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Chronic pain disrupts ability to work by interfering with social function: A cross-sectional study

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HIGHLIGHTS

- Social factors are now recognized to play an important role in chronic pain.
- In a chronic pain survey, interference with social function affected work ability.
- Social function was more significant than pain intensity rating in ability to work.
- Pain interventions targeting social function may improve the ability to work.

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ABSTRACT

Background and aims: Some 100 million adults in the United States suffer from chronic pain. While research to date has focused primarily on pain interference with physical and psychological function and its effects on employment, few studies have examined the impact of pain interference on social functioning and its effects on employment. The aims of our study were to (1) evaluate the association between pain interference with ability to work and actual employment status among working age adults with chronic pain; and (2) evaluate pain interference with four types of functioning – cognitive, physical, psychological, and social – as possible mediators of pain interference with the ability to work.
Methods: Data were collected via a self-selected sample of individuals visiting the American Chronic Pain Association (ACPA) website. The final dataset included 966 respondents. We examined the association between pain interference with the ability to work and employment in a population with chronic pain. We then analyzed pain interference with four types of functioning, physical, psychological, cognitive, and social, for their impact on the ability to work.
Results: Pain interference with ability to work was significantly inversely associated with employment status, i.e., the less that pain interfered with one's ability to work, the greater the likelihood of being employed. Moreover, pain interference with ability to work was a stronger predictor of employment status than an individual's rating of their pain intensity. Pain interference with social functioning partially mediated the effects of pain interference with cognitive and physical functioning and fully mediated the effects of pain intensity and pain interference with psychological functioning on pain interference with the ability to work. Results suggest that pain interference with social function may be a significant contributor to pain interference with ability to work in working age adults with chronic pain.

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Conclusions: In the development of effective solutions to address the economic and societal burden of chronic pain, this paper highlights the role of social function as an important, yet frequently overlooked, contributor to chronic pain's effect on the ability to work. Our findings underscore the importance of an integrated biopsychosocial approach to managing chronic pain, especially when addressing ability to work. From a clinical standpoint, assessing and managing pain intensity is necessary but not sufficient in addressing the far-reaching negative consequences of chronic pain.
Implications: The development of interventions that improve social function may improve the ability to work in adults with chronic pain. Likewise, sick leave should be prescribed restrictively in the management of chronic pain since it may further interfere with social functioning.
Perspective: This study highlights the importance of the assessment of pain interference with social function as a part of a comprehensive biopsychosocial approach to the evaluation and management of patients with chronic pain. Interventions that improve social function may improve the ability to work in this population. In addition, sick leave should be prescribed restrictively in the management of chronic pain since it by itself interferes with social functioning.

1. Introduction

Chronic pain is recognized as a critical public health challenge [1,2]. The treatment of chronic pain is complex, and is further complicated by the risks associated with opioids, which are one of the most commonly prescribed pharmacologic interventions for pain [3]. The burgeoning epidemic of opioid abuse and overdose in the United States and the push for federal legislation to appropriate new funding to address these problems [4] underscores the importance of understanding this public health challenge. Yet effective solutions to the enormous economic and societal burden that is created by chronic pain continue to be elusive. Some 100 million adults in the United States suffer from chronic pain due to common medical illnesses [1], and chronic pain has a deleterious impact on many areas of personal and professional functioning, including the ability to work [2,5,6].

The ability to work is not only influenced by physical function, but also psychological, cognitive, and social functioning, all of which are affected by pain [7]. This effect of pain on function, or "pain interference", has gained increasing interest recently, and measuring aspects of both pain intensity and pain interference may provide a more comprehensive view of the overall "pain experience" [8]. However, research to date has focused primarily on pain interference with physical and psychological function and resulting effects on employment, while few studies have examined the impact of pain interference on social functioning and employment [2,6]. Pain interference with social function has been measured utilizing patient-reported outcomes that assess both the ability of an individual to participate in everyday relationships and activities as well as the degree of satisfaction with the level of participation [6,2].

While chronic pain is caused by a complex interplay of biopsychosocial factors, social factors are now increasingly recognized to play a more important role than previously understood [9]. Social factors appear to impact an individual's experience of chronic pain. For instance, in patients with low back pain, social factors were found to be important contributors to the overall level of distress experienced [10,11]. Additionally, neuroscience has provided some insights into the possible role of shared neural pathways for both physical and social pain by examining pain pathways associated with social loss [12,13]. Based on these links between pain and social factors, the impact of pain interference on employment may be significantly mediated by altered social function associated with pain. Our principal goal was to explore this connection between social function and pain interference with employment further.

We examined pain interference with four types of functioning – physical, psychological, cognitive, and social – and their impact on the ability to work in a population with chronic pain. The aims of this study were to (1) evaluate the association between pain interference with ability to work and actual employment among working age adults with chronic pain; and (2) evaluate pain interference with four types of functioning – cognitive, physical, psychological, and social – as possible mediators of pain interference with the ability to work. We hypothesized that pain intensity and duration of pain would be major determinants of employment. We also hypothesized that pain interference with all four types of functioning – physical, psychological, cognitive, and social – would correlate with the individual's self-rated ability to work. Furthermore, we predicted that pain interference with social functioning would be the strongest predictor of pain's interference with ability to work.

2. Methods

This study is based on secondary data analysis of a publicly available dataset [14]. Data were collected via a self-selected sample of individuals visiting the American Chronic Pain Association (ACPA) website. Between August 2007 and February 2008, participants responded to the website-based survey that included items eliciting demographic information and chronic pain history [14]. Eligibility criteria stipulated that the respondents must be 21 years of age or older with at least one chronic pain condition for a duration of at least three months prior to taking the survey. Those who met these criteria completed an online informed consent form prior to beginning the survey. The Michigan State University Office of Regulatory Affairs and Human Research Protection Programs has determined this project to be IRB exempt.

Chronic pain. Respondents were asked to report how long they had experienced chronic pain, how long they had been treated by a physician for their chronic pain, and the type of chronic pain conditions they currently had (migraine, rheumatoid arthritis, osteoarthritis, cancer pain, low back pain, neck pain, fibromyalgia, other neurological pain, and other pain). They were also asked to rate their pain level by selecting the one number that best described their pain on average (0 = no pain to 10 = the worst pain).

Pain interference. The Patient-Reported Outcomes Measurement Information System (PROMIS) pain interference scale consists of 47 questions with a one (not at all/never) to five (very much/always) response scale. The questions focus on the extent to which pain interfered with various thoughts and activities in the past 7 days [15]. Items were submitted to a principal components factor analysis with varimax rotation. After examining factor loadings, items that did not cross-load and had a factor loading of greater than .60 were retained and configured into subscales [16]. *Pain Interference with Physical Functioning* resulted in 3 separate subscales, sitting, standing, and day to day activities. Only the "sitting" subscale was selected to represent Pain Interference with Physical Functioning in the following analyses, as it represented the most severe

impairment. This subscale consists of 3 items (i.e., sitting for more than 1 h; sitting for more than 30 min; sitting for more than 10 min; Cronbach's $\alpha = .890$). *Pain Interference with Cognitive Functioning* consisted of 3 items (i.e., ability to remember things; ability to take in new information; ability to concentrate; Cronbach's $\alpha = .855$). *Pain Interference with Psychological Functioning* consisted of 8 items (i.e., make you feel depressed; make you feel discouraged; worry about pain; distressing; emotionally tense; feel anxious; irritable; feel like a burden to you; Cronbach's $\alpha = .895$). *Pain Interference with Social Functioning* consisted of 7 items (difficult for you to plan social activities; ability to participate in social activities; your enjoyment of social activities; keep you from socializing with others; hard to plan social activities; restrict your social life to your home; avoid social activities; Cronbach's $\alpha = .937$). Scales were created by summing the raw score, multiplying by the number of items, and dividing by the number of items that were actually answered. The raw scale scores were then standardized by conversion into *t*-scores [16].

Employment. Respondents were classified as unemployed if they reported that they currently were unemployed, disabled, retired, or on a leave of absence. Those who reported that they were students, part-time employed, or full-time employed were classified as employed. Additionally, a single item from the PROMIS Pain Interference scale (0 = not at all; 5 = very much) was used to assess the extent to which pain interfered with the respondents' ability to work: "In the past 7 days, how much did pain interfere with your ability to work (include work at home)?"

3. Data analysis

A series of univariate analyses of variance tests were performed to examine differences in chronic pain characteristics between respondents based on demographics (Gender: male, female; Marital Status: not married, married; Education: high school or less, some college, college or greater; Occupation: unemployed, employed).

Aim 1: An ordered logistic regression was employed as a method of testing the extent to which variation in pain interference with ability to work accounted for the variation in employment above and beyond respondents' pain rating. In the first step, age, length of time experiencing pain, length of time in treatment, and the number of pain conditions reported were entered into the model. In the second step, pain rating was entered. In the third and final step, pain interference with ability to work was entered.

Aim 2: A hierarchical linear regression was performed to determine the extent to which the different types of pain interference predicted the relationship between pain rating and ability to work. In the first step, age, length of time experiencing pain, length of time in treatment, and the number of pain conditions reported were entered into the model. In the second step, pain rating was entered. In the third step, pain interference with cognitive functioning, physical functioning, and psychological functioning were entered into the model. In the fourth and final step, pain interference with social functioning was entered. This last independent variable was entered separately because we hypothesized that it would be the strongest predictor of pain interference with work among all the function variables.

The *p*-value for significant findings was set at a two-sided $p \leq .05$. All analyses were conducted using SPSS 23 (IBM Corp., Armonk, NY).

4. Results

Subjects: The full dataset included 966 respondents between the ages of 21–96 (Mean [*M*] = 48.19, Standard Deviation [SD] = 11.06). Considering our interest in working age adults, only those who were younger than 62 years of age who had provided complete data were included. The final study sample consisted of 598 respondents between the ages of 22–61 ($M = 46.03$, SD = 9.08). Table 1 summarizes characteristics of the study populations.

The majority identified as female (82.3%) and non-Hispanic white (92.6%;). The most frequently identified pain conditions were low back pain (55.2%), neck pain (47%), and fibromyalgia (37.1%). On average, respondents reported 2.57 pain conditions. Slightly more than half (51.8%) of respondents were employed. There were no significant differences in number of chronic conditions, length of time (years) experiencing pain, or length of time (years) in treatment stratified by gender, marital status, or education. However, respondents who were unemployed ($M = 2.71$, Standard Error [SE] = 0.07) reported significantly more pain conditions than those who were employed ($M = 2.33$, SE = 0.11; $F(F\,statistic)(1, 596) = 9.06$, $p = .003$). Unemployed respondents ($M = 10.39$ years, SE = 0.62) had also experienced pain for a longer time than employed respondents ($M = 7.88$ years, SE = 0.93; $F(1, 596) = 5.00$, $p = .026$). The length of time in treatment was also significantly higher among unemployed respondents ($M = 8.01$ years, SE = 0.49) than those who were employed ($M = 5.67$ years, SE = 0.74; $F(1, 596) = 7.03$, $p = .008$).

Aim 1: Table 2 summarizes the results of the logistic regression detailing factors associated with employment.

In all three steps, age (B [unstandardized Beta] = −.036, $p < .001$), length of time in pain treatment ($B = -.042$, $p = .034$), and number of pain conditions ($B = -.329$, $p = .001$) were each significantly inversely associated with employment. Pain rating, entered in the second step, was also significantly inversely associated with

Table 1
Demographics and description of the sample ($n = 598$).

Variable	Number (*n*) (%)	*M* (SD)
Gender		
Male	103 (17.3)	
Female	492 (82.7)	
Race/Ethnicity		
Non-Hispanic	573 (97.3)	
White	554 (92.6)	
Black	10 (1.7)	
Asian	4 (0.7)	
Native American	5 (0.8)	
Hispanic/Latino	24 (4.0)	
Other/No Response	1 (0.2)	
Education		
High School or less	108 (18.1)	
Some college	296 (49.5)	
College or greater	194 (32.4)	
Relationship Status		
Not married	242 (40.5)	
Married	354 (59.2)	
Occupation		
Not employed	288 (48.2)	
Unemployed	44 (7.4)	
Disabled	244 (40.8)	
Employed	310 (51.8)	
Student	17 (2.8)	
Employed part-time	53 (8.9)	
Employed full-time	240 (40.1)	
Chronic Pain Condition		
Migraine	143 (23.9)	
Rheumatoid arthritis	34 (5.7)	
Osteoarthritis	104 (17.4)	
Cancer pain	2 (0.3)	
Low back pain	330 (55.2)	
Neck pain	281 (47.0)	
Fibromyalgia	233 (39.0)	
Other neurological pain	222 (37.1)	
Other pain	185 (30.9)	
# of Conditions		2.57 (0.91)
Age		46.03 (9.08)
Pain Time (years)		7.18 (6.35)
Treatment Time (years)		6.61 (1.51)

Table 2
Summary of ordered logistic regression analysis for variables associated with employment ($n = 598$).

Variable	Step 1			Step 2			Step 3		
	B[a]	SE B[b]	OR[c]	B	SE B	OR	B	SE B	OR
Age	−.036***	.010	.964	−.035***	.010	.966	−.038***	.011	.963
Pain Time	.012	.015	1.012	.016	.016	1.016	.029	.017	1.029
Treatment Time	−.042*	.020	.959	−.046*	.020	.955	−.060**	.022	.942
# of Conditions	−.329***	.098	.720	−.324***	.099	.723	−.251*	.112	.778
Pain Rating				−.202***	.058	.817	−.004	.068	.996
Pain Interference w/ Ability to Work							−1.482***	.146	.227
Nagelkerke R^2	.088			.113			.387		
χ^2 for step	18.47*			12.46***			152.10***		

[a] Beta.
[b] Standard Error Beta.
[c] Odds ratio.
* $p \leq .05$.
** $p \leq .01$.
*** $p \leq .00$.

employment ($B = -.202$, $p = .001$) in that the lower the pain rating the more likely the respondent would be employed. In the third and final step, pain interference with ability to work was significantly inversely associated with employment ($B = -1.48$, $p < .001$), i.e., the less that pain interfered with the respondent's ability to work, the greater the likelihood of being employed. Of note, pain rating was no longer significant in the final step, indicating that pain interference with one's ability to work fully mediated the effects of the respondents' pain rating on employment. Based on Nagelkerke R^2, the final step explained approximately 39% of the overall variance in employment status, compared to 11% explained by step 2.

Aim 2: Results of the linear regression analysis examining predictors of pain interference with ability to work are summarized in Table 3.

The number of pain conditions reported was a significant predictor of pain interference with work in step 1 and remained significant in step 2, along with pain rating. In the third step, all three pain interference scales were significant in that the greater the pain interference with cognitive functioning, physical functioning, and psychological functioning, the greater the pain interference with ability to work. Pain rating remained a significant predictor, however, the number of pain conditions reported was no longer significant in step 3. In the final step, the only significant predictors of ability to work were pain interference with cognitive, physical, and social functioning. Pain rating did not remain a significant predictor when the functioning variables were entered into the model, and pain interference with psychological functioning was no longer significant in the final step. The greater the pain interference with social functioning (β [standardized Beta] = .444, $p < .001$), the greater the pain interference with ability to work. Pain interference with social functioning partially mediated the effects of pain interference with cognitive and physical functioning and fully mediated the effects of pain rating and pain interference with psychological functioning on pain interference with the ability to work. The final step explained approximately 38% of the overall variance in pain interference with ability to work, compared to 28% explained by step 3 and 10% explained by step 2.

5. Discussion

The primary aim of this study was to evaluate the association between pain interference with the ability to work and actual employment among working age adults with chronic pain. A secondary aim was to assess pain interference with four types of functioning – cognitive, physical, psychological, and social – as possible predictors of pain interference with the ability to work. For the primary aim, our hypothesis was that pain rating and duration of pain would be the factors most strongly associated with employment. Results partially supported that hypothesis, with shorter treatment time significantly associated with likelihood of being employed. The number of pain conditions was also inversely associated with employment, i.e. persons with fewer pain conditions were more likely to be employed. However, pain rating – a measure of pain intensity – while initially significant in our model, was

Table 3
Summary of hierarchical linear regression analysis for variables predicting extent pain interferes with ability to work ($n = 598$).

Variable	Step 1			Step 2			Step 3			Step 4		
	B[a]	SE B[c]	β[b]	B[a]	SE B	β[b]	B[a]	SE B	β[b]	B[a]	SE B	β[b]
Age	.005	.004	.048	.003	.004	.033	.004	.004	.037	.004	.004	.036
Pain Time	.011	.007	.094	.008	.007	.069	.007	.006	.062	.009	.006	.073
Treatment Time	−.007	.009	−.046	−.005	.009	−.032	.002	.008	.012	−.003	.007	−.021
# of Conditions	.136	.044	.129**	.124	.042	.119**	.024	.039	.023	.014	.036	.014
Pain Rating				.174	.025	.278***	.056	.024	.089*	.024	.023	.039
Pain Interference w/ Cog. Functioning							.028	.004	.292***	.016	.004	.164***
Pain Interference w/ Phys. Functioning							.016	.004	.169***	.007	.004	.078*
Pain Interference w/ Psych. Functioning							.013	.004	.137**	.000	.004	.000
Pain Interference w/ Social Functioning										.044	.004	.444***
R^2	.028			.104			.278			.381		
F for change in R^2	4.214**			50.456***			50.705***			98.637***		

[a] Unstandardized Beta.
[b] Standardized Beta.
[c] Standard Error Beta.
* $p \leq .05$.
** $p \leq .01$.
*** $p \leq .001$.

no longer significant when pain interference with ability to work was added to the model. These results informed our secondary aim focusing on studying specific aspects of pain interference with the ability to work. Results supported our hypothesis, that pain interference with social functioning was the strongest predictor of pain's effect on the ability to work.

Pain interference with social function is thus a significant factor in an individuals' ability to work. Although the manner in which this occurs is most likely multifactorial, a number of specific reasons are proposed. First, the loss of employment often results in a loss of social identity for many individuals [7,17]. Work may be one of the most important activities in the lives of many employed individuals [17]. Since work may give meaning both personally and professionally, the loss of employment inevitably involves the loss of social relationships and support [7,17]. In addition, chronic pain itself further negatively impacts social functioning by limiting physical ability to participate in normal daily activities [2]. This overall decline in functioning due to a loss of the ability to engage in daily activities including social functioning directly affects the health-related quality of life for individuals with chronic pain [2].

We did not have data on how patients had been treated for their pain or the proportion of study participants using opioids. However, the widespread use of opioids in the management of chronic pain may likewise play a deleterious role in social functioning. The role of the μ opioid receptor in animal social behaviors has been demonstrated in a number of studies [18]. A link between impaired social behaviors in animals and the level of endogenous opioids is elucidated by the Brain Opioid Theory of Social Attachment (BOTSA) [18]. The underlying premise of BOTSA is supported by the observed decrease in opioid receptor tone when social attachments are removed resulting in an increase in the level of experienced distress [18]. Although these animal studies demonstrate an increase in animal social behaviors with the use of low dose opioids in an acute setting, the use of moderate to high dose μ opioid receptor agonists in the same setting have demonstrated a decrease in social behaviors [18]. Similarly, animals that were chronically administered low dose μ opioid receptor agonists showed a similar decrease in social behaviors [18]. Analogous observations have been observed in humans who are enrolled in opioid maintenance clinics [18]. The long term administration of low dose opioid agonists, as seen in opioid maintenance clinics, appears to produce a similar loss of social attachment [18]. This may provide additional insight into the loss of social function in chronic pain patients particularly when the ongoing use of opioids is a key part of the management.

Our findings underscore the importance of an integrated biopsychosocial approach to managing chronic pain, especially when addressing ability to work. It is well established that pain is not merely a biological phenomenon, and that biomedical approaches alone are ineffective when addressing chronic pain [1]. Our findings show that focusing on assessing and managing pain intensity is necessary, but not sufficient, to appropriately address the negative consequences of chronic pain.

All of the study participants reported substantial time in treatment for their pain: a mean of over 5 years for those who were employed and a mean of 8 years for those unemployed. This speaks to the chronic nature of their pain conditions. When evaluating patients with chronic pain, more attention on the assessment of pain interference with social function may be valuable. Moreover, interventions that improve social function may improve the ability to work. This approach is supported by the reported effectiveness of applying cognitive behavior therapy, acceptance and commitment therapy, and multimodal therapy in addressing recalcitrant pain and return to work [19]. Moreover, one of the few prospective randomized studies of early return-to-work interventions in employees with chronic pain supports the focus on addressing pain interference with social, cognitive, and physical functioning, rather than pain only [20].

One of the limitations of our study is that the population evaluated was primarily female and white. In addition, the study participants represented self-selected individuals that accessed the American Chronic Pain Association website. Although our data may not be representative of all people with chronic pain, the pain conditions represented by participants match the most common pain conditions in the American population. We also did not measure progress over time. Although the survey data was collected in 2007 and 2008, there is little reason to believe findings would differ from more recently collected data. Furthermore, to the best of our knowledge, there has been no prior work applying our multimodal approach to study chronic pain and its interference with the ability to work and actual employment.

Areas for further research might include evaluating objective measure of ability to work, such as functional capacity evaluations, in addition to patients' self-reported or actual employment status. Research evaluating patients' progress over time would also help to better understand the mechanisms by which social factors interfere with the ability to work. Ultimately, a greater understanding may lead to the development of interventions targeting social interference and its impact on the ability to work, and, ultimately, employment.

6. Conclusion

This study demonstrates that pain interference with social function is a significant contributor to pain interference with ability to work in working age patients with chronic pain. In this particular population of adults with chronic pain, pain interference with social function impacted the ability to work more than pain interference with cognitive or physical function. Interestingly, pain rating, which is routinely assessed in the management of chronic pain, did not significantly impact patients' ability to work once pain interference with function was added to the model in our study. In the development of effective solutions to address the economic and societal burden of chronic pain, this paper highlights the role of social function as an important, yet frequently overlooked, contributor to chronic pain's effect on the ability to work. Health care providers should also carefully consider the utility of prescribing sick leave to patients with chronic pain conditions since it may interfere with social functioning, and thus might exacerbate the effects on perceived ability to work and actual employment [20].

It is becoming increasingly clear that pain interference with social function is an important area for all health care providers to routinely assess in their patients with chronic pain. Health care providers who manage chronic pain are well-positioned to collaborate with their patients in the development of a comprehensive approach to the management of chronic pain which addresses all aspects of the biopsychosocial model, and focusing on social factors may be an effective starting point.

Ethical issues

The Michigan State University Office of Regulatory Affairs and Human Research Protection Programs has determined this project to be IRB exempt. Informed consent, Ethics Board approval, and study protocol registration was not required or obtained.

Conflicts of interest

The authors have no relevant financial disclosures or conflicts of interest.

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