Family Strain, But Not Family Support, Is Linked to Worse Pain Interference Among Midlife Adults Reporting New Chronic Pain

Sarah B. Woods[1], Patricia N. E. Roberson[2], and Haneen Abdelkhaleq[1]

[1] Department of Family and Community Medicine, University of Texas Southwestern Medical Center
[2] College of Nursing, University of Tennessee Knoxville

Introduction: Although family relationship quality has been linked to later chronic pain incidence for aging adults, it is unclear whether the quality of these relationships is linked to the impact of pain. We estimated longitudinal associations between family relationship quality (i.e., family support and family strain) and pain interference for adults who develop novel chronic pain across 10 years of midlife. ***Method:*** We conducted a secondary analysis of data from the Midlife in the United States (MIDUS) study. Using path analysis, we tested whether family support and strain reported by participants (54% female, age $M = 54.8$ years) who denied having chronic pain at the study's second wave (MIDUS 2, 2004–2006) but reported chronic pain 10 years later (MIDUS 3, 2014–2016; $N = 406$) was associated with the interference of that pain with daily activities after accounting for key covariates, including sociodemographics, depression symptoms, global physical health, and MIDUS 3 reports of family support and strain. ***Results:*** The hypothesized model demonstrated good fit to the data based on multiple model fit indices. Greater family strain at baseline, but not family support, was significantly associated with greater pain interference 10 years later. ***Discussion:*** Findings build on prior studies to suggest that not only are stressful family relationships likely associated with the odds of developing chronic pain, but they are also linked to the interference of that chronic pain when it develops. We recommend biopsychosocial screening in primary care that captures family relationship quality and can inform best practices for nonpharmacological, family-based pain management.

Public Significance Statement

Though family relationship quality has been linked to later pain incidence for aging adults, it remains unclear whether family relationships are also linked to the impact of that pain once it develops, compromising our ability to develop effective nonpharmacological pain management interventions. This study leveraged data from an existing project on aging health to find that family strain, but not family support, was significantly associated with greater pain interference 10 years later, among aging adults who developed novel chronic pain during that time. The results imply the importance of biopsychosocial screening in primary care to capture family relationship quality and inform family-based pain self-management interventions to ameliorate aging adult pain.

Although psychosocial risk and resilience factors are key to understanding pain pathogenesis, the unique role of family relationship quality in determining pain outcomes is less understood. A growing area of the pain literature suggests the family environment may have powerful impacts on the etiology, maintenance, and treatment of pain (Campbell et al., 2018). Research has supported links between the quality of family relationships and pain severity (Signs & Woods, 2020), pain disability (Akbari et al., 2016), pain-related functioning (McCluskey et al., 2015), and prescription pain medication use (Nguyen et al., 2021). Of particular importance is the valence, or subjective positive/negative quality, of an individual's family relationships and the potentially distinct impacts of family strain versus family support on chronic pain trajectories and outcomes over time.

Overall, research points to links between a more negative family relationship quality (i.e., characterized by greater strain and less support) and worse pain cognitions, disability, and intensity (Akbari et al., 2016; Signs & Woods, 2020). Conversely, positive family relationship quality (i.e., marked by less strain and greater support) is concurrently associated with less pain, especially via improved pain coping (Che et al., 2018) and pain self-management adherence (O. Brown & Newton-John, 2022). The research is generally limited, however, by cross-sectional analyses, with a focus on persons with preexisting chronic pain-related conditions. Thus, it is challenging to tease out the temporal links between family relationship quality and pain severity and interference, associations that are likely bidirectional over time. Recently, however, Woods et al. (2019) tested multiple longitudinal relationship-stress pathways to the etiology of chronic pain, as well as to pain persistence for acute and chronic pain. The authors found that solely family strain predicted an increased risk of developing novel chronic pain over 10 years. Furthermore, family support was the study's sole measure of relationship quality significantly associated with pain persistence, predicting a decreased risk of acute pain evolving into chronic pain over time. Social integration, friend relationship quality, and intimate partner relationship quality were not significantly linked to pain.

What remains unclear is whether, for persons who develop chronic pain, the interference of that pain with daily activities is impacted by family relationship quality. In other words, does baseline family relationship quality not only predict the *etiology* of novel chronic pain, but also the *intensity* of that pain, over time? Teasing out these unique relational pathways to pain may further inform family-based pain interventions. Results that suggest family strain predicts the onset of new pain but not pain interference may indicate the need for preventative assessments of family relationship quality over the life course in primary care, for example. Conversely, findings that point to family strain increasing the risk for future chronic pain *as well as* worse pain interference could convey import for improved access to family therapy for adults with strained family relationships and the potential long-range physical health benefits. Furthermore, intervening in the stressed family relationships of patients with moderate-to-severe chronic pain may prove advantageous for close relationships and pain outcomes. Recent research has explored the novel benefits of couple-based interventions to improve the relationship quality of persons with chronic pain and their intimate partners, with a focus on acceptance and empathy (Caño et al., 2018). However, analogous family-based interventions addressing the impacts of chronic pain and family relationship processes among midlife adults are few (e.g., Fox et al., 2022; Tankha et al., 2018) and, to the best of our knowledge, remain untested. To develop efficacious family-based interventions for pain, it is first critical to determine family-pain pathways. This knowledge has the potential to not only translate to intervention targets but also guide optimal intervention timing.

Present Study

We build upon prior research to test how family relationship quality predicts the interference of chronic pain that develops in midlife. We hypothesized that a more negative premorbid family relationship quality (i.e., greater family strain, less family support at baseline) would predict worse pain interference among midlife adults who develop new chronic pain over a 10-year period. We examined the hypothesized associations with a nationally representative data set.

Method

Sample

Data are from Midlife in the United States (MIDUS), a longitudinal, nationally representative study of aging health currently in its third wave. The baseline wave was completed in 1995–1996 and included 7,108 U.S. adults aged 25–75 ($M_{age} = 46.38$, $SD = 13.0$, 51.1% female) who were largely recruited via nationwide random digit-dialing and oversampling in five metropolitan areas (Brim et al., 2018). MIDUS 1 collected data using an extensive telephone interview and mailed self-administered questionnaire (SAQ) completed at home, with a robust compendium of measures assessing biopsychosocial well-being. The present study used data from MIDUS 2 (the initial follow-up to MIDUS 1, collected in 2004–2006; $N = 4,963$, or 70% of MIDUS 1 participants) and MIDUS 3 (2014–2016; $N = 3,294$, or 66% of MIDUS 2); both repeated administrations of the MIDUS 1 telephone interview and SAQ. MIDUS data are freely available via the Inter-University Consortium for Political and Social Research (Ryff, Almeida, Ayanian, Binkley, et al., 2017; Ryff, Almeida, Ayanian, Carr, et al., 2017); as such, these secondary analyses did not require institutional review board approval.

We extracted the present sample using a pain screener item included at MIDUS 2 and 3 (this question was not asked at MIDUS 1). The question asked, "Do you have chronic pain, that is, do you have pain that persists beyond the time of normal healing and has lasted anywhere from a few months to many years?" and allowed participants to respond dichotomously (yes/no). Most participants denied experiencing chronic and persistent pain (i.e., responded "no" to the pain screener item) at MIDUS 2 ($n = 2,484$); of these, 1,592 participants also completed this item at MIDUS 3. The present analyses used only the subsample of participants who answered "No" to the pain screener item at MIDUS 2 and "Yes" to this same item at MIDUS 3 ($n = 406$).

Measures

Each of the study's measures was completed via the MIDUS SAQ. MIDUS researchers used mean imputation to accommodate missing data in each measure (Ryff, Almeida, Ayanian, Carr, et al., 2017). Each measure's scale score was calculated via averaging item responses for all respondents completing at least one valid item. Table 1 lists descriptive statistics; each of the measures was reliable in the present sample.

Family Strain

Family strain was assessed via a four-item measure developed and validated by Walen and Lachman (2000), which asked participants to report how often family members, "not including your spouse or partner," make too many demands, criticize, let the participant down, or get on the participant's nerves. Responses were on a scale of 1 (*often*) to 4 (*never*) and were reverse coded; higher scores indicate greater family strain. This measure was completed at MIDUS 2 and 3 and has been successfully used in prior pain research (e.g., Signs & Woods, 2020).

Family Support

Family support was assessed using a four-item measure that asked participants to describe how much their family members, "not including your spouse or partner," care about them, understand the way they feel, can be relied on for help in a serious problem, and can be opened up to discuss their worries (Walen & Lachman, 2000). Participants responded on a scale from 1 (*a lot*) to 4 (*not at all*); responses were reverse coded and higher scores indicate greater family support. The family support measure was completed at MIDUS 2 and 3 and has been demonstrated to be valid and reliable in prior pain studies (e.g., Woods et al., 2019).

Pain Interference

Our pain outcome was assessed using the Brief Pain Inventory (BPI) Short Form, measuring pain interference in participants' daily activities (Cleeland, 2009). The measure included five items asking MIDUS 3 participants, "How much, during the past week, your pain interfered with your…," followed by: general activity, mood, relations with other people, sleep, and enjoyment of life. Items were rated using a 10-point Likert scale ranging from 0 (*did not interfere*) to 10 (*completely interfered*). This five-item version of the BPI has been found to be valid and reliable, including with prior MIDUS research (e.g., T. T. Brown et al., 2018). Mean imputation was used for participants with a minimum of two valid item responses.

Table 1

Participant Reports of Family Relationship Quality, Pain Interference, and Control Variables: Correlations and Descriptive Statistics (N = 406)

Variables	1	2	3	4	5	6	7	8	9	10	11
1. T1 Family strain	—										
2. T1 Family support	-0.329***	—									
3. T2 Pain interference	0.174***	-0.037	—								
4. T1 Global physical health	0.030	-0.083	0.244***	—							
5. T1 Depression symptoms	0.087	-0.088	0.067	0.147**	—						
6. T1 Medication use[a]	0.001	-0.025	-0.080	-0.133*	-0.043	—					
7. T1 Age	-0.212***	0.153**	0.013	0.044	-0.133**	-0.101	—				
8. T1 Sex[b]	0.177***	0.025	0.083	-0.053	0.116*	-0.046	-0.155**	—			
9. T1 Income[c]	0.099*	-0.072	-0.067	-0.069	0.014	0.093	-0.266***	-0.055	—		
10. T2 Family strain	0.444***	-0.223***	0.124*	0.011	0.089	-0.038	-0.239***	0.067	0.108*	—	
11. T2 Family support	-0.149**	0.519***	-0.150**	-0.145**	-0.190***	0.019	0.155**	0.081	-0.078	-0.326***	—
M	2.11	1.54	2.22	1.40	2.05	1.45	2.15	1.37	1.95	1.47	2.10
SD	0.58	0.59	0.60	0.55	0.59	0.57	0.60	0.53	0.63	0.57	0.63
α	0.78	0.82	0.87							0.82	0.88

Note. T1 = baseline/MIDUS 2, T2 = MIDUS 3. MIDUS = Midlife in the United States.
[a] Medications: 0 = prescription medication use reported at baseline, 1 = no prescription pain medication use at baseline. [b] Sex: 0 = male, 1 = female. [c] Income: 0 = below the median, 1 = at or above the median.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Control Variables

We accounted for the impact of baseline (MIDUS 2) global physical health, use of pain medications, depression symptoms, age, sex, income, and marital status in testing our hypothesis. Additionally, we controlled for the covariance of MIDUS 3 family support and family strain (i.e., follow-up assessments of the study's independent variables, measured 10 years later) with MIDUS 3 pain interference, to lessen the likelihood that we would estimate the impact of pain on family emotional climate (rather than our intended test of family emotional climate predicting future pain interference).

Global Physical Health. We accounted for baseline physical health via a one-item health appraisal measure which asked participants, "In general, would you say your physical health is excellent, very good, good, fair, or poor?" Responses were rated from 1 (*excellent*) to 5 (*poor*). There were no missing data for this sample.

Pain Medication Use. Most (81%) participants reported whether they had used any prescription pain medication in the past 30 days (1 = *no*, 0 = *yes*). Although the present sample denied having chronic, persistent pain at baseline, a subsample ($n = 65$) reported having taken prescription medication for pain in the past month (at MIDUS 2). As it is possible that those who have been prescribed and used pain medications may have worse pain severity and thus worse long-term interference from pain over time, we estimated this pathway. Patterns of missingness in prescription pain medication use (the sole independent or control variable with missing data) were not statistically linked to pain interference ($F = 0.025$, $p = .875$).

Depression Symptoms. We included a measure of depression symptoms at MIDUS 2 to assess the impact of family strain and support *over and above* any association between baseline depression and later pain interference (as depression and pain are often linked; Khan et al., 2020). We assessed depression symptoms via the World Health Organization's Composite International Diagnostic Interview Short Form (CIDI-SF; Kessler et al., 1998) major depression subscale (depressed affect and anhedonia; Wang et al., 2000). The measure assesses the presence of seven symptoms during a 2-week period in the past 12 months, including trouble concentrating, loss of interest, and change in appetite. Scale scores are calculated as a sum total of "Yes" responses, ranging from 0 (*lowest depression*—denying 2 weeks of depressed affect and denying 2 weeks of anhedonia) to 7 (*highest depression*). The test–retest reliability and diagnostic accuracy of the CIDI/CIDI-SF has been widely supported, including for MIDUS 2 (Busseri & Peck, 2015; Walker & Druss, 2015).

Demographic Controls. Prior research suggests age and sex are each associated with chronic pain (e.g., T. T. Brown et al., 2018; Kennedy et al., 2014); thus, we accounted for the effects of each. Sex is coded dichotomously at MIDUS 2 (1 for *male* and 0 for *female*). We also controlled for any link between baseline income and later pain interference given evidence for socioeconomic-based pain disparities in prior research (e.g., Janevic et al., 2017). Income was dichotomized around the median. Finally, although we hypothesize nonmarital family relationship quality links and pain interference (given prior research failing to support intimate partner relationship quality and pain development associations), we accounted for baseline marital status (1 for *married* and 0 for *not married*, i.e., separated, divorced, or widowed) in our model to estimate the proposed pathways over and above any found effect of romantic relationship structure occurring before pain development.

Analyses

Path analysis was used to test the present pathways via MPlus (Muthén & Muthén, 2017), using listwise deletion, and maximum likelihood as our estimator. This process simultaneously estimates standardized path coefficients, standard errors, and model fit. Listwise deletion is appropriate for handling missing pain medication use data due to patterns of missingness not being linked to our dependent variable (data are missing completely at random), as described above (Allison, 2009). To test the present hypothesis, we regressed MIDUS 3 pain interference onto MIDUS 2 family strain and family support, as well as each of our control variables. We also controlled for autoregressive links between longitudinal family strain and family support by regressing MIDUS 3 family strain onto MIDUS 2 family strain, and MIDUS 3 family support onto MIDUS 2 family support.

(In addition to estimating the covariance between MIDUS 3 family support, family strain, and pain interference, as described above.) To ensure results were robust, we used bootstrapping (5,000 resamples) and reported 95% confidence intervals (CIs) with bootstrap standard errors for pathway estimates, accounting for nonnormality.

Model fit was assessed using the root-mean-square error approximation (RMSEA), the comparative fit index (CFI), and the standardized root-mean-square residual (SRMR). Good model fit was determined if the RMSEA and SRMR were less than 0.05, and the CFI value was greater than 0.95 (Kline, 2015). Although we present the χ^2 model statistic, it is highly sensitive to sample size and likely to be significant.

Results

Sample Demographics

Overall, this sample was an average 54.75 years old ($SD = 11.28$) and was majority (54%) female, White (92.9%), non-Hispanic (97.2%), and married (74%). Median household income was $65,000. Of the 406 midlife adults in the present sample, 78.8% reported having seen a physician

about their pain, and 71.4% reported receiving at least one pain diagnosis from a physician at MIDUS 3. The majority reported a pain diagnosis of arthritis/osteoarthritis (23.2%); additional diagnoses included disk-related issue (19.2%), neck/shoulder problem (6.7%), nerve problem (5.7%), hip problem/sciatica (4.9%), foot/ankle problem (4.9%), and other (e.g., tendonitis, cartilage problems, migraine headaches, etc.; 28.8%). At MIDUS 3, 43.4% reported using prescription pain medications in the past month.

Model Testing

The hypothesized model demonstrated a good fit to the data, $\chi^2(16) = 22.18$, $p = .14$; RMSEA = 0.034, CFI = 0.975, SRMR = 0.040 (Table 2). As hypothesized, greater family strain at baseline (MIDUS 2) was significantly associated with greater pain interference 10 years later (Figure 1). This link between family strain and pain interference was found over and above significant associations between baseline global physical health, income, and marital status and later pain interference. Contrary to our hypothesis, family support was not significantly linked to later

Table 2

Standardized Coefficients and Significance Levels for Longitudinal Pathways Linking Family Emotional Climate and Pain Interference (Standard Errors in Parentheses; N = 329)
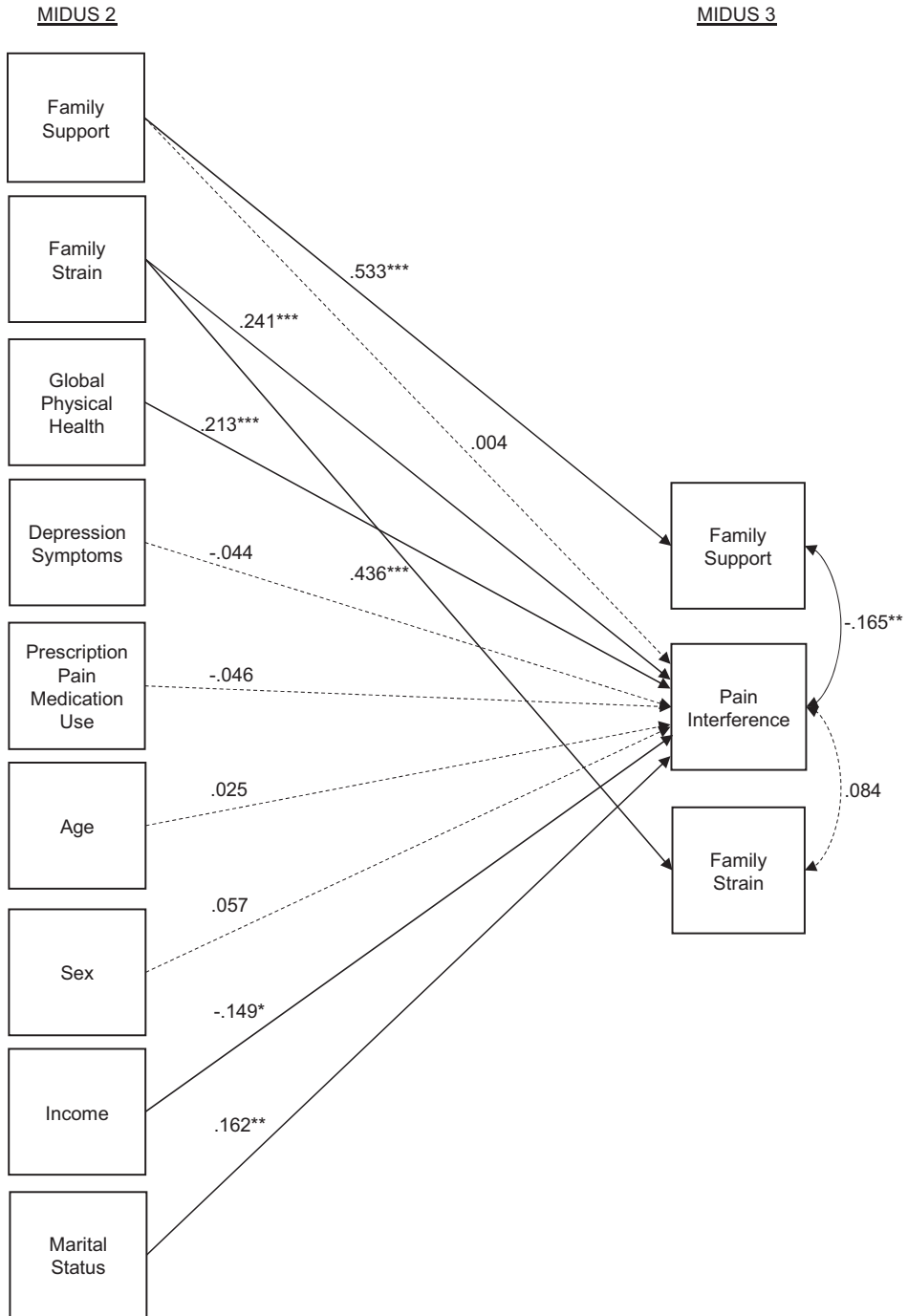
Parameter estimate	Standardized	p	95% CI
MIDUS 2 → MIDUS 3 pain interference			
Family strain	0.241 (0.058)	.000	[0.127, 0.353]
Family support	0.004 (0.054)	.935	[−0.102, 0.111]
Control variables			
Global physical health	0.213 (0.059)	.000	[0.096, 0.328]
Depression symptoms	−0.044 (0.052)	.399	[−0.149, 0.054]
Medication use[a]	−0.046 (0.055)	.411	[−0.150, 0.064]
Age	0.025 (0.057)	.662	[−0.084, 0.138]
Sex[b]	0.057 (0.051)	.267	[−0.046, 0.157]
Income[c]	−0.149 (0.058)	.010	[−0.259, −0.034]
Marital status[d]	0.162 (0.054)	.003	[0.061, 0.273]
Autoregressive paths			
Family strain	0.436 (0.053)	.000	[0.333, 0.539]
Family support	0.533 (0.057)	.000	[0.409, 0.634]
MIDUS 3 covariates[e]			
Family strain	0.084 (0.059)	.156	[−0.033, 0.198]
Family support	−0.165 (0.063)	.008	[−0.283, −0.038]

Note. CI = bias-corrected confidence interval; MIDUS = Midlife in the United States.
[a] Medications: 0 = *prescription medication use reported at baseline*, 1 = *no prescription pain medication use at baseline*. [b] Sex: 0 = *male*, 1 = *female*. [c] Income: 0 = *below the median*, 1 = *at or above the median*. [d] Marital status: 0 = *not married*, 1 = *married*. [e] Pathway estimates of covariance between MIDUS 3 pain interference and MIDUS 3 family strain, family support.

Figure 1

Standardized Path Coefficients for Family Relationship Quality—Pain Interference Pathways (N = 329); $\chi^2(16) = 22.18$, p *= .14; RMSEA = 0.034, CFI = 0.975, SRMR = 0.040*

MIDUS 2   MIDUS 3

Family Support

Family Strain   .533***

.241***

Global Physical Health   .004

.213***

Depression Symptoms   -.044   Family Support

.436***

Prescription Pain Medication Use   -.046   -.165**

Pain Interference

.025

Age   .084

.057   Family Strain

Sex   -.149*

Income   .162**

Marital Status

Note. RMSEA = root-mean-square error approximation; CFI = comparative fit index; SRMR = standardized root-mean-square residual.
* *p* < .05.   ** *p* < .01.   *** *p* < .001.

pain interference. Of note, greater pain interference at MIDUS 3 was significantly associated with decreased concurrent family support.

Discussion

For midlife adults who develop chronic pain, the interference of that pain in daily life is predicted by how strained the person's family relationships were 10 years prior. This finding builds on prior research finding that negative family relationship quality is associated with future pain status (T. T. Brown & Lee, 2020; Woods et al., 2019). It is possible that the association between family strain and chronic pain interference over 10 years may be linked by psychophysiological distress caused or exacerbated by one's negative family relationships. Evidence suggests anxiety and pain elicit similar physiological responses (e.g., increased heart rate, cortisol secretion; Özalp et al., 2003). Research also supports that greater depressive symptoms are linked to increases in inflammation; increased inflammation, in turn, can amplify individuals' pain experience (e.g., Hughes et al., 2014; Kiecolt-Glaser et al., 2015). Therefore, the observed longitudinal impact of family strain on pain interference may be through both psychological distress (e.g., anxiety and depression) and physiological distress (e.g., inflammation, cortisol secretion) pathways. Indeed, there are empirically supported mediational models of the impacts of families on health which could be used to test these mediation pathways in future research, such as the Biobehavioral Family Model (Woods & Denton, 2014; Wood et al., 2021) which is derived from Engel's (1977) biopsychosocial model and has been substantiated for studying pain (Signs & Woods, 2020).

Our finding that baseline family support was not associated with pain interference contrasts with prior research suggesting greater family support is linked cross-sectionally to pain interference (Nguyen et al., 2021) and longitudinally to a decreased likelihood of pain persistence (Woods et al., 2019). This finding may indicate unique mechanisms by which positive family relationships promote healing from acute pain versus protect against the impacts of chronic, unrelenting pain. For example, it is possible that functional support provided in high-quality family environments is a potent characteristic that protects against acute pain evolving into chronic pain. In other words, acute pain typically

dissipates within 6 months and may not only require less family caregiving support than chronic conditions contributing to the development of chronic pain, but may also benefit more easily from a warm, caring, and supportive family context. Among adults who develop pain, how that pain interferes with their life may be less easily assuaged by reliable and understanding family members. Conversely, a negative family relationship environment that is critical and demanding may also lack the tangible support needed for minimizing pain interference. Further research to delineate psychophysiological and behavioral mechanisms linking family relationships to specific pain outcomes is key to informing the development of efficacious family-based pain management interventions—a type of intervention that may be uniquely powerful in impacting patients' pain outcomes but which has heretofore remained largely untapped.

Clinical Implications

Primary care provides an apt clinical environment for addressing both family relationship quality and chronic pain, a common presenting problem (Breuer et al., 2010). We suggest it may be beneficial to routinely assess the quality of family relationships for primary care patients. In the context of the present findings, the goal could be to develop a clinical trajectory of patients' close relationships and how these affect pain. Prior research suggests biopsychosocial screening may capture unidentified relationship concerns (Woods et al., 2015) that, untreated, can have large impacts on patients' health (e.g., can hamper disease self-management support). A secondary goal of biopsychosocial assessment would be to identify areas to target in the event pain is not alleviated. In other words, establishing baseline family functioning and then reassessing relationship quality as part of a biopsychosocial pain management approach may aid in understanding how these relationships may be impacting healing (or, though not a focus of the present study, how these relationships are impacted by pain; Ojeda et al., 2014). Although admittedly barriers to integration exist (e.g., inadequate insurance provisions; Prom et al., 2021), an interdisciplinary team-based approach to pain management may be ideal, including partnering with integrated behavioral health providers (Gatchel et al., 2014) and especially those with specific training and expertise

in family systems and family-centered care as well as pain and biopsychosocial frameworks (e.g., Caño & Leonard, 2006; Signs, 2015; Wirick & Teufel-Prida, 2018).

Family-centered pain management protocols may also serve to benefit the patient–physician relationship and patients' primary and specialty care experiences. First, attending to a patient's psychosocial well-being—which physicians can leverage to provide relief—provides a tangible strategy for clinicians who often describe treating pain as a challenging or low-confidence area of practice (Anderson et al., 2017). Second, there is likely therapeutic benefit to physicians assessing the cascade of losses that can be tied to chronic pain, and understanding how pain is affecting patients' quality of life. Indeed, pain patients have identified the benefits of feeling trusted and listened to by their physician (Upshur et al., 2010). Admittedly, physician training on holistic and systemic pain management is limited (Loeser & Schatman, 2017). We suggest that this is an important training gap that informs clinical care gaps. It is also a training gap that could be ameliorated by providing strategic areas for physicians to learn to explore with patients and families, namely: (a) how pain is affecting close relationship functioning, and, in turn, (b) how close relationships are tied to the impacts of pain on daily life.

Limitations and Future Directions

The present study provides a significant next step in the newer literature exploring links between family relationships and chronic pain. However, it is not without limitations. For example, the selected family strain and support measures do not assess adverse childhood experiences. Although not this study's aim, it is an important area of future research to consider the far-reaching effects of family-based trauma on pain. Importantly, the core MIDUS samples are limited by a lack of sociodemographic diversity, with primarily White, educated, and middle-class participants retained across waves (Radler & Ryff, 2010). Exploring whether family-pain pathways persist across other populations will be important. Finally, we utilized MIDUS's sole measure of pain interference and the two waves where pain items were assessed, 10 years apart. As such, we are unable to assess pain severity, trajectories of pain across midlife (including patterns of acute exacerbations, relapse, or healing), or opioid

versus other prescribed pain medication use. Mixed method studies (and those with more frequent waves) may aid in capturing more nuanced information regarding family processes and links to pain and pain management. While these future directions are necessary to delineate specific pathways by which family relationships impact pain, we tentatively suggest that the cumulation of evidence to date points to the importance of developing accessible family-based interventions for pain coping and pain self-management (alongside suggestions above for early identification of family relationship-specific concerns).

Conclusions

Study findings move beyond prior research identifying family strain is linked to pain development to suggest that family strain is also associated with the interference of that pain later in life. Although further research is needed to test these pathways in additional, more diverse samples including clinical populations, this study provides additional support for conceptualizing family strain as part of the stress-pain pathogenesis process.

References

Akbari, F., Dehghani, M., Khatibi, A., & Vervoort, T. (2016). Incorporating family function into chronic pain disability: The role of catastrophizing. *Pain Research and Management*, *2016*, Article 6838596. https://doi.org/10.1155/2016/6838596

Allison, P. D. (2009). Missing data. In R. E. Millsap & A. Maydeu-Olivares (Eds.), *The Sage handbook of quantitative methods in psychology* (pp. 72–90). Sage Publications. https://doi.org/10.4135/9780857020994.n4

Anderson, D., Zlateva, I., Davis, B., Bifulco, L., Giannotti, T., Coman, E., & Spegman, D. (2017). Improving pain care with Project ECHO in community health centers. *Pain Medicine*, *18*(10), 1882–1889. https://doi.org/10.1093/pm/pnx187

Breuer, B., Cruciani, R., & Portenoy, R. K. (2010). Pain management by primary care physicians, pain physicians, chiropractors, and acupuncturists: A national survey. *Southern Medical Journal*, *103*(8), 738–747. https://doi.org/10.1097/SMJ.0b013e3181e74ede

Brim, O. G., Baltes, P. B., Bumpass, L. L., Cleary, P. D., Featherman, D. L., Hazzard, W. R., Kessler, R. C., Lachman, M. E., Markus, H. R., Marmot, M. G., & Rossi, A. S. (2018). *Midlife in the United States (MIDUS 1), 1995–1996*. Inter-university Consortium

for Political and Social Research [Distributor]. https://doi.org/10.3886/ICPSR02760.v13

Brown, O., & Newton-John, T. R. (2022). The influence of the significant other on treatment adherence in chronic pain management: A qualitative analysis. *Psychology and Health*. Advance online publication. https://doi.org/10.1080/08870446.2022.2032058

Brown, T. T., & Lee, W. (2020). The FUTUREPAIN study: Validating a questionnaire to predict the probability of having chronic pain 7–10 years into the future. *PLoS ONE*, *15*(8), Article e0237508. https://doi.org/10.1371/journal.pone.0237508

Brown, T. T., Partanen, J., Chuong, L., Villaverde, V., Chantal Griffin, A., & Mendelson, A. (2018). Discrimination hurts: The effect of discrimination on the development of chronic pain. *Social Science and Medicine*, *204*, 1–8. https://doi.org/10.1016/j.socscimed.2018.03.015

Busseri, M. A., & Peck, E. (2015). Do (even) depressed individuals believe that life gets better and better? The link between depression and subjective trajectories for life satisfaction. *Clinical Psychological Science*, *3*(5), 715–725. https://doi.org/10.1177/2167702614547265

Campbell, P., Jordan, K. P., Smith, B. H., Scotland, G., & Dunn, K. M. (2018). Chronic pain in families: A cross-sectional study of shared social, behavioural, and environmental influences. *Pain*, *159*(1), 41–47. https://doi.org/10.1097/j.pain.0000000000001062

Caño, A., Corley, A. M., Clark, S. M., & Martinez, S. C. (2018). A couple-based psychological treatment for chronic pain and relationship distress. *Cognitive and Behavioral Practice*, *25*(1), 119–134. https://doi.org/10.1016/j.cbpra.2017.02.003

Caño, A., & Leonard, M. (2006). Integrative behavioral couple therapy for chronic pain: Promoting behavior change and emotional acceptance. *Journal of Clinical Psychology*, *62*(11), 1409–1418. https://doi.org/10.1002/jclp.20320

Che, X., Cash, R., Ng, S. K., Fitzgerald, P., & Fitzgibbon, B. M. (2018). A systematic review of the processes underlying the main and the buffering effect of social support on the experience of pain. *The Clinical Journal of Pain*, *34*(11), 1061–1076. https://doi.org/10.1097/AJP.0000000000000624

Cleeland, C. S. (2009). *The Brief Pain Inventory: User guide*. University of Texas M. D. Anderson Cancer Center. https://www.mdanderson.org/content/dam/mdanderson/documents/Departments-and-Divisions/Symptom-Research/BPI_UserGuide.pdf

Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science*, *196*(4286), 129–136. https://doi.org/10.1126/science.847460

Fox, A. L., Swink, L. A., Prabhu, N., Fruhauf, C. A., Portz, J. D., Van Puymbroeck, M., Sharp, J. L., Leach, H. J., & Schmid, A. A. (2022). Manual development for a multi-modal, dyadic intervention for persistent pain: A Qualitative Study. *British Journal of Pain*, *16*(5), 481–489. https://doi.org/10.1177/20494637221090461

Gatchel, R. J., McGeary, D. D., McGeary, C. A., & Lippe, B. (2014). Interdisciplinary chronic pain management: Past, present, and future. *American Psychologist*, *69*(2), 119–130. https://doi.org/10.1037/a0035514

Hughes, S., Jaremka, L. M., Alfano, C. M., Glaser, R., Povoski, S. P., Lipari, A. M., Agnese, D. M., Farrar, W. B., Yee, L. D., Carson, W. E., III, Malarkey, W. B., & Kiecolt-Glaser, J. K. (2014). Social support predicts inflammation, pain, and depressive symptoms: Longitudinal relationships among breast cancer survivors. *Psychoneuroendocrinology*, *42*, 38–44. https://doi.org/10.1016/j.psyneuen.2013.12.016

Janevic, M. R., McLaughlin, S. J., Heapy, A. A., Thacker, C., & Piette, J. D. (2017). Racial and socioeconomic disparities in disabling chronic pain: Findings from the Health and Retirement Study. *The Journal of Pain*, *18*(12), 1459–1467. https://doi.org/10.1016/j.jpain.2017.07.005

Kennedy, J., Roll, J. M., Schraudner, T., Murphy, S., & McPherson, S. (2014). Prevalence of persistent pain in the U.S. adult population: New data from the 2010 National Health Interview Survey. *The Journal of Pain*, *15*(10), 979–984. https://doi.org/10.1016/j.jpain.2014.05.009

Kessler, R. C., Andrews, A., Mroczek, D., Ustun, B., & Wittchen, H. U. (1998). The World Health Organization composite international diagnostic interview short-form (CIDI-SF). *International Journal of Methods in Psychiatric Research*, *7*(4), 171–185. https://doi.org/10.1002/mpr.47

Khan, W. U., Michelini, G., & Battaglia, M. (2020). Twin studies of the covariation of pain with depression and anxiety: A systematic review and re-evaluation of critical needs. *Neuroscience and Biobehavioral Reviews*, *111*, 135–148. https://doi.org/10.1016/j.neubiorev.2020.01.015

Kiecolt-Glaser, J. K., Derry, H. M., & Fagundes, C. P. (2015). Inflammation: Depression fans the flames and feasts on the heat. *The American Journal of Psychiatry*, *172*(11), 1075–1091. https://doi.org/10.1176/appi.ajp.2015.15020152

Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed.). Guilford Press.

Loeser, J. D., & Schatman, M. E. (2017). Chronic pain management in medical education: A disastrous omission. *Postgraduate Medicine*, *129*(3), 332–335. https://doi.org/10.1080/00325481.2017.1297668

McCluskey, S., de Vries, H., Reneman, M., Brooks, J., & Brouwer, S. (2015). 'I think positivity breeds positivity': A qualitative exploration of the role of family members in supporting those with chronic musculoskeletal pain to stay at work. *BMC Family Practice*, *16*(1), Article 85. https://doi.org/10.1186/s12875-015-0302-1

Muthén, L., & Muthén, B. (2017). *Mplus user's guide* (8th ed.).

Nguyen, N. P., Kim, S. Y., Daheim, J., & Neduvelil, A. (2021). Prescription pain medication use among midlife and older adults with chronic pain: The roles of generativity and perceived family support. *Families, Systems and Health*, *39*(2), 248–258. https://doi.org/10.1037/fsh0000579

Ojeda, B., Salazar, A., Dueñas, M., Torres, L. M., Micó, J. A., & Failde, I. (2014). The impact of chronic pain: The perspective of patients, relatives, and caregivers. *Families, Systems and Health*, *32*(4), 399–407. https://doi.org/10.1037/fsh0000069

ÖZalp, G., Sarioglu, R., Tuncel, G., Aslan, K., & Kadiogullari, N. (2003). Preoperative emotional states in patients with breast cancer and postoperative pain. *Acta Anaesthesiologica Scandinavica*, *47*(1), 26–29. https://doi.org/10.1034/j.1399-6576.2003.470105.x

Prom, M. C., Canelos, V., Fernandez, P. J., Gergen Barnett, K., Gordon, C. M., Pace, C. A., & Ng, L. C. (2021). Implementation of integrated behavioral health care in a large medical center: Benefits, challenges, and recommendations. *The Journal of Behavioral Health Services and Research*, *48*(3), 346–362. https://doi.org/10.1007/s11414-020-09742-0

Radler, B. T., & Ryff, C. D. (2010). Who participates? Accounting for longitudinal retention in the MIDUS national study of health and well-being. *Journal of Aging and Health*, *22*(3), 307–331. https://doi.org/10.1177/0898264309358617

Ryff, C., Almeida, D. M., Ayanian, J., Binkley, N., Carr, D. S., Coe, C., & Williams, D. (2017). *Midlife in the United States (MIDUS 3), 2013–2014*. Inter-university Consortium for Political and Social Research [Distributor]. https://doi.org/10.3886/ICPSR36346.v6

Ryff, C., Almeida, D. M., Ayanian, J., Carr, D. S., Cleary, P. D., Coe, C., Davidson, R. J., Krueger, R. F., Lachman, M. E., Marks, N. F., & Mroczek, D. K. (2017). *Midlife in the United States (MIDUS 2), 2004–2006*. Inter-university Consortium for Political and Social Research [Distributor]. https://doi.org/10.3886/ICPSR04652.v7

Signs, T. L. (2015). The art of letter writing in medical family therapy. *Journal of Family Psychotherapy*, *26*(3), 243–246. https://doi.org/10.1080/08975353.2015.1067535

Signs, T. L., & Woods, S. B. (2020). Linking family and intimate partner relationships to chronic pain: An application of the biobehavioral family model. *Families, Systems and Health*, *38*(1), 38–50. https://doi.org/10.1037/fsh0000459

Tankha, H., Kerns, R. D., & Caño, A. (2018). Treating adults with chronic pain and their families: Application of an enhanced cognitive-behavioral transactional model. In D. C. Turk & R. J. Gatchel (Eds.), *Psychological approaches to pain management: A practitioner's handbook* (3rd ed., pp. 230–249). The Guilford Press.

Upshur, C. C., Bacigalupe, G., & Luckmann, R. (2010). "They don't want anything to do with you": Patient views of primary care management of chronic pain. *Pain Medicine*, *11*(12), 1791–1798. https://doi.org/10.1111/j.1526-4637.2010.00960.x

Walen, H. R., & Lachman, M. E. (2000). Social support and strain from partner, family, and friends: Costs and benefits for men and women in adulthood. *Journal of Social and Personal Relationships*, *17*(1), 5–30. https://doi.org/10.1177/0265407500171001

Walker, E. R., & Druss, B. G. (2015). Rate and predictors of persistent major depressive disorder in a nationally representative sample. *Community Mental Health Journal*, *51*(6), 701–707. https://doi.org/10.1007/s10597-014-9793-9

Wang, P. S., Berglund, P., & Kessler, R. C. (2000). Recent care of common mental disorders in the United States : Prevalence and conformance with evidence-based recommendations. *Journal of General Internal Medicine*, *15*(5), 284–292. https://doi.org/10.1046/j.1525-1497.2000.9908044.x

Wirick, D. M., & Teufel-Prida, L. A. (2018). Chronic lower back pain: Cognitive behavioral therapy with family therapy interventions. *The Family Journal*, *26*(1), 86–89. https://doi.org/10.1177/1066480718756845

Wood, B. L., Woods, S. B., Sengupta, S., & Nair, T. (2021). The Biobehavioral Family Model: An evidence-based approach to biopsychosocial research, residency training, and patient care. *Frontiers in Psychiatry*, *12*, Article 725045. https://doi.org/10.3389/fpsyt.2021.725045

Woods, S. B., & Denton, W. H. (2014). The biobehavioral family model as a framework for examining the connections between family relationships, mental, and physical health for adult primary care patients. *Families, Systems and Health*, *32*(2), 235–240. https://doi.org/10.1037/fsh0000034

Woods, S. B., Priest, J. B., & Denton, W. H. (2015). Tell me where it hurts: A pilot study assessing mental and relational health in primary care using a biopsychosocial assessment intervention. *The Family Journal*, *23*(2), 109–119. https://doi.org/10.1177/1066480714555671

Woods, S. B., Priest, J. B., Kuhn, V., & Signs, T. (2019). Close relationships as a contributor to chronic pain pathogenesis: Predicting pain etiology and persistence. *Social Science and Medicine*, *237*, Article 112452. https://doi.org/10.1016/j.socscimed.2019.112452