Stressful family contexts and health in divorced and married mothers: Biopsychosocial process

Kandauda AS Wickrama¹, Eric T Klopack²* and Catherine W O’Neal¹*

Abstract
Past research suggests that social, psychological and biological processes underlying common health problems are highly interrelated and may be components of a larger biopsychosocial process. This process may be influenced by marital status. The current study investigated a biopsychosocial process involving social, psychological and physical health problems over the second half of the life course, comparing women who were mothers with different marital histories (e.g., consistently married, married to divorced) and investigated the association between this biopsychosocial process and marital stress for consistently married women over the middle years. The current study used structural equation modeling to assess this biopsychosocial process longitudinally using prospective data over 25 years from a sample of 416 women. The results showed that compared to being married, divorcing in early midlife contributed to an adverse biopsychosocial process for women, including physical pain, physical limitations, and depressive symptoms over their mid-later years, regardless of later recoupling. For consistently married mothers, both marital stress and financial stress uniquely influenced biological and psychological problems throughout their mid-later years, and these health problems also selected mothers into further escalating financial and marital stress. Elucidating differential short- and long-term health influences of competing marital and financial stressors for divorced and married mothers provides valuable information for targeted economic and relationship intervention efforts and policy formation. Such interventions can reduce

¹Department of Human Development and Family Science, University of Georgia, Athens, GA, USA
²Leonard Davis School of Gerontology, University of Southern California, Los Angeles, CA, USA

Corresponding author:
Eric T Klopack, University of Southern California, 217A Andrus Gerontology Center, 3715 McClintock Ave., Los Angeles, CA 90089, USA.
Email: klopack@usc.edu
family stressors and develop resiliency factors, thereby preventing the escalation of biopsychosocial processes in middle-aged mothers.

**Keywords**
Midlife, family economics, family conflict, Longitudinal

Past research indicates that the development of health problems in later life may be attributed, in part, to exposure to stressful life experiences in earlier stages of life (Glymour et al., 2010; Lovallo, 2005; Wickrama, Klopak, & O’Neal, 2020). Particularly, marital difficulties (e.g., relationship dissolution, marital stress) and family financial difficulties are two important stressful family contexts. Both marital and family difficulties can operate as powerful stressors to exert persistent influences on both consistently married and divorced mothers’ health outcomes—especially common psychological and physical health problems (e.g., depression, physical pain)—over the life course (Lavelle et al., 2012; Levine, 2011; Lorenz et al., 2006). In turn, mothers’ health problems may be associated with their subsequent financial and marital circumstances (Bronfenbrenner, 1992; Conger et al., 2010; Yorgason et al., 2008), forming a self-perpetuating biopsychosocial process over the life course. That is, biological well-being, psychological status, and social circumstances are three components that interact and reinforce one another as part of a single underlying process.

Although previous studies have documented the link between adult stressful family experiences and later-life health problems, often focusing on a single health problem (e.g., Lee et al., 2020) or a composite health measure (e.g., Lavelle et al., 2012), little is known about the biopsychosocial process characterized by dynamic association between constituent biological, psychological and social components. This process may be influenced by stressful family contexts (divorce, marital stress and financial experiences) in early midlife (∼ ages 30-50) and progress over the mid-later years (∼ ages 50+). Previous stress and family health studies have rarely elucidated this self-perpetuating biopsychosocial process over the second half of the life course. Thus, the findings of the present study investigating this life course process will provide relevant information for policymakers, health professionals, counselors, and preventative and intervention programs that aim to promote health and healthy marital relationships in the mid-later years and in later life.

**Theoretical framework**

**Biopsychosocial perspective**

We draw our theoretical framework from the biopsychosocial perspective of health problems (Engel, 1977; Frankel et al., 2003; Gatchel et al., 2007). This perspective recognizes that the interrelationships among biological changes, psychological status, and sociocultural context must be considered to fully understand the development of physical health problems, particularly biopsychological problems such as physical pain and...
physical limitation that have both biological and psychological components (Gatchel et al., 2007). Such problems can develop from the complex interaction and mutual reinforcement of biological, psychological, and social dimensions, and thus, can be considered as a biopsychosocial phenomenon (Covinsky et al., 2009).

The biopsychosocial perspective suggests that multiple biopsychological problems are manifestations of an underlying shared pathological (i.e., neurological and physiological) condition. According to this perspective, an adverse health process operates as a response to a social stressor, which activates brain regions that are reactive to stress experiences (Chou et al., 2016). Marital research has documented stressful family context associated with both enduring low quality marriages and single parenthood an important social stressor for mothers in their mid-later years (Lorenz et al., 2006; Wickrama et al., 2018). Activation of the brain initiates neurological processes leading to changes in pathophysiological conditions in the body such as alterations in the hypothalamic-pituitary-adrenocortical (HPA) axis and in the sympathetic-adrenal-medullary (SAM) system (Neugebaure et al., 2004). This underlying pathological process, in turn, leads to the development of an array of common health problems, such as pain, physical limitation, depressive symptoms, memory loss and poor sleep (Baliki et al., 2008; Croft et al., 2010; Fine, 2011; Gallo et al., 2009; McEwen & Gianaros, 2010). This suggests comorbidities of these common health problems are largely attributed to their shared pathological conditions (Covinsky et al., 2009). Furthermore, the biopsychosocial perspective contends these health problems and stressful experiences reinforce each other through their interactions and reciprocities (Bronfenbrenner, 1992; Conger et al., 2010; Yorgason et al., 2008).

In the present study, we focus on a set of common biological (i.e., physical pain and limitation) and psychological (i.e., depression) health problems and stressful family context as representative of three components which have been shown to reciprocally associate each other as a broader biopsychosocial phenomenon (Covinsky et al., 2009; Gayman et al., 2011; Steptoe & Marmot, 2003). For example, some studies have shown that depression and pain impair physical functioning (McCracken et al., 2004), which, in turn, exacerbates physical pain (Covinsky et al., 2009), and other studies have shown that pain leads to physical limitation, which, in turn, contributes to depressive symptoms (Williamson & Schulz, 1995). Furthermore, family studies have shown reciprocal associations between stressful family context and mental and physical health (Conger et al., 2010; Wickrama, Klopack, O’Neal & Neppl, 2020; Yorgasan et al., 2008). The associations among biopsychosocial components indicate that a self-perpetuating biopsychosocial process is relatively common and may intensify due to aging body systems (Wang et al., 2016).

Furthermore, we posit that mothers’ marital (divorce and marital stress) and financial experiences in early midlife can operate as powerful stressors involved in this process. Moreover, significant changes in family socioeconomic context often occur during the mid-later years (Lorenz et al., 2006). For divorced mothers, we contend that divorce in its
own right is a life stressor (Lorenz et al., 2006); whereas, for consistently married mothers, marital stress (e.g., conflictual marital relationship) may act as a powerful life stressor and social dimension of common health problems (Lee et al., 2020).

The present study: Specific objectives and the theoretical model

The present study focuses on mothers’ health outcomes in their mid-later years for several reasons. First, research has shown that women are more vulnerable than men to certain biopsychological health problems, such as physical pain, in their mid-later years (CDC, 2018; Patel et al., 2013) and show a higher level of comorbidity among these problems (Meana, 1998). This gender difference is consistent with the vulnerability hypothesis, which posits women are more vulnerable than men to stressful experiences (Sandanger et al., 2004) that lead to physical pain, particularly musculoskeletal pain, and in turn, physical limitations. Additionally, sex hormones may have a significant impact by influencing pain sensitivity and perceptions of pain for women (Picavet, 2010). Second, disadvantaged marital biographies of mothers, especially single-parenthood (Lorenz et al., 2006; Lavelle et al., 2012), as well as marital stress for consistently married mothers (Lee et al., 2020), have been shown to have persistent, adverse influences on health and wellbeing over the life course. Third, most previous studies have not adequately investigated mothers’, particularly single-parent mothers’, life experiences and health outcomes prospectively over an extended period of time. Studies have been unable to fully assess the compromised health and wellbeing of mothers in their later years due to a lack of detailed prospective data and insufficient follow-up periods. Furthermore, mothers in the present sample faced the “farm crisis” of the late 1980s, including the continuing low prices of agricultural products as they were entering middle adulthood. The consequences of economic difficulties, as a particularly stressful life experience for these mid-western families, have been noted (Conger & Elder, 1994; Lorenz et al., 1993).

As shown in Figure 1, using prospective data over 25 years from a sample of 416 women, the first objective of the current study is to investigate this biopsychosocial process over the second-half of the life course comparing women with different marital histories (e.g., consistently married, consistently divorced, married to divorced). The second objective is to investigate the association between biopsychosocial process and marital stress (a unique stressor for married women) for consistently married mothers. Most research has focused solely on either marital status changes or marital stress, but the current study provides a more comprehensive examination of adverse life course processes by considering changes in marital status and marital conflict as two components of marital stress. We discuss these hypothesized associations in the paragraphs that follow.

As previously discussed, social stressors, such as family financial problems, marital/divorce status, as well as conflictual marital interactions are conceptualized as social components of the biopsychosocial process of common health problems over the mid-later years.
Midlife stressful family contexts: Social dimensions of biopsychological process marital status

Because families exert a powerful influence on the health of its members, divorce has long been linked to subsequent physical and emotional health problems (Avison, 1999; Morrison & Rituolo, 2000; Simon & Marcussen, 1999), and research suggests women are more likely than men to experience deteriorating physical health following divorce (Hughes & Waite, 2009; Liu, 2012). For many women, divorce signals the onset of chronic disadvantage caused by the social isolation and economic hardship that often comes with the role of single mother (Wu & Hart, 2002). Family incomes of divorced women are estimated to be 13-35% lower than that of married women (Peterson, 1996), even when there were no income differences between women in the two groups before the separation (Simons, 1996). Thus, in the present study, we consider women’s transition from married to single (and single motherhood in general) as a life stressor that may influence adverse biological (i.e., neurological and physiological) and psychological processes developing persistent physical pain, physical limitations, and depressive symptoms as well as later financial stress. Research notes that the stressful nature of single motherhood can be particularly salient for rural mothers because family relationships are generally highly salient for them (Koball et al., 2010; Snyder & McLaughlin, 2004). As previously discussed, consistently divorced (i.e., mothers who divorced prior to the study period) single-parent status is a life stressor in its own right, as it is associated with social isolation and numerous social, economic, and material

Figure 1. Theoretical Model. Note: Arrow thickness is used to differentiate pathways, not to indicate size of effect; FFS = family financial stress.
deprivations (Lorenz et al., 2006). This powerful stressor may contribute to pathophysiological conditions underlying the biopsychosocial process of common health problems.

Although marriage is generally a protective factor against poor health (Fokkema et al., 2012), there are significant variations in health outcomes among consistently married individuals (Ayalon et al., 2013). For instance, research has documented that adverse marital experiences of married mothers contribute to the development of various health problems over time (Kiecolt-Glaser & Wilson, 2017). In particular, the quality of marital experiences is a powerful predictor of health and wellbeing in later life (Ayalon et al., 2013; Wickrama et al., 2020). Thus, marital stress may contribute to changes in pathophysiological conditions underlying a biopsychosocial process of common health problems.

**Family financial stress**

Previous research suggests that family financial problems contribute to the development of various health problems (Lee et al., 2020; Wickrama et al., 2018), and family finances are highly salient for both married and single mothers. Thus, family financial stress is expected to contribute to adverse changes in pathophysiological conditions underlying a biopsychosocial process of common health problems for both married and single mothers (Landau et al., 2015). In addition, research has shown that the adverse health influence of single parenthood may also operate through structural family financial difficulties, such as lack of affordability of health care and insurance (Lavelle et al., 2012). Thus, as shown in Figure 1, we hypothesize that family financial stress influences a biopsychosocial process of common illness for both divorced and married mothers.

**Self-perpetuating biopsychosocial process**

As previously discussed, stressful life experiences have been found to influence health problems. Consistent with the social selection notion (Conger & Donnellan, 2007), individuals’ poor mental and physical health may in turn select them into adverse financial circumstances. Previous research has shown that physical and mental health problems contribute to stressful marital experiences over time (Yorgasan et al., 2008) and health problems, such as pain, physical limitations, and depressive symptoms may reduce individual employment prospects and working hours and earnings, which, in turn, can further elevate family financial stress (Kronborg et al., 2009). In this manner, mothers experiencing conflictual marriages and single-parenthood may be stuck in a self-perpetuating cycle of adverse life circumstances and poor health (common physical and mental health problems) across the life course.
Methods

Participants and procedures

The data used to evaluate the hypothesized models are from the Family Transition Project (FTP), the Midlife Transitions Project (MTP), and the Later Adulthood Study (LAS). Together, these projects are a 26-year-long panel study of rural white families from a cluster of eight counties in north-central Iowa that closely mirror the economic diversity of the rural Midwest. The FTP began in 1989 as a study of 450 rural couples with children, at least one of whom was a seventh grader in 1989. Two years later, 102 recently divorced mothers (between 1989 and 1991) with children, at least one of whom was a ninth grader in 1991 (Single Parent Project, SPP), were added to the sample. The total sample in 1991 was 522. Families meeting the selection criteria were enumerated through contacts with public and private schools and then randomly selected and recruited into the study, with 78% of the married couples and 99% of the single mothers agreeing to participate (Conger & Elder, 1994; Simons, 1996). Parents from the FTP were recruited to participate in follow-up panels in 1992 and 1994 and in the MTP in 2001 and the LAS in 2015. In 1991, mothers were in their early middle years; their average age was 40 years and ranged from 31 to 55. The median age of their youngest child was 12. In 1989, they averaged 13.54 years of education.

The 416 mothers in this study (80 SPP mothers who were divorced prior to 1991 and 336 FTP mothers who were married when the study began in 1989) participated in 1991, 1992, 1994, and 2001 data collections. Because all the respondents participated and provided data in 1991, the present longitudinal investigation begins using 1991 data. Respondents reported their marital status at each wave. Out of 80 divorced mothers in 1991, 40 remained single and 40 recoupled by 2001. Out of the 336 married mothers in 1991, 296 remained married, and 40 divorced by 2001. From 2001 to 2015, 254 mothers remained married, 38 mothers remained single, and 57 mothers were widowed or otherwise changed their marital status (for a total of 349 participating mothers in 2015). The 296 mothers who remained consistently married from 1989-2001 were used as the reference group for the analysis examining the influence of divorced status (1989-1991) and subsequent changes in marital status (1991-2001) on health in 2015. Marital status categories were created using marital status information from 1991-2001 to investigate later-life health consequences of those earlier marital experiences (regardless of changes after 2001). Using this time point to assess marital status also resulted in marital status groups with adequate group sizes. Participants consented to the study at each wave. The study was approved by the Iowa State University IRB, Study # 01-262.

Measures

Stressful family context

Marital status. Respondent reported marital status in 1991, 1992, 1994, and 2001 were used to identify their marital history typologies for the period from 1991 to 2001. Marital
status categories included: divorced in 1991, divorced to remarried (1991-2001), married to divorced (1991-2001) and consistently married (1989-2001).

**Marital stress.** Consistently married mothers reported on their spouse’s perceived hostile behavior, destructive conflict resolution behavior, and marital instability in 1991, 1992, 1994, and 2001. Previous studies have shown these three dimensions of stressful marital experiences are highly correlated (i.e., large common variance) and define a valid construct of marital stress (Wickrama et al., 2018, 2019). At each time point, a composite measure was computed using standardized measures. The average of 1991, 1992, and 1994 composite measures were used as the measure of early-midlife marital stress.

Hostile marital behaviors were measured in 1991, 1992, 1994, and 2001. Married mothers indicated how often (1 = always; 7 = never) during the past month her partner engaged in 15 hostile behaviors (Matthews et al., 1996). Sample items included “get angry at you,” “shout or yell at you,” and “make you feel guilty.” Responses were reverse coded and averaged with higher scores representing a higher level of hostility (the range of Cronbach’s α was .89 to .91 for mothers across years).

Eight items assessed mothers’ reports of their spouses’ destructive conflict resolution behaviors in 1991, 1992, 1994, and 2001 (e.g., “criticizes you or your ideas for solving the problem,” “ignores the problem,” and “seems uninterested in solving the problem”) (Matthews et al., 1996). All items were scored on a 7-point Likert scale ranging from 1 = always to 7 = never with higher scores indicating more destructive problem-solving behaviors. Mean scores were computed. The internal consistencies varied from .79 to .91 from 1991 to 2001.

To create the measure of marital instability, or divorce proneness, we used a modified version of the five-item short form of the Marital Instability Index (Booth et al., 1983), a scale that has demonstrated validity and reliability. In 1991, 1992, 1994, and 2001, mothers were asked how recently either of them suggested getting divorce, discussed the possibility of getting divorce with a close friend, thought about divorce, talked with each other about consulting an attorney about a divorce, or thought that their marriage might be in trouble (1 = not in the last year, 4 = within the last 3 months). Mean scores were computed. The internal consistencies varied from .64 and .72 from 1991 to 2001.

**Family financial stress**

Financial stress was measured in 1991, 1992, 1994, 2001, and 2015 using a four-item scale developed by Conger and Elder (1994). Respondents reported their perceived financial strain to items such as “we have enough money to afford the kind of food we need” and “we have enough money to afford the kind of medical care we need” with responses ranging from 1 (strongly agree) to 4 (strongly disagree). Items were reverse coded and averaged, and higher scores indicated greater financial stress. Internal consistencies of this measure varied from .75 to .78. The average of 1991, 1992, and 1994 composite measures was used as the measure of early-midlife financial stress.
Common health problems

Recent studies have documented that simple self-assessment questions on physical limitations (Amiard et al., 2019) and physical pain (Bemmel et al., 2019) are useful tools with acceptable validities for evaluating physical limitations and physical pain in adult populations. In the present study, we use self-reports measures of physical limitation and physical pain.

Physical pain. The degree of physical pain was assessed in 1994, 2001, and 2015 using two items from the Rand Health Science Program in Health Survey 1.0 (Hays et al., 1993). On a 6-point scale ranging from 1 (none) to 6 (very severe), respondents indicated how much bodily pain they experienced in the four preceding weeks. Also, on a 5-point scale ranging from 1 (not at all) to 5 (extremely), respondents indicated how much pain interfered with their normal work. Responses were standardized and averaged. The correlation between the two items ranged from .68 and .70 over the measurement occasions.

Physical limitations. In 1994, 2001, and 2015, respondents completed the 10-item Physical Impairment Scale of the Rand 36-Item Health Survey 1.0 (Hays et al., 1993). They indicated on a 3-point scale ranging from 1 = No, not limited at all to 3 = Yes, limited a lot how much they were limited by physical impairments. The scale captures impairment for vigorous (e.g., running or lifting heavy objects) and moderate activities (e.g., moving a table, pushing a vacuum cleaner, lifting or carrying groceries). Responses were averaged to create a measure of overall physical limitations at each time point. Cronbach’s alpha for physical limitations varied from .80 to .91 from 1994 to 2015.

Depressive symptoms. Thirteen items from the Symptom Checklist (SCL-90-R; Derogatis & Melisaratos, 1983) captured self-report ratings of depressive symptoms from the previous week in 1991, 1994, 2001, and 2015. Sample items include, “feelings of worthlessness” and “feeling hopeless about the future.” These items were scored on a 5-point Likert-type scale (1 = Not at all, 5 = Extremely). A sum score was computed with higher scores indicating more depressive symptoms. The internal consistencies were greater than .90 across measurement occasions.

Global poor health. Global poor physical health was used as a control variable because lagged measures of pain and physical imitation (1991) were not available. Self-assessment of global health was obtained in 1991 using an item asking participants to indicate the following on a scale from 1 = excellent to 5 = poor: “How would you rate your overall physical health?” The mean in 1991 was 2.40 (SD = 0.58).

Statistical analyses

Using a structural equation modeling (SEM) framework with Mplus (version 8) statistical software (Muthen & Muthen, 1998-2017), we estimated two models. To assess the consequences of marital history on this biopsychosocial process, the first model (shown in
Figure 2) examined the consequences of mothers’ 1991 marital status and subsequent change in marital status from 1991 to 2001 for 416 mothers. Consistently married mothers from 1989-2001 were used as the reference group. Using subsequent marital status changes, the mothers were further subdivided to take into account the 40 divorced mothers who ‘recoupled’ (either by remarrying or cohabiting) between 1991 and 2001 (divorced to married) and the 40 married mothers who divorced between 1991 and 2001 (married to divorced). To assess the consequences of marital stress, the second model (shown in Figure 3) included only mothers who were consistently married from 1989-2001 (\(n = 296\)) to predict health outcomes in 2015. This provided a group of mothers with an adequate group size for testing hypothesized comprehensive model. In this model, we controlled for change in marital status from married to divorced from 2001 to 2015 (\(n = 42\)).

In both models, we predicted biopsychosocial health outcomes in 1994, 2001, and 2015 using Full Information Maximum Likelihood (FIML) to manage missing data. In listwise deletion, observations with missing data are deleted. Alternatively, FIML maximizes the likelihood function using all information available assuming that data are missing at random. Listwise removal of data can introduce bias into estimates and significance tests if the data are not missing completely at random. FIML is unbiased so long as data are missing at random—that is, information can be non-randomly missing as long as the variables causing the information to be missing are included in the model.
Simulation studies suggest that FIML outperforms listwise deletion, pairwise deletion, and multiple imputation (Enders & Bandalos, 2001).

A range of fit indices was used to evaluate the model fit, including the $\chi^2$ test of model fit, comparative fit index (CFI), and root mean square error of approximation (RMSEA). For the $\chi^2$ fit statistic, the model is thought to fit the data well when the $\chi^2$ divided by the degrees of freedom is below 3.0 (Carmines & McIver, 1981). When the CFI value is near or greater than .95 and the RMSEA value is close to or less than .06, this suggests that the model fits the data well (Hu & Bentler, 1999). More information is available in the online supplement.

The conventional Sobel test for indirect effect uses the product term ($a \times b$) and its’ standard error based on the Sobel formula to calculate test statistics. However, the sampling distribution of product term and Sobel’s Z are not normal. In addition, the Sobel test in often underpowered to detect small effects. The bootstrap approach to test the indirect effects is more efficient than the Sobel test. Bootstrapping generates an empirical sampling distribution of $a \times b$. It takes the original sample to draw values of variables involved in the indirect effect to create a new sample (say 5000). This allows the estimation of the product term and standard error for each bootstrap sample. New estimates

Figure 3. Life Course Biopsychosocial Process in Consistently Married Mothers. Note: Standardized coefficients are shown with $p$ values in parentheses; marital stress and health problems, financial stress and health problems, and health problems themselves were contemporaneously correlated in 91-94, 91, and 15, $p < .05$ (not shown); the effect of Poor Global Health (91) on Physical Pain (94) and Physical Limitations were .24(00) and .38 (00). The effect of Depressive Symptoms (91) on Depressive Symptoms (94) was .53(00). Non-significant ($p > .05$) regression paths are not shown; depressive symptoms in 91 were correlated with marital stress (91-94) ($r = .46(00)$ and financial stress (91-94) ($r = .32(00)$. Control variable, marital status change from married to divorced (01-15) significantly influenced Physical Pain 15 (.40(00). Confidence intervals for all pathways are shown in Supplemental Figure 2.
are the means of these bootstrap samples. The bootstrap procedure improves the distributions, parameter estimates, and confident intervals of estimates (Preacher & Hayes, 2008). In the current analysis, bias-corrected 95% CIs were computed using 5,000 bootstrapped resamples for indirect estimates.

Results

Descriptive statistics and correlations

Bivariate associations (shown in Supplemental Table 1) for all mothers indicated that mothers’ divorce status (89-91) was correlated with subsequent financial stress (91-94) and pain (94) in early midlife. Financial stress in early midlife (91-94) was correlated with their pain, depressive symptoms, and physical limitations at all time points. Financial stress was highly correlated over the mid-later years. For consistently married mothers (Supplemental Table 2), both financial stress and marital stress in early midlife (91-94) were significantly associated with subsequent pain (94), depressive symptoms (94), and physical limitations (94). Both financial and marital stress were highly stable from 94 to 01.

For all mothers and for consistently married mothers alone (Supplemental Tables 1 and 2), there were significant associations among pain, depressive symptoms, and physical limitations at each measurement time (r ranged from .15 to .61, p < .05). Additionally, correlations indicated moderate stability in these health outcomes over time (r ranged from .40 to .58, p < .05). For both divorced and married mothers, pain and depressive symptoms in 94 were associated with financial stress in 2001 during mid-midlife. In general, bivariate associations among study variables were consistent with the hypothesized associations. We tested for measurement invariance of marital stress and financial stress measures over time and found evidence for invariance (more detailed results of the CFAs are provided in Supplemental Figure 5).

Theoretical model for all mothers

The SEM testing the theoretical model for all mothers is shown in Figure 2 (using consistently married mothers as the reference group). The $\chi^2$ test of model fit divided by degrees of freedom was 2.79 ($\chi^2_{(df)} = 145.00_{(52)}$), the CFI was .95, and the RMSEA was .06, suggesting good model fit. Divorced marital status (89-91) was significantly related to subsequent financial stress (91-94) ($\beta = .36, p = .00$) and pain (94) ($\beta = .13, p = .04$) in early midlife (compared to consistently married mothers) after controlling for poor physical health (91) and subsequent transition status from 1991-2001 (married to divorced and divorced to recoupled). Financial stress (91-94) was associated with pain in 94 ($\beta = .21, p = .01$) and in 01 ($\beta = .12, p = .01$) and depressive symptoms in 94 ($\beta = .14, p = .00$) and in 01 ($\beta = .17, p = .00$), after controlling for lagged poor health (91) and depressive symptoms (91). Thus, being divorced (89-91) was associated with poorer health outcomes. This association largely operated through the effects of the divorce on early-midlife financial stress (91-94). Tests of mediation using the bootstrap procedure showed
that indirect effects from divorce 89-91 to health outcomes in 1994 through financial stress 91-94 were statistically significant (see, Supplemental Table 3).

Early-midlife financial stress (91-94) continued into mid-midlife (01) which was contemporaneously correlated with pain (01) \( (r = .13, p = .04, \text{not shown}) \) and depressive symptoms (01) \( (r = .17, p = .03, \text{not shown}) \). Although, mid-midlife financial stress (01) was not related to health outcomes in later years (15), consistent with the social selection notion (Conger & Donnellan, 2007), it appears that depressive symptoms (94) and pain (01) in early middle years select mothers into stressful financial difficulties in mid-midlife and later years (01 and 15, respectively). In later years, financial stress (15) was more strongly correlated with pain \( (r = .22, p = .02, \text{not shown}) \), depressive symptoms \( (r = .26, p = .03, \text{not shown}) \), and physical limitations \( (r = .30, p = .02, \text{not shown}) \).

Physical limitation in 94 was associated with pain in 01 \( (\beta = .15, p = .00) \). Depressive symptoms in 01 were related to more physical limitations in 15 \( (\beta = .14, p = .04) \). Physical limitation in 01 was associated with pain in 15 \( (\beta = .15, p = .03) \), and pain in 01 was associated with depressive symptoms in 15 \( (\beta = .17, p = .02) \). The indirect effects from health outcomes in 1994 to health outcomes in 2015 were statistically significant (Supplemental Table 3). This interplay among social, psychological, and physical health problems suggests a self-amplifying adverse health process during mid-later years. All three health problems were contemporaneously and significantly correlated with each other in 94, 01, and 15 \( (r \text{ ranged from .08 to .47, } p < .05, \text{not shown}) \). Age was included as a control variable, but age was only significantly associated with pain (01) and physical limitations (15).

**Theoretical model for consistently married mothers (1989-2001)**

The SEM testing the theoretical model for consistently married mothers is shown in Figure 3. The \( \chi^2 \) test of model fit divided by degrees of freedom was 2.45 \( (\chi^2(\text{df}) = 98.79(40)) \), the CFI was .97 and the RMSEA was .05, suggesting good model fit. Both financial stress (91-94) and marital stress (91-94) were significantly correlated with depressive symptoms (91) and poor physical health (91) (not shown in the figure) suggesting poor health was associated with marital and financial problems in early midlife. In addition, both financial stress (91-94) and marital stress (91-94) were significantly related to subsequent pain (94) \( (\beta_s = .14 \text{ and } .08, \text{respectively}) \) and depressive symptoms (94) \( (\beta_s = .13 \text{ and } .10, \text{respectively}) \), after controlling for lagged health status (91), showing the unique influences of marital and family stress on subsequent pain and depressive symptoms in early middle years. Financial stress was highly stable over time (from 91-94 to 01) \( (\beta = .66, p = .00) \), and financial stress in mid-midlife (01) was related to greater pain, depressive symptoms, and physical limitations in later years (15) \( (\beta_s = .15, p = .02, .11, p = .04 \text{ and } .16, p = .01, \text{respectively}) \). Thus, financial stress was associated with the common health problems examined in a subsequent life stage. All three health problems were significantly, contemporaneously correlated with each other in 94, 01, and 15, \( p < .05 \).

Marital stress was also highly stable from early to mid-midlife (from 91-94 to 01) \( (\beta = .62, p = .00) \). Marital stress in mid-midlife (2001) was not related to subsequent health
problems, suggesting that financial stress has a stronger association with health outcomes in later life stages compared to marital stress. In mid-midlife, significant contemporaneous correlations emerged between financial stress and depressive symptoms, between marital stress and depressive symptoms, and between financial stress and physical limitations. Consistent with the social selection notion (Conger & Donnellan, 2007), depressive symptoms in 94 were associated with subsequent marital stress (β = .14, p = .00) in 01, and pain in 01 was associated with greater financial stress in 15 (β = .19, p = .00), indicating a strengthening cumulative biopsychosocial process over the life course. Early midlife physical limitations (94) were associated with subsequent pain (01) (β = .17, p = .00), physical limitations (01) were associated with later pain (15) (β = .17, p = .03), and mid-midlife pain (01) was associated with subsequent depressive symptoms (15) (β = .16, p = .03). As presented in Supplemental Table 4, most of indirect effects from marital stress and financial stress (91-94) on health outcomes in 2011, and indirect effects from health outcomes in 2001 to health outcomes in 2015 were statistically significant. Together, these findings suggest a self-amplifying adverse health process over the mid-later years for consistently married mothers. Although age was included as a control variable, age was not significantly related to any study constructs. We controlled for change in marital status from married to divorced from 2001 to 2015 because these changes might have influenced health outcomes in 2015. This status change (01-15) significantly influenced physical pain in 2015 (β = .40, p = .02, not shown).

As a supplemental analysis, we estimated the parallel latent growth curves of study variables (Supplemental Figures 3 and 4). The results showed that although growth curve (GC) analysis estimate within individual changes in attributes (trajectories) over time (Lee et al., 2021), it did not reveal the time-sequential processes involving a) stabilities of the same study attributes over time, and b) longitudinal mutual (cross-lagged) influences involving repeated measures as in the cross-lagged auto-regressive (CL-AR) modeling (Wickrama et al., 2016). In the present GC analysis, the influences of the level of a variable on slopes of other variables were not significant. However, parallel GC models showed contemporaneous associations between initial levels and slopes.

**Discussion**

Although previous studies have documented the link between adult stressful life experiences and later-life health and well-being, little is known about the dynamics of biopsychosocial process as assessed by self-reports linking stressful family contexts and multiple health problems across the mid-later years, particularly for mothers. Thus, using a sample of 416 mothers with prospective data over a quarter century, the first objective of the present study was to investigate a biopsychosocial process elucidating associations between social, psychological, and biological problems for mothers with differing marital statuses over their mid-later years. The second objective of this study was to investigate this biopsychosocial process over the life course for consistently married mothers, to examine the role of their marital stress. We drew theoretical support for the study hypotheses from the biopsychosocial perspective of individual illness (Gatchel et al., 2007) within the life course perspective (Elder & Giele, 2009).
Influence of divorce and marital stress on biopsychosocial process

The results suggested that early-midlife divorce contributed to adverse biopsychosocial process directly and indirectly through financial stress regardless of subsequent recoupling (Lorenz et al., 2006). Divorced marital status was associated with physical pain directly, whereas divorced status was indirectly related to depressive symptoms and pain through financial stress. More importantly, early-midlife financial stress (not mid-later financial stress) had a long-term impact on mothers’ physical pain and physical limitation in later years. As expected, these health problems showed stabilities over time while mutually influencing each other over mid-later years. These findings are consistent with previous research findings that showed divorced mothers experience long-term health consequences of post-divorce family economic hardship (Lovallo, 2005; Lorenz et al., 2006). However, as previous research has documented (e.g., Lorenz et al., 2006), unlike physical health consequences, psychological consequences of divorce may recede a few years after divorce.

Also, results showed that the transition from divorced to married is associated with reduced subsequent financial stress (Figure 2), suggesting an improvement in financial circumstances. However, the results showed that there was no association between recoupling and health outcomes, suggesting that recoupling in middle age may not significantly change the physical health impact of divorce, potentially because of the continuation of limited availability and accessability of socioeconomic and personal health resources. Furthermore, it is also possible that early health problems and health-related risk behaviors may continue even after recoupling. It seems that the adverse physiological impact of divorce remained in mothers despite the subsequent financial improvement associated with recoupling (Lorenz et al., 2006).

Furthermore, for divorced mothers, financial stress in mid-midlife and later years was contemporaneously associated with common health problems. However, unlike early-midlife financial stress, it was not associated with subsequent changes in common health problems in later years. This suggests that although divorced mothers experience adverse physical health consequences of divorce in their early years (and these consequences can proliferate over time), they potentially gain resilience, or develop hardiness, against adverse health consequences of later financial difficulties. Future studies should investigate the development of resilience factors of divorced mothers.

For consistently married mothers, both marital stress and financial stress were involved in the biopsychosocial process over the life course. Marital stress and financial stress uniquely influenced common health problems (i.e., pain, physical limitations and depressive symptoms) in early midlife. Although marriage generally provides health benefits for mothers compared to those who divorce, for consistently married mothers, marital problems act as a powerful stressor with health implications, independent of financial difficulties (Wickrama et al., 2019). For consistently married mothers, unlike divorced mothers, not only early midlife financial stress but also mid-midlife financial stress continued to be associated with residual changes in pain, physical limitations, and depressive symptoms in later years, suggesting that financial difficulties operate as a powerful continuous stressor for married mothers over the life course. These findings
inform the current policy debate surrounding the question whether the economic interventions are a more pressing need than interventions targeting relationships directly (Karney et al., 2018).

**Stability and comorbidity of common health problems**

The biopsychosocial process involving physical pain, depressive symptoms, and physical limitations progressed over mothers’ mid-later years through stabilities and contemporaneous associations (comorbidities) and mutual influences. More specifically, physical pain, depressive symptoms, and physical limitations were moderately stable over their mid-later years. The contemporaneous associations among pain, depressive symptoms, and physical limitations were statistically significant \((p < .05)\) in both models. There were also reciprocal longitudinal influences between physical pain, depressive symptoms, and physical limitations suggesting a mutually reinforcing adverse health process over the life course (Covinsky et al., 2009). Contrary to previous research findings, the results did not show reciprocal longitudinal influences between middle-aged mothers’ physical limitations and depressive symptoms. This may be due to the strong stability in depressive symptoms over their mid-later years.

More importantly, observed contemporaneous correlations (comorbidities) suggest that these health problems may share underlying common pathophysiological process (Covinsky et al., 2009). Although not tested in the present study, this pathological process may adversely influence mothers’ later-life functioning as reflected by compromised sleep, cardiovascular health, and numerous chronic diseases (Croft et al., 2010; Fine, 2011). Future studies should investigate how mothers’ impaired later-life functioning is linked to midlife marital and financial stress through this pathological process.

The results also demonstrated that health problems select both divorced mothers and consistently married mothers into escalated adverse life circumstances over the life course (Conger et al., 2010). Specifically, results showed that depressive symptoms and physical pain further aggravate mothers’ marital and financial stress. Divorced and maritaly stressed mothers may be stuck in a self-perpetuating cycle of cumulating adverse life circumstances and health problems across their mid-later years.

**Limitation and conclusion**

Several factors limit the generalizability of the results. Attrition analyses showed that a substantial percentage of the (relatively) disadvantaged mothers dropped from the study, introducing a degree of bias into the sample. However, we suspect that the associations found in the present study would have been stronger if these more “at-risk” cases were included. Because this study focused only on middle-aged White mothers residing in a rural areas who experienced the farm crisis in late 80s, these analyses must be replicated with more diverse and nationally representative samples to increase confidence in their general applicability. Furthermore, all study variables, life stressors, and health problems were assessed using self-report. Future studies should use more objective measures (e.g., tax returns) and clinical measures for psychobiological attributes (e.g., clinically
measured pain and physical limitations) to validate the present findings. Also, the present study did not measure and include non-marital cohabitation. Future research should investigate the effect of non-marital cohabitation on these processes.

The present study used cross-lagged auto-regressive (CL-AR) modeling for the analysis of longitudinal data. As previously noted, CL-AR models allowed us to examine time-sequential processes involving a) stabilities of the same study attributes over time, and b) longitudinal mutual (cross-lagged) influences and contemporaneous associations between different attributes. However, in these models, cross-lagged influences between attributes are dependent on the stabilities of attributes. Another disadvantage of CL-AR modeling is that it is unable to reveal within individual changes in attributes (trajectories) over time (Lee et al., 2021).

Because we included multiple control variables associated each regression path, we are at increased risk of type 1 errors, and consequently false positive statistical significance. Researchers (e.g., Cribbie, 2007) suggest that for the studies with large sample sizes, statistical procedures such as controlling for false discovery rate can be used to correct inflation of Type 1 error. However, the present study sample may not be large enough to successfully apply these procedures to improve the evaluation of statistical significance. Thus, the results, particularly observed significance levels, should be considered cautiously.

Despite these limitations, the current study contributes to the enhancement of knowledge about the long-term influences of mothers’ midlife marital and financial stress on self-amplifying adverse health processes. This study also addresses methodological issues stemming from previous research. The timing of divorce in the study sample (early middle years) and the study duration are appropriate for a study on health in the mid-later years. The study examined health outcomes of mothers over 25 years, which enables an investigation of the consequences of divorce in the early middle years, including biopsychosocial processes as manifested by common health problems in increasingly susceptible women in their mid-later years. Furthermore, comprehensive panel studies that examine multiple health outcomes over time are still few in number, and more are needed to better understand the health consequences of divorce.

This study revealed the role of physical pain, which has been investigated by only a handful of studies, as it relates to this health process over the life course (McCracken et al., 2004; Covinsky et al., 2009). These findings provide support for the value and necessity of policies aimed at improving mothers’ economic conditions and strengthening marital relationships in married couples. Particularly, the findings suggest that the economic interventions are a pressing need for healthy marital relationships. These results are also important for consideration by medical and mental health professionals and counselors as future treatments and interventions should not overlook earlier (i.e., midlife) stressful life experiences as a potential cause of health and wellbeing problems in later years. Furthermore, study findings emphasize the need for preventive and intervention programs and policies, focusing on multiple common health problems together that form biopsychosocial process rather than focusing on specific health problems.
Funding
The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research is currently supported by a grant from the National Institute on Aging (AG043599, Kandauda A. S. Wickrama, PI). The content is solely the responsibility of the authors and does not necessarily represent the official views of the funding agencies. Support for earlier years of the study also came from multiple sources, including the National Institute of Mental Health (MH00567, MH19734, MH43270, MH59355, MH62989, MH48165, MH051361), the National Institute on Drug Abuse (DA05347), the National Institute of Child Health and Human Development (HD027724, HD051746, HD047573, HD064687), the Maternal and Child Health Bureau (MCJ-109572), and the MacArthur Foundation Research Network on Successful Adolescent Development Among Youth in High-Risk Settings.

Data accessibility statement
Several waves of data from this project are available through the ICPSR: https://doi.org/10.3886/ICPSR26721.v2.

Open research statement
As part of IARR’s encouragement of open research practices, the authors have provided the following information: This research was not pre-registered. Several waves of data from this project are available through the ICPSR: https://doi.org/10.3886/ICPSR26721.v2. The materials used in the research are not available.

ORCID iDs
Eric T Klopack https://orcid.org/0000-0002-0019-1332
Catherine W O’Neal https://orcid.org/0000-0002-3869-2394

Supplemental material
Supplemental material for this article is available online.

References
Amiard, V ., Libert, J., & Descatha, A. (2019). Is there an accurate relationship between simple self-reported functional limitations and the assessment of physical capacity in early old age? PLoS One, 14(3), Article e0211853. https://doi.org/10.1371/journal.pone.0211853
Avison, W. R. (1999). Family structure and process. In A. V . Horwitz, & T. L. Scheid (Eds.), A handbook for the study of mental health: Social contexts, theories, and systems (pp. 228–240). Cambridge University Press.
Ayalon, L., Shiovitz-Ezra, S., & Palgi, Y . (2013). Associations of loneliness in older married men and women. Aging and Mental Health, 17(1), 33–39, https://doi.org/10.1080/13607863.2012.702725
Baliki, M. N., Geha, P. Y ., Apkarian, A. V ., & Chialvo, D. R. (2008). Beyond feeling: Chronic pain hurts the brain, disrupting the default-mode network dynamics. Journal of Neuroscience, 28(6), 1398–1403. https://doi.org/10.1523/jneurosci.4123-07.2008
Fine, P. G. (2011). Long-term consequences of chronic pain: Mounting evidence for pain as a neurological disease and parallels with other chronic disease states. *Pain Medicine, 12*(7), 996–1004. https://doi.org/10.1111/j.1526-4637.2011.01187.x

Fokkema, T., De Jong Gierveld, J., & Dykstra, P. A. (2012). Cross-national differences in older adult loneliness. *The Journal of Psychology, 146*(1–2), 201–228. https://doi.org/10.1080/002223980.2011.631612

Frankel, R. M., Quill, T. E., & McDaniel, S. H. (Eds.). (2003). *The biopsychosocial approach: Past, present, future.* University of Rochester Press.

Gallo, L. C., de los Monteros, K. E., & Shivpuri, S. (2009). Socioeconomic status and health: What is the role of reserve capacity? *Current Directions in Psychological Science, 18*(5), 269–274. https://doi.org/10.1177/1047840509332426

Gatchel, R. J., Peng, Y. B., Peters, M. L., Fuchs, P. N., & Turk, D. C. (2007). The biopsychosocial approach to chronic pain: Scientific advances and future directions. *Psychological Bulletin, 133*(4), 581–624. https://doi.org/10.1037/0033-2909.133.4.581

Gayman, M. D., Brown, R. L., & Cui, M. (2011). Depressive symptoms and bodily pain: The role of physical disability and social stress. *Stress and Health, 27*(1), 52–63. https://doi.org/10.1002/smi.1319

Glymour, M. M., Errel, K. A., & Berkman, L. (2010). What can life-course epidemiology tell us about health inequalities in old age? In T. C. Antonucci, & J. S. Jackson (Eds.), *Annual review of gerontology and geriatrics* (pp. 77–97). Springer.

Hays, R. D., Sherbourne, C. D., & Mazel, R. M. (1993). The rand 36-item health survey 1.0. *Health Economics, 2*(3), 217–227. https://doi.org/10.1002/hec.4730020305

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Hughes, M. E., & Waite, L. J. (2009). Marital biography and health at mid-life. *Journal of Health and Social Behavior, 50*(3), 344–358. https://doi.org/10.1177/002214650905000307

Karney, B. R., Bradbury, T. N., & Lavner, J. A. (2018). Supporting healthy relationships in low-income couples: Lessons learned and policy implications. *Policy Insights from the Behavioral and Brain Sciences, 5*(1), 33–39. https://doi.org/10.1177/2372732217747890

Kiecolt-Glaser, J. K., & Wilson, S. J. (2017). Lovesick: How couples’ relationships influence health. *Annual Review of Clinical Psychology, 13*(1), 421–443. https://doi.org/10.1146/annurev-clinpsy-032816-045111

Koball, H. L., Moiduddin, E., Henderson, J., Goesling, B., & Besculides, M. (2010). What do we know about the link between marriage and health? *Journal of Family Issues, 31*(8), 1019–1040. https://doi.org/10.1177/0192513x10365834

Kronborg, C., Handberg, G., & Axelsen, F. (2009). Health care costs, work productivity and activity impairment in non-malignant chronic pain patients. *The European Journal of Health Economics, 10*(1), 5–13. https://doi.org/10.1007/s10198-008-0096-3

Landau, M. J., Kay, A. C., & Whitson, J. A. (2015). Compensatory control and the appeal of a structured world. *Psychological Bulletin, 141*(3), 694–722. https://doi.org/10.1037/a0038703

Lavelle, B., Lorenz, F. O., & Wickrama, K. A. S. (2012). What explains divorced women’s poorer health? The mediating role of health insurance and access to health care in a rural Iowan sample. *Rural Sociology, 77*(4), 601–625. https://doi.org/10.1111/j.1549-0831.2012.0009.x
Lee, S., Wickrama, K. K., Lee, T. K., & O’Neal, C. W. (2020). Long-term physical health consequences of financial and marital stress in middle-aged couples. *Journal of Marriage and Family, 83*(4), 1212–1226. https://doi.org/10.1111/jomf.12736

Lee, T. K., Wickrama, K. A. S., & O’Neal, C. W. (2021, May 6). Modeling Longitudinal dyadic processes in family research. *Journal of Family Psychology. Advance Online Publication.* https://doi.org/10.1037/fam0000862

Levine, J. A. (2011). Poverty and obesity in the U.S. *Diabetes, 60*(11), 2667–2668. https://doi.org/10.2337/db11-1118

Liu, H. (2012). Marital dissolution and self-rated health: Age trajectories and birth cohort variations. *Social Science & Medicine, 74*(7), 1107–1116. https://doi.org/10.1016/j.socscimed.2011.11.037

Lorenz, F. O., Conger, R. D., Montague, R. B., & Wickrama, K. A. S. (1993). Economic conditions, spouse support, and psychological distress of rural husbands and wives. *Rural Sociology, 58*(2), 247–268. https://doi.org/10.1111/j.1549-0831.1993.tb00493.x

Lorenz, F. O., Wickrama, K. A. S., Conger, R. D., & Elder, G. H. Jr. (2006). The short-term and decade-long effects of divorce on women’s midlife health. *Journal of Health and Social Behavior, 47*(2), 111–125. https://doi.org/10.1177/002214650604700202

Lovallo, W. R. (2005). *Stress and health: Biological and psychological interactions* (2nd ed.). Sage.

Matthews, L. S., Wickrama, K. A. S., & Conger, R. D. (1996). Predicting marital instability from spouse and observer reports of marital interaction. *Journal of Marriage and the Family, 58*(3), 641–655. https://doi.org/10.1177/002214650604700202

McCracken, L. M., Vowles, K. E., & Eccleston, C. (2004). Acceptance of chronic pain: Component analysis and a revised assessment method. *Pain, 107*(1–2), 159–166. https://doi.org/10.1016/j.pain.2003.10.012

McEwen, B. S., & Gianaros, P. J. (2010). Central role of the brain in stress and adaptation: Links to socioeconomic status, health, and disease. *Annals of the New York Academy of Sciences, 1186*(1), 190–222. https://doi.org/10.1111/j.1749-6632.2009.05331.x

Meana, M. (1998). The meeting of pain and depression: Comorbidity in women. *Canadian Journal of Psychiatry, 43*(9), 893–899. https://doi.org/10.1177/070674379804300902

Morrison, D. R., & Ritalo, A. (2000). Routes to children’s economic recovery after divorce: Are cohabitation and remarriage equivalent? *American Sociological Review, 65*(4), 560–580. https://doi.org/10.2307/2657383

Muthén, L. K., & Muthén, B. O. (1998–2017). *Mplus user’s guide* (8th ed.). Muthén & Muthén. Neugebauer, V., Li, W., Bird, G. C., & Han, J. S. (2004). The amygdala and persistent pain. *Neuroscientist, 10*(3), 221–234. https://doi.org/10.1177/1073858403261077

Patel, K. V., Guralnik, J. M., Dansie, E. J., & Turk, D. C. (2013). Prevalence and impact of pain among older adults in the United States: Findings from the 2011 National health and aging trends study. *Pain, 154*(12), 2649–2657. https://doi.org/10.1016/j.pain.2013.07.029

Peterson, R. R. (1996). A re-evaluation of the economic consequences of divorce. *American Sociological Review, 61*(3), 528–536. https://doi.org/10.2307/2096363

Picavet, H. S. J. (2010). Musculoskeletal pain complaints from a sex and gender perspective. In P. Croft, F. M. Blyth, & D. van der Windt (Eds.), *Chronic pain epidemiology from aetiology to public health* (pp. 119–126). Oxford University Press.
Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879–891. https://doi.org/10.3758/BRM.40.3.879

Sandanger, I., Nygård, J. F., Sørensen, T., & Moum, T. (2004). Is women’s mental health more susceptible than men’s to the influence of surrounding stress? *Social Psychiatry and Psychiatric Epidemiology, 39*(3), 177–184. https://doi.org/10.1007/s00127-004-0728-6

Simon, R. W., & Marcussen, K. (1999). Marital transitions, marital beliefs, and mental health. *Journal of Health and Social Behavior, 40*(2), 111–125. https://doi.org/10.2307/2676367

Simons, R. L. (1996). *Understanding differences between divorced and intact families: Stress, interaction, and child outcome*. Sage Publications.

Snyder, A. R., & McLaughlin, D. K. (2004). Female-headed families and poverty in rural America. *Rural Sociology, 69*(1), 127–149. https://doi.org/10.1526/003601104322919937

Steptoe, A., & Marmot, M. (2003). Burden of psychosocial adversity and vulnerability in middle age: Associations with biobehavioral risk factors and quality of life. *Psychosomatic Medicine, 65*(6), 1029–1037. https://doi.org/10.1097/01.psy.0000097347.57237.2d

Wang, M., Yi, Y., Roebothan, B., Colbourne, J., Maddalena, V., Wang, P. P., & Sun, G. (2016). Body mass index trajectories among middle-aged and elderly Canadians and associated health outcomes. *Journal of Environmental and Public Health, 2016*(4), 1–9. https://doi.org/10.1155/2016/7014857

Wickrama, K. A. S., Klopack, E., O’Neal, C. W., & Neppl, T. (2020b). Patterning of midlife marital trajectories in enduring marriages in a dyadic context: Physical and mental health outcomes in later years. *Journal of Social and Personal Relationships, 37*(5), 1472–1493. https://doi.org/10.1177/0265407519899726

Wickrama, K. A. S., Klopack, E. T., & O’Neal, C. W. (2020a). Husbands’ and wives’ stressful work, couple BMI dynamics, and later-life physical health. *Stress & Health*. https://doi.org/10.1002/smi.2952

Wickrama, K., Lee, T. K., O’Neal, C. W., & Lorenz, F. (2016). *Higher-order growth curves and mixture modeling with Mplus: A practical guide*. Routledge.

Wickrama, K. A. S., O’Neal, C. W., Klopack, E. T., & Neppl, T. K (2018). Life Course trajectories of negative and positive marital experiences and loneliness in later years: Exploring differential associations. *Family Process, 59*(1), 142–157. https://doi.org/10.1111/famp.12410

Wickrama, K. A. S., O’Neal, C. W., & Neppl, T. K. (2019). Midlife family economic hardship and later life cardiometabolic health: The protective role of marital integration. *The Gerontologist, 59*(5), 892–901. https://doi.org/10.1093/geront/gny047

Williamson, G. M., & Schulz, R. (1995). Activity restriction mediates the association between pain and depressed affect: A study of younger and older adult cancer patients. *Psychology and Aging, 10*(3), 369–378. https://doi.org/10.1037/0882-7974.10.3.369

Wu, Z., & Hart, R. (2002). The effects of marital and nonmarital union transition on health. *Journal of Marriage and Family, 64*(2), 420–432. https://doi.org/10.1111/j.1741-3737.2002.00420.x

Yorgason, J. B., Booth, A., & Johnson, D. (2008). Health, disability, and marital quality: Is the association different for younger versus older cohorts? *Research on Aging, 30*(6), 623–648. https://doi.org/10.1177/0164022708322570