The Gerontologist
cite as: *Gerontologist*, 2021, Vol. 61, No. 6, 930–941
doi:10.1093/geront/gnab007
Advance Access publication January 16, 2021

Research Article

Heterogeneity in Husbands' and Wives' Physical Pain Trajectories Over Mid-Later Years: Biopsychosocial Stratification and Implications for Later-Life Well-Being

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Received: September 12, 2020; Editorial Decision Date: January 5, 2021

Decision Editor: Suzanne Meeks, PhD, FGSA

Abstract

Background and Objectives: The present study investigated pain trajectories of husbands and wives over their mid-later years, the grouping of these trajectories, and differences in baseline biopsychosocial profiles and health and well-being outcomes in later years across the pain trajectory groups.

Research Design and Methods: Growth mixture modeling was used to identify latent classes of 244 husbands' and wives' physical pain trajectories over their mid-later years (1994–2015, average ages of 44–65 years). Analyses were conducted to identify how these pain trajectory classes were associated with respondents' biopsychosocial profiles in 1994 and health and well-being in later years (2017 [>67 years]).

Results: The individual pain trajectories of husbands and wives were clustered into 3 heterogeneous groups with differing trajectory patterns. Nonnormative pain trajectory groups (with either a high pain level and/or persistent pain) were associated with adverse baseline biopsychosocial characteristics. These groups also experienced poorer health and well-being outcomes in later years (2017) compared to those with consistently low pain after controlling for lagged measures in 2015.

Discussion and Implications: The identification of pain trajectory groups and characteristics of group members provides a potentially useful prognostic tool for early preventive intervention efforts, treatment, and policy formation. Such interventions can promote and develop resiliency factors, thereby aiding in the redirection of middle-aged husbands' and wives' adverse pain trajectories.

Keywords: Growth mixture modeling, Mental health, Older adults, Pain trajectories, Physical health

Although physical pain is often a symptom of underlying biological conditions, it can also be a health condition in its own right with both biological and psychosocial components (Croft et al., 2010). Empirically, physical pain is measured as experiences of bodily discomfort that interfere with day-to-day activities (Hays et al., 1993). Physical pain can impact mental and physical health and quality of life, in addition to creating a substantial economic burden (Fine, 2011). The prevalence of physical pain, particularly in middle-aged men and women, has exponentially increased in recent years (Gaskin & Richard, 2012). For these reasons, physical pain is a

major public health concern in the United States (Centers for Disease Control and Prevention [CDC], 2018; Chou et al., 2016). Reducing physical pain can improve health conditions and quality of life and lower the economic burden at the individual and population levels (Gaskin & Richard, 2012).

Research has shown that the prevalence of chronic pain is disproportionately higher among socioeconomically disadvantaged groups (van Hecke et al., 2013). Specifically, previous studies have documented that various social and economic factors are associated with the prevalence of physical pain at the population level, including social class and economic insecurity (Chou et al., 2016), race/ethnicity and immigrant status (Kellner et al., 2013), and occupational conditions (Shaw et al., 2006). These socioeconomic factors play a large role in individuals' lives and can give rise to social inequalities in chronic health conditions, including physical pain (Marmot et al., 2001). The current study sheds light on how individual biopsychosocial processes of pain may operate, which can inform pain prevention and management strategies, including efforts that address both macro-level and micro-level factors and processes.

The Present Study

The present study investigates individual-level biopsychosocial processes of husbands' and wives' pain development within a dyadic context and the consequences of pain for later-life health and well-being using prospective data from 244 long-term married, heterosexual couples over 23 years (married 42+ years by the last measurement occasion).

As explained in detail in later sections, theoretical support for the current study is drawn from the biopsychosocial model of pain (Gatchel et al., 2007) and the life course perspective (Elder, 1998). The biopsychosocial model posits that psychological and social factors influence the development of individual physical pain. The life course perspective contends that early disadvantages lead to later adverse health outcomes through developmental trajectories (O'Rand & Hamil-Luker, 2005). Importantly, recent life course social epidemiological research suggests that these health trajectories are inherently heterogeneous (i.e., unique clusters of trajectories exist; Wickrama, Lee, & O'Neal, 2020; Wickrama, O'Neal, et al., 2020). Further, the life course "linked lives" notion posits that husbands' and wives' life experiences are mutually dependent (Elder, 1998). The findings of our previous studies provide empirical evidence for this theoretical alliance. We expect that the present study findings will extend on previous empirical work in various ways, including identifying mutual dependencies in spouses' pain experiences.

Building on Previous Research

Our previous research demonstrated that mental and physical health outcomes in men and women form linear trajectories over mid-later years. Also, individuals' health trajectories often cluster together to form heterogeneous groups of trajectories. For example, Wickrama, Lee, and O'Neal (2020), using latent trajectory class analysis, demonstrated men's and women's body mass index (BMI) trajectories cluster to form trajectory classes with different BMI patterns over time. Further, the heterogeneous trajectory classes of BMI were differentially associated with background socioeconomic characteristics and later physical health outcomes.

In addition, our previous studies used a dyadic analytical framework incorporating data from both husbands and wives to demonstrate contemporaneous dependencies between husbands and wives (e.g., between husbands' and wives' background characteristics as well as between husbands' and wives' later-life health outcomes). For example, Wickrama, O'Neal, and colleagues (2020) and Wickrama and O'Neal (2020) showed that husbands' and wives' midlife financial stress and later-life loneliness and memory functioning are contemporaneously associated. Also, these studies identified transactional (i.e., cross-over) influences in associations between these health trajectory classes and covariates (e.g., spouses' trajectory classes and partners' background characteristics and/or partners' later-life health outcomes; Wickrama, Lee, & O'Neal, 2020; Wickrama, O'Neal, et al., 2020). However, to our knowledge, no study has examined physical pain trajectory classes in mid-later adults and their associations with background characteristics and/or with later-life health outcomes while simultaneously considering possible transactional influences between spouses. Thus, extending our previous work to husbands' and wives' physical pain will provide an investigation of their pain trajectories, including potential heterogeneous trajectory classes, and differential and transactional associations with socioeconomic characteristics and later-life health outcomes. We provide theoretical and empirical support for the study constructs and their expected associations in the paragraphs that follow.

Physical Pain Trajectories and Their Heterogeneity Over the Mid-Later Years

Pain can be a symptom of an underlying medical problem (Croft et al., 2010), and its severity may vary over the life course producing long-term intraindividual pain trajectories. These pain trajectories can vary between individuals with different growth factors (i.e., differences in the level/severity and rate of change) and may reflect different developmental courses (Wickrama et al., 2016).

Importantly, social and developmental perspectives (House et al., 2005) suggest that health trajectories are inherently heterogeneous over the life course due to underlying

social processes. As noted earlier, such heterogeneity has been supported by previous empirical studies (Wickrama et al., 2019), and there may be groups (i.e., clusters) of individuals with similar pain trajectories (Wickrama et al., 2016). Ignoring these clusters (or subpopulations) and assuming uniform variation in individuals' pain trajectories may produce biased parameter estimates because it violates standard regression assumptions. Describing an entire population using a single trajectory form may be an oversimplification of the complex growth patterns with distinct change patterns for different groups (Muthén, 2004; Wickrama et al., 2016). Thus, we expect linear trajectories of pain over husbands' and wives' mid-later years and heterogeneity in these trajectories.

Baseline Biopsychosocial Profiles and Development of Pain Trajectories

The biopsychosocial model posits that social factors influence the development of physical pain (Croft et al., 2010; Fine, 2011). These factors interact with brain processes to produce sensations of physical pain as a brain–pain mechanism (Gatchel et al., 2007). Further, life course health research has shown that individual baseline social profiles initiate and shape health trajectories over the life course (O'Rand & Hamil-Luker, 2005). Particularly, research has shown that economic hardship produces daily financial worries, which are associated with greater experiences with pain (Marshall et al., 2018). Thus, we expect that baseline social factors, particularly economic hardship, will vary across the pain trajectory classes.

The biopsychosocial model also posits that biopsychological factors influence the development of physical pain (Croft et al., 2010; Fine, 2011). Through their persistent influence, *biological* conditions including injuries, physical disabilities, fatigue, sleep disturbance, and comorbid conditions, such as underlying health conditions, may contribute to pain trajectories (Covinsky et al., 2009; O'Neill et al., 2018). Further, baseline *psychological* conditions, such as depressive symptoms, anxiety, and stress, may also be associated with the development of pain trajectories. For example, Leino-Arjas and colleagues (2018) found that early depressive symptoms were associated with high or increasing musculoskeletal pain trajectories over the early life course. Accordingly, we expect that disadvantaged biopsychosocial conditions in early midlife will be associated with pain trajectory class membership, with the classes characterized by varying severity and rate of change in pain over the mid-later years.

Later-Life Implications of Pain Trajectories

Previous empirical research has shown adverse health consequences of persistent physical pain, such as physical functioning, depression, brain function, memory, sleep, sexual functions, and cardiovascular health (Croft et al., 2010; Fine, 2011), and physiological and neurological pathways play a role in the detrimental influence of persistent pain on subsequent health. For example, as a mechanism of pain suppression, blood pressure changes contribute to poor cardiovascular health, including hypertension (Chung et al., 2008). Chronic pain can also negatively impact the immune system (Apkarian et al., 2004), and persistent pain can negatively impact cognitive functioning, including memory and altered brain activation (Apkarian et al., 2005). Pain is also implicated in increased rates of major depressive disorder (Ohayon & Schatzberg, 2003).

In addition, persistent pain negatively impacts the overall quality of life (McCarberg et al., 2008). For example, persistent pain has been shown to contribute to adults' economic hardship because pain resulted in a decreased number of working days/hours, early retirement, and increased health care cost (Marshall et al., 2018). Persistent pain also negatively impacts social interactions and daily activities, such as personal relationships (Breivik et al., 2006), which may contribute to loneliness in later years.

The impact of pain on health and well-being has been shown to be related to characteristics of pain trajectories, such as pain severity (Chung et al., 2008) and chronicity (Apkarian et al., 2004), which characterize different pain trajectory classes. Thus, we expect pain trajectory classes are differentially associated with later-life health and well-being outcomes.

Dyadic Associations Between Spouses in Enduring Marriages

Consistent with the life course "linked lives" tenet (Elder, 1998; Meegan & Berg, 2002), spouses' daily life activities are closely connected, and there can be various cross-over, or partner, effects between spouses. For example, a spouse's stress, mood, and feelings (e.g., financial strain) can be transmitted to their partner (Kiecolt-Glaser & Wilson, 2017), influencing his/her pain development. Cross-over effects are also plausible with regard to later-life health and well-being. For example, persistent pain by one spouse may result in increased depressive symptoms for their partner because of reduced positive interactions or shared activities (Wickrama, O'Neal, et al., 2020). These dependencies may be particularly strong for older spouses in enduring marriages because emotional investment in the marriage relationship typically increases over time (Meegan & Berg, 2002). Thus, we expect cross-over influences between husbands and wives in relation to associations of pain trajectory classes as well as their background characteristics and later-life health and well-being outcomes.

Gender Differences

Gender differences have been reported in the prevalence and severity of physical pain, with a higher prevalence of chronic pain for women (CDC, 2018). This may be

attributed to several factors. First, research suggests that women may be more vulnerable to developing pain, at least in part, due to differential sex hormones that may have a significant impact on pain sensitivity (Picavet, 2010). Second, research has documented that wives are more exposed to, and affected by, chronic stressful family circumstances, generating stronger stress responses (Wickrama, Lee, and O'Neal, 2020). Third, social factors, such as traditionally lower work status and fewer work rewards, for women may have emotional and physical consequences (De Sio et al., 2017). However, other studies reported no prominent gender differences related to the predictors of pain (Mundal et al., 2014). Thus, although the present study does not hypothesize gender differences, possible gender differences are examined in the association of pain trajectories with baseline biopsychosocial profiles as well as with health and well-being in later years.

The Theoretical Framework and Specific Hypotheses

Based on the previously discussed theoretical and empirical support, the study's theoretical framework is outlined in Figure 1, and the following specific hypotheses were developed.

1. There is heterogeneity (i.e., clustering) in husbands' and wives' physical pain trajectories over their mid-later years that gives rise to classes of pain trajectories (1994–2015; average ages of 43–65 years; depicted by the middle boxes in Figure 1).
2. Baseline biopsychosocial characteristics of husbands and wives are differentially associated with the identified physical pain trajectories (i.e., biological and psychosocial clustering; as depicted by A1h and A1w paths). We also expect that cross-over associations exist between husbands' and wives' biopsychosocial characteristics and their pain trajectories (as depicted by paths P1s).
3. Pain trajectory classes (1994–2015) are differentially associated with husbands' and wives' changes (residual from 2015 to 2017) in health and well-being in later years (>67 years; as depicted by A2h and A2w paths in Figure 1). We also expect that cross-over associations exist between husbands' and wives' pain trajectory classes and their later-life health and well-being (as depicted by paths P2s).

Method

Participants and Procedures

The data used to evaluate these hypotheses are from the Iowa Youth and Family Project (IYFP, 1989–1994), which was later continued as two panel studies: the Midlife Transitions Project (2001) and the Later Adulthood Study (2015–2017). Together, these projects provide data over 27 years on rural families from a cluster of eight counties in north-central Iowa that closely mirror the economic diversity of the rural Midwest. The IYFP began in 1989 as a study of rural couples with children, at least one of whom was a seventh grader in 1989 (Conger & Elder, 1994). The present study was limited to husbands and wives who were consistently married from 1991 to 2017 (n = 244) and participated in 1991, 1994, 2001, 2015, and 2017 data collections. Data collected in 1991, rather than 1989, were used as the first time point of the present study due to the availability of study variables.

The attrition rate was 31% from 1991 to 2017. An attrition analysis compared demographic characteristics (i.e., age, education level, economic hardship measured by counts of economic cutbacks, and divorce proneness; Booth et al., 1983) and study variables (e.g., depressive symptoms, physical illness) in 1991 between the current analytic sample of consistently married couples and couples who were excluded from the current analyses due to divorce or study attrition. The only significant difference noted was for divorce proneness in 1991, with higher scores reported for couples who were excluded from the current analysis.

In 1991, spouses were in their early middle years. The average ages of husbands and wives were 42 and 40 years, respectively, and their ages ranged from 33 to 59 for husbands and 31 to 55 for wives. On average, the couples had been married for 19 years and had three children. The median age of the youngest child was 12. The average number of years of education for husbands and wives was 13.68 and 13.54 years, respectively. Because there are very few minorities in the rural area studied, all participating families were White. Participants' demographic information is shown in Table 1.

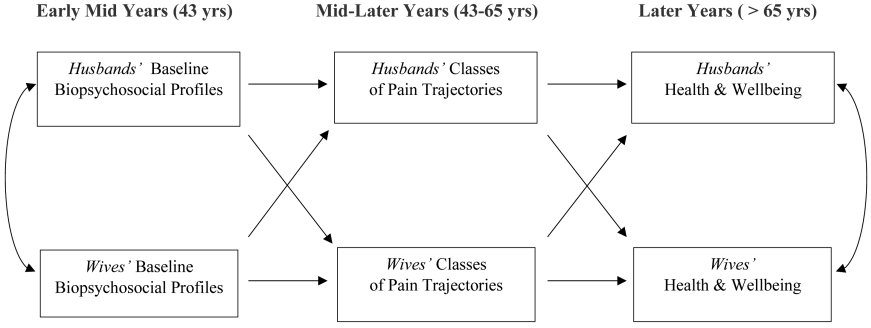


Figure 1. The theoretical framework.

Table 1. Means and Standard Deviation Among Background Variables

	Overall	Consistently low[a]	Moderate and increasing[b]	High and decreasing[c]	
Background characteristics	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)	*F*-value
Family level					
Family income (1994)	51464.22 (42365.75)	55980.31 (49068.18)	426465.44 (19347.12)	39969.02 (17899.25)	2.67†
Husbands					
Education level (1989)	13.70 (2.28)	14.04 (2.31)	13.20 (2.10)	12.37 (1.83)	6.29$^{**c, b<a}$
Family financial strain (1994)	2.38 (0.75)	2.26 (0.72)	2.72 (0.75)	2.40 (0.83)	7.14$^{**a<b}$
Depressive symptoms (1994)	17.92 (5.35)	16.94 (4.53)	20.10 (6.53)	19.89 (5.98)	8.21$^{***a<b,c}$
Physical illness (1994)	3.36 (2.23)	2.85 (1.90)	4.27 (2.38)	4.95 (2.73)	14.20$^{***a<b,c}$
Physical limitations (1994)	1.14 (0.24)	1.09 (0.18)	1.14 (0.16)	1.51 (0.46)	32.41$^{***a, b<c}$
Wife family financial strain	2.37 (0.87)	2.32 (0.86)	2.80 (0.89)	2.33 (0.85)	7.00$^{**a<b}$
Wives					
Education level (1989)	13.57 (3.97)	13.95 (4.69)	12.76 (1.16)	12.84 (1.42)	2.02
Family financial strain (1994)	2.45 (0.87)	2.37 (0.88)	2.74 (0.74)	2.28 (0.89)	3.92$^{*c<b}$
Depressive symptoms (1994)	19.38 (6.65)	18.95 (6.50)	20.33 (6.69)	20.21 (7.97)	0.93
Physical illness (1994)	4.15 (2.73)	4.02 (2.71)	4.35 (2.70)	4.63 (3.02)	0.58
Physical limitations (1994)	1.17 (0.26)	1.18 (0.22)	1.15 (0.20)	1.18 (0.22)	0.18

Note: Group comparisons are indicated at the $p < .05$ level. $^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Measures

Baseline biopsychosocial characteristics

One family-level baseline characteristic was examined along with five individual-level baseline characteristics. Individual-level characteristics were reported separately by husbands and wives. Some baseline characteristics in midlife were also measured in later life as indicators of well-being (measurement occasions are stated for each construct).

Family-level characteristics

Family income.—Family income was measured by taking the mean of husbands' and wives' reports of the total gross family income (in dollars) in 1994.

Individual-level characteristics

Education.—Educational status was measured by the number of years of formal education reported in 1989. Mean years of education for husbands and wives were 13.67 years and 13.41 years, respectively.

Family financial strain.—Family financial strain (FFS) was measured in 1994 and 2017 using a four-item scale developed by Conger and Elder (1994) for the IYFP. Respondents reported on their perceived financial strain on items such as "we have enough money to afford the kind of clothing 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 averaged, and higher scores indicated greater FFS. Internal consistencies (i.e., α) were greater than .77 for all occasions for both husbands and wives.

Depressive symptoms.—Thirteen items from the Symptom Checklist-90-R (Derogatis & Melisaratos, 1983) captured self-report ratings of depressive symptoms from the previous week for husbands and wives in 1994 and 2017. 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 for husbands and wives across measurement occasions.

Physical illness.—Respondents were presented with a list of 46 health conditions in 1994, 2015, and 2017 and asked whether they "had any problems with any of the symptoms or diseases listed" during the past 12 months. The illnesses ranged from relatively minor conditions, such as the common cold and sore throats, to more severe diseases such as heart conditions, diabetes, and cancer. The items were summed to create a count of reported illnesses.

Physical limitations.—The 10-item Physical Impairment Scale of the Rand 36-Item Health Survey 1.0 (Hays et al., 1993) measured physical limitations. 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) ranging from 1 = *no, not limited at all* to 3 = *yes, limited a lot*. Responses were averaged to create a measure of overall physical limitations. Cronbach's alpha for the measure was greater than .80 for husbands and wives for all occasions. The means (*SD*s) for husbands were 1.23 (1.55), 1.44 (0.42), and 1.41 (0.76) in 1994, 2015, and 2017, respectively. The means (*SD*s) for wives in 1994, 2015, and 2017 were 1.32 (0.65), 1.37 (0.31), and 1.47 (0.75), respectively.

Physical pain.—The degree of *physical pain* was assessed in 1994, 2001, and 2015 by two items from the Rand Health Science Program in Health Survey 1.0 (Hays et al., 1993) to capture the presence and severity of pain. On a 6-point scale 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 from 1 = *not at all* to 5 = *extremely*, respondents indicated "how much pain interfered with normal work." Responses were standardized and averaged to create the physical pain measure. The correlation between the two items was more than .70 for husbands and wives for all occasions.

Later-life well-being

In addition to measuring later-life well-being through FFS, depressive symptoms, physical illness, and physical limitations (describe above), loneliness and subjective memory impairment (SMI) were measured in later life.

Loneliness.—Husbands and wives completed the UCLA Loneliness Scale (Russell et al., 1978) in 2015 and 2017. The 20-item scale was designed to measure one's subjective feelings of loneliness as well as feelings of social isolation. Participants rated each item on a 4-point scale (1 = *never*, 4 = *often*), and items were averaged. The internal consistencies for both husbands and wives were more than .80 for both occasions.

Subjective memory impairment.—SMI was measured in 2017 using the revised, shortened Everyday Memory Questionnaire, which captures three aspects of memory performance, including "retrieval," "attentional tracking," and "visual reconstruction" (Royle & Lincoln, 2008). Thirteen items indicated SMI in the previous month for both husbands and wives. Sample items include "having to check whether you had done something that you should have done" and "forgetting when it was that something happened; for example, 'was it yesterday or last week'" (1 = *once or less in the last month*, 5 = *once or more in a day*). A mean score was computed with higher scores indicating more SMI. The internal consistencies were .94 and .93 for husbands and wives, respectively.

Statistical Analyses

A latent class trajectory analysis (Wickrama et al., 2016) was used to identify unobserved patterns of pain trajectories (1994–2015). To evaluate the models, several fit indices were used, including sample size-adjusted Bayesian information criterion (SSABIC; lower value is preferred), entropy (≥.70 is acceptable), interpretability (sample size of the smallest class >5%), and the Lo–Mendell–Rubin likelihood ratio test (LMR-LRT; a significant *p*-value indicates the *k* class model is better than *k*–1 class model). Second, to investigate the associations between biopsychosocial profiles and pain trajectory classes, a series of analyses of variance were performed.

Next, using a dyadic regression model, the trajectory classes were utilized as predictor variables explaining health and well-being outcomes in later years (2017) after controlling for lagged health variables in 2015 to predict residual changes from 2015 to 2017 (except for SMI, which was unavailable in 2015). All coefficients were adjusted after controlling for the effects of age. A range of fit indices was used to evaluate model fit, including the chi-squared statistic, cumulative fit index (CFI), and root mean square error of approximation (RMSEA). For the chi-squared fit statistic, the model is thought to fit the data well when the chi-square divided by the degrees of freedom is below 3.0 (Carmines & McIver, 1981). CFI values near or greater than .95 and RMSEA values close to or less than .06 indicate that the model fits the data well (Hu & Bentler, 1999). Analyses were conducted in Mplus (version 8.00; Muthén & Muthén, 1998–2018) and SPSS (version 25). Full-information maximum likelihood was used to estimate paths with missing data.

Results

Identification of Pain Trajectory Classes

The model fit indices for the latent class trajectory analyses for husbands' and wives' pain trajectories are shown in Table 2. Significant *p*-values were associated with the adjusted LMR-LRT for the models with four classes, which indicates that these models were a better fit compared to model with three classes (i.e., *k*–1). However, the four-class model included very small classes for husbands (n = 5; 2.2%) and wives (n = 6; 2.5%). For both husbands' and wives' pain trajectory classes, the three-class models had lower SSABIC values compared to two-class models. Also, entropy values were acceptable for husbands' and wives' three-class models. Taken together, the three-class models were selected as the optimal class models for both husbands' and wives' pain trajectories.

Estimated mean trajectories for husbands' and wives' pain trajectory classes are shown in Figure 2. In general, both husbands' and wives' pain trajectories indicated similar patterns across the three identified classes. For example, for both husbands' and wives' pain trajectories, individuals in one class (n = 19 [8.2%] and n = 19 [7.8%] for husbands and wives, respectively) had high initial levels of pain but decreasing pain over time (i.e., *high and decreasing*). Individuals in the second class (n = 51 [22.0%] and n = 53 [21.7%] for husbands and wives, respectively) experienced moderately high levels of pain (standardized scores close to 0) and increasing pain over time (i.e., *moderate and increasing*). Individuals in the third class (n = 162 [69.8%] and n = 172 [70.5%] for husbands and wives, respectively) reported consistently low pain over time (i.e., *consistently low*). Husbands' and wives' pain trajectory class membership was not associated with each other (χ^2(df) = 2.61(4), p = .624).

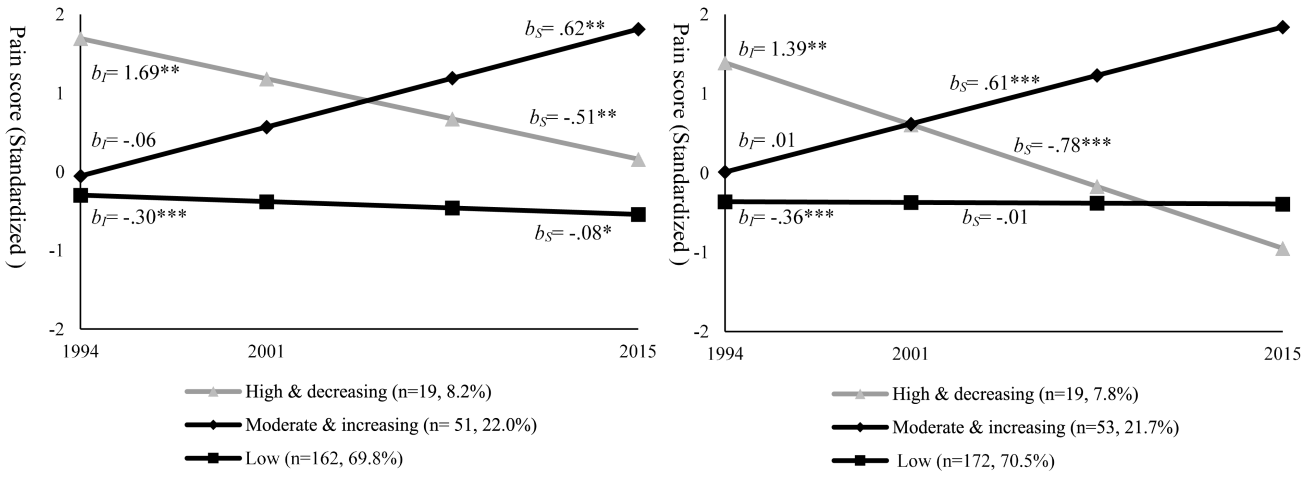
Biopsychosocial Characteristics in Early Mid Years and Pain Trajectory Classes

Estimated means of family- and individual-level characteristics for each of the three classes for both husbands and wives are shown in Table 1. Compared to those in the consistently low pain trajectory class, husbands in the moderate and increasing and high and decreasing trajectories generally reported more adverse early experiences. For example, compared to those in the consistently low pain class, husbands in the moderate and increasing class and the high and decreasing class averaged lower education levels, more depressive symptoms, and more physical illnesses. In addition, husbands in the moderate and increasing class typically experienced more FFS compared to those in the consistently low class. For wives, fewer differences in background biopsychosocial characteristics across pain classes were found. The one significant difference was that wives in the moderate and

Table 2. Model Fit Indices for Latent Growth Class Models

Latent class trajectory models	SSABIC	Entropy	Adj. LMR-LRT (p-value)	Smallest class sizes (%)
Husbands				
Two classes	1635.125	0.714	96.787, p < .001	64 (27.5%)
Three classes	**1605.211**	**0.814**	**34.627, p = .17**	**19 (8.2%)**
Four classes	1581.820	0.819	28.479, p < .05	5 (2.2%)
Five classes[a]	1588.652	0.844	0.000, p = .50	9 (0.0%)
Wives				
Two classes	1651.913	0.828	34.873, p = .29	25 (10.2%)
Three classes	**1642.314**	**0.742**	**15.633, p = .60**	**19 (7.8%)**
Four classes	1590.610	0.923	38.467, p < .01	6 (2.5%)
Five classes[a]	1621.183	0.861	5.218, p = .08	1 (0.01%)

Notes: Adj. LMR-LRT = adjusted Lo–Mendell–Rubin likelihood ratio test; SSABIC = sample size-adjusted Bayesian information criterion. The models identified as the optimal class models are indicated in bold.
[a]No repeated log-likelihood.



Panel a) Husbands' pain trajectories (n=232)

Panel b) Wives' pain trajectories (n=244)

Figure 2. Estimated three-class trajectories in husbands' and wives' pain. *Note*: b = unstandardized coefficient; I = initial level; S = slope. *p < .05. **p < .01. ***p < .001.

increasing class showed higher levels of FFS compared to those in the high and decreasing class.

Pain Trajectory Classes and Health and Well-Being in Later Years

Longitudinal associations were examined between pain trajectory classes and health and well-being in later adulthood (2017) after controlling for health and well-being in 2015. Thus, the findings reflect how pain trajectory classes over the mid-later years were implicated in the change in health and well-being from 2015 to 2017. The results are shown in Figure 3. The model was an acceptable fit to the data (χ^2(df) = 218.20(128), $p < .001$; CFI = .95; RMSEA = .05).

Compared to members of the consistently low pain classes, husbands and wives in both of the nonnormative pain trajectory classes (i.e., the moderate and increasing class and the high and decreasing class) experienced poorer health and well-being outcomes in later years (2017; i.e., actor effects) after controlling for lagged measures (2015). There was evidence of gender similarities and differences. For example, both husbands and wives in the high and decreasing pain class averaged more depressive symptoms than those with consistently low pain after controlling for depressive symptoms in 2015. However, using the consistently low pain class as the comparison, husbands in the high and decreasing class also experienced more SMI. In contrast, for wives, high and decreasing pain was implicated in more physical limitations and loneliness after controlling for the lagged measures in 2015.

Likewise, findings for the moderate and increasing pain classes for husbands and wives were similar in some ways yet different in other ways. For example, for both husbands and wives, experiencing moderate and increasing pain, compared to experiencing consistently low pain, predicted increases in their own financial strain. However, regarding other later adult outcomes, moderate and increasing pain was only predictive of one other later-life outcome for husbands. Husbands in the moderate and increasing pain class averaged greater SMI compared to members of the consistently low class. For wives, moderate and increasing pain predicted both physical illness and physical limitations compared to members of the consistently low pain class.

The results also indicated distinct patterns of partner effects between husbands' and wives' pain trajectory classes and their spouses' health and well-being outcomes. There were no statistically significant associations between husbands' pain trajectories and wives' subsequent health and well-being outcomes. However, wives' pain trajectory class membership was related to several of the

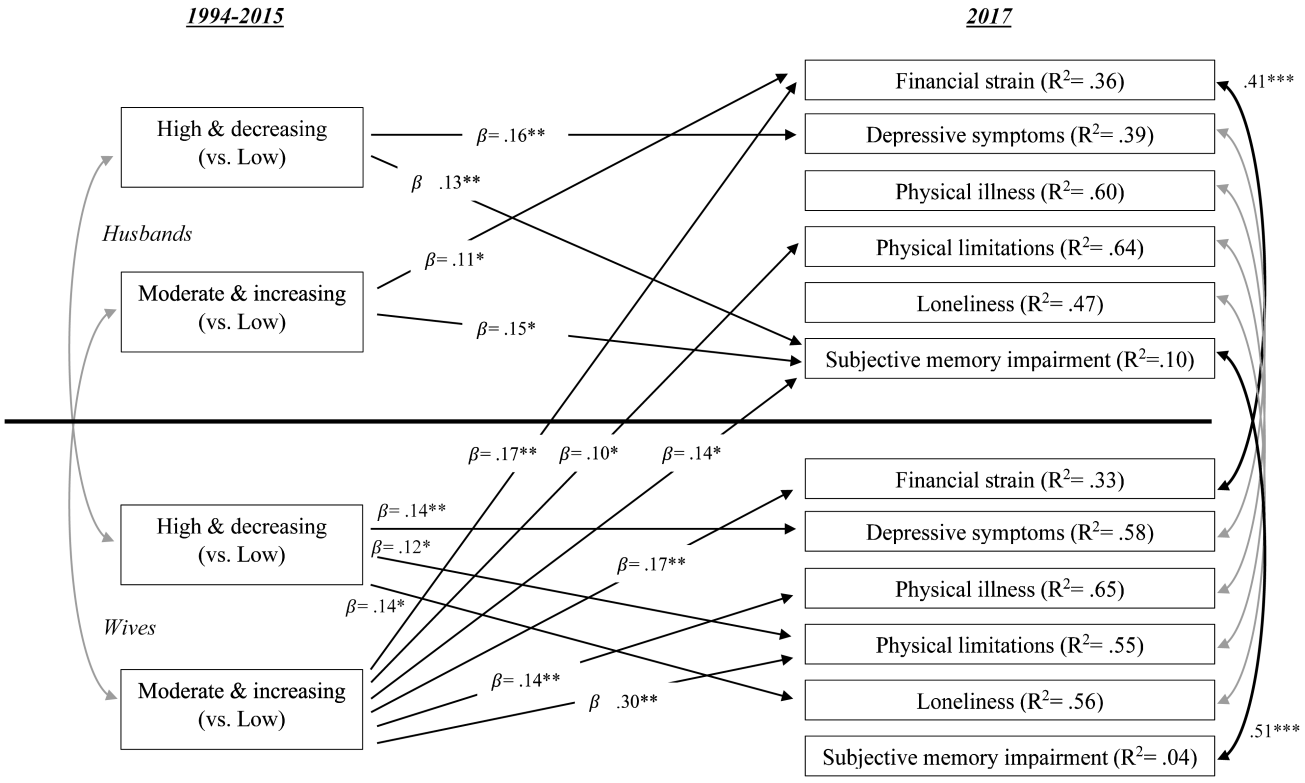


Figure 3. Adjusted estimated regression coefficients between couple's pain class trajectories and their health and well-being after controlling for lagged measures in 2015 (except for memory functioning). *Note*: Standardized coefficients are shown. Nonsignificant regression coefficients are not shown in the figure. Health and well-being outcomes at 2015 were specified into the regression model. Grayed double arrows indicate nonsignificant correlations. χ^2(df) = 218.20, $p < .001$. Cumulative fit index = .95; root mean square error of approximation = .05. *$p < .05$. **$p < .01$. ***$p < .001$.

later-life outcomes of husbands, particularly for wives with moderate and increasing pain. Wives' moderate and increasing pain predicted husbands' reports of greater financial strain, more physical limitations, and more SMI. There were positive correlations (i.e., interdependence) between husbands and wives for two health and well-being outcomes even after adjusting for the effects of pain trajectories, such that, in later life, husbands' and wives' perceptions of financial strain were positively correlated ($r = .41$, $p < .001$), as were their experiences of SMI ($r = .51$, $p < .001$).

Discussion

Persistent physical pain has been shown to be a health condition in its own right, with both biopsychosocial antecedents and detrimental consequences for later health and well-being outcomes (Croft et al., 2010). Although chronic pain often persists for many years (Breivik et al., 2006), there is little research investigating the existence of heterogeneous long-term pain trajectories. Such trajectories are important because they may have different biopsychosocial profiles and unique implications for later-life health and well-being. Moreover, research has not investigated long-term trajectories of pain within a dyadic context. Thus, the present study attempted to fill these research gaps.

The results of the present study revealed that individuals' pain trajectories are clustered into heterogeneous groups with differing trajectory patterns. Consistent with the biopsychosocial model (Gatchel et al., 2007), adverse pain trajectory groups (with either a high pain level and/or persistent/worsening pain) were associated with adverse baseline biopsychosocial characteristics. Also, these adverse pain trajectory groups predicted poor health and well-being in later years. Thus, the results provide evidence for the role of pain trajectories over more than two decades linking early midlife biopsychosocial conditions to later-life health and well-being.

Previous dyadic research has provided evidence for the life course "linked lives" tenet. For example, Wickrama, Lee, and O'Neal (2020) and Wickrama, O'Neal, and colleagues (2020) demonstrated that husbands' and wives' behaviors, feelings, and beliefs are often contemporaneously associated and also influence their partners' health outcomes (partner effects) in addition to their own health outcomes. The findings of the present study extended this work to show that husband–wife dependencies also exist for neurophysiological attributes of spouses (i.e., pain). This is a substantive advancement in understanding couple processes and the life course "linked lives" tenet.

Physical Pain Trajectories and Trajectory Classes

Consistent with previous research (CDC, 2018), women in the current study generally reported a higher level of pain than men. This gender difference is consistent with the vulnerability hypothesis, which posits that women are more vulnerable to developing pain than men (Sandanger et al., 2004). Gender differences in pain may be partly due to differences in sex hormones, as these hormones influence pain sensitivity (Picavet, 2010). Also, although husbands' and wives' reports of pain in their early middle years were not correlated, their pain reports were significantly correlated in their mid-later years. This is consistent with the notion of increasing health congruence between husbands and wives in later years (Kiecolt-Glaser & Wilson, 2017).

Regarding pain trajectories, husbands' and wives' trajectory classes had similar patterns. Trajectory classes were comprised of individuals with high and decreasing pain over time (8.2% and 7.8% of husbands and wives, respectively), moderate and increasing pain (22% and 21.7% of husbands and wives, respectively), and consistently low pain (69.8% and 70.5% of husbands and wives, respectively). Importantly, the class sizes were approximately the same for husbands and wives. Together, the moderate and increasing and high and decreasing classes include one-third of the sample, which highlights the prevalence of pain among these husbands and wives in enduring marriages. These estimates are comparable with population-based study findings (CDC, 2018). We estimated life course pain trajectories using three repeated measures over more than two decades. Although these trajectories do not reveal micro, short-term changes in pain conditions, they capture long-term persistent pain and changes in pain and enable an evaluation of the cumulative influence of pain experiences on later health and well-being outcomes.

Trajectory Classes and Baseline Biopsychosocial Profiles

For husbands, all baseline biological, psychological, and socioeconomic factors were associated with both high and decreasing and moderate and increasing pain trajectory groups. However, only one socioeconomic factor (FFS) differed across the classes of wives' pain trajectories, which indicates both spouses' vulnerability to FFS. In particular, for husbands, high and decreasing pain was associated with a high level of physical illness at baseline (early midlife), which suggests that this relatively small group of husbands were severely physically ill in early midlife and recovered later. Also, the results revealed some cross-over influences. For example, wives' experiences of financial strain were associated with the development of pain by husbands. Such partner effects may exist because stress experiences and perceptions are transmitted between spouses. For example, if a wife experiences financial strain, this can be communicated within the interdependent marital context to her husband, whose emotional response, in turn, may be connected to experiences of physical pain (Berscheid & Ammazzalorso, 2001). This possibility is consistent with the "linked lives" notion of the life course perspective.

Predicting Health and Well-Being in Later Years

Both for husbands and wives, consistent with the "chain of risk" notion of the life course perspective (O'Rand & Hamil-Luker, 2005), nonnormative pain trajectories were associated with poor health and well-being outcomes in later years. In general, the results showed some gender differences in health and well-being consequences of pain trajectory classes. For example, none of the pain trajectory classes contributed to change in husbands' physical limitations, physical illness, or loneliness in later years. For wives, none of the pain trajectory classes contributed to SMI in later years. Future studies should further investigate these observed gender differences.

Regarding gender similarities, for both husbands and wives, moderate and increasing pain predicted financial strain in later years. These findings highlight the proximal effect of increased pain on financial conditions for both spouses. Also, for both husbands and wives, high and decreasing pain was implicated in more depressive symptoms in later years compared to consistently low pain, suggesting psychological problems arise from early experiences of severe pain, and these psychological problems may persist over the life course despite pain recovery.

Regarding cross-over or partner effects between pain trajectories and later-life health and well-being, gender asymmetry was evident, particularly for couples where the wives experienced moderate and increasing pain, as the husbands of these wives reported more financial strain, more physical limitations, and more memory impairment. However, husbands' pain trajectory classes were not related to any of the outcomes examined for wives. Future research should further investigate this asymmetrical transmission of pain experiences between husbands and wives.

Previous pain research has documented that persistent or chronic physical pain leads to poor health through physiological and neurological pathways, including decreased prefrontal and thalamic gray matter density (Massart et al., 2016), altered brain activation (Apkarian et al., 2005), and impaired immune system functioning (Apkarian et al., 2004). However, the present findings showed that high, but decreasing, physical pain also detrimentally influenced health and well-being outcomes years later. The specific mechanisms responsible for this continued effect of early pain is a direction for future research.

Also, controlling for lagged measures (2015) when predicting outcomes (2017) (except for SMI) enabled the examination of residual change from 2015 to 2017 for these health and well-being outcomes. Predicting change in health outcomes from 2015 to 2017 mitigated the potential for reversed directions of effect.

Limitations

There are limitations to the present study that should be noted. First, all study variables, for baseline biopsychosocial profiles, physical pain, and later-life health and well-being were assessed using self reports. Future studies should use more objective and clinical measures (e.g., financial records and clinically measured pain) to validate the present findings. Second, due to the nature of the sample (i.e., comprised entirely of non-Hispanic White couples who experienced the farm crisis in the Midwest during the late 1980s), several important structural characteristics, such as rurality, health service availability, and characteristics related to systematic racial/ethnic discrimination, could not be investigated. Third, the gaps between reported measures of physical pain are too large to capture changes in pain over shorter periods of time. Fourth, a lagged measure of memory impairment (SMI) was not available; thus, possible reverse causation from SMI to pain could not be mitigated. Finally, the present study limited socioeconomic factors to education, financial strain, and family income, but other baseline social factors warrant investigation, such as stressful life events, stressful work, and marital and parental strain, as they may also have long-term effects on physical pain.

Implications

These findings provide support for the value and necessity of national- and state-level policies aimed at improving families' biopsychosocial conditions, which may operate as antecedents of individual pain trajectories. Particularly, related to social and economic factors influencing pain, it is possible that both macro- and micro-level factors may influence pain trajectories simultaneously through multilevel processes. In order to develop effective treatment plans and prevention strategies, chronic pain needs to be understood in the context of macro-level social and economic factors. For example, the influence of individual socioeconomic adversity on pain may be amplified within an adverse community/cultural context (i.e., moderation effects). Similarly, mediational effects are also possible. Thus, future research should identify existing macro-level socioeconomic contexts (e.g., different adverse work and community conditions) in which individuals' biopsychosocial process of pain may operate, which necessitates studies focused on structural macro-level socioeconomic determinants of pain.

Although efforts can alleviate some baseline individual conditions implicated in pain trajectories, their impact may persist over the life course. The study results also highlight the need to investigate long-term pain trajectories to shed light on health and well-being outcomes in later years. Moreover, the identification of individuals who experience an adverse pain trajectory (i.e., high and decreasing, moderate and increasing) can be used as a prognostic tool by mental health professionals and counselors as well as physicians. These results emphasize that future interventions should not overlook socioeconomic factors as a potential cause or correlate of physical pain. Clinical implications also include consideration of interdependencies between spouses in

enduring marriages, efforts targeting the reduction of detrimental cross-over influences, and improved interpersonal processes that may successfully protect from long-term pain development. Overall, the findings of the present study contribute to efforts targeting the reduced prevalence of pain. Reducing physical pain will improve health conditions and quality of life while promoting social and family engagement and lowering the economic burden at both the individual and population levels.

Funding

This research is currently supported by a grant from the National Institute on Aging (AG043599, K. 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 Bureau of Maternal and Child Health (MCJ-109572), and the MacArthur Foundation Research Network on Successful Adolescent Development Among Youth in High-Risk Settings.

Conflict of Interest

None declared.

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