on how people feel and function every day.

Our study shows that individuals who regularly practice mind-body activities, such as yoga, tai chi, or Pilates, tend to experience higher levels of overall well-being, as assessed by flourishing, over 20 years. These practices support emotional, psychological, and social health (Blumenthal et al., 2007; De Moor et al., 2008). Our findings also align well with Keyes' (2002) idea of flourishing, which involves thriving across many aspects of life. For example, recent research revealed the effect sizes of yoga-related mind-body intervention on various cognitive domains ranged between 0.3 and 0.4, even in persons with dementia, which are similar to what we commonly found in randomized controlled trials on cholinesterase inhibitors such as donepezil, in participants with similar cognitive functionality (Bhattacharyya, Andel, et al., 2021). Because cognitive performance is also directly related to well-being in later life, our findings align with earlier research of similar lines.

We found that better cardiovascular health, measured by Life's Essential 8, is linked with greater flourishing. Lloyd-Jones et al. (2022) found that heart health plays an important role in overall well-being. Similarly, Kubzansky et al. (2018) showed that positive mental health can reduce the risk of heart problems, suggesting two relationships between mind and cardiac health. However, past research on whether cardiovascular health mediates this relationship has yielded mixed results. Ren et al. (2023) found some mediation effects, while Xu et al. (2024) reported a stronger direct connection between cardiovascular health metrics and mental health issues. Understanding how factors such as socioeconomic status and geographic location influence these relationships is also crucial. Studies like those by Gong et al. (2019) and Lewis-Thames et al. (2022) have pointed out that where individuals live and the resources available to them can greatly impact their health and access to practices that support flourishing. Our findings align with the earlier view that suggested incorporating various cultural viewpoints into theories of flourishing as a crucial step toward global inclusiveness (Kiknadze & Fowers, 2023).

Biomedical aspects of mind-body practices that have been studied so far can help explain their working mechanisms. Many studies revealed positive physiological effects of mind-body practice on blood pressure, heart rate, respiration rate, and oxygen consumption. An extended body of research has found that mind-body practices are associated with enhanced physical activity, lower stress, and higher well-being (Bhattacharyya et al., 2023; Maric et al., 2021). The negative effects of stress on cognitive function are well-documented (Marin et al., 2011). Stress is associated with negative health consequences, triggering individuals' sympathetic nervous system; as a result, inflammatory neurotransmitters such as cytokines are released, causing adverse effects on cognitive functions. Mind-body practice, through a down regulatory effect on the sympathetic nervous system and hypothalamus-pituitary-adrenal axis in response to stress, may reduce the production of inflammatory neurotransmitters through a complex neuronal mechanism and, thus, reduce stress (Bhattacharyya et al., 2022; Ulrich-Lai & Herman, 2009), which ultimately helps reducing blood pressure, heart rate, respiration rate, and the entire cardiovascular system. Contextually, a study involving 4,307 randomly selected individuals in yoga practice found that the majority of participants reported experiencing improved happiness (87%), energy (85%), sleep (69%), social relationships (67%), and weight (57%) after practicing yoga (Ross et al., 2013). Individuals may turn to mind-body practice for these stress-reducing effects. Additionally, engaging in physical activity, such as mind-body practices like yoga, can enhance muscle strength and body flexibility, as well as improve respiratory and cardiovascular function. Both factors have been associated with higher levels of well-being in previous studies (Bhattacharyya et al., 2023; Rocha et al., 2012); this may explain why persistent engagement in mind-body practice helps individuals flourish better. Earlier research also found that comorbidity was associated with a higher frequency of mind-body practice over 20 years, independent of sociodemographic status, suggesting that individuals engaged in mind-body practice might do so because they expect positive health benefits (Bhattacharyya, Hueluer, et al., 2021; Bhattacharyya et al., 2023). Mind-body practice may also provide individuals with an opportunity to remain physically active and incline them to practice for a longer time.

Future research should delve deeper into several areas to further understand the associations between mind-body practice, cardiovascular health, and holistic well-being. Also, it is essential to explore how various mind-body practices affect mental health aspects, such as anxiety, and identify potential mediators like inflammation or social support. More research

is needed among diverse and vulnerable populations, such as rural communities and individuals living in long-term care, to help us understand how mind-body practices and cardiovascular health impact well-being in various contexts. Future studies should focus on the combined effects of stress-related factors, such as disturbed sleep, on cardiovascular health and other chronic conditions, and how mind-body practice could offer insights into those associations, targeting holistic health promotion. These areas can enhance interventions aimed at improving both physical and mental health outcomes across populations.

8 Limitations

The current study has some limitations. First, the retrospective selection of reported data raises concerns of recall bias, especially in participants' history of mind-body practice. Further, the study participants were not initially screened for cognitive problems, which raised a generalizability concern. Second, our sample comprises only participants who completed all three waves of MIDUS, raising potential bias due to non-random attrition. Socioeconomic and health status, including cardiovascular-related mortality, might influence study retention. Third, the key independent variable (i.e., mind-body practice) encompasses multiple reasons for engaging in such practice; specifically, doing mind-body practice because of illness prevention and doing mind-body practice because of illness treatment are different and may create uncertainty in causal direction, inducing a generalizability bias. For example, it is plausible that individuals with better cardiovascular health were more likely to sustain mind-body practices, rather than mind-body practices improving cardiovascular health. Additionally, mind-body practice was assessed as "exercise or movement therapy" in the last 12 months, with examples including yoga, tai chi, and Pilates. Because the available data does not identify which mind-body practice approach was used by the participants, the broad question precluded us from examining the effects associated with specific types of practice, again inducing a generalizability concern. Furthermore, our analyses were based on two data points on mind-body practice, which precluded the analysis of non-linear trends; therefore, selection bias is a large concern in the current study—we acknowledge that individuals who can and cannot continue mind-body practice over 10 years likely differ in ways that are systematically associated with the outcomes. However, using the MIDUS data, it is not possible to extract whether one persistently continued mind-body practices over the ten-year study period. Fourth, the racial makeup of the current sample is predominantly White, which limits the external validity to diverse racial/ethnic groups that include a representative number of African Americans, Hispanics, and Asians. Lastly, the study data are relatively old, and changes in socioeconomic factors may affect the applicability of the results to today's populations, especially given the growing trends in mind-body practice adoption in the Western countries today. Future research should also consider sociocultural variables and explore more diverse and contemporary samples for broader applicability.

9 Conclusion

The study findings contribute important theoretical insights into the relationship between mind-body practices, cardiovascular health, and holistic well-being, highlighting the positive impact of these practices on flourishing and overall well-being. Additionally, it also finds that ideal cardiovascular health did not significantly boost the association between mind-body practice and well-being over time when correlated with multiple other factors. Mind-body practice, with its physical activity component, is often associated with better cardiovascular health; however, many other factors may influence this association, offering a new perspective for future research. Further studies should explore the mechanisms behind the impact of other socioeconomic and cultural factors on the relationship between mindfulness practices, cardiovascular health, and well-being across the lifespan. With the increasing trend of mindfulness practice as a complementary approach, policies are also needed to recognize this alternative therapeutic practice as a potentially viable complement to medical management for many chronic conditions.

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Data Availability Data can be assessed from the publicly available MIDUS dataset: https://midus.colectica.org/The impact of cardiovascular health in the association between mind-body practice and holistic well-being: Findings from a 20-year study in US adults.

Declarations

Conflict of interest The authors declare that they have no conflicts of interest.

Ethical Approval The IRB approval for this study was not requested as this analysis is based on a de-identified publicly available dataset through the Inter-University Consortium for Political and Social Research.

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