Psychological Research on Urban Society

Volume 4
Number 1 *Vol. 4 No. 1 (2021): April 2021*

Article 10

4-30-2021

# Insomnia and HRQoL of Indonesians with Chronic Pain: The Role of Catastrophizing and Anxiety

Fariza Nur Shabrina
*Faculty of Psychology, Universitas Indonesia*, Fariza.nur91@ui.ac.id

Sali Rahadi Asih
*Faculty of Psychology, Universitas Indonesia*, sali.rahadi@ui.ac.id



## Recommended Citation

Shabrina, Fariza Nur and Asih, Sali Rahadi (2021) "Insomnia and HRQoL of Indonesians with Chronic Pain: The Role of Catastrophizing and Anxiety," *Psychological Research on Urban Society*: Vol. 4: No. 1, Article 10.
DOI: 10.7454/proust.v4i1.109
Available at: https://scholarhub.ui.ac.id/proust/vol4/iss1/10

e-ISSN 2615-8582
p-ISSN 2620-3960

ORIGINAL RESEARCH PAPER

# Insomnia and HRQoL of Indonesians with Chronic Pain: The Role of Catastrophizing and Anxiety

Psychological Research on Urban Society
2021, Vol. 4(1): 15-24

DOI: 10.7454/proust.v4i1.109
proust.ui.ac.id

**Fariza Nur Shabrina[1], Sali Rahadi Asih[1*]**
[1]Faculty of Psychology, Universitas Indonesia

*Received: December 21st, 2020*
*Revision Accepted: April 12th, 2021*

**Abstract**
Insomnia and chronic pain share the same catastrophizing cognitive tendency. The high prevalence of insomnia and chronic pain was found in the urban population. Seeing the interaction between both in influencing individuals is imperative. Most studies in insomnia and pain are conducted in the Western population, with little to no research conducted in Indonesian urban population. As a part longitudinal chronic pain study, this research explored (a) the mediating role of pain catastrophizing in linking insomnia with health-related quality of life (HRQoL) and (b) the moderating role of anxiety trait in influencing the mediation within Indonesian adults with chronic pain. The data were gathered through self-administered online questionnaires, and the moderated-mediation analyses were conducted at the beginning phase of the longitudinal study. The results from 415 participants validated that pain catastrophizing partially mediated the relationship between insomnia and HRQoL. Furthermore, no significant moderating effect of anxiety trait was found. People with insomnia showed rumination, worry, and dysfunctional beliefs regarding their sleep, which generalized into catastrophic thoughts regarding their pain experience. This pain catastrophizing in turn influenced the HRQoL. Interventions that simultaneously target both catastrophic thoughts in insomnia and pain would prove to be beneficial in mitigating pain among Indonesian adults.

**Keywords**
Chronic Pain, Health-Related Quality of Life, Insomnia, Pain Catastrophizing

Insomnia is a sleep disorder that is often comorbid with chronic pain. It is estimated that 32% to 75% of those living with chronic pain experience at least one symptom of insomnia (Mathias et al., 2018; Roberts & Drummond, 2016; Tang et al., 2007). Within the chronic pain population, the presence of insomnia is associated with a more severe and persistence of pain (Finan & Smith, 2013; Kelly et al., 2011; Palermo et al., 2012; Roberts & Drummond, 2016). Its impact in reducing physical function and quality of life among chronic patients also has been documented in various studies (Dragioti et al., 2017; Palermo et al., 2012; Wagner et al., 2012). The significant role of insomnia in chronic pain suggests that it may be beneficial to approach the two conditions in an integrative manner rather than two distinct issues.

Previous studies have shown the possible existence of shared cognitive processes in the form of catastrophizing in maintaining both pain and insomnia (Jeff Bryson et al., 2015; MacDonald et al., 2008; Tang, 2018). Furthermore, pain catastrophizing has received wide attention due to its strength in predicting negative outcomes for pain issues (Flink et al., 2013; Neblett, 2017). Pain catastrophizing is defined by Sullivan et al. (2001) as *"an exaggerated negative mental set brought to bear during actual or anticipated painful experiences"* (p.53). In people with insomnia, negative thought processes occur in the form of nighttime worry and rumination combined with

**Corresponding Author:**
Sali Rahadi Asih
*Faculty of Psychology, Universitas Indonesia*
*Kampus Baru UI, Depok, West Java – 16424*
Email: sali.rahadi@ui.ac.id
ORCID ID: https://orcid.org/0000-0002-9377-3605

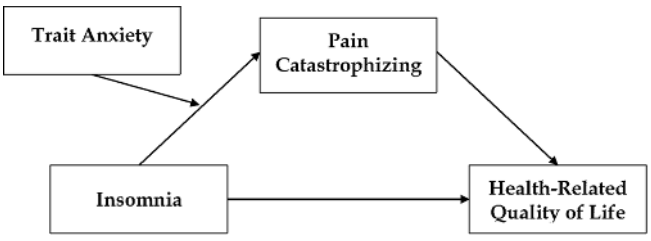
preoccupied attention to threat and dysfunctional beliefs regarding their sleep behaviors (Kaplan et al., 2009). These processes overlap with components of pain catastrophizing that are rumination, magnification, and helplessness (Sullivan et al., 2001). As individuals with pain experience more severe insomnia, their negative thought processes regarding sleep might be generalized and influence how they perceive their pain experience. This was supported by a study from Lerman et al. (2017) who found that a decrease in sleep-related catastrophic thinking is also followed with a decrease in general trait catastrophizing.

Not only through overlapping cognitive outcomes, insomnia also affects pain catastrophizing in the neurological levels by increasing their susceptibility to pain sensation (Sørensen et al., 2019; Wei et al., 2018). Sleep deprivation is associated with hyperalgesia, a change in HPA-axis which increases sensitivity to pain perception (Sørensen et al., 2019). The more severe insomnia the night before, the poorer reactivity to pain in the following day (Wei et al., 2018). Since pain catastrophizing occurs as response to pain experience, a severe pain experience might stimulate negative emotions and in turn set off catastrophic thoughts (Vlaeyen & Linton, 2000).

Further, pain catastrophizing is influenced by dispositional factors (Vlaeyen & Linton, 2000). One factor that is thought to predispose pain catastrophizing is anxiety (Burri et al., 2018). Anxiety can be defined as an organic response appearing as uneasiness and increased vigilance in the face of uncertain dangers or potential threats to the individuals (Leal et al., 2017). Certain degrees of anxiety are paramount for survival, but some people have difficulties controlling this emotional reaction thus they are always tense and in constant vigilance state (Gutiérrez-García & Contreras, 2013). As a personality trait, anxiety is a relatively stable disposition within one self to evaluate a wide range of situations as potential threats (Mascarenhas & Smith, 2011). Those with high levels of anxiety are prone to misinterpret physiological reactions as a more serious condition. Thus, chronic pain individuals with high anxiety might attribute an increased pain sensitivity because of insomnia as something more threatening, therefore triggering pain catastrophizing (Greenberg et al., 2020). When catastrophizing tendencies persist, it can lead to avoidance behaviors which turns into perceived physical disability (Vlaeyen & Linton, 2000). This condition ultimately results in decreasing health-related quality of life (HRQoL), creating a full picture on how insomnia integrates itself in chronic pain development (Shim et al., 2018)

Prior studies analyzed insomnia and pain catastrophizing as important yet distinct variables affecting chronic pain experience, and little saw them as interrelated processes (Buenaver et al., 2012). Moreover these studies are predominantly conducted in Western population, with Asian representatives majorly hailed from East Asia. Little is known about the relation among these variables in Indonesian population. Seeing as several evidences found higher pain catastrophizing tendency among Asian compared to Caucasian, different interaction might emerge thus the need for localized studies (Fabian et al., 2011; Hsieh et al., 2010). This study aimed to fill these gaps, with exploring the underlying mechanism between insomnia and negative outcomes of chronic pain represented by HRQoL through a moderated mediation model of pain catastrophizing and anxiety within Indonesian chronic pain population. We hypothesized that a) pain catastrophizing would mediate the relationship between insomnia and HRQoL among Indonesian with chronic pain, and b) trait anxiety would moderate the relationship between insomnia and pain catastrophizing. The findings would illuminate the understanding on how insomnia affects chronic pain experience leading to negative outcomes through cognitive mechanisms of pain catastrophizing in Indonesian population. It is expected that the findings would be beneficial in designing psychological interventions that integrate insomnia and pain issues in targeting pain catastrophizing.

**Figure 1.** *Conceptual Model*



## Methods

### *Participants*

This study was part of a longitudinal study assessing the role of psychological factors in chronic pain development conducted from May 2020 to October 2020. The inclusion criteria were age 18 years and above with reported chronic pain. Chronic pain was defined as pain which lasts or recurs for more than three months (Treede et al., 2015). We adopted the non-probability sampling method in the form of convenience sampling. Participants were recruited from two clinics: Klinik Surya Medika Kendal and Klinik Pratama Bunga Asih, and through online platforms. A total of 451 eligible participants (72.5% females, mean age 34.3 years, SD 12.6 years) completed the self-administered questionnaire. The types of pain reported including: musculoskeletal pain, headache, orofacial pain, abdominal pain, and period pain.

### *Measures*

**Insomnia.** Insomnia was assessed using Insomnia Severity Index (ISI), a reliable and valid instrument in measuring the severity and impact of insomnia (Morin et al., 2011). It is a seven-item self-reported instrument with five-point Likert scale and total score ranging from 0 to 28. Higher scores represent greater insomnia symptoms. Total score of 0-7 indicates the absence of insomnia, 8-14 indicates subthreshold insomnia, 15-21 indicates moderate clinical insomnia, and 22-28 indicates severe clinical insomnia. The Indonesian version of ISI has been tested and yielded a satisfactory reliability and validity (Swanenghyun, 2015). The α coefficient of ISI in this study was 0.88.

**Trait Anxiety.** The Trait subscale of The State-Trait Anxiety Inventory (STAI-T) was used to assess trait anxiety in this study (Spielberger, 1983). It consists of twenty items measuring the relatively permanent aspect in individuals that predispose them to have anxiety (Julian, 2011). STAI-T uses a four-point Likert scale, ranging from 1 (almost never) to 4 (almost always). Higher scores indicate higher tendency of anxiety. STAI-T has high validity and reliability in the pain population (Santangelo et al., 2016; Siciliano et al., 2019). The α coefficient of STAI-T in this study was 0.95.

**Pain Catastrophizing.** Pain catastrophizing was assessed using the 13-item Pain Catastrophizing Scale (PCS) by Sullivan et al. (1995). It measures the catastrophizing tendency in relation to deal with the pain experience. The measure uses a five-point Likert scale (0 = not at all to 4 = always) with total scores ranging from 0 to 52. Higher scores in this instrument reflect greater degrees of pain catastrophizing. PCS has been translated in several languages and its total score shows a high internal consistency across translations (Ikemoto et al., 2020). In this study, the α coefficient for PCS was 0.95.

**Short Form-12 Health Survey Version 2 (SF-12v2).** Short Form-12 Health Survey Version 2 (SF-12v2) is the revised version of Short Form-12 (SF-12) created by Ware et al. (1996), which is widely used to measure HRQoL. It consists of twelve items divided into eight subscales: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health. The Indonesian version of SF-12v2 has been tested with content validity index of 0.97 and 0.83 for item and subscale, as well as α coefficients for subscale ranging from 0.58 to 0.81 (Wicaksana et al., 2020). The α coefficient of SF-12v2 for this study was 0.85.

### *Procedure*

This study was approved by the Ethical Review Board of the Faculty of Psychology University of Indonesia and all participants agreed to the informed consent before the procedure began. This study was a part of a longitudinal study on psychological factors in chronic pain development. Participants completed questionnaires at 4 time points: At enrollment, 1-month follow-up, 2 -month follow-up, and 3-month follow-up. At enrollment, 200 randomized participants received a Rp 50,000.00 (Approximately $3.5) reward. Eligible participants were then asked to participate in the follow-up procedure for the next three months. All follow-up questionnaires were completed through an online platform Google Form. For every follow-up completed, participants received monetary reward with a

total of Rp 100,000.00 (Approximately $10) for three follow-up questionnaires. Participants completed questionnaires about their pain intensity, pain interference level, pain catastrophizing tendency, resilience, emotion-focused coping, problem-focused coping, religious coping, HRQoL, insomnia symptoms, and depressive symptoms. This study focused on the data collected at enrollment time-point.

### *Data Analysis*

Analyses were performed using Statistical Package for the Social Sciences (SPSS) version 24.0 for Windows (IBM, 2016). The Hayes' PROCESS macro plug-in was used to perform the moderated-mediation analysis (Hayes, 2017). The statistical significance levels for analyses used in this study were 0.05 and two-tailed. Descriptive analyses were conducted for sociodemographic variables and study measures. Means and standard deviations were calculated for continuous variables (age and study measures), as well as percentages for categorical variables (gender, age group, and education). Moderated-mediation or conditional process modeling was the main analysis in this study. This analysis was used to understand the conditional nature in which the transmitting mechanism or mechanisms occur (Hayes, 2017). In this study, moderated-mediation was performed to see the mediating effect of pain catastrophizing between insomnia and HRQoL, as well as the conditional effect of anxiety trait to pain catastrophizing. Insomnia was proposed to influence pain catastrophizing, in which this effect was moderated by anxiety trait. In turn, pain catastrophizing would affect HRQoL.

## Results

### *Participants' Characteristics*

Participants consisted of 415 Indonesian adults living with chronic pain, with the majority of them were females ($n$ = 305, 73.5%) and young adults ($n$ = 255, 61.5%). 160 participants (38.6%) met the criterion of subthreshold insomnia, 144 participants (34.7%) had moderate clinical insomnia, while 45 participants (10.8%) had severe clinical insomnia. 310 of them (74.7%) were categorized as having clinically significant anxiety symptoms. Almost half of the participants ($n$ = 197, 47.5%) had high levels of pain catastrophizing, and 106 participants (25.5%) had moderate levels of pain catastrophizing. The descriptive statistics for each measure was presented in Table 2.

**Table 1.** ***Demographic of the participants***

| | | *n* | % |
|---|---|---|---|
| Gender | Female | 305 | 73.5 |
| | Male | 110 | 26.5 |
| Age | 18–35 (young adult) | 255 | 61.5 |
| | 36 and 73 (middle and late adult) | 160 | 38.5 |
| Marital status | Single | 139 | 35.0 |
| | Married | 235 | 56.6 |
| | Divorced | 23 | 5.5 |
| | Not answering | 18 | 4.3 |
| Education | High school and below | 194 | 46.7 |
| | Undergraduate degree | 196 | 47.2 |
| | Postgraduate degree | 25 | 6.0 |
| Insomnia | No clinical insomnia | 66 | 15.9 |
| | Subthreshold insomnia | 160 | 38.6 |
| | Moderate insomnia | 144 | 34.7 |
| | Severe insomnia | 45 | 10.8 |
| Trait anxiety | No clinically significant anxiety symptoms | 105 | 25.3 |
| | Clinically significant anxiety symptoms | 310 | 74.7 |
| Pain catastrophizing | Low | 112 | 27.0 |
| | Moderate | 106 | 25.5 |
| | High | 197 | 47.5 |
| Total | | 415 | 100 |

### *Moderated-Mediation Analysis Result*

A moderated mediation analysis was conducted to test the study hypothesis (presented in Table 3). There were two hypotheses in this study. First, it was hypothesized that pain catastrophizing mediated the relationship between insomnia and HRQoL. Second, it was hypothesized that trait anxiety moderated the impact of insomnia on pain catastrophizing. After controlling for gender and age, the mediator variable model ($F$

**Table 2.** *Means, Standard Deviations, and Correlation Matrix*

| | *M* | *SD* | *Range* | *α* | *1* | *2* | *3* | *4* |
|---|---|---|---|---|---|---|---|---|
| Age | 34.25 | 12.35 | 18—73 | | | | | |
| 1. Insomnia | 13.75 | 6.30 | 0—28 | .88 | — | .64*** | .60*** | -.62*** |
| 2. Anxiety Traits | 48.78 | 13.32 | 20—80 | .95 | .64*** | — | .59*** | -.72*** |
| 3. Pain Catastrophizing | 27.54 | 12.92 | 0—52 | .95 | .60*** | .59*** | — | -.71*** |
| 4. HRQoL | 49.98 | 10.08 | 0—100 | .88 | -.62*** | -.72*** | -.71*** | — |

*Note.* $N$ = 415. *$p$ < .05. **$p$ < .01. ***$p$ < .001

= 62.03, $R^2$ = 0.43, $p$ < 0.001) significantly predicted pain catastrophizing and the dependent variable model ($F$ = 133.33, $R^2$ = 0.57, $p$ < 0.001) significantly predicted HRQoL. Insomnia positively predicted pain catastrophizing ($b$ = 0.76, $p$ < 0.001), pain catastrophizing negatively predicted HRQoL ($b$ = -0.41, $p$ < 0.001), and insomnia negatively predicted HRQoL ($b$ = -0.51, $p$ < 0.001). These findings indicated a partial mediating effect of pain catastrophizing on the relationship between insomnia and HRQoL. Therefore, our first hypothesis was supported. A positively significant effect of trait anxiety on pain catastrophizing was also found ($b$ = 0.34, $p$ < 0.001), although trait anxiety did not significantly moderate the impact of insomnia on pain catastrophizing ($b$ = -0.01, $p$ = 0.095). This result indicated that there was no moderating effect of trait anxiety in the association between insomnia and pain catastrophizing. Thus, our second hypothesis was not supported.

**Table 3.** *Moderated-mediation Analysis*

| | *b* | *SE* | *t* | *p* |
|---|---|---|---|---|
| *Mediator variable model* | | | | |
| Constant | 28.28 | 1.51 | 18.77 | .000 |
| Gender | −1.40 | 1.10 | −1.27 | .205 |
| Age | 0.00 | 0.04 | 0.07 | .948 |
| **Insomnia*** ** | 0.76 | 0.10 | 7.57 | .000 |
| **Trait anxiety*** ** | 0.34 | 0.05 | 6.93 | .000 |
| Insomnia x trait anxiety | −0.01 | 0.01 | −1.67 | .095 |
| *Dependent variable model* | | | | |
| Constant | 61.93 | 1,39 | 44.51 | .000 |
| Gender | −0.48 | 0,75 | −0.64 | .521 |
| Age | −0.02 | 0,03 | −0.57 | .568 |
| **Insomnia*** ** | −0.51 | 0,07 | −7.73 | .000 |
| **Pain catastrophizing*** ** | −0.41 | 0,03 | −12.88 | .000 |
| | ***B*** | ***Boot SE*** | ***Boot LLCI*** | ***Boot ULCI*** |
| *Conditional indirect effect analysis at IA = M ± SD* | | | | |
| M - 1 SD | −0.36 | 0.05 | −0.45 | −0.27 |
| M | −0.31 | 0.04 | −0.39 | −0.23 |
| M + SD | −0.26 | 0.05 | −0.36 | −0.17 |

Note. $N$ = 415. Bootstrap sample size = 5000. LL = low limit, CI = confidence interval, UL = upper limit. *$p$ < .05. **$p$ < .01. ***$p$ < .001.

## Discussion

This study aimed to evaluate the moderated mediation model to analyze the underlying mechanisms between insomnia and HRQoL among Indonesian living with chronic pain. The result of our study also indicated that pain catastrophizing partially mediated the relationship between insomnia and HRQoL. Previous studies have shown that pain catastrophizing was a risk factor for HRQoL (Larice et al., 2020; van Aken et al., 2017). However, to our knowledge no studies have explored the effect of insomnia on pain catastrophizing, much less the mediating effect of pain catastrophizing in the relation between insomnia and HRQoL. Our findings supported our assumption that insomnia affected pain catastrophizing, and pain catastrophizing partially mediated the impact of insomnia on HRQoL. However, our hypothesis that trait anxiety moderated the relation between insomnia and pain catastrophizing left unsupported. Trait anxiety was a significant predictor of pain catastrophizing, but no significant interaction between insomnia and anxiety was found.

Our study also found that the majority of our participants met the criteria for high levels of trait anxiety as well as pain catastrophizing.

These findings are consistent with previous studies exploring differences between Asian (Chinese) and Caucasian ethnicity (Hsieh et al., 2010; Lin et al., 2001). The significant relationship we found between insomnia and HRQoL is also in line with existing literature (Dragioti et al., 2017; Galvez-Sánchez et al., 2020; Roberts & Drummond, 2016). High levels of insomnia is associated with lower well-being represented by decrease in HRQoL scores. Prolonged sleep problems can lead to fatigue and abnormalities in pain modulation (Kishi et al., 2010; Turkyilmaz et al., 2012). Negative consequences of insomnia might affect judgement about overall health condition and in turn lower individuals' perception regarding their HRQoL.

Our current model supports the Fear Avoidance Model of Chronic Pain which suggests that pain catastrophizing is influenced by several dispositional factors (Vlaeyen & Linton, 2000). In addition to trait anxiety, we found that insomnia significantly may function as a dispositional factor of pain catastrophizing through the shared mechanism of cognitive patterns (Jeff Bryson et al., 2015). We also found that trait anxiety predicted pain catastrophizing, but not moderating the relation between insomnia and pain catastrophizing. The increased arousal which is prominent within high levels of anxiety not only affects pain catastrophizing, but may also act as a pathway to insomnia (Dragioti et al., 2017). There is a possibility that trait anxiety plays a role in predicting insomnia and pain catastrophizing, rather than moderating the relationship between the two.

When people have high levels of pain catastrophizing, they evaluate their pain situation as more negative and show attentional bias towards pain-related information (Sullivan et al., 2001). To compensate for these cognitive biases, individuals may start doing pain avoidance behaviors (Vlaeyen & Linton, 2000). Their avoidance behaviors only exaggerate their pain and illness-related behaviors and complaints, while restricting them from healthy behaviors such as exercising (Edwards et al., 2006; Taylor et al., 2017). The physical inactivity in turn increases disability perception and thus affecting HRQoL (Shim et al., 2018; Vlaeyen & Linton, 2000).

This study has several limitations to be noted. First, this study uses cross-sectional data from one time point of the longitudinal study. Thus, interpretation of causality should be done with caution. Future studies using longitudinal data or experimental studies may be done to confirm the causal relationship among variables. Second, the self-report and online survey method restricts the data validity due to several possible biases. Therefore, future research may consider offline data gathering and from multiple informants (e.g. patients, caregivers, attending physicians). Third, this study has yet to control the type of pain experienced by participants. Considering that difference in pain conditions may affect the psychological variables, future research may study specific pain conditions or account them as covariates.

In spite of the limitations, this is the first study that attempts to test the mediating role of pain catastrophizing and moderating role of trait anxiety in the relationship between insomnia and HRQoL. It further our understanding about the mechanisms underlying the connection between insomnia and HRQoL, specifically how insomnia affects HRQoL through the cognitive mechanism of pain catastrophizing. This is also one of the few studies to see the relationship between said psychological variables conducted in Asia, specifically Indonesia. It deepens our knowledge regarding the pain experience among Indonesian with chronic pain, and how the variables interact with each other. This study provides practical implications for healthcare professionals in giving psychological interventions to mitigate negative outcomes of chronic pain among patients. The significance of insomnia within the chronic pain population suggests that hybrid approach may work better in alleviating pain problems (Tang, 2018). Insomnia and chronic pain partly share the same catastrophizing tendencies, and targeting these cognitive biases may prove to be an effective alternative.

## Conclusions

Pain catastrophizing plays a mediating role between insomnia and HRQoL within chronic pain populations, suggesting that insomnia and chronic pain share some cognitive patterns in the form of catastrophic thoughts. This findings further implies the feasibility of hybrid interventions which simultaneously target insomnia and chronic pain. Although not significant as a mod-

erator, trait anxiety establishes itself as a significant predictor of pain catastrophizing. Assessing trait anxiety before treatment and intervention may aid clinicians in predicting the onset of pain catastrophizing and help to tailor suitable interventions in regards to patients' dispositional tendencies.

**Declaration of Conflicting Interest.** The authors declare no conflicts of interest in preparing this article.

**Acknowledgment.** We want to express our appreciation to our research team for their continued support and help: Lathifah Hanum for the valuable discussion and inputs, Khusnul Norma for creating the online questionnaires, as well as Muthmainah Mufidah and Afini Wirasenjaya for their assistance in data gathering.

**Funding.** This research was supported by the Ministry of Research, Technology & Higher Education of Indonesia through its "Penelitian Dasar Unggulan Perguruan Tinggi" program with grant number NKB-2831/UN2.RST/HKP.05.00/2020. The views and opinion conveyed in this article are those of authors and do not necessarily reflect those of the Ministry of Research, Technology & Higher Education of Indonesia. The Ministry of Research, Technology & Higher Education of Indonesia had no role in the data gathering, analysis, or decision in publishing or preparing this manuscript.

## References

Buenaver, L. F., Quartana, P. J., Grace, E. G., Sarlani, E., Simango, M., Edwards, R. R., Haythornthwaite, J. A., & Smith, M. T. (2012). Evidence for indirect effects of pain catastrophizing on clinical pain among myofascial temporomandibular disorder participants: The mediating role of sleep disturbance. *Pain*, *153*(6), 1159–1166. https://doi.org/10.1016/j.pain.2012.01.023

Burri, A., Ogata, S., Rice, D., & Williams, F. (2018). Pain catastrophizing, neuroticism, fear of pain, and anxiety: Defining the genetic and environmental factors in a sample of female twins. *PLOS ONE*, *13*(3), e0194562. https://doi.org/10.1371/journal.pone.0194562

Dragioti, E., Levin, L. Å., Bernfort, L., Larsson, B., & Gerdle, B. (2017). Insomnia severity and its relationship with demographics, pain features, anxiety, and depression in older adults with and without pain: Cross-sectional population-based results from the PainS65+ cohort. *Annals of General Psychiatry*, *16*(1), 1–10. https://doi.org/10.1186/s12991-017-0137-3

Edwards, R. R., Bingham, C. O., Bathon, J., & Haythornthwaite, J. A. (2006). Catastrophizing and pain in arthritis, fibromyalgia, and other rheumatic diseases. *Arthritis & Rheumatism*, *55*(2), 325–332. https://doi.org/10.1002/art.21865

Fabian, L. A., McGuire, L., Goodin, B. R., & Edwards, R. R. (2011). Ethnicity, Catastrophizing, and Qualities of the Pain Experience. *Pain Medicine*, *12*(2), 314–321. https://doi.org/10.1111/j.1526-4637.2010.01015.x

Finan, P. H., & Smith, M. T. (2013). The comorbidity of insomnia, chronic pain, and depression: Dopamine as a putative mechanism. *Sleep Medicine Reviews*, *17*(3), 173–183. https://doi.org/10.1016/j.smrv.2012.03.003

Flink, I. L., Boersma, K., & Linton, S. J. (2013). Pain Catastrophizing as Repetitive Negative Thinking: A Development of the Conceptualization. *Cognitive Behaviour Therapy*, *42*(3), 215–223. https://doi.org/10.1080/16506073.2013.769621

Galvez-Sánchez, C. M., Montoro, C. I., Duschek, S., & Reyes del Paso, G. A. (2020). Depression and trait-anxiety mediate the influence of clinical pain on health-related quality of life in fibromyalgia. *Journal of Affective Disorders*, *265*(October 2018), 486–495. https://doi.org/10.1016/j.jad.2020.01.129

Greenberg, J., Mace, R. A., Funes, C. J., Silverberg, N. D., Iverson, G. L., Caplan, D. N., & Vranceanu, A. M. (2020). Pain Catastrophizing and Limiting Behavior Mediate the Association Between Anxiety and Postconcussion Symptoms. *Psychosomatics*, *61*(1), 49–55. https://doi.org/10.1016/j.psym.2019.09.004

Gutiérrez-García, G. A., & Contreras, M. C. (2013). Anxiety: An Adaptive Emotion. In F. Durbano (Ed.), *New Insights into Anxiety Disorders* (pp. 21–37). InTech. https://doi.org/10.5772/53223

Hayes, A. F. (2017). Introduction to Mediation, Moderation and Conditional Process Analysis - Appendices A & B (V3). In *Methodology in the Social Sciences* (Vol. 53, p. 527). https://books.google.de/books?hl=en&lr=&id=6uk7DwAAQBAJ&oi=fnd&pg=PP1&ots=YZT5nUOwnF&sig=MHqqjLCOChgix8LtpSh-0FAX1gg#v=onepage&q&f=false

Hsieh, A. Y., Tripp, D. A., Ji, L.-J., & Sullivan, M. J. L. (2010). Comparisons of Catastrophizing, Pain Attitudes, and Cold-Pressor Pain Experience Between Chinese and European Canadian Young Adults. *The Journal of Pain*, *11*(11), 1187–1194. https://doi.org/10.1016/j.jpain.2010.02.015

Ikemoto, T., Hayashi, K., Shiro, Y., Arai, Y., Marcuzzi, A., Costa, D., & Wrigley, P. (2020). A systematic review of cross-cultural validation of the pain catastrophizing scale. *European Journal of Pain*, *24*(7), 1228–1241. https://doi.org/10.1002/ejp.1587

Jeff Bryson, W., Read, J. B., Bush, J. P., & Edwards, C. L. (2015). The Need for an Integrated Cognitive-Behavioral Model for Co-occurring Chronic Pain and Insomnia. *Journal of Rational - Emotive and Cognitive - Behavior Therapy*, *33*(3), 239–257. https://doi.org/10.1007/s10942-015-0213-z

Kaplan, K. A., Talbot, L. S., & Harvey, A. G. (2009). Cognitive Mechanisms in Chronic Insomnia: Processes and Prospects. *Sleep Medicine Clinics*, *4*(4), 541–548. https://doi.org/10.1016/j.jsmc.2009.07.007

Kelly, G. A., Blake, C., Power, C. K., O'Keeffe, D., & Fullen, B. M. (2011). The Association Between Chronic Low Back Pain and Sleep. *The Clinical Journal of Pain*, *27*(2), 169–181. https://doi.org/10.1097/AJP.0b013e3181f3bdd5

Kishi, A., Natelson, B. H., Togo, F., Struzik, Z. R., Rapoport, D. M., & Yamamoto, Y. (2010). Sleep stage transitions in chronic fatigue syndrome patients with or without fibromyalgia. *2010 Annual International Conference of the IEEE Engineering in Medicine and Biology*, 5391–5394. https://doi.org/10.1109/IEMBS.2010.5626478

Larice, S., Ghiggia, A., Di Tella, M., Romeo, A., Gasparetto, E., Fusaro, E., Castelli, L., & Tesio, V. (2020). Pain appraisal and quality of life in 108 outpatients with rheumatoid arthritis. *Scandinavian Journal of Psychology*, *61*(2), 271–280. https://doi.org/10.1111/sjop.12592

Leal, P. C., Goes, T. C., da Silva, L. C. F., & Teixeira-Silva, F. (2017). Trait vs. state anxiety in different threatening situations. *Trends in Psychiatry and Psychotherapy*, *39*(3), 147–157. https://doi.org/10.1590/2237-6089-2016-0044

Lerman, S. F., Finan, P. H., Smith, M. T., & Haythornthwaite, J. A. (2017). Psychological interventions that target sleep reduce pain catastrophizing in knee osteoarthritis. *PAIN*, *158*(11), 2189–2195. https://doi.org/10.1097/j.pain.0000000000001023

Lin, M. C., Endler, N. S., & Kocovski, N. L. (2001). State and trait anxiety: A cross-cultural comparison of Chinese and Caucasian students in Canada. *Current Psychology*, *20*(1), 95–111. https://doi.org/10.1007/s12144-001-1006-3

MacDonald, S., Linton, S. J., & Jansson-Fröjmark, M. (2008). Avoidant Safety Behaviors and Catastrophizing: Shared cognitive-behavioral processes and consequences in co-morbid pain and sleep disorders. *International Journal of Behavioral Medicine*, *15*(3), 201–210. https://doi.org/10.1080/10705500802222675

Mascarenhas, D. R. D., & Smith, N. C. (2011). Developing the performance brain. In *Performance Psychology* (pp. 245–267). Elsevier. https://doi.org/10.1016/B978-0-443-06734-1.00017-1

Mathias, J. L., Cant, M. L., & Burke, A. L. J. (2018). Sleep disturbances and sleep disorders in adults living with chronic pain: a meta-analysis. *Sleep Medicine*, *52*, 198–210. https://doi.org/10.1016/j.sleep.2018.05.023

Morin, C. M., Belleville, G., Bélanger, L., & Ivers, H. (2011). The Insomnia Severity Index: Psychometric Indicators to Detect Insomnia Cases and Evaluate Treatment Response. *Sleep*, *34*(5), 601–608. https://doi.org/10.1093/sleep/34.5.601

Neblett, R. (2017). Pain catastrophizing: An historical perspective. *Journal of Applied Biobehavioral Research*, *22*(1), 1–6. https://doi.org/10.1111/jabr.12086

Palermo, T. M., Law, E., Churchill, S. S., & Walker, A. (2012). Longitudinal course and impact of insomnia symptoms in adolescents

with and without chronic pain. *Journal of Pain*, *13*(11), 1099–1106. https://doi.org/10.1016/j.jpain.2012.08.003

Roberts, M. B., & Drummond, P. D. (2016). Sleep Problems are Associated With Chronic Pain Over and Above Mutual Associations With Depression and Catastrophizing. *The Clinical Journal of Pain*, *32*(9), 792–799. https://doi.org/http://dx.doi.org/10.1097/AJP.0000000000000329

Santangelo, G., Sacco, R., Siciliano, M., Bisecco, A., Muzzo, G., Docimo, R., De Stefano, M., Bonavita, S., Lavorgna, L., Tedeschi, G., Trojano, L., & Gallo, A. (2016). Anxiety in Multiple Sclerosis: psychometric properties of the State-Trait Anxiety Inventory. *Acta Neurologica Scandinavica*, *134*(6), 458–466. https://doi.org/10.1111/ane.12564

Shim, E. J., Hahm, B. J., Go, D. J., Lee, K. M., Noh, H. L., Park, S. H., & Song, Y. W. (2018). Modeling quality of life in patients with rheumatic diseases: the role of pain catastrophizing, fear-avoidance beliefs, physical disability, and depression. *Disability and Rehabilitation*, *40*(13), 1509–1516. https://doi.org/10.1080/09638288.2017.1300691

Siciliano, M., Trojano, L., Trojsi, F., Monsurrò, M. R., Tedeschi, G., & Santangelo, G. (2019). Assessing anxiety and its correlates in amyotrophic lateral sclerosis: The state-trait anxiety inventory. *Muscle & Nerve*, mus.26475. https://doi.org/10.1002/mus.26475

Sørensen, L., Jensen, M. S. A., Rathleff, M. S., & Holden, S. (2019). Comorbid insomnia, psychological symptoms and widespread pain among patients suffering from musculoskeletal pain in general practice: A cross-sectional study. *BMJ Open*, *9*(6), 1–8. https://doi.org/10.1136/bmjopen-2019-031971

Spielberger, C. D. (1983). *State-Trait Anxiety Inventory for Adults*. https://doi.org/https://doi.org/10.1037/t06496-000

Sullivan, M. J. L., Bishop, S. R., & Pivik, J. (1995). The Pain Catastrophizing Scale: Development and validation. *Psychological Assessment*, *7*(4), 524–532. https://doi.org/10.1037/1040-3590.7.4.524

Sullivan, M. J. L., Thorn, B., Haythornthwaite, J. A., Keefe, F., Martin, M., Bradley, L. A., & Lefebvre, J. C. (2001). Theoretical perspectives on the relation between catastrophizing and pain. *Clinical Journal of Pain*, *17*(1), 52–64. https://doi.org/10.1097/00002508-200103000-00008

Swanenghyun, G. (2015). *Validitas dan reliabilitas alat ukur insomnia severity index (ISI-INA) pada remaja jalanan di Yogyakarta*. Universitas Gadjah Mada.

Tang, N. K. Y. (2018). Cognitive behavioural therapy in pain and psychological disorders: Towards a hybrid future. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *87*, 281–289. https://doi.org/10.1016/j.pnpbp.2017.02.023

Tang, N. K. Y., Wright, K. J., & Salkovskis, P. M. (2007). Prevalence and correlates of clinical insomnia co-occurring with chronic back pain. *Journal of Sleep Research*, *16*(1), 85–95. https://doi.org/10.1111/j.1365-2869.2007.00571.x

Taylor, S. S., Davis, M. C., Yeung, E. W., Zautra, A. J., & Tennen, H. A. (2017). Relations between adaptive and maladaptive pain cognitions and within-day pain exacerbations in individuals with fibromyalgia. *Journal of Behavioral Medicine*, *40*(3), 458–467. https://doi.org/10.1007/s10865-016-9811-1

Treede, R.-D., Rief, W., Barke, A., Aziz, Q., Bennett, M. I., Benoliel, R., Cohen, M., Evers, S., Finnerup, N. B., First, M. B., Giamberardino, M. A., Kaasa, S., Kosek, E., Lavand'homme, P., Nicholas, M., Perrot, S., Scholz, J., Schug, S., Smith, B. H., … Wang, S.-J. (2015). A classification of chronic pain for ICD-11. *PAIN*, 1. https://doi.org/10.1097/j.pain.0000000000000160

Turkyilmaz, A. K., Kurt, E. E., Karkucak, M., & Capkin, E. (2012). Sociodemographic Characteristics, Clinical Signs and Quality of Life in Patients with Fibromyalgia. *The Eurasian Journal of Medicine*, *44*(2), 88–93. https://doi.org/10.5152/eajm.2012.21

van Aken, M. A. W., Oosterman, J. M., van Rijn, C. M., Ferdek, M. A., Ruigt, G. S. F., Peeters, B. W. M. M., Braat, D. D. M., & Nap, A. W. (2017). Pain cognition versus pain intensity in patients with endometriosis: toward personalized treatment. *Fertility and Sterility*, *108*(4), 679–686. https://doi.org/10.1016/j.fertnstert.2017.07.016

Vlaeyen, J. W. S., & Linton, S. J. (2000). Fear-

avoidance and its consequences in chronic musculoskeletal pain: A state of the art. *Pain*, *85*(3), 317–332. https://doi.org/10.1016/S0304-3959(99)00242-0

Wagner, J.-S., DiBonaventura, M. D., Chandran, A. B., & Cappelleri, J. C. (2012). The association of sleep difficulties with health-related quality of life among patients with fibromyalgia. *BMC Musculoskeletal Disorders*, *13*(1), 199. https://doi.org/10.1186/1471-2474-13-199

Ware, J. E., Kosinski, M., & Keller, S. D. (1996). A 12-Item Short-Form Health Survey: Construction of Scales and Preliminary Tests of Reliability and Validity. *Medical Care*, *34*(3), 220–233. https://doi.org/10.1097/00005650-199603000-00003

Wei, Y., Blanken, T. F., & Van Someren, E. J. W. (2018). Insomnia really hurts: Effect of a bad night's sleep on pain increases with insomnia severity. *Frontiers in Psychiatry*, *9* (AUG), 1–8. https://doi.org/10.3389/fpsyt.2018.00377

Wicaksana, A. L., Maharani, E., & Hertanti, N. S. (2020). The Indonesian version of the Medical Outcome Survey - Short Form 12 version 2 among patients with cardiovascular diseases. *International Journal of Nursing Practice*, *26*(2). https://doi.org/10.1111/ijn.12804