ORIGINAL ARTICLE

Premenopausal and perimenopausal predictors of postmenopausal health and well-being: Testing a disposition-belief-motivation framework

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Abstract

The present study tested a Disposition-Belief-Motivation model of peri- and post-menopausal health and well-being using a 20-year prospective design from the Mid-life in the United States (MIDUS) study. Screening algorithms based on World Health Organization guidelines produced a sample of women that was premenopausal at Time 1, perimenopausal at Time 2, and postmenopausal at Time 3 ($N = 247$). Prospective path modeling tested the direct and indirect effects of premenopausal factors on peri- and post-menopausal health and well-being. The results showed positive premenopausal attitudes toward aging were directly associated with greater postmenopausal well-being. Older baseline age was indirectly associated with greater postmenopausal well-being through perimenopausal well-being. Greater premenopausal functional ability was indirectly associated with greater self-rated postmenopausal health via greater perimenopausal self-rated health. Although premenopausal factors predicted perimenopausal optimism, coping, and symptoms, none was directly associated with postmenopausal health or well-being. Controlling for perimenopausal health and well-being,

This work was preregistered at AsPredicted.org and can be found at this link https://aspredicted.org/6NM_6WM. The analysis code is provided in the supplemental material, and the dataset can be found here.

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the results highlight the roles of greater premenopausal age, greater functional ability, and less concern about fertility, attractiveness, and illness in predicting perceptions of health and well-being across the menopause transition. The finding for aging attitudes, in particular, suggests the importance of reinforcing positive messaging and norms for women's aging and health, rather than medicalizing menopause and its symptoms.

KEYWORDS

aging attitudes, health, menopause, personality traits, subjective well-being

INTRODUCTION

The process of menopause typically begins between the ages of 45 and 55 and describes the permanent cessation of menstruation resulting from natural age-related changes in reproductive function (Monteleone et al., 2018; NIH, 2017). The present work uses the stages of menopause defined by the World Health Organization (1996), which include pre-menopausal (i.e., the entire reproductive lifespan until the final menstrual period), perimenopausal (i.e., the period of time immediately before and one year after the final menstrual period), and postmenopausal (the duration of the lifespan after the 1-year post-menstruation mark) stages.

Extant research examining menopause has relied upon a variety of conceptual framings, where symptoms are often the focal topic (e.g., Monteleone et al., 2018; Sassoon et al., 2014; Simon et al., 2018). With symptoms as the research foci, an illness/condition (i.e., menopause) is presumed to be the cause. As a result, this research framing primarily conceptualizes menopause as a biomedical and/or clinical phenomenon. For example, studies guided by the biomedical model have shown changes in endocrine system functioning during perimenopause were associated with vasomotor symptoms (i.e., sweating, temperature dysregulation), headaches, accelerated weight gain, increased blood pressure, higher LDL cholesterol, loss in bone density, and decreased collagen production (Monteleone et al., 2018). Symptom-focused research that includes psychosocial constructs showed menopause symptoms to be cross-sectionally associated with greater stress (Bosworth et al., 2003), depression and anxiety symptoms (Elavsky & McAuley, 2009), and decreased social activity (Wieder-Huszla et al., 2014). However, research has also shown menopause status alone does not significantly predict differences in life quality and satisfaction (Bondarev et al., 2020; Hu et al., 2017; Jafary et al., 2011).

A clear exception to the reliance on cross-sectional designs is the Study for Women's Health Across the Nation (SWAN, n.d.), which has produced scores of published works examining midlife health. As a large-scale epidemiological study wherein one of the secondary aims is to characterize "psychosocial issues" (SWAN Scientific Areas Description), SWAN utilizes a clinical lens for psychological factors, e.g., focusing on depression and anxiety (e.g., Bromberger et al., 2013, 2022; Colvin et al., 2017; Kravitz et al., 2014, 2022). As it relates to the psychosocial approach of the present work, Avis et al. (2021) reported the effects of optimism, (lower) anxiety, resilience, and attitudes toward menopause on a post-menopausal composite measure of psychological well-being.

However, this study employed a time-varying design that was unable to clearly align some factors to pre-menopausal, perimenopausal, post-menopausal stages (based on the varied timing of assessments of different variables) – a design limitation addressed in the present work.

Taken together, prior approaches have generally used a biomedical and clinical, rather than a psychosocial and normative, framing of menopause (e.g., Rocca et al., 2011), despite on-going calls to conceptualize and integrate menopause among other processes of midlife quality and health (e.g., Kalra & Kalra, 2020; Newhart, 2013). While a normative framework acknowledges that the timing and mode of the menopause transition can vary, it posits menopause as a universal experience that should not only be rendered as a disease or reduced to a set of symptoms (Newhart, 2013).

Using a Disposition-Belief-Motivation framework (cf. Bogg et al., 2023; Bogg & Milad, 2020; Griffith et al., 2024; Vo & Bogg, 2015) with prospective data from the Midlife in the United States (MIDUS) study, the present work aligned psychosocial and health-related constructs to premenopausal, perimenopausal, and postmenopausal stages to test theoretically-informed paths to well-being and health status across the menopause transition. Moving beyond solely clinical or biomedical renderings of menopause, the influences of premenopausal personality traits, gender norms, bodily sensitivity, attitudes, and demographic characteristics on post-menopausal appraisals of health and well-being were tested across a 20-year time span. Moreover, the influence of perimenopausal symptoms on postmenopausal self-rated health and well-being were tested in concert with premenopausal traits and candidate peri-menopausal factors, including optimism, coping, perceived activity, and health status and well-being.

By testing the prospective effects of psychosocial and health-related factors implicated in prior cross-sectional research (e.g., Wieder-Huszla et al., 2014), the aim of the current study was to clarify a stage-informed and normatively-oriented process model of menopause adjustment. The timing of the three assessments aligned with the positioning of the hypothesized effects (i.e., premenopausal, perimenopausal, and postmenopausal stages) and, while perimenopause-associated symptoms were assessed, they were situated among health-related and psychosocial factors as partial influences on postmenopausal health and well-being, rather than as primary features of the model. As described in the sections that follow, the present work integrates empirical support from disparate lines of inquiry to test this stage-informed and normatively-oriented model of the menopause transition.

Dispositions, beliefs, and the menopause process

As noted above, outside of intervention studies and limited prospective studies, most prior research on the psychosocial determinants of menopause adaptation, including dispositions (e.g., personality traits) and beliefs (e.g., attitudes), has used cross-sectional designs, despite the (typical) years-long nature of the menopausal transition.

In work examining Big Five personality traits, greater neuroticism has been shown to be associated with greater global stress appraisal, anxiety, depression, sexual distress, lower social functioning, and poorer physical health in samples of middle-aged women either approaching or experiencing menopause (Bosworth et al., 2003), and experiencing menopause symptoms (Elavsky & McAuley, 2009; Wieder-Huszla et al., 2014). In one of the few studies using a short-term prospective design, neuroticism predicted increased symptom severity for insomnia-related functioning in a sample of perimenopausal women (Sassoon et al., 2014). Implicated as a lower-order feature of neuroticism, trait-level bodily sensitivity (cf. Costa & McCrae, 1987) has been shown to

be associated with greater symptom "bother" in a sample of middle-aged women experiencing hot flashes or night sweats, excluding premenopausal and hysterectomy status (Thurston et al., 2008).

Greater agreeableness (caring, warm), conscientiousness (organized versus careless), extraversion (outgoing, lively), and openness (broad-minded, curious) have shown associations with greater self-reported quality of life in a sample of middle-aged women (Bosworth et al., 2003). Moreover, baseline agreeableness and conscientiousness prospectively predicted a lower likelihood of an insomnia diagnosis in a sample of perimenopausal women (Sassoon et al., 2014). Regarding openness, research examining other developmental transitions among women (e.g., returning to the workforce after bearing a child) shows this trait is associated with gender-norm ideology (beliefs that women and men have different or unbalanced roles; Weiss et al., 2012). Specifically, women with greater openness *and* weaker beliefs that women and men hold different or unbalanced roles showed greater levels of subjective well-being across these transitions (Weiss et al., 2012). Beyond Big Five traits, dispositional optimism (cf. Carver & Scheier, 2014) is cross-sectionally associated with fewer reported depression and anxiety symptoms in a sample of menopausal women participating in an intervention for physical activity (Elavsky & McAuley, 2009).

Beyond broad personality traits, beliefs about the menopause transition also are associated with health status (Nosek et al., 2010). There are multiple measures of beliefs about menopause. For example, a popular measure developed by Neugarten et al. (1963) assesses positive (e.g., *"many women with many interests in life hardly notice the menopause"*) and negative (e.g., *"many women worry about losing their mind during menopause"*) sentiment themes regarding menopause. Longitudinal research using items from this scale, such as *"many women become depressed or irritable during the menopause,"* and *"many women feel regret when their periods stop for the last time"* found that negative attitudes among premenopausal women were associated with greater physical problems and depressive symptoms 3 years later (at which time, many had transitioned to peri-, post-, or surgical-menopause stages; Avis & McKinlay, 1991).

Research that developed assessments of attitudes based on qualitative themes from a small sample of women, with feedback on item content from experts, found that some attitudes are associated with multiple well-being domains (e.g., women who agree that *"Menopause is a natural event in women's life"* have significantly less vasomotor, psychological, physical, and sexual symptoms; Yanikkerem et al., 2012). In MIDUS assessments, the women's section of the self-administered questionnaire included beliefs about getting older. As a result, the measurement of women's aging beliefs in the present work is focused on three domains; (loss in) fertility, physical attractiveness, and health (referred to in other work as attitudes toward menopause, Strauss, 2011a, 2011b), which reflect some of the attitudinal themes evaluated in prior research.

Despite different methods of assessment and administration, a systematic review of relevant literature on attitudes and menopause showed consensus: Negative attitudes (variously conceptualized and measured) toward menopause were associated with greater symptoms (Ayers et al., 2010). Moreover, research using SWAN data showed positive attitudes toward menopause and aging (items measuring aging, affective quality, freedom, and regret) significantly predicted postmenopausal psychological well-being (Avis et al., 2021).

Coping and the menopause process

To explain well-being status during menopause, research has examined global stress appraisals and self-reported coping behavior (Bosworth et al., 2003). For example, Simpson and Thompson (2009) assessed postmenopausal women attending a menopause care clinic and found general

stress was lower among women who had their last period 3–5 years prior compared to those who had transitioned to menopause more recently, indicating that coping strategies may be most relevant at peri-menopause. Additional research examining coping strategies in the context of menopause demonstrated cross-sectional associations between well-being and active and passive coping strategies. Specifically, problem-focused (active) coping strategies (e.g., problem-solving, such as *"made a plan of action and followed it"*) were not associated with stress appraisals, while passive strategies (e.g., avoidance, such as *"went on as if nothing had happened"*) were positively correlated with stress in a sample of middle-aged women (Bosworth et al., 2003). Research has also examined menopause coping strategies and physical health during the menopause process. In a randomized trial, Rotem et al. (2005) found instrumental support-seeking (e.g., participation in menopause education programming and facilitated peer discussions), engaging in wellness-promotion activities (i.e., exercise), and action planning increased menopausal health.

Informed by the control-focused strategies implemented by Rotem et al. (2005), as well as the mixed patterns of findings in cross-sectional research, the present work used the coping framework of Connor-Smith and Flachsbart (2007). In this conceptualization, the broad categories of coping strategies are characterized as primary (e.g., problem-solving) or secondary (e.g., cognitive restructuring, withdrawal) control coping mechanisms, where the selection of coping strategies is partially influenced by personality traits.

The present study

Taken together, the research findings described above indicate relatively stable individual difference factors, including Big Five traits and dispositional optimism, are associated with post-menopausal health and well-being. Research also indicates post-menopausal health and well-being are associated with contextualized individual difference factors, including bodily sensitivity, symptom severity, and coping strategies. Although suggestive of a temporal or stage process of menopausal adaptation, the evidence for these associations is largely based on cross-sectional designs and/or longitudinal research that did not directly assess menopausal transition status or measure canonical personality traits (cf. Avis et al., 2021; Milad & Bogg, 2020; Wieder-Huszla et al., 2014). To address these gaps and limitations, the present work used three waves of prospective data (i.e., 1995–1996, 2004–2006, and 2013–2014) from the Midlife in the United States (MIDUS) study to examine premenopausal and perimenopausal health-related and psychosocial influences on postmenopausal health status and well-being.

The present work uses a Disposition-Belief-Motivation framework to guide the organization and predictions for the multiple psychosocial and health-related factors under consideration. Such frameworks have four overarching propositions: 1) theoretically- and/or evidence-supported stable dispositional and contextual factors (e.g., personality traits, socioeconomic status) should have direct (temperamental) effects on health-related behaviors and outcomes; 2) stable dispositional and contextual factors also should have indirect (instrumental) effects on health-related behaviors and outcomes via theoretically- and/or evidence-supported belief constructs (e.g., attitudes, self-efficacy) and/or motivation constructs (e.g., intention, goal importance); 3) theoretically- and/or evidence-supported belief constructs should have direct effects, as well as indirect effects, on health-related behaviors and outcomes via motivation constructs, and; 4) theoretically- and/or evidence-supported motivation constructs should have direct effects on health-related behaviors and outcomes (Bogg & Milad, 2020; ; Godfrey et al., 2024; Griffith et al., 2024; Bogg et al., 2023; Vo & Bogg, 2015).

Aligned with this organizing framework and consistent with the three stages of the menopause process, direct and indirect associations were tested over time. The ordering of the assessments and pre-registered hypotheses are depicted in Figure 1. The temporally informed stage model includes temperamental (direct) and instrumental (indirect) pathways. In the following sections, the specific hypothesized temperamental and instrumental pathways are described.

Premenopausal temperamental (direct) pathways

Personality traits

Controlling for associations with other baseline variables, each Big Five personality trait was hypothesized to be directly associated with post-menopausal self-rated health and subjective well-being (Agreeableness ($+$), Conscientiousness ($+$), Extraversion ($+$), Openness ($+$), and Neuroticism ($-$)).

Premenopausal norms, attitudes, and beliefs

Controlling for associations with other baseline variables, lower endorsement of traditional gender norm ideology, lower trait bodily sensitivity, and positive attitudes toward aging at baseline were hypothesized to be directly associated with greater post-menopausal self-rated health and subjective well-being.

Demographic and health-related factors

Controlling for associations with other baseline variables, age, functional ability, and education were hypothesized to be directly associated with perimenopausal self-rated health and subjective well-being.

Perimenopausal temperamental (direct) pathways

Perimenopausal coping, optimism, activity, symptom frequency

Greater perimenopausal primary control coping and secondary control coping, perceived activity, and lower symptom frequency were hypothesized to be directly associated with greater post-menopausal self-rated health and subjective well-being.

Instrumental (indirect) pathways

Primary control coping

It was hypothesized that associations between greater conscientiousness, greater extraversion, greater agreeableness, greater openness, lower internalized gender norms at baseline
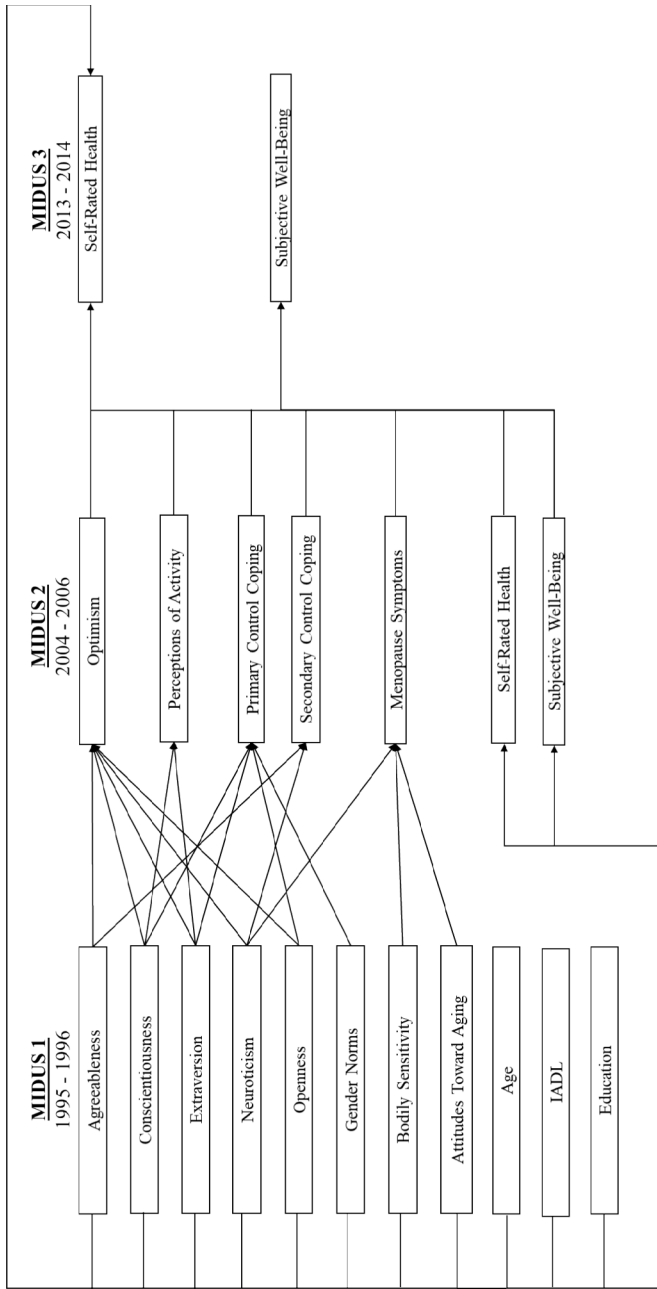
FIGURE 1 Hypothesized direct and indirect effects.

(premenopausal stage), and greater postmenopausal self-rated health and subjective well-being would be maintained, in part, by greater perimenopausal primary control coping.

Secondary control coping

It was hypothesized that the association between greater agreeableness at baseline (premenopausal stage) and greater postmenopausal self-rated health and subjective well-being would be maintained, in part, by greater perimenopausal secondary control coping. It also was hypothesized that the association between greater neuroticism at baseline (premenopausal stage) and lesser postmenopausal self-rated health and subjective well-being would be maintained, in part, by greater perimenopausal secondary control coping.

Perceptions of activity

It was hypothesized that the associations between greater conscientiousness and extraversion at baseline (premenopausal stage) and greater postmenopausal self-rated health and subjective well-being would be maintained, in part, by greater perimenopausal perceptions of activity.

Optimism

It was hypothesized that the associations between greater agreeableness, greater conscientiousness, greater extraversion, lower neuroticism, and greater openness at baseline (premenopausal stage) and greater postmenopausal self-rated health and subjective well-being would be maintained, in part, by greater perimenopausal optimism.

Self-reported symptom frequency

It was hypothesized that the associations between greater neuroticism and bodily sensitivity at baseline (premenopausal stage) and greater postmenopausal self-rated health and subjective well-being would be maintained, in part, by greater perimenopausal symptoms.

METHOD

Transparency and openness

This work was based on secondary analyses of open-access data from the MIDUS study. MIDUS research adheres to ethical standards for human subjects research and receives informed consent from participants at each wave of assessment. Justification for the present work's methodology including all case selection criteria and processes, data treatment, and analysis are described in the following sections and supplemental materials. The pre-registered hypotheses and analyses may be found at https://aspredicted.org/6NM_6WM, and the analytic code

appears in the supplemental materials. MIDUS data and documentation may be found at ICPSR. The analytic data set is available here.

Sample and procedure

The data was sourced from three waves of the Midlife in the United States study (MIDUS 1, MIDUS 2, MIDUS 3; Brim et al., 1995–1996; Ryff et al., 2004–2006, 2013–2014). A deductive approach was used for participant selection to retain the maximum number of participants who met the nominal criteria/symptoms of perimenopause (Monteleone et al., 2018). The case selection steps and criteria are fully described in the supplemental materials. The final sample retained from the inclusion/exclusion algorithm ($N = 247$) included women who were premenopausal at MIDUS 1, perimenopausal at MIDUS 2, and post-menopausal at MIDUS 3, with status primarily characterized by the timing of the last period, as well as supplemental item responses across each wave of assessment. This resulted in a smaller sample than prior work examining menopause-related outcomes in MIDUS (e.g., Strauss, 2013). However, this approach produced a sample that closely aligns with the meaning of menopausal stages.

Measures

Big five personality traits, MIDUS 1

Extraversion ($\alpha = .74$), neuroticism ($\alpha = .73$), conscientiousness ($\alpha = .53$), agreeableness ($\alpha = .76$), and openness ($\alpha = .77$) were measured using a 30-item scale (Lachman & Weaver, 1997), with responses ranging from 1(a lot) to 4 (not at all). Items were recoded so that greater scores reflected greater trait standing. The extraversion scale excluded "active" due to overlap with the assessment of feeling active (see below).

Internalized gender norms, MIDUS 1

Gender ideology was assessed using 11 items on a scale from 1 (agree strongly) to 7 (disagree strongly), where statements such as "women can have full and happy lives without any children" were rated (Ryff et al., 2013–2014). Greater scale scores reflected endorsement of traditional gender role ideology ($\alpha = .62$).

Attitudes toward aging, MIDUS 1

Attitudes toward aging (MIDUS label = "Attitudes Toward Menopause" were assessed using a 3-item scale measure. The item stem reads as follows; *"Women sometimes worry about the future and getting older. How much do you worry about [being too old to have children,] [being less attractive as a woman,] and [having more illness as you get older?]"* (Brim et al., 1995–1996). A greater mean scale score reflects less concern about aging ($\alpha = .51$).

Bodily sensitivity, MIDUS 1

Bodily sensitivity was assessed with five items (e.g., "I am often aware of various things in my body") using a four-point response scale; 1 (not true) to 4 (extremely true). Greater scores reflect greater sensitivity (Barsky et al., 1988; α = .58).

Optimism, MIDUS 2

Optimism was assessed with three items from the Life Orientation Test (e.g., Scheier et al., 1994). Greater scale scores indicate a dispositional tendency toward positive expectations (e.g., "in uncertain times, I usually expect the best"; α = .69).

Coping strategies, MIDUS 2

Primary control coping was assessed with five items at (Lachman & Weaver, 1998), where greater scale scores (ranging from 1 to 4) reflect greater persistence in goal striving (e.g., "when I encounter problems, I don't give up until I solve them,"; α = .77). Secondary control coping was assessed with three items, where greater scale scores (ranging from 1 to 4) reflect greater use of positive reappraisals (e.g., "when a goal is decided, I keep in mind the benefits" α = .51).

Perception of feeling active, MIDUS 2

Feeling "active" was assessed via a single item regarding the past 30 days using a 5-point response scale: "all the time" to "none of the time".

Menopausal symptom severity, MIDUS 2

Symptom severity was measured via assessment of 30-day frequency of problems with headaches, sweating, irritability, hot flashes, falling and staying asleep, leaking urine, and pain or discomfort during intercourse. The scale score presented in analyses reflects the mean of the 7 reverse-scored items, in which a scale score of 6 indicates experience of symptoms almost every day.

Self-rated health, MIDUS 2, 3

Self-reported health was measured with responses ranging from 0 (worst) to 10 (best) for the following item stem: "Rate your current health".

Subjective well-being, MIDUS 2, 3

One life satisfaction item was assessed across MIDUS 2 and 3: *"Rate life overall currently,"* on a scale from 0 (worst) to 10 (best).

Covariates

Instrumental activities of daily living (IADL) at MIDUS 1 were used as a covariate of baseline personality traits and beliefs and as an indirect prospective predictor of MIDUS 3 self-rated health and subjective well-being via MIDUS 3 self-rated health and subjective well-being. IADL reflects the degree to which health interferes with activities such as "climbing several flights of stairs" on a scale from 1 (a lot) to 4. Greater IADL scores reflect greater ability to perform instrumental activities. The corrected MIDUS 1 age (revised in 2019) was used as a covariate/predictor, as prior research showed older age is associated with more positive responses to menopause (Strauss, 2013). Finally, the highest level of education completed by MIDUS 1 served as an indicator of socioeconomic status, with the scale ranging from 1 (no school/some grade school) to 12 (professional degree).

Analyses

Descriptive statistics for study variables were calculated using JASP version 0.16.3. Univariate statistics revealed MIDUS 1 IADL, MIDUS 2 and 3 Self-Rated Health, and MIDUS 2 and 3 Subjective Well-Being did not meet normality assumptions for structural equation modeling, where skewness and/or kurtosis scores were greater than 3.2x their standard error (Z-test; e.g., Kim, 2013). These variables were adjusted using a Blom transformation (e.g., Hicks et al., 2004). All other variables were admissible for the first round of analyses. Observed age and education presented exponentially greater variance than all other variables in the structural equation modeling. These constructs were transformed by dividing the raw values by 10 (reflective of decades). Correlational analyses assessed the magnitude and direction of the relationships among the dispositional factors, coping strategies, perception of feeling active, self-rated health, subjective well-being, as well as the covariates.

Full Information Maximum Likelihood (FIML) with bootstrapping procedures using Lavaan (RStudio v2022.12.0 + 353) was used to model missing values based on all other information available in the matrix of variables. This approach performs better than simple imputation, multiple imputation, and other ways of handling missing data (Enders, 2001). The model estimation reflected the use of single-item latent variables for MIDUS 2 and MIDUS 3 self-rated health and subjective well-being. Manifest terms or error terms were specified to freely covary within waves of assessment, and path model specification follows the hypotheses described above. Model fit was examined using two measures, the comparative fit index (CFI) and the root mean square error of approximation (RMSEA; Browne & Cudeck, 1992). To reduce the possibility of Type 1 error given the number of tests, the Benjamini-Hochberg False Discovery Rate (FDR; Cribbie, 2007) was set to .05. This procedure adjusts the critical value for each hypothesis test based on the prior number of tests employed, and effects with an adjusted critical value larger than .05 were excluded from consideration.

RESULTS

Table 1 displays the descriptive statistics for all study variables at MIDUS 1, MIDUS 2, and MIDUS 3. Further case selection and sampling details are provided in the online supplemental materials.

TABLE 1 Descriptive statistics.

	N	Mean	Std. deviation	Skewness (SE)	Kurtosis (SE)
MIDUS 1 constructs					
Age	247	39.92	7.01	0.65 (.16)	3.20 (.31)
Education	246	7.08	2.43	0.28 (.16)	−0.81 (.31)
IADL	245	3.65	0.57	−2.37 (.16)	5.68 (.31)
Normalized IADL	245	−0.04	0.88	−0.57(.16)	−0.47(.31)
Agreeableness	240	3.52	0.45	−1.11 (.16)	2.31 (.31)
Conscientiousness	239	3.45	0.43	−0.45 (.16)	−0.55 (.31)
Extraversion	243	3.17	0.55	−0.31 (.16)	−0.34 (.31)
Openness	239	2.92	0.54	−0.25 (.16)	0.16 (.31)
Neuroticism	243	2.39	0.66	0.33 (.16)	−0.54 (.31)
Bodily sensitivity	244	2.61	0.54	0.02 (.16)	−0.10 (.31)
Gender norms	239	2.84	0.76	1.03 (.16)	1.86 (.31)
Attitudes	244	3.04	0.64	−0.69 (.16)	0.42 (.31)
MIDUS 2 constructs					
Menopause symptoms	230	2.56	0.91	0.61 (.16)	−0.22 (.32)
Perceived activity	170	3.65	1.11	−0.96 (.19)	−0.09 (.37)
Primary coping	242	3.17	0.54	−0.18 (.16)	−0.65 (.31)
Secondary coping	242	2.82	0.53	−0.14 (.16)	−0.24 (.31)
Optimism	174	4.11	0.83	−1.16 (.18)	0.75 (.37)
MIDUS 3 constructs					
Raw self-rated health					
MIDUS 2	244	7.33	1.56	−0.81 (.16)	0.70 (.31)
MIDUS 3	137	7.41	1.61	−0.86 (.21)	0.35 (.41)
Normalized self-rated health					
MIDUS 2	244	−0.01	0.95	−0.11 (.16)	−0.17 (.31)
MIDUS 3	137	−0.01	0.93	−0.13 (.21)	−0.25 (.41)
Raw subjective well-being					
MIDUS 2	245	7.70	1.53	−1.28 (.16)	3.26 (.31)
MIDUS 3	135	7.89	1.63	−1.38 (.21)	2.44 (.41)
Normalized subjective well-being					
MIDUS 2	245	−0.01	0.94	−0.14 (.16)	−0.23 (.31)
MIDUS 3	135	−0.01	0.93	−0.19 (.21)	−0.29 (.41)

Note: Rejection of the normality assumption for univariate distributions was determined by dividing the skewness and kurtosis statistics by each respective standard error.

Bivariate associations with MIDUS 3 self-rated health and subjective well-being

Bivariate observed and FIML-based implied moment correlations between MIDUS 1 and MIDUS 2 variables and MIDUS 3 self-rated health and subjective well-being are presented in Table 2. As hypothesized, MIDUS 2 and 3 self-rated health and subjective well-being were significantly positively associated within and across the two assessment windows. Greater functional well-being at baseline, greater perceived activity at MIDUS 2, and lower symptom reports at MIDUS 2 were significantly associated with MIDUS 3 self-rated health. Older age at baseline, positive aging attitudes at baseline, greater optimism at baseline, and lower menopause symptoms at MIDUS 2 were associated with greater MIDUS 3 subjective well-being. The FIML-based implied moment correlations provide an account of bivariate associations within the tested structural model.

Multivariate associations with MIDUS 3 self-rated health and subjective well-being

Informed by the hypotheses and bivariate associations with MIDUS 3 self-rated health and subjective well-being, the path model in Figure 2 includes MIDUS 1 aging attitudes, IADL, agreeableness, conscientiousness, extraversion, neuroticism, openness, bodily sensitivity, gender norms, age, and education, MIDUS 2 self-rated health, subjective well-being, primary control coping, secondary control coping, optimism, perceptions of activity, and menopause symptoms, and MIDUS 3 self-rated health and subjective well-being. Autoregressive paths were included for MIDUS 2 and MIDUS 3 latent variables of self-rated health and subjective well-being. Manifest variables and error terms were allowed to freely covary, as indicated by correlational results. These were included in the analytic model but excluded from Figure 2 to facilitate presentation. All are reported in the supplemental materials.

The model converged with 247 iterations and was bootstrapped 1,000 times, allowing for the estimation and reporting of 95% confidence intervals. The model fit statistics suggested adequate fit for the regression equation; X^2 (48) = 119.02, $p < .001$; $CFI = .91$; $RMSEA$ (95% CI) = .08 (.06, .10), $SRMR = .08$. Post-hoc power analysis using the RStudio semPower Package showed the model was sufficiently powered, achieving nearly double the critical chi-square value (65.17) where critical Alpha and RMSEA are set to .05 or below, resulting in a power score (1-β) of 79.66%. The error terms for latent self-rated health and subjective well-being were positively correlated at MIDUS 2 (r (95% CI) = .23 (.09, .37), $p < .01$) and 3 (r (95% CI) = .32 (.17, .47), $p < .001$). The model accounted for 11% of the variance in MIDUS 2 self-rated health, 13% of the variance in MIDUS 2 subjective well-being, 49% of the variance in MIDUS 3 self-rated health, and 39% of the variance in MIDUS 3 subjective well-being (as inferred by r-squared).

As can be seen in Figure 2, consistent with expectations, less concern about aging at MIDUS 1 was a significant predictor of MIDUS 3 subjective well-being (β (95% CI) = .17 (.03, .32), $p = .02$). Greater baseline IADL predicted greater MIDUS 2 self-rated health (β (95% CI) = .28 (.14, .43), $p < .001$) and well-being (β (95% CI) = .14 (.01, .27), $p = .03$). Greater baseline age predicted greater MIDUS 2 well-being (β (95% CI) = .21 (.08, .34), $p < .001$).

Partial support for the hypothesized associations between baseline traits and intermediating MIDUS 2 variables were observed as follows; neuroticism predicted greater symptoms (β (95%

TABLE 2 Observed and FIML-estimated correlates of MIDUS 3 self-rated health and subjective well-being.

|		Pearson's *r*	
	N	*Observed*	*Model implied*
MIDUS 3 normalized self-rated health			
MIDUS 3 normalized subjective wellbeing	134	0.44**	0.48
Agreeableness	133	−0.07	−0.09
Conscientiousness	132	0.15	0.10
Extraversion	134	0.03	0.03
Openness	135	.00	0.04
Neuroticism	134	−0.11	−0.12
Bodily sensitivity	135	−0.02	0.02
Gender norms	131	−0.05	−0.14
Attitudes toward menopause	135	0.16	0.21
MIDUS 2 self-rated health	136	0.63**	0.65
MIDUS 2 subjective wellbeing	136	0.30**	0.28
Menopause symptoms	129	−0.22*	−0.16
Activity	97	0.27**	0.23
Primary coping	135	0.12	0.09
Secondary coping	135	0.06	0.08
Optimism	102	0.08	0.11
MIDUS 1 age	137	.17	0.04
IADL	136	.27**	0.22
MIDUS 3 normalized subjective wellbeing			
Agreeableness	132	−0.09	−0.03
Conscientiousness	131	0.02	0.03
Extraversion	133	−0.02	0.04
Openness	134	0.03	0.12
Neuroticism	133	−0.08	−0.06
Bodily sensitivity	134	−0.14	−0.04
Gender norms	130	0.08	−0.04
Attitudes toward menopause	134	0.23**	0.24
MIDUS 2 self-rated health	134	0.32**	0.33
MIDUS 2 subjective wellbeing	134	0.52**	0.51
Menopause symptoms	127	−0.20*	−0.14
Activity	94	0.20	0.16
Primary coping	133	0.07	0.09
Secondary coping	133	−0.04	−0.05
Optimism	100	0.22*	0.21
MIDUS 1 age	135	.41**	0.11
IADL	135	.15	0.14

*p < .05,**p < .001.
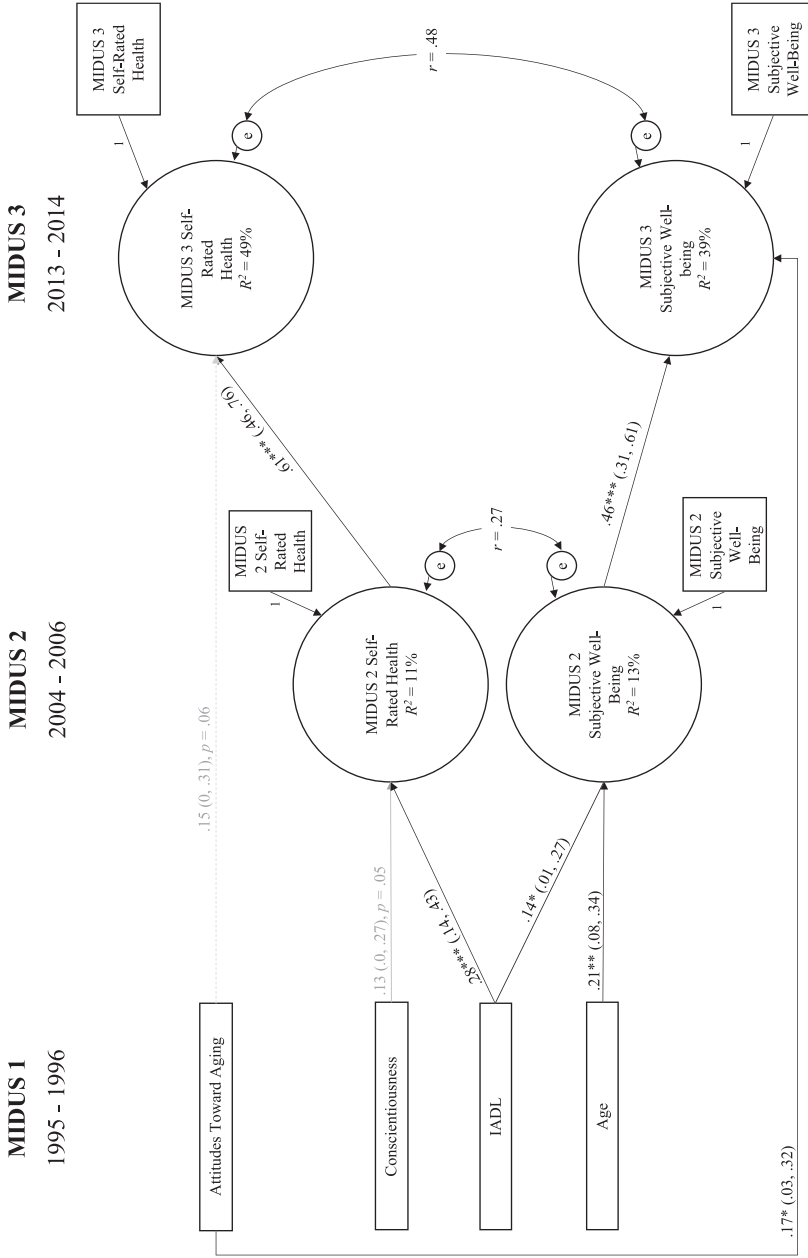
FIGURE 2 Robust prospective standardized direct effects of MIDUS 1 and MIDUS 2 variables on MIDUS 2 and MIDUS 3 self-rated health and subjective well-being. Values in parentheses are 95% CIs for standardized effects. Additional direct effects and correlated terms are described in the text and in complete detail in the supplemental materials. *p < .05, **p < .01, ***p < .001. Confidence interval excludes 0 for conscientiousness, but rounded to zero.

CI) $= .23$ (.09, .36), $p < .001$) and lower optimism (β *(95% CI)* $= -.18$ ($-.32$, $-.04$), $p = .01$), conscientiousness predicted greater primary coping (β *(95% CI)* $= .15$ (.04, .26), $p = .01$), and extraversion predicted greater primary coping (β *(95% CI)* $= .14$ (.01, .27), $p = .03$) and greater optimism (β *(95% CI)* $= .36$ (.19, .54), $p < .001$).

There were two significant indirect effects. Baseline IADL predicted MIDUS 3 self-rated health via MIDUS 2 self-rated health (β *(95% CI)* $= .17$ (.07, .27), $p < .001$), and age predicted MIDUS 3 subjective well-being via MIDUS 2 subjective well-being (β *(95% CI)* $= .10$ (.02, .17), $p = .01$). In addition, two indirect paths emerged at $p = .05$. MIDUS 1 IADL predicted MIDUS 3 subjective-wellbeing via MIDUS 2 subjective well-being (β *(95% CI)* $= .06$ (0, .13), $p = .05$), and conscientiousness predicted MIDUS 3 self-rated health via MIDUS 2 self-rated health (β *(95% CI)* $= .08$ (0, .16), $p = .05$). Among the 16 tested total effects of baseline variables on MIDUS 3 outcomes, only aging attitudes exhibited a significant total effect on well-being (β *(95% CI)* $= .22$ (.06, .38), $p = .01$).

The Benjamini-Hochberg correction uses rank-ordered p-values to assign a more stringent probability threshold given the relative number of tested paths (Cribbie, 2007). Among the 50 tested paths modeling direct and indirect prospective effects on MIDUS 3 self-rated health and subjective well-being, the autoregressive effects from MIDUS 2 to MIDUS 3 self-rated health and subjective well-being, the effect of IADL on MIDUS 2 self-rated health, and the effect of age on MIDUS 2 subjective well-being were robust to the Benjamini-Hochberg false-discovery rate correction at 5%. The effect of attitudes on MIDUS 3 subjective well-being fell above the more conservative p-value estimate by 2 percentage points (adjusted critical estimate, $p = .005$; observed estimate $p = .03$). In keeping with the pre-registration, all statistically significant effects are discussed in this work. The reported correction provides a conservative lens for the probability of detected effects. The discussion that follows situates the results in the context of an acceptable, but not large sample size for the number of hypothesized effects, as well as the study's robust screening approach and temporal design.

DISCUSSION

Using a disposition-belief-motivation model of menopause adjustment, the present study tested direct and indirect associations of pre-menopausal personality traits, gender norms, bodily sensitivity, and attitudes toward aging, as well as peri-menopausal optimism, coping, perceptions of feeling active, and menopausal symptoms with post-menopausal subjective well-being and self-rated health in the MIDUS study. Aside from the unique and informative nature of its prospective menopause stage design, the study also controlled for pre-menopausal age, education, and instrumental activities of daily living, as well as peri-menopausal subjective well-being and self-rated health. The bivariate analyses partially replicated prior cross-sectional research examining personality traits and menopause-associated variables (i.e., the associations between neuroticism and symptoms, and symptoms and subjective well-being, i.e., Bal & Sahin, 2011; Kishida & Elavsky, 2017).

As described below, evidence from the structural model provided partial support for the hypotheses, clarifying a more normatively oriented process model of menopause adjustment. However, null results were observed for the hypotheses specifying direct associations between premenopausal Big Five personality traits, internalized gender norm ideology, trait bodily sensitivity, postmenopausal self-rated health, and subjective well-being. Moreover, null results were observed for the hypotheses specifying direct associations between perimenopausal coping

strategies, activity perceptions, optimism, symptoms, postmenopausal self-rated health, and subjective well-being above.

Among the hypothesized paths from MIDUS 1 (premenopausal stage) to MIDUS 3 (postmenopausal stage), positive attitudes toward aging emerged as the sole direct prospective (and non-autoregressive, i.e., not the same construct predicting itself across different time points) predictor of greater postmenopausal subjective well-being. Lay and biomedical renderings of menopause often characterize this period as being typified by illness and unfamiliarity (e.g., Morgan et al., 2012; Talaulikar, 2022), and such expectations may shape future experience (e.g., Deeks & McCabe, 2004; Formanek, 2013; McKeon, 1988). Despite shared variance with other constructs, especially neuroticism, pre-menopausal attitudes toward aging showed a direct prospective effect on subjective well-being 20 years later. While non-significant ($p = .06$), the bootstrapped path estimation suggested that positive attitudes toward aging may also predict greater health 20 years later.

Among the MIDUS 1 premenopausal demographic and health-related factors, functional ability (via the IADL) predicted perimenopausal subjective well-being and self-rated health, while greater premenopausal age predicted greater perimenopausal subjective well-being. Moreover, two related significant indirect effects were observed, such that 1) greater perimenopausal self-rated health was an instrumental pathway for the association between greater premenopausal functional ability and greater postmenopausal self-rated health, and 2) greater perimenopausal subjective well-being was an instrumental pathway for the association between greater premenopausal age and greater postmenopausal subjective well-being.

Implications and limitations

The finding for the effects of the aging attitudes scale assessing menopause-related worry about fertility, attractiveness, and illness on subjective well-being 20 years later highlights the importance of perceptions of functioning in these disparate domains. This finding raises two issues unaddressed in the present work. The first is to clarify the construct space of the measure, i.e., the extent to which it measures attitudes toward development and aging, attitudes toward the passage of time, and/or attitudes that are truly specific to the developmental stage participants were instructed to consider (i.e., menopause). The second issue is related to measuring the degree to which attitudes about illness, attractiveness, and fertility were informed by experiences during the course of the study, i.e., a possible pathway linking premenopausal aging attitudes and post-menopausal well-being. The results showed that positive attitudes predicted greater global appraisals of well-being, but specific and precise measurements of intermediating experiences that might inform lower post-menopausal appraisals about life satisfaction may clarify the association between such attitudes and well-being. The seeming self-fulfilling prophecy observed between pre-menopausal attitudes and post-menopausal subjective well-being (and non-significantly, self-rated health) may be more precisely articulated via measurement of the health- and well-being-related experiences that women lived through during this developmental period.

Covarying positively with menopause attitudes, greater premenopausal functional ability directly predicted greater perimenopausal self-rated health and subjective well-being and indirectly predicted greater postmenopausal self-rated health via perimenopausal self-rated health. These results show greater functional ability in daily tasks at the premenopausal stage influenced global perceptions of health-related and psychological well-being throughout the

course of the menopause transition. This finding highlights how limitations in functioning are deeply intertwined with perceptions of health, as would be expected, but also well-being. This is consistent with research linking IADL to healthier and happier aging (Brown et al., 2017; Charles et al., 2023).

Tied directly to age, the evidence showing older participants at the premenopausal stage (mean age 40 years) reported greater subjective well-being at the perimenopausal and postmenopausal stages (via perimenopausal subjective well-being) aligns with prior research investigating aging effects on life satisfaction. Specifically, prior research has shown age predicts gains and losses in satisfaction in different areas of life functioning, rather than an overall decline (McAdams et al., 2012). Future research on the menopause transition should examine satisfaction within specific domains of functioning (e.g., romantic relationships, sexual). The present findings for age also align with research showing how aging may be associated with gains in life satisfaction across midlife (Baird et al., 2010). Explanations for growth in life satisfaction at midlife remain wanting. Mean-level observations of this growth may depend on cultural context and life events (e.g., relationships, generative achievements; Baird et al., 2010).

The null direct effects observed from coping strategies to self-rated health and subjective well-being, while consistent with prior work examining surrogate health markers in a larger subsample of MIDUS (e.g., Milad & Bogg, 2020), highlight limitations of general coping measures that are not contingent upon perceived stressors. The present work focused on the individual's appraisal of general coping patterns (akin to mindsets) without consideration of specific coping actions deployed in response to perceived stressors. Future research should move beyond these measurement and design limitations to understand how dispositional tendencies (e.g., neuroticism, conscientiousness) influence the selection of varying lower-order coping actions (e.g., seeking social support, information seeking) in response to varying perceived midlife stressors in women (e.g., divorce, becoming an empty-nester, experiencing intermittent periods).

Two additional limitations of this work are common considerations of secondary data analyses. Development of the personality trait measure in MIDUS 1 prioritized brevity and employed adjectives as items (Lachman, 2005), which limited the internal consistency of some of the scales. However, research has indicated the assessment maintains an appropriately structured five-factor model and shows no change in variance and covariance when split across subgroups like age, providing some degree of confidence in its use (Zimprich et al., 2012). Beyond measurement limitations, conclusions about the generalizability of the effects reported here must be tempered by the inherent constraints of the sample characteristics and attrition of MIDUS (predominantly White and more highly educated), as well as the necessary selection strategy used to create a sample that closely aligned with WHO definitions of the menopause process.

SUMMARY

In the present work, the influence of age, functional ability, and attitudes toward aging emerged as the most robust predictors of self-rated health and subjective well-being across the menopause transition. The results also clarified how perimenopausal symptoms were not robust predictors of postmenopausal health and well-being. Notably, the findings draw attention to the need to focus on premenopausal functional challenges, as well as premenopausal worries about fertility, attractiveness, and illness, as candidate targets to improve downstream postmenopausal perceptions of quality of life.

CONFLICT OF INTEREST STATEMENT

The authors declare they have no conflict of interest

DATA AVAILABILITY STATEMENT

This work was preregistered at AsPredicted.org. The analysis code is provided in the supplemental material, and the dataset can be found here. Publicly available data from the MIDUS study was used for this research. MIDUS I, MIDUS II, and MIDUS III were funded by the John D. and Catherine T. MacArthur Foundation Research Network, and the National Institute on Aging (P01-AG020166, U19-AG051426).

ETHICS STATEMENT

Publicly available data from the MIDUS study was used for this research, so new independent institutional ethics approval was not required. The MIDUS data collection is reviewed and approved by the Education and Social/Behavioral Sciences IRBs at the University of Wisconsin-Madison, and participants provide informed consent for each MIDUS assessment. More information about the MIDUS studies is available here: https://www.midus.wisc.edu/index.php

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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