

RESEARCH ARTICLE

Meaning in life moderates the association between pain catastrophizing and mental quality of life in older adults with chronic pain: A cross-sectional study

Mariko Horii^{1,2*}, Takeshi Hatta³, Satoshi Shimai³, Akihiko Iwahara⁴¹Department of Education, Graduate School of Faculty of Human Development and Education, Kyoto Women's University, Kyoto, Japan²Medical Corporation Souwakai, Otsu, Shiga, Japan³Department of Health Sciences, Faculty of Health Welfare, Kansai University of Welfare Sciences, Kashiwara, Osaka, Japan⁴Department of Psychology and Collaboration, Faculty of Psychology and Collaboration, Kyoto Women's University, Kyoto, Japan

*Corresponding author:

Mariko Horii
(22121201@kyoto-wu.ac.jp)

Citation: Horii M, Hatta T, Shimai S, Iwahara A. Meaning in life moderates the association between pain catastrophizing and mental quality of life in older adults with chronic pain: A cross-sectional study. *Health Psychol Res.* 2026;14(2):026080043.
doi: 10.36922/HPR026080043

Received: February 17, 2026**Revised:** April 25, 2026**Accepted:** May 11, 2026**Published online:** May 29, 2026

Copyright: © 2026 Author(s). This is an Open-Access article distributed under the terms of the Creative Commons AttributionNon-Commercial 4.0 International (CC BY-NC 4.0), which permits all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Publisher's Note: AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Abstract

Background: The burden of chronic pain is high among older adults and is associated with a reduction in health-related quality of life (HRQOL). Pain catastrophizing is a key psychological factor that exacerbates pain-related distress; however, the role of the meaning in life (MIL) in this relationship remains unclear.

Objective: This study aimed to examine whether the MIL, a key construct in positive psychology, moderates the relationship between pain catastrophizing and HRQOL among older individuals living with chronic pain.

Methods: A cross-sectional online survey was conducted targeting adults aged ≥ 65 years with chronic pain. Of the 400 respondents, 349 (177 women, 172 men) met the inclusion criteria and were included in the analysis. The study used standardized instruments: the catastrophizing scale, the Meaning of Life Questionnaire, pain intensity assessments, and HRQOL measures. Correlation analysis and multiple regression were performed, with statistical significance set at $p < 0.05$.

Results: MIL was identified as a moderator of the relationship between mental quality of life (QOL) and magnification ($\beta = 0.130^*$). Specifically, higher levels of MIL attenuated the negative association between magnification and mental QOL. In contrast, no such moderating effect was observed for physical QOL.

Conclusion: The MIL may serve as a psychological resource that buffers the adverse impact of maladaptive pain-related cognitions on mental QOL in older adults with chronic pain. Interventions aimed at enhancing the MIL may help improve psychological well-being in this population.

Keywords: Meaning in life; Quality of life; Catastrophizing; Pain; Older adults

1. Introduction

Population aging is rapidly progressing worldwide, and the prevalence of chronic pain among older adults has become a major public health concern. In Japan, approximately 39% of community-dwelling older adults experience chronic pain,¹ and this is significantly associated with reduced health-related quality of life (HRQOL).² Chronic pain in older adults is not merely a sensory symptom but a complex phenomenon involving biological, psychological, and social factors, including age-related physiological vulnerability, multimorbidity, and functional decline.³ It is conceptualized as an unpleasant sensory and emotional experience, with subjective and multidimensional impacts on HRQOL. Given this complexity, it is particularly important to focus on the role of psychological factors.⁴

Among these, pain catastrophizing has been identified as one of the most robust predictors of poor outcomes in older adults experiencing pain.⁵ Defined as a maladaptive cognitive response characterized by rumination, magnification, and helplessness, catastrophizing has been consistently associated with increased pain intensity and reduced HRQOL.^{6,7} Conventional interventions such as cognitive behavioral therapy have been shown to effectively reduce catastrophizing.^{8,9} However, there is growing recognition of the need to integrate positive psychological resources to enhance resilience among older adults living with persistent pain.

In particular, the ability to find value in life despite adversity may represent a key factor in pain management in later life. Central to this is the concept of meaning in life (MIL)—the sense that one's existence has purpose, coherence, and significance—which has gained attention as an important protective resource.¹⁰ In general, in older populations, higher levels of MIL have been associated with greater psychological well-being,¹¹ lower mortality,^{12,13} and higher HRQOL.^{14–16} In the context of chronic pain, MIL may foster psychological flexibility, enabling individuals to reappraise life goals and maintain functioning despite physical limitations. However, empirical evidence regarding the protective role of MIL in pain-related outcomes remains inconsistent. For example, some studies suggest that MIL attenuates the impact of physical pain on HRQOL,^{17,18} whereas other findings indicate that it may not consistently weaken the association between pain intensity and functional outcomes.¹⁹

Importantly, previous research has demonstrated independent associations between MIL and HRQOL, as well as between pain catastrophizing and HRQOL. However, the interaction between these cognitive and existential factors remains insufficiently understood. In particular, it is unclear whether a strong sense of meaning

in life can buffer the negative effects of specific components of catastrophizing—namely, rumination, magnification, and helplessness—on HRQOL. Older adults, who often face irreversible declines in physical functioning, may increasingly rely on existential resources to maintain quality of life (QOL), highlighting the importance of clarifying these interactions.

Therefore, the present study aims to examine whether meaning in life moderates the relationship between specific dimensions of pain catastrophizing and HRQOL (both physical and mental) among community-dwelling older adults with chronic pain. We hypothesize that MIL functions as a significant moderator of the association between catastrophic thinking and HRQOL and may serve as a target for meaning-centered interventions to enhance resilience in this vulnerable population.

2. Materials and methods

2.1. Ethical considerations

Prior to participation, all individuals were informed of the study's purpose and provided their consent via an electronic informed consent form. The survey began with a detailed explanation of the research objectives, assurances of participants' anonymity, and an emphasis on the confidentiality of all responses. To ensure confidentiality, all personally identifiable information was excluded from the dataset. Responses were stored on secure, encrypted servers, accessible only to authorized researchers. Participants were assigned randomized ID codes, and no names, email addresses, or IP addresses were linked to their responses. The data were analyzed and reported in aggregate form to prevent the identification of individual participants.

Participants were explicitly informed that their involvement was voluntary and that they could discontinue participation at any time without any negative consequences. The study protocol was reviewed and approved by the Research Ethics Committee of Kyoto Women's University (Approval No. 2022-17). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki (1975), as revised in 2013.

2.2. Participants

This study enrolled 400 participants through a professional survey agency (Cross Marketing Inc., Japan). The required sample size was determined using Cochran's formula for an infinite population, assuming a 95% confidence level, a $\pm 5\%$ margin of error, and a standard deviation of 5%, yielding a target of 384 participants. To ensure sufficient statistical power, the sample was rounded up to 400 participants.

An anonymous, self-administered online questionnaire was distributed over a 1-month period beginning October 1, 2022. The survey targeted individuals aged 65 years or older. Of the initial respondents, 349 individuals who reported experiencing pain were included in the final analysis. Those who indicated an absence of pain ($n = 51$) were excluded based on the predetermined criterion. All usable responses were complete, and thus the study had no missing data.

2.3. Procedure

This cross-sectional study was conducted over 1 month, from October 1 to October 31, 2022. The survey agency invited individuals aged ≥ 65 years registered in its panel to complete the online questionnaire. Participants accessed and completed the survey online in accordance with relevant ethical and procedural guidelines. Only respondents who reported experiencing pain were included in the final dataset. This study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines for cross-sectional studies.

2.4. Instruments

2.4.1. Pain intensity

Pain intensity was assessed using the Japanese version of the Brief Pain Inventory.²⁰ Participants rated their pain on an 11-point numerical scale ranging from 0 (no pain) to 10 (the worst imaginable pain). Higher scores reflected greater levels of pain intensity.

2.4.2. The pain catastrophizing scale

Catastrophizing was evaluated using the validated Japanese version of the Pain Catastrophizing Scale (PCS) developed by Sullivan *et al.*⁶ and adapted by Matsuoka and Sakano.²¹ The PCS measures three cognitive dimensions related to pain perception: rumination (e.g., “I keep worrying about whether the pain will go away”), helplessness (e.g., “I think the pain is so bad it will never get better”), and magnification (e.g., “I think something terrible might happen”). The scale includes 13 items, and participants responded on a 5-point Likert scale ranging from 0 (not at all) to 4 (all the time), indicating the extent to which each item described their typical pain-related thoughts. Higher total scores denote more pronounced levels of catastrophizing. In this study, internal consistency for each PCS subscale was confirmed using Cronbach's alpha: rumination ($\alpha = 0.902$), helplessness ($\alpha = 0.917$), and magnification ($\alpha = 0.869$).

2.4.3. Meaning in life

The construct of MIL was assessed using the Japanese

version of the Meaning of Life Questionnaire (MLQ),²² translated and validated by Steger *et al.*²³ This measure includes five items, such as “I understand the meaning of my life,” and participants responded using a 7-point Likert scale ranging from 1 (not at all true of me) to 7 (completely true of me). Higher scores represent a stronger sense of MIL. In this study, the internal consistency of the scale, as evaluated by Cronbach's alpha, was $\alpha = 0.889$.

2.4.4. Quality of life

Quality of life was measured using the Japanese version of the Medical Outcomes Study 8-Item Short Form Health Survey (SF-8), a widely used instrument for assessing health-related QOL.²⁴ This tool provides a comprehensive evaluation of an individual's health status and functional capacity, independent of age, disease type, or treatment condition. The SF-8 comprises two primary domains: physical and mental QOL. Physical QOL includes: (i) physical functioning, (ii) role limitations due to physical health, (iii) bodily pain, and (iv) general health perception. Mental QOL includes: (i) vitality, (ii) social functioning, (iii) emotional role functioning, and (iv) mental health. Collectively, these eight subscales form an overall picture of QOL, with higher scores reflecting better perceived QOL. In this study, the scale demonstrated high internal reliability (Cronbach's $\alpha = 0.910$).

2.5. Statistical analysis

Statistical analyses were conducted using SPSS version 28 (IBM Corp., United States of America). Descriptive statistics, including means and standard deviations, were calculated, and correlations among variables were determined. Regression and interaction analyses were performed using Hideo's analysis and data, developed by Shimizu.²⁵ The results are reported as R^2 , adjusted R^2 , F -values, and p -values, with statistical significance set at $p < 0.05$.

To assess the adequacy of the sample size, power analysis was performed using G*Power version 3.1.9.2 (Heinrich Heine University Düsseldorf, Germany).²⁶ The parameters were set as follows: effect size $f^2 = 0.35$ (indicating a large effect), $\alpha = 0.05$, total sample size = 349, and number of predictors = 11. The results indicated a denominator degree of freedom of 337 and a statistical power of 1.00. In other words, the analysis confirmed a 100% probability of detecting a true effect, providing strong evidence for the sufficiency of the sample size.

3. Results

The study included 349 participants (age range: 65–80 years, mean age: 71.74 years [standard deviation =

4.33]). The sex distribution was nearly even (177 women, 172 men). In terms of geographic distribution, 215 participants (61.6%) resided in the Kanto region, and 134 participants (38.4%) were from the Kansai region. Regarding educational background, 13 participants had completed higher elementary school, 4 junior high school, 109 high school, 27 vocational school, 39 junior college, and 150 university; 7 reported other forms of education. Occupational status included 22 professionals or technicians, 19 clerical workers, 1 in agriculture/forestry/fisheries, 24 self-employed individuals, 113 homemakers, 141 unemployed, and 29 in other occupations.

3.1. Descriptive statistics

Descriptive statistics and correlation analysis results for each variable are shown in Table 1. A negative correlation was observed between mental QOL and pain ($r = -0.325$), rumination ($r = -0.555$), helplessness ($r = -0.648$), and magnification ($r = -0.597$). Physical QOL showed negative correlations with pain ($r = -0.404$), rumination ($r = -0.614$), helplessness ($r = -0.628$), and magnification ($r = -0.581$) and a positive correlation with MIL ($r = 0.175$).

3.2. Effect of meaning in life on the relationship between mental QOL and catastrophizing

To examine the effect of catastrophizing on mental QOL (Step 1), a multiple regression analysis was conducted, with age, sex, educational background, occupation, and pain intensity as adjustment variables and the catastrophizing

components (rumination, helplessness, and magnification) as explanatory variables (Table 2). The model was significant ($R^2 = 0.446$, adjusted $R^2 = 0.433$, $F = 34.180$), indicating that helplessness ($\beta = -0.457$) and magnification ($\beta = -0.173$) negatively impacted mental QOL.

In Step 2, to examine the effect of the MIL on mental QOL, we conducted a multiple regression analysis by adding the MIL to the variables in Step 1. The model was significant ($R^2 = 0.459$, adjusted $R^2 = 0.455$, $F = 31.970$), with helplessness ($\beta = -0.430$) and magnification ($\beta = -0.188$) negatively impacting mental QOL, and MIL ($\beta = 0.122$) positively impacting it.

In Step 3, interaction analyses were conducted to examine the interaction between helplessness, magnification, and the MIL. As interaction terms were included, all explanatory variables were centered. The model was significant ($R^2 = 0.468$, adjusted $R^2 = 0.451$, $F = 26.995$), and the interactions between magnification and MIL ($\beta = 0.130$) and between helplessness and MIL ($\beta = -0.130$) were significant. The variance inflation factor values indicated no multicollinearity.

To further explore the interaction between magnification and the MIL, a simple slope analysis was conducted (Figure 1). Individuals with a high MIL maintained stable mental QOL regardless of the degree of magnification. In contrast, participants with a lower MIL exhibited a notable decline in mental QOL as magnification increased.

Table 1. Descriptive statistics for research variables and correlation coefficients

Variable	M	SD	Correlation matrix						
			1	2	3	4	5	6	7
1. Age	71.74	4.33	–	–	–	–	–	–	–
2. Pain intensity	4.85	2.08	0.119	–	–	–	–	–	–
3. Rumination	8.68	5.09	0.046	0.426**	–	–	–	–	–
4. Helplessness	5.33	4.35	0.050	0.440**	0.764**	–	–	–	–
5. Magnification	3.72	2.91	0.033	0.365**	0.826**	0.822**	–	–	–
6. MLQ	20.86	5.10	0.184**	–0.042	–0.189**	–0.203**	–0.158**	–	–
7. Mental QOL	16.52	3.31	0.052	–0.325**	–0.555**	–0.648**	–0.597**	0.256**	–
8. Physical QOL	16.23	3.14	–0.065	–0.404**	–0.614**	–0.628**	–0.581**	0.175**	0.753**

Note: **denotes $p < 0.01$

Abbreviations: M: Mean; MLQ: Meaning in Life Questionnaire; QOL: Quality of life; SD: Standard deviation.

Table 2. Meaning in life and contribution of pain catastrophizing to mental quality of life

Variable	Step 1			Step 2			Step 3		
	B	SE	β	B	SE	β	B	SE	β
Age	0.059	0.030	0.081	0.039	0.030	0.054	0.038	0.030	0.052
Sex	-0.252	0.263	-0.040	-0.217	0.261	-0.035	-0.196	0.260	-0.031
Education	-0.082	0.089	-0.040	-0.108	0.088	-0.053	-0.119	0.088	-0.058
Occupation	-0.082	0.086	-0.040	-0.075	0.086	-0.036	-0.078	0.085	-0.038
Pain intensity	-0.061	0.070	-0.040	-0.073	0.069	-0.048	-0.072	0.069	-0.048
Rumination	-0.032	0.047	-0.051	-0.020	0.047	-0.032	-0.026	0.046	-0.042
Helplessness	-0.330	0.054	-0.457**	-0.310	0.054	-0.430**	-0.322	0.054	-0.446**
Magnification	-0.186	0.092	-0.173*	-0.203	0.091	-0.188*	-0.184	0.091	-0.171*
MLQ	–	–	–	0.075	0.026	0.122**	0.070	0.027	0.114**
MLQ $\times$ helplessness	–	–	–	–	–	–	-0.020	0.009	-0.130*
MLQ $\times$ magnification	–	–	–	–	–	–	0.025	0.011	0.130*
R^2	–	–	0.446**	–	–	0.459**	–	–	0.468**
Adjusted R^2	–	–	0.433	–	–	0.455	–	–	0.451
F-value	–	–	34.180	–	–	31.970	–	–	26.995

Notes: * denotes $p < 0.05$, **denotes $p < 0.01$

Abbreviations: B: partial regression coefficient; β : Standard partial regression coefficient; MLQ: Meaning of Life Questionnaire; SE: Standard error.

Subsequently, another simple slope analysis was performed to examine the interaction between helplessness and the MIL (Figure 2). When helplessness was low, participants with a higher MIL reported better mental QOL than those with a lower MIL. However, among those with greater helplessness, those with a higher MIL experienced a greater reduction in mental QOL than their counterparts with a lower MIL.

3.3. Effects of meaning in life and catastrophizing on physical QOL

To examine the effect of catastrophizing on physical QOL (Step 1), we conducted a multiple regression analysis, with age, sex, education level, occupation, and pain intensity as adjustment variables and rumination, helplessness, and magnification as explanatory variables (Table 3). The model was significant ($R^2 = 0.452$, adjusted $R^2 = 0.439$, $F = 35.039$), indicating that rumination ($\beta = -0.280$) and helplessness ($\beta = -0.331$) negatively impacted physical QOL.

In Step 2, to examine the effect of the MIL on physical QOL, we conducted a multiple regression analysis by

adding the MIL to the variables in Step 1. The model was significant ($R^2 = 0.454$, adjusted $R^2 = 0.440$, $F = 35.398$), revealing that rumination ($\beta = -0.272$) and helplessness ($\beta = -0.319$) negatively affected physical QOL, whereas MIL did not.

4. Discussion

The present study examined whether MIL moderates the relationship between pain catastrophizing and HRQOL among older adults with chronic pain. The results indicated that MIL moderated the association between pain magnification and mental QOL, but not physical QOL. These findings suggest that the role of psychological resources may differ across domains of HRQOL.

A key finding of this study is that MIL moderated the relationship between pain magnification and mental QOL. Specifically, individuals with higher levels of MIL maintained relatively stable mental QOL regardless of the degree of pain magnification, whereas those with lower levels of MIL exhibited a marked decline in mental QOL as pain magnification increased. This suggests that MIL may

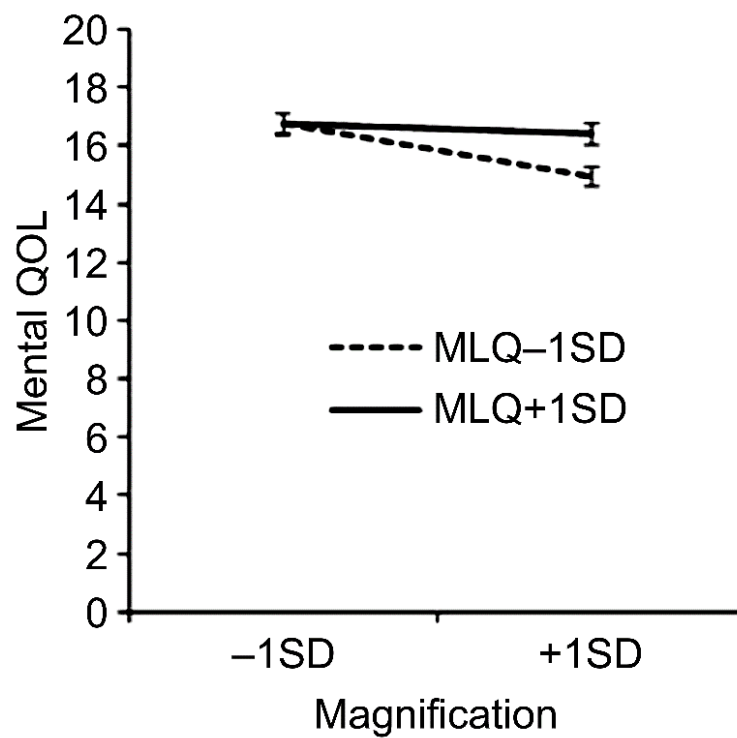


Figure 1. Association between magnification and mental quality of life (QOL), moderated by meaning in life (Meaning of Life Questionnaire [MLQ]). The figure shows simple slopes at high (+1 SD; solid line) and low (-1 SD; dashed line) levels of MLQ.

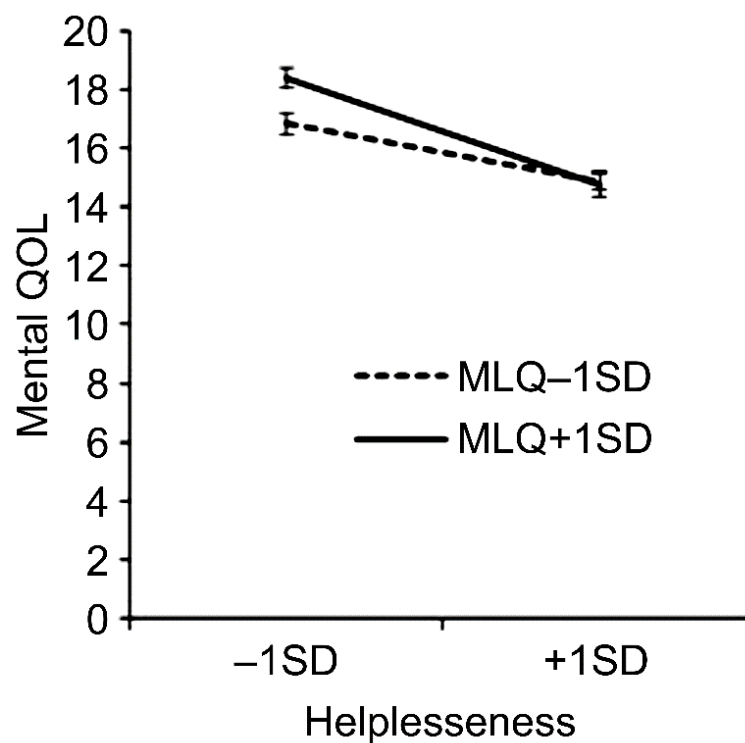


Figure 2. Association between helplessness and mental quality of life (QOL), moderated by meaning in life (Meaning of Life Questionnaire [MLQ]). The figure shows simple slopes at high (+1 SD; solid line) and low (-1 SD; dashed line) levels of MLQ.

Table 3. Meaning in life and contribution of pain catastrophizing to physical quality of life

Variable	Step 1			Step 2		
	<i>B</i>	SE	β	<i>B</i>	SE	β
Age	−0.020	0.030	−0.027	−0.028	0.030	−0.039
Gender	0.073	0.261	0.012	0.088	0.261	0.014
Education	0.063	0.088	0.031	0.052	0.088	0.025
Occupation	−0.014	0.086	−0.007	−0.010	0.086	−0.005
Pain intensity	−0.197	0.069	−0.131**	−0.202	0.069	−0.135**
Rumination	−0.172	0.046	−0.280**	−0.167	0.047	−0.272**
Helplessness	−0.238	0.054	−0.331**	−0.229	0.054	−0.319**
Magnification	−0.030	0.091	−0.028	−0.037	0.091	−0.034
MLQ	—	—	—	0.033	0.026	0.053
R^2	—	—	0.452	—	—	0.454
Adjusted R^2	—	—	0.439	—	—	0.440
<i>F</i> -value	—	—	35.039	—	—	35.398

Notes: * denotes $p < 0.05$, ** denotes $p < 0.01$

Abbreviations: *B*: Partial regression coefficient; β : Standard partial regression coefficient; MLQ: Meaning of Life Questionnaire; SE: Standard error.

function as a psychological buffer, mitigating the adverse effects of maladaptive cognitive responses to pain.

Several psychological and physiological mechanisms may underlie this buffering effect. First, individuals with a strong sense of meaning in life are more likely to reinterpret stressful experiences and maintain emotional stability,²⁷ which may help attenuate the negative impact of exaggerated pain perceptions. Furthermore, higher levels of MIL have been associated with lower allostatic load, reflecting reduced cumulative physiological stress responses.²⁸ In addition, individuals with higher MIL tend to engage more in health-promoting behaviors and adopt proactive coping strategies in the face of adversity,^{29,30} which may render them less vulnerable to the effects of pain magnification.

From a cognitive perspective, chronic pain is known to impair attentional control, leading to amplified pain perception.³¹ This process involves executive functions, particularly within the dorsolateral prefrontal cortex, and declines in working memory and inhibitory control have been identified as factors that hinder pain regulation.^{32,33} Interestingly, individuals with higher MIL have been reported to exhibit better working memory performance and a lower risk of cognitive decline.³⁴ These findings

suggest that MIL may support the regulation of pain-related thoughts through enhanced cognitive control, thereby reducing the impact of pain magnification on mental QOL.

In contrast, no moderating effect of MIL was observed for physical QOL. This finding suggests that MIL may primarily influence psychological and emotional well-being rather than physical functioning per se. Consistent with our findings, previous studies have reported that MIL is associated with mental QOL but not significantly with physical QOL.¹⁷ Physical QOL is likely to be more directly determined by biological factors, disease severity, and functional limitations,^{35,36} which may not be easily modified by psychological resources alone. Therefore, the influence of MIL may be more pronounced in domains involving emotional regulation and cognitive appraisal.

Interestingly, the interaction between helplessness and MIL revealed an unexpected pattern. Individuals with a strong sense of meaning in life exhibited a more pronounced decline in mental QOL under conditions of high helplessness. One possible explanation is that individuals who perceive their lives as meaningful may experience greater psychological conflict when they feel a loss of control over pain, leading to increased distress.

Furthermore, helplessness may amplify the emotional dimension of pain, heighten feelings of despair, and reduce perceived control,^{37,38} all of which are strongly associated with poorer mental QOL. However, this interpretation remains speculative, and further research is needed to elucidate the underlying mechanisms.

These findings suggest that incorporating meaning-centered interventions into chronic pain management can effectively complement conventional cognitive behavioral therapy. For older adults with rich life experiences, therapeutic approaches that focus not only on pain reduction but also on the reappraisal of values and reconstruction of purpose may be particularly beneficial. Such interventions may help patients shift from a pain-centered life to a value-driven life, thereby maintaining mental QOL even in the presence of persistent physical symptoms. Future research should examine whether integrating meaning-based interventions into chronic pain management programs improves psychological outcomes.

4.1. Limitations

Several limitations should be noted. First, due to the cross-sectional design, causal relationships cannot be inferred. Second, the use of an online survey may have introduced selection bias, as older adults with higher levels of digital literacy and social engagement may have been more likely to participate. To address this issue, future studies should adopt mixed recruitment strategies—combining online surveys with paper-based assessments in community settings—to obtain a more representative sample, including individuals at higher risk of social isolation. Finally, longitudinal study designs are needed to clarify the temporal dynamics among MIL, catastrophizing, and QOL.

5. Conclusion

Meaning in life functions as a protective factor that buffers the negative effects of amplified pain perceptions on mental QOL in older adults. However, its influence appears to be limited to the psychological domain and may be attenuated under conditions of high helplessness. Incorporating meaning-based approaches into clinical practice may provide a promising pathway for improving the mental well-being of older adults living with persistent pain.

Acknowledgments

We would like to thank Editage (www.editage.com) for English language editing.

Funding

None.

Conflict of interest

The authors declare that they have no conflicts of interest.

Author contributions

Conceptualization: Mariko Horii, Akihiko Iwahara

Data curation: Mariko Horii, Akihiko Iwahara

Methodology: Mariko Horii, Akihiko Iwahara

Writing—original draft: Mariko Horii

Writing—review & editing: All authors

Ethics approval and consent to participate

The study design was approved by the Research Ethics Committee of Kyoto Women's University (Approval No. 2022-17). Informed consent was obtained electronically from all participants prior to participation in the study. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki, as revised in 2013.

Consent for publication

All participants provided electronic informed consent prior to participation, including consent for the anonymous use and publication of the collected data for research purposes.

Availability of data

The datasets generated and/or analyzed during the current study are not publicly available due to ethical and privacy restrictions, but are available from the corresponding author on reasonable request.

References

1. Yamada K, Fujii T, Kubota Y, *et al.* Prevalence and municipal variation in chronic musculoskeletal pain among independent older people: Data from the Japan Gerontological Evaluation Study (JAGES). *BMC Musculoskelet Disord.* 2022;23(1):755.
doi: 10.1186/s12891-022-05694-y
2. Golovchanova N, Owiredua C, Boersma K, Andershed H, Hellfeldt K. Presence of meaning in life older men and women: The role of dimensions of frailty and social support. *Front Psychol.* 2021;12:730724.
doi: 10.3389/fpsyg.2021.730724
3. Dong HJ, Gerdle B, Bernfort L, Levin LÅ, Dragioti E. Pain Catastrophizing in Older Adults with Chronic Pain: The Mediator Effect of Mood Using a Path Analysis Approach. *J Clin Med.* 2020;9(7):2073.
doi: 10.3390/jcm9072073
4. Presto P, Sehar U, Kopel J, Reddy PH. Mechanisms of pain in aging and age-related conditions: Focus on caregivers. *Ageing Res Rev.* 2024;95:102249.

- doi: 10.1016/j.arr.2024.102249
5. Afrashteh MY, Abbasi M, Abbasi M. The relationship between meaning of life, perceived social support, spiritual well-being and pain catastrophizing with quality of life in migraine patients: The mediating role of pain self-efficacy. *BMC Psychol.* 2023;11(1):17.
doi: 10.1186/s40359-023-01053-1
6. Sullivan MJL, Bishop SR, Pivik J. The pain catastrophizing scale: development and validation. *Psychol Assess.* 1995;7(4):524-532.
doi: 10.1037/1040-3590.7.4.524
7. Simic K, Savic B, Knezevic NN. Pain catastrophizing: How far have we come. *Neurol Int.* 2024;16(3):483-501.
doi: 10.3390/neurolint16030036
8. Yamin JB, Meints SM, Edwards RR. Beyond pain catastrophizing: rationale and recommendations for targeting trauma in the assessment and treatment of chronic pain. *Expert Rev Neurother.* 2024;24(3):231-234.
doi: 10.1080/14737175.2024.2311275
9. Schütze R, Rees C, Smith A, Slater H, Campbell JM, O'Sullivan P. How can we best reduce pain catastrophizing in adults with chronic noncancer pain? A systematic review and meta-analysis. *J Pain.* 2018;19(3):233-256.
doi: 10.1016/j.jpain.2017.09.010
10. Martela F, Steger MF. The meaning of meaning in life: Coherence, purpose and significance as the three facets of meaning. *J Posit Psychol.* 2016;11(5):531-545.
doi: 10.1080/17439760.2015.1137623
11. Coelho A, Lopes M, Barata M, et al. Biopsychosocial Factors That Influence the Purpose in Life among Working Adults and Retirees. *Int J Environ Res Public Health.* 2023;20(8):5456.
doi: 10.3390/ijerph20085456
12. Boylan JM, Tompkins JL, Krueger PM. Psychological well-being, education, and mortality. *Health Psychol.* 2022;41(3):225-234.
doi: 10.1037/hea0001159
13. Sutin AR, Luchetti M, Karakose S, Stephan Y, Terracciano A. Meaning in life and all-cause and cause-specific mortality in the UK Biobank. *J Psychosom Res.* 2025;188:111971.
doi: 10.1016/j.jpsychores.2024.111971
14. Fischer IC, Feldman DB, Tsai J, et al. Purpose in life and physical health in older U.S. military veterans: Cross-sectional results from the National Health and Resilience in Veterans Study. *Prev Med.* 2023;170:107495.
doi: 10.1016/j.ypmed.2023.107495
15. Vinaccia S, Castelblanco-Toro SM, Quiceno JM, Vargas MDR. Ikigai (purpose in life) and quality of life in older adults in socially disadvantaged conditions within a rural Colombian context. *Rev Esp Geriatr Gerontol.* 2025;60(5):101657.
doi: 10.1016/j.regg.2025.101657
16. Mutai H, Obuchi K, Yokoi K, Furukawa T. Factors associated with health-related quality of life among community-dwelling older adults without social participation in Japan: A Cross-Sectional Study. *J Appl Gerontol.* 2025;44(6):893-901.
doi: 10.1177/07334648241290099
17. Almeida VM, Carvalho C, Pereira MG. The contribution of purpose in life to psychological morbidity and quality of life in chronic pain patients. *Psychol Health Med.* 2020;25(2):160-170.
doi: 10.1080/13548506.2019.1665189
18. Horii M, Hatta T, Hasegawa Y, et al. The association between health-Related quality of life and the meaning of life in community-dwelling older adults. *BMC Geriatr.* 2026;26:658.
doi: 10.1186/s12877-026-07425-7
19. Reed DE 2nd, Day MA, Ferreira-Valente A, Jensen MP. Belief in living a meaningful life and adjustment to chronic pain. *Pain Med.* 2025;26(1):30-38.
doi: 10.1093/pm/pnae091
20. Uki J, Mendoza T, Cleeland CS, Nakamura Y, Takeda F. A brief cancer pain assessment tool in Japanese: The utility of the Japanese Brief Pain Inventory-BPI-J. *J Pain Symptom Manage.* 1998;16(6):364-373.
doi: 10.1016/s0885-3924(98)00098-0
21. Matsuoka H, Sakano Y. Assessment of cognitive aspect of pain: Development, reliability, and validation of Japanese Version of Pain Catastrophizing Scale. *Jpn J Psychosom Med.* 2007;47(2):95-102. [In Japanese]
doi: 10.15064/jjpm.47.2_95
22. Steger MF, Frazier P, Oishi S, Kaler M. The meaning in life questionnaire: Assessing the presence of and search for meaning in life. *J Couns Psychol.* 2006;53(1):80-93.
doi: 10.1037/0022-0167.53.1.80
23. Steger MF, Kawabata Y, Shimai S, Otake K. The meaningful life in Japan and the United States: Levels and correlates of meaning in life. *J Res Pers.* 2008;42(3):660-678.
doi: 10.1016/j.jrp.2007.09.003
24. Fukuhara S, Ware JE, Kosinski M, Wada S, Gandek B. Psychometric and clinical tests of validity of the Japanese SF-36 Health Survey. *J Clin Epidemiol.* 1998;51(11):1045-1053.
doi: 10.1016/S0895-4356(98)00096-1
25. Shimizu H. An introduction to the statistical free software HAD: Suggestions to improve teaching, learning and practice

- data analysis. *J Media Informat Commun.* 2016;1:59-73.
26. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods.* 2007;39(2):175-191.
doi: 10.3758/BF03193146
 27. Sutin AR, Luchetti M, Stephan Y, Sesker AA, Terracciano A. Purpose in life and stress: An individual-participant meta-analysis of 16 samples. *J Affect Disord.* 2024;345:378-385.
doi: 10.1016/j.jad.2023.10.149
 28. Lewis NA, Hill PL. Sense of purpose in life and allostatic load in two longitudinal cohorts. *J Psychosom Res.* 2023;170:111346.
doi: 10.1016/j.jpsychores.2023.111346
 29. Nie S, Peng H, Ju Q, *et al.* The relationship between meaning in life and health behaviors in adults aged 55 years and over during the COVID19 pandemic: the mediating role of risk perception and the moderating role of powerful others health locus of control. *Int J Behav Med.* 2023;30(3):388-397.
doi: 10.1007/s12529-022-10100-x
 30. Wlazło M, Szlacheta P, Grajek M, *et al.* The impact of kinesiphobia on physical activity and quality of life in patients with chronic diseases: A systematic literature review. *Appl Sci.* 2025;15(4):2086.
doi: 10.3390/app15042086
 31. Ranjbar S, Mazidi M, Sharpe L, Dehghani M, Khatibi A. Attentional control moderates the relationship between pain catastrophizing and selective attention to pain related stimuli. *Sci Rep.* 2020;10(1):12885.
doi: 10.1038/s41598-020-69910-2
 32. Friedman NP, Robbins TW. The role of prefrontal cortex in cognitive control and executive function. *Neuropsychopharmacology.* 2022;47(1):72-89.
doi: 10.1038/s41386-021-01132-0
 33. Romanella SM, Mencarelli L, Burke MJ, *et al.* Targeting neural correlates of placebo effects. *Cogn Affect Behav Neurosci.* 2023;23(2):217-236.
doi: 10.3758/s13415-022-01039-3
 34. Lewis NA, Turiano NA, Payne BR, Hill PL. Purpose in life and cognitive functioning in adulthood. *Neuropsychol Dev Cogn B Aging Neuropsychol Cogn.* 2017;24(6):662-671.
doi: 10.1080/13825585.2016.1251549
 35. Veinot J, Cane D, Hashmi JA. Low working memory underpins the association between aberrant functional properties of pain modulation circuitry and chronic back pain severity. *J Pain.* 2025;28:104795.
doi: 10.1016/j.jpain.2025.104795
 36. Yang Y, Dong J, Qin P, *et al.* Impact of multimorbidity on health-related quality of life: the mediation role of intrinsic capacity - evidence from the WHO ICOPE pilot program in Lianyungang of China (2024). *Arch Public Health.* 2025;83(1):302.
doi: 10.1186/s13690-025-01791-1
 37. Wilk M, Losińska K, Pripp AH, Korkosz M, Haugeberg G. Pain catastrophizing in rheumatoid arthritis, psoriatic arthritis and axial spondyloarthritis: Biopsychosocial perspective and impact on health-related quality of life. *Rheumatol Int.* 2022;42(4):669-682.
doi: 10.1007/s00296-021-05070-4
 38. Alvarez-Astorga A, García-Azorín D, Hernández M, *et al.* Pain catastrophising in a population of patients with migraine. *Neurología (Engl Ed).* 2021;36(1):24-28.
doi: 10.1016/j.nrl.2018.10.005