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Understanding links between aging adults, families, and chronic pain: measurement challenges and potential solutions

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Objectives: Psychosocial risk and resilience factors are powerful determinants of chronic pain trajectories and lived experiences. Yet, a key source of support or stress for most people—close family relationships—remains a relatively untapped area of pain intervention, particularly for midlife and aging adults. In this article, we discuss methodological approaches to advance research identifying family-specific impacts on chronic pain in later life.

Methods: We present two persistent measurement challenges in studying family-specific contributors to pain: (1) *linear and traditional notions of family conceptualization* marked by limited considerations of community and intergenerational context, particularly in regards to aging families; and (2) a *broad operationalization of 'social support*,' which is defined ambiguously and inconsistently across the literature and which often prioritizes marital or intimate partner relationships as having overriding importance for determining health (including pain) for adults. These consistent gaps prevent the formulation of testable family-pain hypotheses and limit our ability to build a solid body of evidence explicating how rich and dynamic family environments may protect against, or worsen, pain outcomes in older adulthood.

Results: We propose measurement solutions, including a theoretically-driven approach to conceptualizing family emotional. We outline potential analytic strategies for testing family-pain pathways and consider potential statistical challenges.

Discussion: Innovative research to identify family contributors to chronic pain may be limited by methodological challenges often inherent to family research. The proposed measurement solutions have the potential to contribute to advancing pain research and the optimization of family-based pain management interventions particularly for aging adults.

KEYWORDS
aging, chronic pain, family emotional climate, intergenerational relations, measurement, theory

Introduction

The study of chronic pain within family science has evolved over the past four decades. Exploring psychosocial risk and resilience factors within families is a critical component of this area of investigation, given their role in determining chronic pain trajectories (1, 2). A particularly robust source of psychosocial support—or stress/strain—that is gaining increasing attention in pain research is the role of *family relationships* (3). While there is a growing literature on caregiver relationships, dyadic coping, spousal responses, and family functioning, there has been less attention to how evolving family relationships determine pain trajectories or how indivdiual factors such as aging interact with family level factors (3, 4). This gap compromises the development of family-based pain management interventions that can be designed to harness the unique healing power of healthy family relationships and generativity, particularly important in midlife and older adulthood (5).

Early work in the 1980s and 1990s largely focused on family systems and behavioral models and the prevalence of pain within families. These early studies emphasized family risk and how family interactions, marital relationships, and reinforcement of pain behaviors could contribute to the maintenance of chronic pain (6, 7) or predict pain intensity. Subsequent scholarship broadened this perspective by recognizing the response to and reciprocal impact of chronic pain on family functioning (5). Aging involves changes in physical functioning, independence, social roles, and family relationships. These changes may alter how family members communicate, provide support, express emotion, and respond to pain (5). Indeed, family relationships may amplify or dampen pain intensity and interference, while chronic pain may also strengthen or weaken family functioning and relationship quality over time.

More recent research has shifted toward biopsychosocial and socioecological frameworks, examining how shared family emotional climate (e.g., support/strain), family emotional systems (i.e., toxic stress/resilience) across nuclear, extended, and multigenerational family, and socioeconomic/environmental conditions influence the lived pain experience across time and generations (8, 9). Specifically, family emotional climate refers to the overall intensity and valence (positivity or negativity) of family emotional exchange (9). The balance or imbalance of positivity or negativity in the family emotional climate is one facet of family-level emotion regulation: when family relationships are more negative, they include criticism and hostility, whereas when these relationships are more positive, they are characterized by support, warmth, and affection. This evolution reflects (1) a transition from viewing families primarily as modifiers of pain behavior to understanding them as dynamic social systems embedded within larger contexts that shape pain risk, incidence, adaptation, and disparities, and (2) a greater focus on the bidirectional and consequential (potentiate/attenuate) effect of family systems on multiple dimensions of chronic pain (e.g., intensity, interference, function/disability, persistence, progression, and coping).

Further, a health equity lens reinforces understanding that family processes do not occur in isolation but are shaped by broader social, economic, and structural determinants of health. Consequently, family support should be examined not only as an interpersonal resource but also as a potential operant mechanism through which health inequities are either mitigated or reinforced during the aging process. The key is to avoid treating age simply as a demographic covariate and instead position aging as a developmental, relational, and contextual process that influences family emotional climate and chronic pain experiences independently and interdependently. Here are several example conceptual pathways:

- Developmental: Aging-related changes → family emotional climate ↔ chronic pain experience
- Relational: Chronic pain → functional limitations → changes in family roles → family emotional climate ↔ pain experience
- Contextual: Current lifecourse environment ↔ Family emotional climate × functional limitation → chronic pain

In this review, we present two measurement challenges in studying family-specific contributors to pain that we argue have hampered progress: (1) conceptualization of "family" that is marked by linear and traditional notions of what and who family encompasses, particularly in regards to aging families, and (2) a broad operationalization of 'social support' often defined ambiguously and inconsistently across the literature and that prioritizes the marital or intimate partner relationship. We then propose a theoretically driven approach to conceptualizing family emotional climate and outline potential analytic strategies for testing family-pain pathways with the eventual goal of optimizing family-based pain management interventions.

Measurement challenges

Challenge 1: family conceptualization

Conceptualizing "family" is challenging for many reasons, a few of which we consider with the aim of optimizing pain and pain management research. First, "family" is rarely a defined construct in pain literature; it is generally incorporated as part of social support, resulting in non-specific findings that may, or may not, apply to any one type of family relationship. There is evidence that, in the absence of being told who to consider as family when completing family relationship measures, research participants use varying personal definitions of family, resulting in measurement variance and differing self-report outcomes of family functioning (10). Conversely, defining "family" for patients/participants as one type of relationship, and assessing the quality of that one relationship may artificially censor measurements of the totality of family relationships' influence. These research procedures likely set statistical and real-world brackets around the type of impact we may otherwise be able to capture through pain research and intervention.

Second, notions of family are often driven by linear and/or traditional conceptualizations that lack community-specific and intergenerational context. For example, family is potentially culturally constrained, and driven by a dominant narrative which presumes a linear evolution from family-of-origin to procreative family in the transition to adulthood, as opposed to intergenerational and intercommunity notions of family

dominant in Black, Hispanic, and Indigenous American communities (11, 12). At least some of the imprecision observed in pain researchers' definition of the "family" construct is likely due to the complexity inherent in the natural history of family relationships for adults. The development and transitions that naturally occur across the life course result in changes in social network makeup and size (e.g., as discussed in the context of aging families), normative movement into occupying multiple intersecting family roles, waxing and waning of relationship quality and closeness, and changes in partnership and parenthood status over time. These expected developmental shifts in relationships result in rich relationship biographies that include branches of family-of-origin, sibling, romantic relationship, and parenting histories, to include times of singlehood, multigenerational living, or kinship networks (13). Further, within-family variations in intergenerational relationship quality and family experiences likely contribute important differences to chronic health outcomes (14). As a result, capturing relationship biographies to reflect the accumulation and totality of relational experiences over time that could affect pain and pain management is not easy, and requires intricate and innovative methodology (15). Relationship biographies focus on key interpersonal ties and are qualitative profile that traces how a person's connections, social bonds, and partnerships evolve alongside major life transitions.

The limited emphasis on intergenerational relationships and family effects on pain, however, is unique to adult pain research —the same gap does not exist in pediatric research, which often estimates the impact of family on pain (16). Indeed, the pediatric pain literature includes rich, dynamic conceptualizations of family to include a focus on parents' wellbeing (e.g., emotional wellbeing, parental pain status) (17), family relationship quality (e.g., conflict, cohesion), and parenting practices (e.g., protectiveness) (16, 18). As a result, there is a greater availability of family-based interventions that benefit pediatric pain (e.g., via intervening on parenting) (19, 20).

Third, who people define as "family" may vary over the life course, and it is important to account for how normative as well as non-normative variations in family relationships unfold over time to impact and intersect with pain among older adults. This is especially the case with regard to aging families, as aging potentiates both changes in social network structure and contact as well as an increased likelihood of chronic illness and concomitant pain (21, 22). For example, aging family members increasingly rely on informal and unpaid caregivers in the context of chronic health conditions including persistent pain. Caregivers are often family members—and, if a child, most likely to be the adult child an older parent feels closest to emotionally (23). While relying on informal caregiving provided by an adult child is often considered a normative change, caregiving for a parent with chronic pain may be especially likely to predict parent-child relationship tension (24)–understanding more about how parent-child relationship quality unfolds over time to impact, and be impacted by pain-related caregiving may be key to improving aging pain outcomes. This is especially true in light of older adults' concerns about losing autonomy which may serve as a barrier to communicating about chronic pain with family (25) despite the value of family-based communication for pain management (5). Overall, family relationships may become especially critical in determining older adults' health outcomes as less significant members of social networks are often trimmed and the need for health-related support grows (21). The diversity and quality of later-life family relationships, coupled with age-related increases in pain and disability, underscore the importance of precisely defining and contextualizing family in studies of chronic pain outcomes.

Challenge 2: broad operationalization of social support

Advances in understanding the impact of family on pain are limited by a persistent focus on social support, amorphously defined. There is "no consensus on the operational definition of 'social support'" (26). (p. 1062) It has been variously defined as the perception of being cared for, as well as the tangible receipt of support from others, and operationalized widely, to include: social integration and number of social roles, social role functioning, social isolation, frequency of contact with close relations or social network members, network interconnectedness, satisfaction with support received, instrumental support, emotional support, companionship, belonging, and pain-specific support, as examples (26–30). Though these operationalizations reflect attempts to move beyond studying social support in the general sense, independent social support measures are often highly correlated, which can result in multicollinearity errors (e.g., measures of separate social support variables tend to load on a single factor despite attempts to differentiate them (28). Additionally, pain research often fails to determine from whom social support is received (29). The broad operationalization of 'social support' may be (1) perpetuated by the prevailing use of the biopsychosocial model of pain which provides a valuable though nonspecific emphasis on the "social" domain (31), and (2) at times made more specific via a focus on the spousal relationship which, while it may aid in targeted intervention development, precludes the consideration of many other types of family relationships that may benefit pain management outcomes.

Delimiting "social" in biopsychosocial

The biopsychosocial model of pain [adapted from Engel's biopsychosocial model (32)] has been widely accepted in explicating mechanisms of influence on long-term pain outcomes (33, 34). The model is a rich and practical guide to holistically conceptualizing the etiology, assessment, and treatment of pain, capturing biological underpinnings and health behavior pathways, psychological contributors and sequelae, and social factors tied to pain outcomes. However, in applying the biopsychosocial model to chronic pain, the social contributors and modifiers of pain experiences have been broadly defined as social support and sociodemographic characteristics tied to between-group pain disparities (e.g., socioeconomic status, race/ethnicity (35). More specific social determinants of health receive far less attention in the literature (36), with a predominant focus on biological components of pain and psychosocial mechanisms emphasizing emotional and cognitive factors (31).

The lack of specification of the -social component of the biopsychosocial model of pain may stem from the lack of undergirding theory. Indeed, it is likely more accurate to view the biopsychosocial model as a framework, clinical heuristic, or paradigm shift than a theory (37). Engel's original biopsychosocial model did not specify aspects of the model's levels, or how the levels interrelate (32). His model revision in 1980 (38), though more detailed, did not specify variables nor explicit relationships among the model's individual components. Though the biopsychosocial approach helpfully points us toward the contributions of the social realm, it lacks sufficient detail for what (or who) constitutes "social" and *why* (39). This shortcoming of the model, in the face of consensus about its value for explaining pain, may limit how social contributors to pain are explicated in research and applied in pain interventions (40).

Prioritizing marriage

When 'social support' is emphasized in pain research, it is at times made more specific by referring to the interpersonal domain of romantic or intimate partnerships. Indeed, families and health research has regularly posited that intimate partnerships—usually marriage—are the most salient relationships for adults, and at times positioned marriage as an inherent source of positive support (41, 42). This is also true of the pain literature, which has prioritized couples-based research (1, 4, 43). Soto et al. (44), for example, echo earlier relationships and health research in justifying their focus on cohabiting spouse/partner impacts on physical activity in osteoarthritis (45–47). Specifically, these authors suggest that coresidential intimate partners are "often studied" because their influence is strongest due to "daily proximity and emotional closeness" to their partners living with pain (44) (p.686). Hung et al. take a slightly wider view in their examination of links between relationship quality and depression for adults with arthritis and posit relationships with spouses *and* children are most central (27). Understanding the role of children in pain management may be especially important for aging adults who often rely on adult child caregivers for health support (48), as discussed above. Alternatively, Romano et al. suggest spouses are more represented in research in part because they are more likely to be available during the assessment and treatment of adults with chronic pain than other family (49).

As others have emphasized (13, 42, 50), the assumption of the overriding impact of spouses on health is flawed by failing to account for: (1) historical trends in marriage, family formation, and household composition (51); (2) the impact of early life family relationships on health in adulthood; and, (3) culturally-specific differences in how family is conceptualized, prioritized, or organized which is impacted by (4) laws governing family structure that are rooted in structural racism and which decrease the likelihood of marriage for minoritized Americans while perpetuating inequity (11, 52). Moreover, studies have not supported the greater impact of intimate partnerships over non-intimate family relationships for adult health. Indeed, recent research has suggested the opposite, positing a longer-term influence of the emotional climate of family-of-origin relationships (i.e., parents, siblings) which begin in childhood and often continue into adulthood so as to have longitudinal as well as concurrent influences on health (50). The narrow emphasis on intimate partner relationships (especially marriage)—found across research on adult health (13) including pain research—reflects an evidence acceptance bias.

Measurement solutions

Solution 1: conceptualizing family emotional climate

To address the above measurement challenges in pain research, we propose a theoretically-driven and clearly defined conceptualization of family functioning—specifically *family emotional climate*—in order to foster the specification of clearly hypothesized and testable biopsychosocial pathways to pain. Biopsychosocial models in other research areas have advanced through the use of specified constructs and pathways of effect (41). The Biobehavioral Family Model (BBFM) is one such model (53), and likely the most explicit and empirically-supported biopsychosocial model to date (37, 41, 54). The BBFM is the most comprehensive yet flexible evidence-based model to support examination of the impact of relational factors on any health condition. Its constructs are designed, and have been demonstrated, to be broadly applicable to children, adolescents, and adults across cultural, racial, ethnic, and socioeconomic contexts. The BBFM prioritizes family relational factors in the -social dimension based on the theoretical assumption that the family system serves as a buffer and means to adapting to social stress and adversity, as well as a potential stressor to individual family members (55). Importantly, the BBFM is based on normative (instead of dysfunction-based) concepts of family relationships which are culturally general. Furthermore, the dimensional nature of the model provides for consideration of protective *and* negative effects of family relations on the patient, by specifically conceptualizing both positive (supportive) and negative (stressful) aspects of family relational dimensions. A key construct of the BBFM, a mediational model, is *family emotional climate*, posited to impact individual family members' disease activity (e.g., pain outcomes) via psychobiological pathways (i.e., biobehavioral reactivity (54).

The BBFM also defines the following family variables as key to characterizing family-level processes important for health: proximity (i.e., interpersonal connectedness), generational hierarchy (i.e., developmentally appropriate caregiver responsibility for children and a strong parental alliance), parent-parent relationship quality (positive or negative, setting the stage for family-level emotional climate), and responsivity (i.e., family members' responsiveness to one another reflecting a continuum of resonance from empathy to neglect).

The BBFM has been substantiated in studies of adult health, including in tests of relational contributors to pain (56, 57). In adult health research, family emotional climate is specified as originally defined, with the inclusion of intimate partner emotional climate to define the emotional climate of intimate partner relationships as separate but related to relationships with other family members. Family emotional climate has been flexibly operationalized, with family functioning (57), family

strain and support (perceived or given) (58, 59), marital/intimate partner strain and support, marital satisfaction (56, 60), and marital dysfunction (including marital risk and chances of separation) (61), as examples. Parent-child relationships have also been included in characterizations of family emotional climate and operationalized as support and strain experienced by older adults in their relationships with their adult children (50), or as remote experiences of parental abuse and neglect (60) or paternal/maternal affection (62) experienced in childhood—a direction with newer support in adult pain research (63). There are few reliable and valid self-report instruments with clinical utility in assessing Family Emotional Climate (FEC), and Table 1 provides a brief description of several tools.

Conceptualizing family emotional climate for pain research

Conceptualizing family relationships in pain research using the BBFM could define family relational variables as: family emotional climate (valence and intensity), connectedness (sharing of affection and self-disclosure), family roles [e.g., caregiving roles experienced as appropriate or inappropriate, Family Impact of Pain Scale (FIPS); childcare burden], and responsivity (e.g., emotional support, family members' own emotion regulation, partner responsiveness). Further, a theory-driven assumption is that these variables co-occur and are important to assess *across types of relationships,* including not only intimate partnerships but also family-of-origin (e.g., siblings, grandparents) and parent-child relationships (including adult children). Assessing the family relational quality of non-traditionally defined family relationships including close friends, kin networks, or church community-members, and incorporating culturally relevant conceptualizations of *who* is in the family (and why) will also be critical.

Family serves as the interface between these larger social factors and individuals' health and wellbeing and requires research attention to provide a full and complete picture of the contextual experience of pain. The BBFM can serve as a guide for this work by providing the necessary specificity for *how* we pay attention to family relationships in research and *what* areas are ripe for family-based intervention. Indeed, it is impossible to measure the complexity of these interpersonal relationships without first conceptualizing them clearly. Bernardes and colleagues recently tested a new measure, the Informal Social Support for Autonomy and Dependence in Pain Inventory (ISSADI-PAIN), a clinical self-report instrument designed to measure how family and social support systems either encourage independence (emotional and physical autonomy) or foster reliance (dependence) in individuals experiencing acute or chronic pain (64). This tool may help advance our measurement and understanding of pain coping, adaptation, and persistence. Next, we consider possible solutions for analyzing family emotional climate.

Solution 2: analyzing family emotional climate

Coupled with challenges in conceptualizing and measuring "family" in pain research is analytic complexity that may serve as a barrier to advances in understanding how family relationships impact pain outcomes. Pain is not a single outcome and encompasses multiple dimensions as mentioned earlier. Family emotional climate may influence these dimensions differently in terms of directionality, magnitude, and

TABLE 1 Practical tools to measure family emotional climate.

Tool name	Description	Author name, Year
Family Environment Scale (FES)	90-item true/false inventory measuring 10 subscales grouped into Relationships (cohesion, expressiveness, conflict), Personal Growth, and System Maintenance (organization, control).	R. Moos, 1974
Family Expressiveness Scale	40 written scenarios describing emotional expressions. Assesses the frequency in which family members display both positive and negative emotions, capturing socialization patterns and emotional climates. Divided into 4 affect/power categories: Positive-dominant, Positive-nondominant/submissive, Negative-dominant, Negative-nondominant/submissive.	A.G. Halberstadt, 1986
Family Emotional Involvement and Criticism Scale (FEICS)	A brief 14-item questionnaire assessing perceived criticism and emotional involvement within the family to gauge expressed emotion.	C.G. Shields, 1994
Self-Expressiveness in the Family Questionnaire (SEFQ)	40-item questionnaire assesses the frequency of an individuals' expressiveness within the family.	A.G. Halberstadt, 1995
Family Attitude Scale (FAS)	A 30-item questionnaire specifically designed to measure the critical and hostile emotional climate of a family. Measures the emotional climate of families.	D.J. Kavanaugh, 1997
Family Adaptability and Cohesion Scale IV Short Form (FACES-IV-SF)	Short form questionnaire adapted from the FACES-IV (D. Olson, 2011) that includes 24 questions to determine levels of balanced and unbalanced cohesion and adaptability in marital and family systems; tool can be easily integrated into clinical and research settings.	J.B. Priest, 2020
Family Climate Questionnaire (FCQ)	10-item questionnaire that evaluates dimensions of family interactions, emotional support, autonomy, and positive versus negative climates. Measure the degree of autonomy-support among family members for a person regarding health decisions and concerns.	S.L. Sayers, 2024

moderation. We propose a stepwise process as a strategy to analyzing family—pain associations and explicate potential analytic challenges that may complicate modeling.

Statistical strategies

We first outline a stepwise analytic process that may serve to advance understanding of how individual family emotional climate variables—and their combination—convey risk or resilience for adult pain outcomes. Specifically, analyses may proceed via:

- testing the independent contributions of separate measures of positive as well as negative family relationship quality assessed across several types of family relationships (e.g., univariate regression analyses testing measures of family strain, family support, intimate partner strain, intimate partner support, etc. and pain development 10 years later (9) using Midlife in the United States data (65);
- testing positive and negative family relationship quality, simultaneously, within individual types of relationships either as independent predictors (e.g., to estimate the risks of family strain while accounting for the benefits of family support on pain interference, or, to account for partner responses to pain while estimating links between consensus, cohesion, and satisfaction in intimate partner relationships and pain (66) or via moderation models (e.g., to test possible buffering effects of marital satisfaction against the risks of spousal responses to pain communication for pain severity (67); and/or,
- averaging valence-specific measures of family relationship quality, across types of relationships in order to estimate the risk or protective benefits of average levels of support versus strain (e.g., averaging across measures of positive support received from spouses, children, and other family to create an overall positive support score, and separately averaging across measures of source-specific negative support to create an overall negative support score, in order to test links between quality of family support, depression, and pain (27) using Health and Retirement Study 2012 HRS Core public use dataset (68).

Alternatively, models that analyze samples' underlying class structures via estimating how reports of positive and negative family relationship quality (and/or other family constructs) cluster across types of relationships may provide rich views of unique and more real-world family emotional climate profiles for persons experiencing, or at risk for, chronic pain. This type of analysis may also be used to incorporate several types of family emotional climate variables in singular profiles holistically characterizing participants' family environments.

Statistical challenges

One of the possible complicating factors in modeling family emotional climate is changes in residential, parenting, or partnering status(es) across samples or within-participants over time. Though emotional climate can be modeled separately for unique types of relationships or for partnered versus unpartnered subsamples (56), it is also possible to use the analyses described above and (a) estimate latent profiles of family emotional climate for partnered and unpartnered subsamples (using appropriate family measures for each) separately, (b) export the assigned categories for each subsample, and then (c) collapse the determined subsample classes into a singular family emotional climate categorical predictor variable for a full sample. To move closer to a relationship biographies approach, researchers could utilize second-order latent class analysis to model trajectories of family emotional climate profiles over time and their intersection with the longitudinal evolution of pain outcomes (2, 69). Each of the above analyzes could also be leveled up to include dyadic or family-level data—that is, reports of family functioning completed by two or more family members in order to estimate rich pictures of family relationships using potentially diverse perspectives within patients' families.

Finally, unintended missing data issues can arise given the complexities of different types of relationships that may or may not simultaneously exist in one participant (e.g., married and unmarried individuals in one sample). Traditional missing data handling procedures (e.g., full information maximum likelihood, list-wise deletion, mean replacement) are problematic because these procedures either eliminate participants for not being a part of all relationship types, or incorrectly estimate scores for individuals who do not have a given relationship type. Advanced statistical methods typically applied in other fields, such as cross-classified multilevel models (70), can account for "missing" data linked to relationship status and should be incorporated into family-pain research. In total, these types of analyses move beyond selecting out solely marital relationships for ease (an approach that creates at least as many problems as it solves), or merely "controlling" for marital status, and towards truly accounting for the varied and dynamic nature of family relationships in adulthood. Future research should determine which chronic pain outcomes are most likely to be affected by family emotional processes and their effect on the aging lifespan and healthspan.

Conclusion

The power of close relationships to improve adult pain outcomes remains a relatively untapped target for treatment (4). Given the nature of how relationships continue to evolve in midlife and for aging adults, yet remain powerfully impactful for pain, intervening on family relationships is relatively low-hanging fruit, ripe for intervention. Improving how we define, measure, and model "family" is a key next step for optimizing non-pharmacological pain management intervention design.

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No datasets were generated or analyzed in this article.

Ethics statement

No ethical review or IRB approval was needed because no data are presented in this article.

Author contributions

SW: Supervision, Writing – review & editing, Conceptualization, Funding acquisition, Writing – original draft, Resources. PR: Methodology, Writing – review & editing, Conceptualization, Writing – original draft. QB: Writing – original draft, Writing – review & editing. BW: Conceptualization, Writing – review & editing, Writing – original draft. SB: Writing – original draft, Writing – review & editing, Conceptualization.

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