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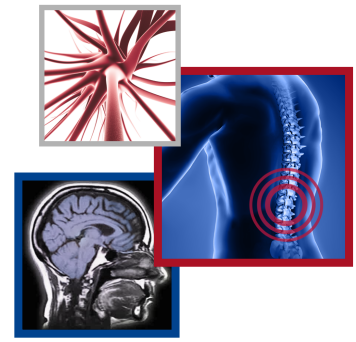

A 20-year study of the bidirectional relationship between anxious and depressive symptomology and pain medication usage

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Aim: To investigate the 20-year relationship between anxiety, depression and pain medication use. **Patients:** A total of 521 individuals reporting chronic pain from the National Survey of Midlife Development in the USA (MIDUS) study. **Methods:** Structural equation modeling of 20-year longitudinal survey data. **Results:** Over 20 years, a bidirectional relationship between depression and anxiety in individuals with chronic pain was indicated. Pain medication utilization predicted later use at 10 years. Pain medication use was not strongly related to later anxiety; however, heightened anxiety was associated with later use. **Conclusion:** Depression and anxiety show an extensive long-term bidirectional relationship. While there was little indication of a relationship between pain medication use and later negative mood, anxiety was associated with subsequent pain medication use.

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Keywords: anxiety • chronic pain • depression • opioids • pharmacological management of pain

Despite recent advances in psychiatric medications and improved access to mental health services, the prevalence rates of depressive and anxiety disorders have remained remarkably high at 16.1 and 12.3%, respectively [1]. Further, these disorders share a 59.2% comorbidity rate [2]. While previous longitudinal studies in community and young adult populations indicate negative mood may be stable over a span of a few years, this study evaluated mood stability over a longer period of time, and examined how the associated symptoms may be bidirectionally related to pain medication use in middle-aged adults experiencing chronic pain [3–5].

Data from The 2012 National Health Interview Study reveal that 11.2% of adults, approximately 25.3 million Americans, concurrently experience chronic pain, which involves having pain every day for the previous 3 months [6]. Chronic pain also has been associated with a variety of mental disorders including anxiety and depression. Indeed, the biopsychosocial model of chronic pain views this condition, which is affected by biological, psychological and social factors, as a subjective reaction to disease [7,8]. This model is theoretically supported by Melzack's Neuromatrix Theory of Pain, which proposes that pain is the result of cognitive, sensory and affective components which produce pain-related experiences and behaviors; thus, pain is not simply the result of sensory stimulation alone [9,10]. As a main line of treatment, opioid pain medications provide relief for chronic pain via psychological means by modulating attention and affect and by altering neuropharmacological processes [11]. Thus, affective components, such as anxiety, depression and emotional stress, may be significant factors in the development and maintenance of chronic pain.

Research indicates that mood may play a contributory role to the experience of pain. Heightened anxiety levels have been found to influence pain severity and tolerance [12], and continual anxiety is linked to extended experiences of pain [7]. For example, in a longitudinal study of individuals with lower extremity trauma, anxiety predicted chronic pain at 24 months [13]. Other studies reveal a role of depressive symptoms in chronic pain and pain outcomes [14]. Depression is associated with chronic pain prevalence, pain intensity and pain chronicity, but the exact nature of the relationship is still unclear [15–17]. A possible cyclical or bidirectional relationship may exist between chronic pain and depression [13,15]. Okifuji and Turk have proposed a model of the depression–pain relationship which reflects a bidirectional nature that is mediated by sense of control, self-efficacy and social support [18]. However,

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some findings support the role of depression as simply a reactive response to pain [7,19,20]. Further, anxiety may further confound depression levels in chronic pain patients, as changes in pain-related anxiety were found to predict changes in depression scores [21]. Therefore, both anxious and depressive symptoms appear to have a significant influence on the experience of chronic pain, above and beyond pain intensity.

For individuals with chronic pain, negative affect may be both an outcome and moderator of pain, and may also possibly influence opioid medication usage [22]. Multiple studies have found those with chronic pain, who have comorbid mood and anxiety disorders, have higher rates of opioid pain medication usage and may receive greater doses [22–25]. It is possible that depressive symptoms and mental health disorders may also predict extended use and inability to discontinue medications [26,27]. However, data are not conclusive [28].

It is also conceivable that prescribing patterns may reflect an indirect use of opioid medications to regulate mood or stress [29]. Some opioid-based medications have been shown to provide dose-dependent secondary mood and anxiety-regulating effects at initiation, but few long-term studies of the effects exist [29–31]. Further, depressive symptoms have been found to moderate the relationship between pain severity and increased likelihood of opioid medication use [32]. In summary, theory and research suggest negative affect may influence opioid use initiation and continuation in individuals suffering from chronic pain, possibly by alleviating psychological symptoms. If this is the case, greater emphasis on treatments for psychological symptoms should occur in those suffering with co-occurring pain.

Opioid use as a contributor to mental health outcomes

It appears that extended opioid pain medication use may affect mental health outcomes. Research conducted on chronic pain patients with osteoarthritic pain found associations between pain interference, improved mood, better sleep and higher enjoyment of life with controlled-release oxycodone use at 6, 12 and 18 months [33]. Other data indicate that extended use may not have an effect on mood or may even worsen psychological well-being [34–38]. It is possible that short-term improvements may be seen in mood and anxiety with initiation of opioid pain medication use [29]. However, extended use of opioid pain medications may cause or exacerbate depression and anxiety. There is still a need for additional research in this area as many studies were either retrospective, of small sample size, or of shorter duration; thus, further investigation is merited. Data suggest that long-term effects of opioid medication usage should reflect heightened anxiety and depression, as individuals may rely on pain medication and not develop alternative coping skills.

Current study

It seems that associations between chronic pain, opioid use and depression and anxiety are quite complex, multifaceted and bidirectional. However, a majority of the evidence supports the idea that anxious and depressive symptoms may contribute to opioid medication use above and beyond pain intensity. Additionally, short-term longitudinal studies, while limited in number, indicate that use of opioid medication may intensify levels of negative affect as duration of use increases. This study seeks to further investigate the relationship between depression, anxiety, prescription opioid use over an extended time period. Specifically, it aims to examine the role of negative affect on opioid use, and the effects of opioid use on subsequent depressive and anxious symptoms over time. Based on theory and prior research, it was hypothesized that after controlling for anxiety at baseline (Time 1), anxiety 10 years later (Time 2) would predict higher pain medication use frequency 20 years later (Time 3). Controlling for depression at Time 1, it was hypothesized that higher depression at Time 2 would predict higher pain medication use frequency at Time 3. Further, it was predicted that higher pain medication use at Time 2 would predict higher anxiety and depression at Time 3. It was also predicted that anxiety at Time 1 would predict higher anxiety at Times 2 and 3, and similarly, that depression at Time 1 would predict higher depression at Times 2 and 3. Finally, it was hypothesized that higher pain medication use at Time 2 would predict higher pain medication use at Time 3.

Methods

Participants & recruitment procedure

The participants and data for this study came from Waves 1 (1995–1996), 2 (2004–2006) and 3 (2013–2014) of the National Survey of Midlife Development in the USA (MIDUS) study, whose methodology is described in prior publications [39–41]. Use of this public dataset is exempted from the University of Tennessee's Institutional

Review Board (IRB) process. The study was originally conducted at Harvard Medical School and is now managed by the Education and Social/Behavioral Sciences and the Health Sciences IRBs at the University of Wisconsin–Madison [42]. In the current study, the sample consisted of participants who endorsed chronic pain in both Waves 2 and 3, yielding a sample size of 521. If siblings or twins were present in the sample, only data from the lower individual ID number was included. The sample was 38.8% male, 61.2% female, with average age of 47.81 years (standard deviation [SD] = 11.03) in Wave 1, 56.76 years (SD = 10.95) in Wave 2 and 65.83 years in Wave 3 (SD = 10.94). As the sample aged, the number of chronic medical conditions increased from 3.48 (SD = 2.96) in Wave 1, to 3.56 (SD = 3.00) in Wave 2, to 5.11 (SD = 4.04) in Wave 3.

Measures

In Wave 1, a structured questionnaire was verbally administered by trained interviewers to gather information on demographics, depression and anxiety [39]. In Waves 2 and 3, these questions were re-administered in a paper questionnaire format along with additional questions, including those which specifically addressed pain medication usage and presence of chronic pain [40,41]. During all waves of data collection, age at the time of the phone interview was calculated from the date of birth, and gender was also recorded.

Depression & anxiety

In all waves, depression and anxiety were assessed via phone interview using portions of the World Health Organization's Composite International Diagnostic Interview Short Form a modification of the WHO-CIDI [43,44]. This measure has shown good diagnostic capabilities and demonstrates strong psychometric properties such as test-retest reliability ($K \geq 0.68$) and concordance with clinical assessment ($K \geq 0.73$) [45,46]. To screen for depression, participants were asked if they had felt sad and blue for all or almost all of each day for most or all days during a 2-week period over the past 12 months. If they reported depressive symptoms, then they were asked if they were depressed 'all day', 'most of the day', 'half the day' or 'less than half the day' during that 2-week period. If this duration was high ('all day' or 'most of the day'), they were then asked about depression frequency (i.e., if they felt this way 'every day', 'almost every day', 'less often than that'). Those who answered 'every day' or 'almost every day' were then questioned further and asked if, during that 2-week period while they felt sad, blue or depressed, did the participant also have such symptoms as: . . . 'feel down on yourself, no good or worthless?' or 'lose interest in most things?' Total number of 'yes' responses to these questions was used to capture depression severity. Scores ranged from 0 to 7 depending on the number of symptoms reported. Those with no symptoms and those who did not answer the duration and frequency questions were given a score of 0. Variables were treated as continuous.

To screen for anxiety, individuals were first asked how much they worried in the last month in comparison with others, and answers were 'more', 'less', 'about the same', 'not at all', 'do not know', or 'refused'. Participants endorsed worry then described the frequency of worry by responding if they worried 'every day', 'just about every day', 'most days', 'about half the days', 'less than half the days', or 'do not know/not sure'. Individuals who answered they worried 'about half the days' or more also answered questions which assessed anxiety duration. Participants indicated anxiety duration by answering whether it lasted 'all day', 'most of the day', 'about half the day', or 'less than half the day'. Those who indicated a degree of worry also responded to questions measuring generalized anxiety disorder symptomology severity. They answered questions such as 'How often – over the past 12 months – you were restless because of your worry?' For each selection of 'most days', 1 point was given. Continuous total scores ranged from 0 (low or no symptoms) to 10 (highest score). Those who did not answer these questions received a 0 for this variable. Variables were treated as continuous.

Pain

Presence of chronic pain was measured during the second and third waves of the study, at 10 and almost 20 years later, respectively. During those times, participants were asked 'Do you have chronic pain, that is do you have pain that persists beyond the time of normal healing and has lasted anywhere from a few months to many years?' Those who reported suffering from pain were coded '1' for 'Yes', and others were coded '2' for 'No'. Only individuals who reported chronic pain at both time periods were included in this study.

Pain medication usage

All participants were asked if they had used prescribed pain medications within the past 30 days in Waves 2 and 3. Because separate questions assessed use of medications to treat diseases such as arthritis or migraines and

nonprescription pain medication usage, the report of pain medication usage was equated with opioid medication usage. In further support of this assumption, during the study time frame, treatment trends of those with back pain indicated that opioids were prescribed to a majority of patients [47]. Individuals who marked 'Yes' for having used pain medications also indicated frequency of use by marking either 'Daily' = 1, 'A few times week' = 2, 'Once a week' = 3, 'A few times a month' = 4 or 'Once this month' = 5. This was treated as a continuous variable.

Data analysis

Cross-lagged longitudinal structural equation modeling tested pathways between the latent variables of anxiety, depression and observed opioid use. Analyses were conducted using MPlus Version 7.2 [48]. Structural equation modeling, which allows investigation of several regression relationships simultaneously, offers several advantages as it can accommodate more complicated models, especially those which contain several dependent variables, and can incorporate chains of influence between variables [49]. First, a confirmatory factor analysis was conducted to evaluate the measurement properties of the proposed model and to establish factorial invariance of measured constructs over time. Given the high correlations (Table 1) among duration, frequency and severity at each time point, these items were used to form a latent depression variable. Similarly, a latent variable for anxiety was created due to strong correlations between anxiety duration, frequency and severity. Pain medication use was treated as an observed variable. In this sample, less than 2% of data were missing. Little's Test of Missing Completely at Random was not significant, χ^2 = 181.27, degrees of freedom (DF) = 173, p = 0.31, suggesting data were missing completely at random. Therefore, Full Information Maximum Likelihood Estimation was used to address missing data.

Four goodness-of-fit indices were used to evaluate the adequacy of the CFA and structural models: the comparative fit index, the Tucker–Lewis Index, the standardized root mean square residual, and the root mean square error of approximation. Values equal to, or greater than 0.90 for the comparative fit index and Tucker–Lewis Index, and values at or lower than 0.08 for the root mean square error of approximation and standardized root mean square residual, were considered indicators of acceptable model fit [50–53].

Results

For the CFA model, configural, weak and strong invariance was established (Table 2). In the structural model, the paths from depression at Time 2 to pain medication use at Time 3 (β = 0.00, standard error [SE] = 0.05) and from pain medication use at Time 2 to anxiety (β = 0.03, SE = 0.04) and depression at Time 3 (β = 0.08, SE = 0.04) were not significant and neither was the path from anxiety at Time 1 to pain medication use at Time 2 (β = 0.05, SE = 0.05). In addition, correlations between depression at Time 3, anxiety at Time 3 and pain medication use at Time 3 were not significant. Covariates of age and number of chronic conditions did not contribute significantly to the model, and were excluded from the final model. The nonsignificant regression paths and within time point correlations were removed from the final structural model. That model is depicted in Figure 1.

Results from our final path model supported the stability of anxiety, depression and pain medication use over time. Anxiety at Time 1 predicted anxiety at Time 2 (β = 0.37, p < 0.001), and anxiety at Time 2 predicted anxiety at Time 3 (β = 0.37, p < 0.001). Depression at Time 1 predicted depression at Time 2 (β = 0.26, p < 0.001), and depression at Time 2 predicted depression at Time 3 (β = 0.20, p < 0.001). Pain medication use at Time 2 predicted pain medication use at Time 3 (β = 0.39, p = 0.01). In addition, model results revealed that, after controlling for anxiety at baseline, higher anxiety at Time 2 predicted higher pain medication use 10 years later at Time 3, (β = 0.09, p = 0.05) (Table 3). However, depression at Time 2 did not emerge as a longitudinal predictor of pain medication use at Time 3, and pain med use at Time 2 did not predict anxiety or depression at Time 3. Within time point, correlations between depression and pain medication use at Time 3 and anxiety and pain medication use at Time 3 were also not significant.

Consistent with the findings from our previous model, we found evidence to support the stability of anxiety, depression and pain medication use over time (see Table 3 & Figure 1). In addition, depression at Time 1 emerged as a positive predictor of pain medication use at Time 2 (β = 0.12, p = 0.01). We also found evidence to support a positive bidirectional relationship between depression and anxiety over time. Depression at Time 1 significantly predicted anxiety at Time 2 (β = 0.13, p = 0.01), and depression at Time 2 predicted anxiety at Time 3 (β = 0.13, p = 0.01). Similarly, anxiety at Time 1 predicted depression at Time 2 (β = 0.14, p = 0.002), and depression at Time 3 was predicted by anxiety at Time 2 (β = 0.17, p < 0.001).

Table 1. Means, standard deviations and correlations.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Depression duration, Time 1	1																			
Depression duration, Time 2	0.35†	1																		
Depression duration, Time 3	0.32†	0.34†	1																	
Depression frequency, Time 1	0.88†	0.28†	0.29†	1																
Depression frequency, Time 2	0.32†	0.88†	0.30†	0.30†	1															
Depression frequency, Time 3	0.29†	0.26†	0.88†	0.28†	0.25†	1														
Depression severity, Time 1	0.84†	0.31†	0.28†	0.93†	0.32†	.28†	1													
Depression severity, Time 2	0.33†	0.83†	0.34†	0.31†	0.94†	0.29†	0.35†	1												
Depression severity, Time 3	0.31†	0.33†	0.85†	0.30†	0.33†	0.95†	0.32†	0.37†	1											
Anxiety duration, Time 1	0.42†	0.27†	0.20†	0.39†	0.25†	0.19†	0.42†	0.24†	0.20†	1										
Anxiety duration, Time 2	0.27†	0.41†	0.23†	0.24†	0.39†	0.23†	0.30†	0.40†	0.27†	0.31†	1									
Anxiety duration, Time 3	0.31†	0.34†	0.48†	0.26†	0.29†	0.44†	0.25†	0.32†	0.44†	0.32†	0.32†	1								
Anxiety frequency, Time 1	0.33†	0.22†	0.17†	0.28†	0.20†	0.17†	0.31†	0.19†	0.19†	0.78†	0.33†	0.25†	1							
Anxiety frequency, Time 2	0.20†	0.37†	0.19†	0.19†	0.36†	0.20†	0.22†	0.37†	0.23†	0.33†	0.76†	0.29†	0.37†	1						
Anxiety frequency, Time 3	0.28†	0.29†	0.38†	0.25†	0.22†	0.34†	0.24†	0.24†	0.36†	0.34†	0.34†	0.82†	0.30†	0.37†	1					
Anxiety severity, Time 1	0.35†	0.16†	0.21†	0.24†	0.18†	0.25†	0.39†	0.17†	0.27†	0.50†	0.27†	0.23†	0.47†	0.23†	0.22†	1				
Anxiety severity, Time 2	0.19†	0.27†	0.28†	0.21†	0.30†	0.29†	0.23†	0.37†	0.34†	0.19†	0.42†	0.26†	0.15†	0.38†	0.25†	0.38†	1			
Anxiety severity, Time 3	0.21†	0.26†	0.37†	0.22†	0.28†	0.38†	0.24†	0.32†	0.44†	0.29†	0.25†	0.45†	0.26†	0.25†	0.41†	0.43†	0.57†	1		
Pain med use, Time 1	0.15†	0.20†	0.15†	0.11‡	0.17†	0.13†	0.13†	0.16†	0.16‡	0.08	0.13†	0.09‡	0.08	0.09‡	0.10‡	0.05	0.11†	0.10‡	1	
Pain med use, Time 2	0.19†	0.13†	0.09	0.15†	0.10‡	0.08	0.14†	0.10‡	0.10‡	0.11‡	0.13†	0.12‡	0.10‡	0.08	0.05	0.40†	0.09	0.06	0.02	1
Mean (SD)	0.93 (1.44)	0.76 (1.33)	0.78 (1.35)	0.49 (1.01)	0.38 (.90)	0.10 (.93)	1.07 (2.27)	0.81 (2.03)	0.92 (2.18)	0.67 (1.04)	0.62 (.99)	0.61 (1.04)	1.86 (1.36)	1.82 (1.33)	1.74 (1.26)	0.36 (1.43)	0.23 (1.24)	0.29 (1.35)	1.80 (2.21)	2.60 (2.21)

†Correlation is significant at the 0.01 level (two-tailed).
‡Correlation is significant at the 0.05 level (two-tailed).
SD: Standard deviation.

Table 2. Fit indices of structural equation models of depression, anxiety and pain medication use in individuals reporting chronic pain at times 2 and 3 (n = 521).

Model type	X^2	df	p-value	RMSEA (95% CI)	SRMR	CFI	TLI
Configural invariance	402.12	126	<0.001	0.07 (0.06–0.07)	0.06	0.97	0.95
Weak invariance	424.87	134	<0.001	0.07 (0.06–0.07)	0.06	0.97	0.95
Strong invariance	482.93	143	<0.001	0.07 (0.06–0.07)	0.07	0.96	0.95
Initial structural	470.58	140	<0.001	0.07 (0.06–0.07)	0.08	0.96	0.95
Final structural	471.98	143	<0.001	0.07 (0.06–0.07)	0.08	0.96	0.95

CFI: Comparative fit index; CI: Confidence interval; df: Degrees of freedom; RMSEA: Root mean square error of approximation; SRMR: Standardized root mean square residual; TLI: Tucker–Lewis Index.

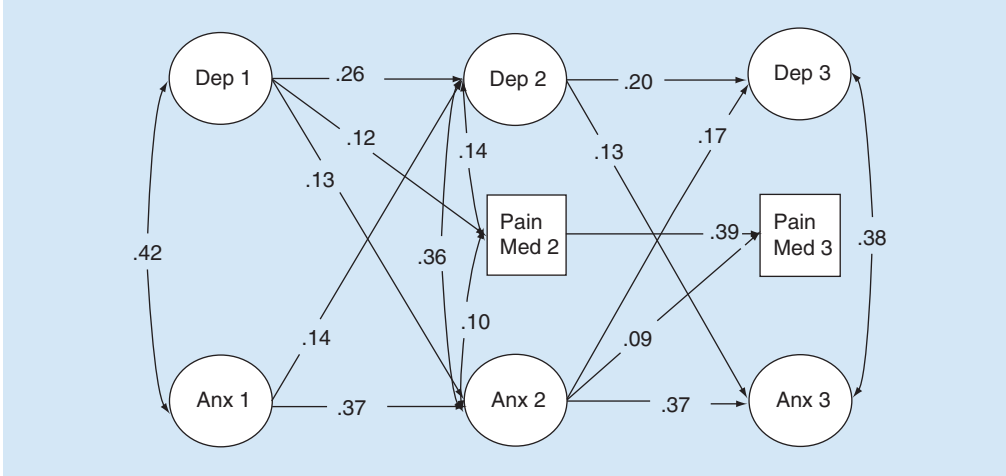

Figure 1. Standardized structural equation modeling results of cross-lagged model demonstrating the temporal relationship between anxiety, depression and pain medication use.
Anx: Anxiety; Dep: Depression; Med: Medication.

Table 3. Final structural model regression results (final pruned model).

Outcome	Predictor	β	SE	p-value
Pain med use Time 2	Depression Time 1	0.12	0.11	0.01
Pain med use Time 3	Anxiety Time 2	0.09	0.04	0.05
	Pain med use Time 2	0.39	0.04	0.01
Depression Time 2	Depression Time 1	0.26	0.04	0.00
	Anxiety Time 1	0.14	0.05	0.00
Depression Time 3	Depression Time 2	0.20	0.05	0.00
	Anxiety Time 2	0.17	0.05	0.00
Anxiety Time 2	Depression Time 1	0.13	0.05	0.01
	Anxiety Time 1	0.37	0.05	0.00
Anxiety Time 3	Depression Time 2	0.13	0.05	0.01
	Anxiety Time 2	0.37	0.06	0.00

SE: Standard error.

Discussion

Utilizing data from a representative sample of middle-aged residents of the USA who experience chronic pain, the current study tested the temporal relationship between pain medication use, depression and anxiety in individuals with chronic pain over a period of 20 years, expanding previous research studies which looked at these relationships using cross-sectional or short-term longitudinal data. A significant relationship was found between pain medication use at baseline and 10 years later, as results showed that early pain medication use predicted continued use at

10 years, even if the effects of age and number of chronic conditions were considered. This may reflect the challenge of discontinuing long-term medication interventions, and likely manifests the prior historical trend of long-term opioid prescribing [54]. As the current study incorporated data through 2014, when heightened awareness of long-term opioid use risk was of growing concern and alternative treatments were being more intently explored, it still appears that many sufferers of chronic pain were having difficulty discontinuing opioid medication use for pain.

Importantly, over a period of approximately 20 years, a robust relationship was found between anxiety and depression. It appears that anxiety and depression have a long-term bidirectional relationship in chronic pain patients, similar to findings of a previous 4-year study [55]. As predicted, anxiety at baseline predicted anxiety at 10 and 20 years. Similar results were found for depression, although these results were not as strong. This implies that negative affect, specifically depression and anxiety, may have trait-like stability in chronic pain sufferers, replicating findings in community samples [4]. While not hypothesized *a priori*, strong bidirectional predictive effects were also found between anxiety and depression over time. This indicates stability of mood disorders, and moreover, their overlap suggests that certain common etiological factors such as genetic or social influences may exist and should be further examined. These results indicate that individuals who have chronic pain should be regularly monitored for anxiety and depression concurrently, and that specific treatments for mood disorders might demonstrate superior efficacy for improvement of anxiety and depression, despite co-occurring changes in chronic pain levels. This finding supplements a review of nonpharmacological interventions for pain associated with spinal cord injury, which found inconclusive results for the efficacy of pain treatment effects on mood [56]. However, there is promise that appropriate physical activity may improve mood and chronic pain [57]. A comparison study examining the long-term effects of psychological interventions and physical activity for mood disorders is warranted in this population.

Despite predictions, results did not support a major role of pain medication use on long-term depression or anxiety. While there was a minor effect of reported depression in the first wave on pain medication use in the second wave, and of reported anxiety in the second wave on pain medication use in the third wave, values were small, indicating that other factors must contribute more significantly to pain medication usage trends. These findings, while not predicted, appear to support a prior study which found no positive effect of internalizing distress on pain medication usage, and to dispute studies which have found a positive relationship between negative affect and pain medication usage [35,37,38,58].

There are several possible reasons for these findings. Some studies examined different populations. One study was also from a large sample and covered over 10 years, but it screened out individuals with a prior diagnosis of depression and only examined those individuals just beginning an opioid pain management regimen [37]. It is possible that those individuals with no prior diagnosis and who are naive to pain medication may represent a specific subpopulation, that may experience different temporal changes associated with mood. Further, another study sample contained individuals being treated in a pain management hospital, and not the general population [35]. These individuals are likely to have higher pain and disease severity, possibly yielding a different prognosis. Finally, our study utilized structural equation modeling as opposed to the Smith *et al.* study which utilized multivariate logistical regressions to examine group differences [38]. Structural equation modeling allows evaluation of multiple relationships at once as opposed to sequentially, and incorporates measurement error into the model itself [59].

A clinical implication is that providers may benefit from monitoring patients with chronic pain for depression and anxiety, and should not expect a positive association between improvement in pain intensity and mood. Further, depression and anxiety are not strongly related to long-term pain medication use. Thus, results suggest that reported mood symptoms may alternate between a more anxious or depressive slant over time, and may be very difficult to resolve due to their trait-like quality. This is significant as negative mood has been linked to difficulty maintaining some treatment regimens such as utilization of physical activity, which is helpful in reducing chronic pain [57]. Due to these findings, separate but concurrent treatment of mood disorders is indicated.

Several limitations exist that may impact validity and reliability. Assessment of depression and anxiety were based upon unvalidated short versions of previously validated scales and relied on retrospective reporting. However, the variables used were consistent with the definitions and meanings attributed to the constructs in the literature. Additionally, chronic pain was not measured during the first wave of the study. This model also cannot account for changes in prescribing trends which may have occurred over the past 20 years due to modified prescribing recommendations and medication development and availability. Further, the attrition rate for the entire study was 46% over this 20-year time frame. If third wave attrition trends were similar to the second, individuals who continued to participate were more likely to be white, female, married, and have better overall health and more

education, and this may limit generalizability [60]. In addition, as the sample consisted of residents of the USA, results may not generalize to the international population. Finally, concurrent use of antidepressants or anxiolytics or other mental health treatments was not considered. Further research may want to study the impact of additional medications.

Despite these limitations, the findings of this study highlight the trait-like qualities of negative mood in a chronic pain population utilizing a pain medication regimen. Over a period of 20 years, the results showed that anxiety and depression were relatively stable over time. In addition, they also showed that pain medication use does not appear to have a significant effect on depression or anxiety. Thus, while interventions targeting negative affect are relevant for individuals with chronic pain, it does not appear that these will indirectly also impact long-term pain medication use.

Conclusion

This study found that negative mood, specifically depressive and anxious symptoms, demonstrate trait-like stability over a period of 20 years in adults with chronic pain. However, symptoms may shift over time, possibly reflecting a bidirectional relationship. Further, utilization of pain medication predicts use 10 years later. While previous research indicated a potential association between negative mood and pain medication use, our study found this relationship was very limited as only anxious symptoms predicted pain medication use at 10 years. Therefore, in treating individuals with long-term chronic pain, interventions that focus on managing appropriate use of pain medication when coupled with separate treatments targeting negative affect may prove more efficacious.

Summary points

- A 20-year relationship between anxiety, depression and pain medication was evaluated.
- Structural equation modeling of 20-year longitudinal survey data using a subset of the National Survey of Midlife Development in the USA (MIDUS) study was conducted.
- A bidirectional relationship between depression and anxiety in individuals with chronic pain was indicated.
- Pain medication use predicted subsequent use at 10 years.
- Elevated anxious symptoms were associated with later pain medication use.
- Trait like qualities of negative mood were demonstrated.
- Pain medication use showed no significant relationship to later depressive or anxious symptomology.

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