

# Men, Chronic Pain, and Prescription Pain Medication Use: The Role of Gender Role Beliefs in a Longitudinal Moderated Mediation Model

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## Abstract

**Objective.** Although past research has established that men with chronic pain are more likely to misuse prescription pain medications in a myriad of ways compared with women, little is known about men's medication use in the context of their gender role beliefs. The aim of the present study was to examine the role of men's domestic gender role beliefs on their use of prescription pain medication for chronic pain. **Methods.** Using a nationally representative data set with 304 men with chronic pain, this study examined a longitudinal moderated mediation model in which pain interference mediates the longitudinal relationship between somatic amplification and prescription pain medication use, with domestic gender role beliefs as a moderator of the aforementioned mediated relationship. **Results.** Results indicated a significant moderated mediation model in which pain interference fully mediated the relationship between somatic amplification and prescription pain medication use, with men's domestic gender role beliefs moderating this mediated relationship. Specifically, domestic gender role beliefs moderated the relationship between pain interference and prescription pain medication use. Men with higher levels of traditional domestic gender role beliefs strengthened the mediated relationship, contributing to increased prescription pain medication use. **Conclusions.** These findings suggest that although men's perceptions of somatic stimuli through its perceived interference contribute to their medication use, the extent to which they consume prescription pain medication depends on their beliefs in domestic gender roles during chronic pain.

**Key Words:** Men with Chronic Pain; Prescription Pain Medication Use; Somatic Amplification; Pain Interference; Domestic Gender Role Beliefs

Prescription pain medications are the most frequently consumed medication, with approximately one in three adult men using them per year [1,2]. The use of prescription pain medications is an area for concern, as it has been found to be positively associated with psychological distress, suicide risk, and pain medication abuse, misuse, and dependence [3–5]. This is especially salient for people with chronic pain as they consume more prescription pain medications than people with nonchronic pain [6,7]. Furthermore, the alleviation of pain is reported as a leading cause of illicit use [6]. Specifically, compared with women, men with chronic pain may be at a greater risk of the dangers associated with excessive prescription pain medication use given their increased misuse tendencies, including underreporting use [1], self-increasing

doses [8], altering route of administration [9], and obtaining pain medications from nonmedical sources [10]. Men are also more likely to have opioid use disorder [11]. Given the reported gender differences in prescription pain medication use, gender role beliefs may play a moderating role.

Although men with chronic pain are more likely to misuse prescription pain medications than women in a variety of ways, pain research has tended to only focus on gender differences in individuals' response to pain. A few studies have examined male-specific pain responses influenced by gender role beliefs. They predominantly included collegiate men and women; within-group comparisons in men focused on their response to induced or imagined pain [12–14], and only one focused on

responses to naturally occurring pain in men with acute chest pain [13]. Furthermore, to our knowledge, no study to date has examined how gender role beliefs relate to prescription pain medication use among men with chronic pain or examined these relationships longitudinally. Thus, given the dangers associated with excessive prescription pain medication use, the aim of the present study was to examine the role of men's domestic gender role beliefs on their prescription pain medication use during chronic pain.

The Fear Avoidance Model (FAM) helps explain the process through which people perceive and deal with pain [15]. According to FAM, when individuals experience pain, they may undergo one of two different pathways. One, they may appropriately interpret and confront the pain without negative thoughts, resulting in an acceptance of the pain and quicker recovery [16]. Or two, in contrast, they may misinterpret the pain and amplify (i.e., catastrophize) its experience, resulting in its increased perceived effect (e.g., interference) and avoidance [16]. This pathway can become a chronic cycle and is characterized by safety-seeking behaviors such as increased medication usage and poor medication adherence [16]. Thus, individuals' perceptions of somatic stimuli during pain are predictive of which pathway an individual may undergo, as the increased amplification of somatic stimuli (i.e., tendency to perceive a physical sensation as intense and disturbing) leads to increased perceived pain interference (i.e., pain's perceived consequence) and the pathway of avoidance [15]. Therefore, men's interpretation of painful stimuli would likely influence prescription pain medication use through pain's perceived interference. This suggests that pain interference would mediate the relationship between somatic amplification and prescription pain medication use.

The suggested mediation between somatic amplification and prescription pain medication use through pain interference is consistent with several pain researchers' conceptualization of somatic amplification's predictive influence on individuals' perceptions of pain interference and their prescription pain medication use [17–20]. Specifically, it is believed that perceptions of increased somatic severity lead to increased pain interference and increased medication use over time. Other studies have also reported a positive association from pain interference to prescription pain medication use [4]. Further, an individual's perceptions of pain have been found to mediate relationships between induction of painful stimuli and disability outcomes [21–23]. Thus, in a longitudinal mediated relationship, it is expected that somatic amplification at time 1 would positively predict pain interference at time 2, and in turn pain interference would be positively associated with prescription medication use at time 2 in men with chronic pain. Further, as previously discussed, given the reported gender differences in prescription pain medication use, gender role beliefs may play a moderating role in this mediated relationship.

Prior research has extensively examined gender differences in individuals' response to pain, with men reporting greater pain tolerance, a greater pain threshold, and lower pain unpleasantness than women [14,24]. These differences may be influenced by the gender role concept of traditional "masculinity," in which the ideal man tolerates pain and does not want to come across as weak [25,26]. For example, in studies where men were induced with pain by an administrator, they were less likely to report their level of pain to female administrators than to male administrators, and even less likely to report this to females they perceived as attractive [26,27]. In addition, when in pain, men are seen as less masculine by nurses and nonmedical observers in health care settings [28]. Furthermore, men with chronic pain are less likely to be referred for psychosocial treatments, and men's pain is frequently seen as less severe or urgent than females' [29,30]. However, little is known about how specifically men's gender role beliefs are associated with pain-related outcomes, and even less is known about men with chronic pain. The limited research that has examined within-group differences among men suggests that men with higher levels of traditional masculine identities are less likely to seek help for their pain and disclose symptoms related to pain [12–14]. However, they are reported to have greater pain tolerance [12–14]. This suggests that men with similar gender role beliefs would consume less prescription pain medication given the positive association between perceived pain severity and pain medication use [4–6].

Mencarini defined gender role beliefs as an individual's opinions of the set norms that are considered socially appropriate for males and females in the context of a specific culture [31]. These beliefs in men have been identified to be relatively stable across time [32] and one of the prominent domains of social influence [33], including the transition of gender role beliefs from parents to children [34]. Researchers suggest that in the United States, a more traditional belief in domestic gender roles includes the idea that marriage, child care, and house work are female domains and essential to female identity, whereas males are characterized as being the breadwinner or provider for the family while maintaining their independence and strength [35,36]. According to self-categorization theory, when men categorize themselves in salient social groups such as being a "man," they adopt a social identity, which leads to increased adherence to group norms such as more traditional masculine gender role beliefs [14,37].

Several studies have demonstrated men's gender role beliefs to relate to health-related outcomes, including higher overall traditional masculine norms (or hegemonic masculinity) being associated with increased alcohol and tobacco consumption as well as decreased engagement in healthful behaviors [33,38–40]. However, men with specifically higher levels of traditional domestic gender role beliefs have been found to consume less alcohol and have

less illicit drug use than men with nontraditional domestic gender role beliefs [41,42]. Therefore, men's domestic gender role beliefs may influence their prescription pain medication use, which suggests a possible moderating relationship with higher levels of traditional beliefs contributing to decreased prescription pain medication use.

Given FAM and relevant research, we proposed a longitudinal moderated mediation model in which pain interference at time 2 mediates the relationship between somatic amplification at time 1 and prescription pain medication use at time 2, with domestic gender role beliefs at time 2 as a moderator in the aforementioned mediated relationship in men with chronic pain. With this model in mind (Figure 1), we tested four hypotheses. In hypothesis 1 ( $H_1$ ), we anticipated somatic amplification at time 1 to significantly and positively predict men's prescription pain medication use at time 2. In hypothesis 2 ( $H_2$ ), we predicted pain interference to partially mediate the relationship between somatic amplification and prescription pain medication use, in that somatic amplification at time 1 would positively predict pain interference at time 2 and prescription pain medication use at time 2, and in turn pain interference would be positively associated with prescription medication use. In hypothesis 3 ( $H_3$ ), we expected an overall significant moderated mediated model, in which domestic gender role beliefs at time 2 would moderate the mediated relationship in  $H_2$  in the b pathway between pain interference and prescription pain medication use (Figure 1). In other words, the magnitude of indirect effects of somatic amplification on prescription pain medication use through pain interference would depend on men's level of domestic gender role beliefs. In hypothesis 4 ( $H_4$ ), we expected the mediated relationship to be weaker at higher levels of traditional domestic gender role beliefs.

## Methods

### Participants

Data were analyzed from a secondary community sample of 304 men with chronic pain from the second and third waves of the National Survey of Midlife Development in the United States (MIDUS), which is a nationally representative longitudinal study data set consisting of midlife and older populations. The study was developed to collect information on psychological, social, and various other factors that influence individuals' health over time. Participants were recruited through a random digit dialing procedure; they were then invited to complete a telephone interview. Participants were mailed self-administered questionnaires and completed a cognitive interview via phone. Data from the second (MIDUS II) [43] and third (MIDUS III) [44] waves of the study, which were collected about nine to 10 years apart, were used in the current study. A total of 3294 adults participated in both the MIDUS II (time 1) and MIDUS III

(time 2) studies, and among those, 304 who met inclusion criteria were included in this study. Inclusion criteria included men who endorsed experiencing chronic pain on an item (e.g., "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?") at time 2 (MIDUS III) and answered all items for each measure (recommended for a Process macro analysis) [45]. Specific duration of chronic pain was not available. Chronic pain is usually defined as recurring pain lasting longer than three months [28]. However, given the unavailability of this information, determination of whether participants met this cutoff was not possible, and the authors had to go off of participants' self-endorsement of having chronic pain. Frazier and colleagues recommend sample sizes of 200 or more participants for a multiple interaction model [46]. The participant ages ranged from 34 to 80 ( $M = 54.53$ ,  $SD = 10.41$ ) years at time 1 (MIDUS II) and 43 to 90 ( $M = 63.67$ ,  $SD = 10.39$ ) years at time 2 (MIDUS III). Participants identified as white (92%), African American (2%), Native American (1%), Pacific Islander (1%), and other (4%).

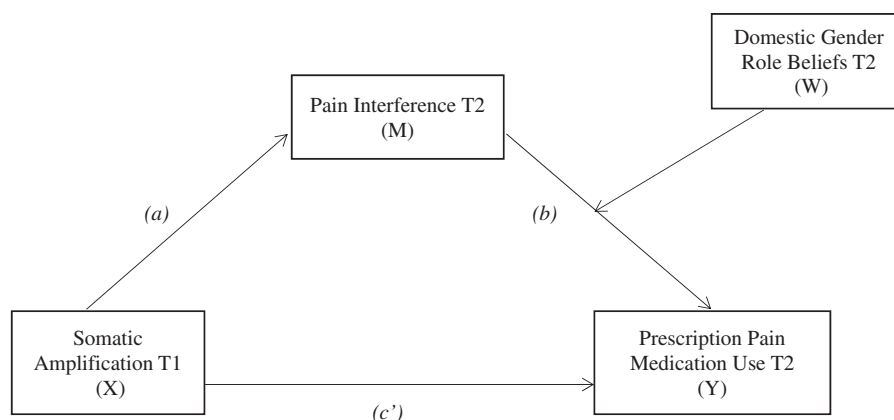
## Measures

### Somatic Amplification

Taken at time 1 (i.e., MIDUS II), the five-item somatic amplification scale was used to assess the degree to which somatic symptoms are experienced as intense or uncomfortable [47]. The items were 1) "I am often aware of various things happening in my body," 2) "I hate to be too hot or too cold," 3) "Sudden loud noises really bother me," 4) "I am quick to sense hunger contractions in my stomach," and 5) "I have a low tolerance for pain." Participants rated their level of awareness of bodily symptoms using a four-point scale (1 = not at all true, 2 = a little true, 3 = moderately true, 4 = extremely true). A total score was calculated by averaging the responses across items, such that higher scores indicated greater somatic symptom amplification. The scale has been shown to have strong positive correlations with psychopathological symptoms, including depression, anxiety, hostility, and somatic symptoms [47]. In a sample of MIDUS participants, the scale was shown to have questionable reliability (Cronbach's  $\alpha = 0.60$ ) [48]. Further, in a sample of patients with upper respiratory tract infections, Barsky and colleagues validated this scale and reported an internal consistency of 0.72 with a test-retest reliability of 0.85 [47]. In the current study, the scale displayed poor reliability, with a Cronbach's  $\alpha$  of 0.55.

### Pain Interference

For participants who endorsed experiencing chronic pain at time 2, their level of pain interference was measured using a five-item version of the Brief Pain Inventory's interference subscale from MIDUS III (BPI) [49]. The scale assessed pain interference in the following domains:



**Figure 1.** Hypothesized moderated mediation model. T1 = time 1; T2 = time 2.

general activity, mood, sleep, enjoyment of life, and relationships with others. The items (e.g., “During the past week, how much did your pain interfere with your enjoyment of life?”) were assessed on a scale of 0 (not at all) to 10 (completely). An overall score of pain interference was calculated by averaging the responses across items, such that higher scores were indicative of greater pain interference. In a sample of patients with chronic pain, scale scores were positively associated with pain intensity, pain catastrophizing, and pain-related fear [50]. In a sample of MIDUS participants, the scale has been shown to have excellent internal consistency (Cronbach’s  $\alpha = 0.95$ ) [51]. Cronbach’s  $\alpha$  was 0.92 in the present study.

### Domestic Gender Role Beliefs

Domestic gender role beliefs were assessed through four items at time 2 (MIDUS III), which were derived from a group of items that assessed participants’ beliefs about men and women’s roles in marriage and parenting. The four questions were the following: “Women can have full and happy lives without marrying,” “Employed mothers can have just as good as a relationship with children,” “Men should share equally with their wives,” and “Men should share equally with their wives in taking care of children.” The item responses ranged from 1 (strongly agree) to 7 (strongly disagree). An overall score was calculated through the average of responses across items, with higher scores indicating endorsement of more traditional domestic gender role beliefs. In MIDUS samples, items have been found to be positively associated with behavioral traditionalism in relationships and traditional attitudes in marriage, family, and tasks [35,52]. In the same sample, items yielded a Cronbach’s  $\alpha$  of 0.63 [35]. In the current study, the scale had adequate reliability, with a Cronbach’s  $\alpha$  of 0.70.

### Prescription Pain Medication Use

The frequency of prescription pain medication use at time 2 (MIDUS III) was assessed with a single item from a scale of medication frequency, developed specifically

for the MIDUS survey. The question assesses the frequency of pain medication use within the past 30 days (“During the past 30 days, have you taken prescription medicine for pain?”). Participants responded to this question on a scale from 0 (not at all) to 5 (daily), such that higher responses reflected greater frequency of prescription pain medication use.

### Statistical Analysis Plan

A secondary data analysis was conducted using SPSS Statistics 23 [53]. Bivariate correlations were used to investigate our model’s variable relationships a priori including the association ( $H_1$ ) between somatic amplification and prescription pain medication usage. Conditional process modeling was used to test  $H_2$ ,  $H_3$ ,  $H_4$ , and alternative models. Specifically, Hayes’ PROCESS macro for SPSS, which uses predefined models to test moderation and mediation models, was used [45]. Recommended by Hayes, our analysis progressed stepwise; thus each relationship was examined independently [45]. First, PROCESS model 4 was used to assess the mediation ( $H_2$ ) of pain interference at time 2 in the relationship between somatic amplification at time 1 and prescription pain medication use at time 2. Finally, PROCESS model 14 tested moderated mediation and was used for  $H_3$  and  $H_4$  (Figure 1). PROCESS automatically generates an index of moderated mediation; if it does not include 0, the moderated mediation model is assumed statistically significant ( $P < 0.05$ ). To see the nature of the moderated mediation effect, the bias-corrected 95% confidence interval (CI) was calculated using 5,000 bootstrapping re-samples to evaluate the conditional direct and indirect effects. If the 95% CI does not include 0, it is concluded that the conditional direct and indirect effects are statistically significant ( $P < 0.05$ ). All results were standardized through the conversion of raw data to z-scores.

## Results

### Main Analyses

Descriptive statistics (means and standard deviations) of variables are presented in Table 1. Of respondents, 48%

**Table 1.** Means, standard deviations, and bivariate correlations among variables (N = 430)

Variable	M	SD	1	2	3	4	5
1. Somatic amplification	02.33	01.54	—				
2. Pain interference	02.92	12.58	0.18**	—			
3. Domestic gender role beliefs	02.23	11.08	0.06**	-0.02**	—		
4. Prescription pain medication usage	01.77	12.11	0.12**	0.50**	0.07	—	
5. Age	53.53	10.41	-0.01*	-0.06**	0.08	0.14*	—

All variables were recoded at time 2, except somatic amplification and age at time 1.

\* $P < 0.05$ ; \*\* $P < .01$ .

of participants reported consuming prescription pain medications within the last 30 days, including daily (23%), a few times a week (7%), once a week (5%), a few times a month (7%), and once this month (6%). Fifty-two percent of participants reported not taking prescription pain medications within the last month but having chronic pain. Participants reported the primary location of their chronic pain pertaining to their back (N = 151), legs (N = 117), knees (N = 99), shoulders (N = 82), arms (N = 77), hips (N = 64), neck (N = 58), and head (N = 5). Seventy-three percent of participants reported being diagnosed with a pain diagnosis by a physician (type of diagnosis unavailable). Six participants reported the autoimmune disorder of Lupus. Fifty-two participants were identified as having a diagnosed mental disorder at time 2, including 34 with major depressive disorder (11%), four with generalized anxiety disorder (1%), and 14 with pain attacks (5%). Two participants were identified as having a comorbid depression and anxiety diagnosis, and two with comorbid depression and panic attacks. Diagnoses in the data were based on the definitions and criteria specified in the third edition-revised of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders [54].

Bivariate correlations (Table 1) indicated support for H<sub>1</sub>. Results indicated somatic amplification at time 1 to significantly and positively predict prescription pain medication use at time 2 ( $r = 0.12$ ,  $P < 0.05$ ). Further, correlations revealed that somatic amplification at time 1 significantly and positively predicted pain interference at time 2, as well as a positive association between pain interference at time 2 and prescription pain medication use at time 2. Age was also found to be significantly and positively associated with prescription pain medication use.

The results indicated partial support for H<sub>2</sub>. Pain interference at time 2 significantly mediated the relationship between somatic amplification at time 1 and prescription pain medication usage at time 2 ( $F = 53.604$ ,  $P < 0.001$ ,  $R^2 = 0.263$ ). Increased somatic amplification at time 1 predicted increased pain interference at time 2 (Path a:  $B = 0.180$ ,  $P = 0.002$ , 95% CI = 0.069 to 0.291). Pain interference at time 2 was positively associated with prescription pain medication use at time 2 (Path b:  $B = 0.507$ ,  $P < 0.001$ , 95% CI = 0.408 to

0.605). In turn, a significant indirect effect of somatic amplification at time 1 on prescription pain medication use at time 2 through pain interference at time 2 (Effect = 0.091, 95% CI = 0.034 to 0.152) was found. However, contrary to our hypothesis, somatic amplification at time 1 was not significantly associated with prescription pain medication use at time 2 while assessing pain interference at time 2 as a covariate (Path c:  $B = 0.025$ ,  $P = 0.618$ , 95% CI = -0.074 to 0.124). These results indicate that pain interference at time 2 fully mediates the relationship between somatic amplification at time 1 and prescription pain medication use at time 2, given somatic amplification's significant relationship with prescription pain medication use without assessing for pain interference (Path c:  $r = 0.12$ ,  $P < 0.05$ ).

Table 2 shows the results of our moderated mediation. The results indicated significant model pathways (a, b) and significant indirect effects of somatic amplification at time 1 (X) on prescription pain medication use at time 2 (Y) through pain interference at time 2 (M) at all levels of domestic gender role beliefs at time 2 (W). A significant interaction effect of domestic gender role beliefs (W) on the b pathway in the relationship between pain interference (M) and prescription pain medication use (Y) was found. However, higher levels of traditional domestic gender role beliefs appeared to strengthen the positive mediated relationships between somatic amplification and prescription pain medication use through pain interference, as evidenced when comparing the conditional effects of pain interference on prescription pain medication use at 1 standard deviation above (high; effect = 0.620,  $P < 0.001$ , 95% CI = 0.473 to 0.768) and below (low; effect = 0.428,  $P < 0.001$ , 95% CI = 0.301 to 0.555) domestic gender role beliefs' mean. Visualization of interaction effect further supported this result (Figure 3). This result yielded the opposite of the hypothesized effect (H<sub>4</sub>). Most importantly, a significant model index (index = 0.019, 95% CI = 0.001 to 0.044) was found, supporting a significant moderated mediation model and H<sub>3</sub>. In other words, pain interference at time 2 mediated the relationship between somatic amplification at time 1 and prescription pain medication use at time 2, whereas domestic gender role beliefs at time 2 moderated the mediated relationship in men with chronic pain (Figure 2).

**Table 2.** Longitudinal standardized PROCESS macro model 14

Final Moderated Mediation Analyses						
Pathway	Variable	B	SE	P	LLCI	ULCI
a	SA (T1) to PI	0.180	0.057	<0.002	0.069	0.291
b	PI to PPRU	0.522	0.050	<0.001	-0.423	0.621
	PI × DGRB to PPMU	0.104	0.052	<0.048	-0.001	0.206
c	SA (T1) to PPU	0.021	0.050	<0.674	-0.077	0.119

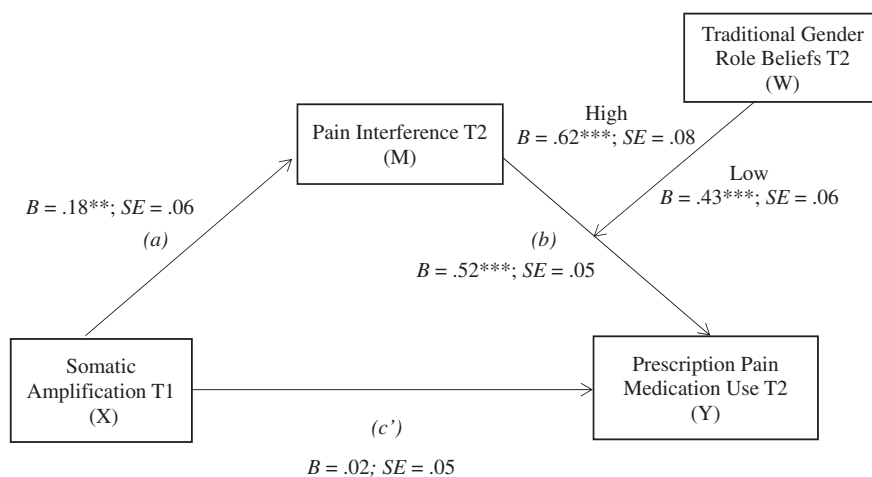
  

Indirect effects of SA (T1) on PPMU through PI at values of DGRB						
DGRB	Effect	Boot SE	P	LLCI	ULCI	
-0.91 (-1 SD)	0.077	0.029	—	0.025	0.138	
-0.21 (mean)	0.090	0.031	—	0.030	0.153	
-0.95 (+1 SD)	0.112	0.039	—	0.038	0.194	

Conditional effects of PI on PPMU at values of DGRB						
DGRB	Effect	Boot SE	P	LLCI	ULCI	
-0.91 (-1 SD)	0.428	0.064	<0.001	0.301	0.555	
-0.21 (mean)	0.500	0.050	<0.001	0.402	0.599	
-0.95 (+1 SD)	0.620	0.075	<0.001	0.473	0.768	

DGRB = domestic gender role beliefs; LLCI = lower level 95% confidence interval; PI = pain interference; PPMU = prescription pain medication use; SA (T1) = somatic amplification time 1; ULCI = upper level 95% confidence interval.



**Figure 2.** Moderated mediated model showing standardized analysis of somatic amplification on prescription pain medication use through pain interference and moderated by domestic gender role beliefs (model 14) [47]. \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ . T1 = time 1; T2 = time 2.

When age was added as a covariate, our overall moderated mediation was no longer significant (index = 0.017, 95% CI = -0.000 to 0.041). Specifically, although model pathways (a, b) remained significant, the interaction effect of domestic gender role beliefs was no longer significant ( $B = 0.095$ ,  $P = 0.064$ , 95% CI = -0.006 to 0.197). The results indicated that age plays an important role in the relationships between somatic amplification, pain interference, domestic gender role beliefs, and prescription pain medication use over time. To help explain this role, we divided our sample into three age groups according to the mean age of our sample at time 1, including younger (i.e.,  $\geq -1$  SD, 34–45-year-olds,  $N = 70$ ), middle-aged (i.e.,  $-1$  SD  $< x < +1$  SD, 46–64-year-olds,  $N = 174$ ), and older (i.e.,  $\leq +1$  SD, 65–80-year-olds,

$N = 60$ ). We reran our moderated mediated model in each group. The results indicated nonsignificant moderated mediation models for the younger (index = 0.007, 95% CI = -0.082 to 0.073) and older groups (index = -0.004, 95% CI = -0.042 to 0.026). However, the moderated mediation model was found to be significant in the middle-aged group (index = 0.029, 95% CI = 0.000 to 0.072). In this middle-aged group, somatic amplification at time 1 significantly positively predicted pain interference at time 2 ( $B = 0.174$ ,  $P = 0.016$ , 95% CI = 0.033 to 0.316), and pain interference was positively associated with prescription pain medication use at time 2 ( $B = 0.503$ ,  $P < 0.001$ , 95% CI = 0.367 to 0.639). A significant interaction effect of domestic gender role beliefs was also found in the model ( $B = 0.165$ ,  $P =$

0.035, 95% CI = 0.012 to 0.318). Conditional indirect effects indicated that participants with high traditional domestic gender role beliefs (high; effect = 0.115,  $P < 0.05$ , 95% CI = 0.012 to 0.228) contributed to increased pain medication use compared with participants with low traditional domestic gender role beliefs (low; effect = 0.055,  $P < 0.05$ , 95% CI = 0.004 to 0.124). Results for the middle-aged group are similar to the overall sample's model without holding age constant, suggesting that the model's variable relationships including domestic gender role beliefs are more relevant for our middle-aged participants.

### Post Hoc Alternative Models

We further tested some alternative models, a recommended process when using moderated mediation analyses [38,55]. First, using Model 1 [45], domestic gender role beliefs did not significantly moderate the relationship between somatic amplification at time 1 and pain interference at time 2 ( $B = -0.049$ ,  $P = 0.354$ , 95% CI =  $-0.151$  to  $0.054$ ). In addition, the relationship between somatic amplification at time 1 and prescription pain medication usage at time 2 was not significantly moderated by domestic gender role beliefs ( $B = -0.073$ ,  $P = 0.163$ , 95% CI =  $-0.177$  to  $0.030$ ).

These results suggest that domestic gender role beliefs would not moderate the a and/or c pathways of our model. Second, to validate this suggestion, we examined model 59 [46] and specified domestic gender role beliefs as a moderator in the a, b, and c pathways of the model. Consistent with findings from our proposed model, domestic gender role beliefs significantly moderated the relationship between pain interference and prescription pain medication use ( $B = 0.119$ ,  $P = 0.025$ , 95% CI =  $0.015$  to  $0.224$ ). However, domestic gender role beliefs did not significantly moderate the relationships between somatic amplification and pain interference ( $B = -0.049$ ,  $P = 0.354$ , 95% CI =  $-0.151$  to  $0.054$ ) or somatic amplification and prescription pain medication usage ( $B = -0.069$ ,  $P = 0.134$ , 95% CI =  $-0.160$  to  $0.021$ ). Finally, using model 4 [45], somatic amplification at time 2 was specified as a mediator between pain interference at time 1 and prescription pain medication use at time 2. Results did not indicate a significant mediation (indirect effect:  $B = -0.021$ , 95% CI =  $-0.015$  to  $0.066$ ). Pain interference at time 1 was positively associated with somatic amplification at time 2 (Path a:  $B = 0.063$ ,  $P < 0.001$ , 95% CI =  $0.032$  to  $0.094$ ) and prescription pain medication use at time 2 (Path c:  $B = 0.358$ ,  $P < 0.001$ , 95% CI =  $0.237$  to  $0.478$ ). However, somatic amplification at time 2 was not significantly related to prescription pain medication use at time 2 (Path b:  $B = 0.338$ ,  $P = 0.249$ , 95% CI =  $-0.239$  to  $0.914$ ). Hence, there was no evidence for a significant alternative model. Results from these alternative models provide further support for our moderated mediation model (Figure 2).

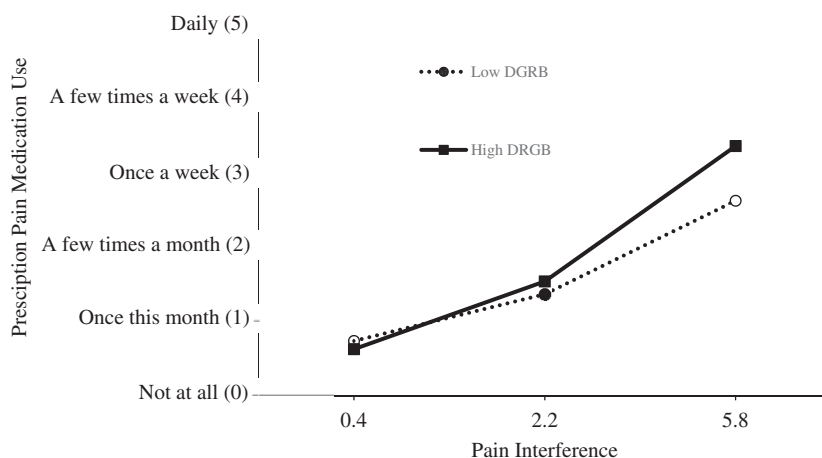
## Discussion

Past research has established that, compared with women, men with chronic pain misuse prescription pain medications including under-reporting use, self-increasing doses, altering route of administration, and obtaining pain medications from nonmedical sources. Gender role beliefs have been posited as a contributor to differences between men's and women's pain tolerance, pain threshold, and perceptions of men in pain [28]. However, only a few studies have examined the relationships between male-specific pain responses and their gender role beliefs, and even these studies have not examined prescription pain medication use [12–14]. Given this gap, the present study examined a longitudinal moderated mediation model of associations among somatic amplification, pain interference, domestic gender role beliefs, and prescription pain medication use in men with chronic pain (Figure 1).

The results supported all four of our hypotheses. First, somatic amplification at time 1 predicted prescription pain medication use at time 2 ( $H_1$ ). Second, pain interference at time 2 significantly and fully mediated the relationship between somatic amplification at time 1 and prescription pain medication use at time 2, in which somatic amplification positively predicted pain interference and not prescription pain medication use, and in turn, pain interference was positively associated with prescription pain medication use ( $H_2$ ). Third, a significant moderated mediation model was found in which domestic gender role beliefs at time 2 moderated the mediated relationship ( $H_3$ ) (Figure 2). Finally, domestic gender role beliefs at time 2 significantly moderated the relationship between pain interference at time 2 and prescription pain medication use at time 2 (b pathway), in which the mediated relationship was stronger at higher levels of men's traditional domestic gender role beliefs ( $H_4$ ) (Figure 3).

Each result from our primary hypotheses ( $H_1$ – $H_4$ ) provides insight into prescription pain medication use in men with chronic pain. In the  $H_1$  results, increased somatic amplification predicted increased prescription pain medication usage. This finding supports previous research that indicates that greater amplification of stimuli leads to increased avoidance behaviors when experiencing pain [16]. Men with chronic pain who have an increased tendency to appraise somatic sensations as abnormal or severe may be at greater risk of excessive medication use. This finding suggests that the timely assessment of somatic amplification may prevent the excessive use of prescription pain medications. Additionally, as increased prevalence of somatic amplification is well known to be associated with psychological distress [56], our finding supports the need for early diagnosis and treatment for men with both chronic pain with psychiatric disorders who are prone to have increased somatic symptoms.

In the results for  $H_2$ , pain interference at time 2 significantly mediated the relationship between somatic



**Figure 3.** Relationship between pain interference and prescription pain medication use at low ( $-1$  SD) and high ( $+1$  SD) levels of domestic gender role beliefs, controlling for somatic amplification at time 1.

amplification at time 1 and prescription pain medication use at time 2, in which increased somatic amplification predicted increased pain interference, and in turn, as pain interference increased, prescription pain medication use increased. However, contrary to our hypothesis, somatic amplification did not significantly predict prescription pain medication use over time while assessing for pain interference. These results indicated a full mediation. This finding suggests that the increased amplification of somatic stimuli may lead to perceptions of greater interference on one's life from pain over time. Further, this increased perception of pain interference may contribute to greater pain medication use and act as a mechanism through which somatic amplification influences prescription pain medication use. This relationship can be explained by the tendency of men with chronic pain to perceive somatic stimuli as painful, regardless of nature, leading to increased interference and subsequent prescription pain medication use. This finding is consistent with the Fear Avoidance Model [15]. Further, previous research supports this result, which found the perceived impact of pain to mediate the relationship between somatic experiences and difficulty performing daily activities [22,23].

Concerning the results for  $H_3$  and  $H_4$ , a significant moderated mediation model was found, with pain interference mediating the relationship between somatic amplification and prescription pain medication use, and domestic gender role beliefs moderating the mediated relationship (Figure 2). The model findings identified domestic gender role beliefs to moderate the mediated relationship between pain interference and prescription pain medication use ( $b$  pathway). However, contrary to our hypothesis, men with higher levels of traditional domestic gender role beliefs strengthened the positive mediated relationship. In other words, the positive indirect effect of somatic amplification through greater levels of pain interference led to increased pain medication use in men with higher

levels of traditional domestic gender role beliefs (Figure 3). This finding is contrary to our hypothesized moderating influence of domestic gender role beliefs. Previous studies have found that higher levels of traditional domestic gender role beliefs in men were linked to less alcohol consumption and less illicit drug use than men with nontraditional beliefs [41,42]. Additionally, several studies have found that men with higher levels of traditional masculine identities report greater pain tolerance compared with men with lower traditional masculine identities [12–14], which is connected to a decreased likelihood of pain medication use [4–6]. Therefore, we originally hypothesized that men with higher levels of traditional domestic gender role beliefs would weaken the positive indirect effect of somatic amplification on medication use through pain interference, contributing to reduced prescription pain medication. However, men's gender role beliefs have not been examined as a moderator in relationships to their pain responses or been examined in relationship to prescription pain medication use; thus this study provides the initial empirical support in these relationships.

There are several possible explanations for this finding. According to the gender role norm model [57], adherence to men's traditional gender roles beliefs is based upon what most traditional men do or how they should be perceived by others in a situation, ultimately shaping their health behaviors. Men with more traditional gender role beliefs would act and behave in a way they believe the "ideal" man would during pain, thus influencing the magnitude or direction of pain perceptions' relationship with medication use, indicating a moderating effect. For example, it is socially argued that the "ideal" man does not show pain and is not "weak" [58,59]. Men with more traditional gender role beliefs may not want to be perceived as being in pain, so as pain interference increases, engaging in behaviors to hide this pain increases, such as through increased pain medication use.



These results are consistent with the help-seeking literature, which suggests that being perceived as weak is a barrier for men seeking medical help [60].

Studies suggest that men with high traditional domestic gender role beliefs value independence, self-sufficiency, providing for their family, and being perceived as strong [59,61]. As aspiring “breadwinners” [62], men may not want their pain to interfere with their ability to work and provide for their family. Therefore, as pain interference increases, men increasingly turn to prescription pain medications to manage their pain. Additionally, these same men may see themselves as burdens should they become dependent on others due to their increased pain interference, so they rely on pain medications to remain independent. Furthermore, pain medications can be viewed as “quick relief,” allowing traditional men to avoid seeking medical help. This is consistent with the help-seeking literature, where men have lower rates of medical help-seeking than women, which has been suggested as a link to their higher mortality rates [60].

When age was held as a covariate in our moderated mediation, it was no longer significant. This indicates that participants’ age played a role in our model. Upon closer examination, our moderated mediation model was significant in middle-aged participants (46–64-year-olds) but not younger (34–45-year-olds) or older participants (65–80-year-olds). Empirical evidence has repeatedly indicated a positive association between age and medication use [6,7,63]. In older and younger participants, domestic gender role beliefs may play a less salient role. Older participants would consume more prescription pain medications regardless of domestic gender role beliefs and influence a nonsignificant finding. Fifty-nine percent of older participants reported using prescription pain medications within the last month, with 25% reporting daily use. Further, despite their chronic pain status, younger participants would likely consume less prescription pain medication given their age, regardless of their level of traditional domestic gender role beliefs. In our sample, 63% of younger participants reported not consuming prescription pain medications within the last month. Contrary to younger and older adults, middle-aged men’s domestic gender role beliefs may be more salient. The findings suggest that our model explains middle-aged men’s prescription pain medication use behaviors during chronic pain, but not younger or older men. The findings also suggest that age should be considered in prescription pain medication use behaviors.

Our moderated mediation model highlights the role of somatic amplification, pain interference as a mediator, and that of domestic gender role beliefs as the moderator, showing the mechanisms that influence prescription pain medication use in men with chronic pain. Further, this finding suggests that although the way in which men with chronic pain perceive physical stimuli through pain’s perceived interference contributes to their medication use, the extent to which they consume prescription

pain medication depends on their beliefs regarding domestic gender roles.

The results of the present study have potentially important clinical and practical implications. Our findings indicate that men’s gender role beliefs help shape the relationships between somatic symptoms, pain interference, and pain medication use during pain. In primary care medical practice, somatization is the rule rather than the exception and is commonly observed in the presence of concurrent medical illnesses such as chronic pain [64–66]. Given the dominant role that psychological and cultural factors play in promoting somatization [66], which parallels the importance of psychosocial risk and protective factors in chronic pain, we encourage physicians to assess and recognize psychosocial function, such as domestic gender role beliefs, rather than solely focusing on organic pathology when working with chronic pain patients. This information needs to be integrated into diagnosis, assessment, and treatment planning including prescribing pain medication.

Measures of gender role beliefs could be administered before prescribing prescription pain medications by clinicians. Men in the extreme levels of domestic gender role beliefs may warrant further examination for potential poor medication adherence or increased pain medication abuse or misuse. With this information, implementing targeted interventions for these men may help to prevent or manage these behaviors, such as self-increasing dosages. Cognitive behavioral-based interventions may be helpful in modifying men’s constructions of gender role beliefs, promoting behavioral health changes [61,67,68]. For example, cognitive restructuring may change pain medication use through examining evidence for and against beliefs such as “if I show pain, others will think I am weak” [61].

The dialogue regarding the interaction between domestic gender role, somatic amplification, pain interference, and pain medication use may, for example, present itself when men who adhere to more traditional gender roles may need to be asked some pointed questions regarding their beliefs about chronic pain, medication, and physical symptoms. They may need to be asked about their gender role and how that may influence their attitude toward pain medication when experiencing physical symptoms, including what it means to have chronic pain as a man and how they feel about taking pain medication. Such meaningful conversation concerning the psychology of pain and pain medication use in the context of male gender norms among multidisciplinary teams in pain medicine could significantly advance our understanding and treatment of chronic pain among men.

There are important limitations in the present study that should be considered. The present study used a secondary data set (MIDUS), limiting measurement options. For example, description of type of prescription pain medication, average severity of pain, and names of pain diagnoses were not available, which could have added

further to the interpretation of the findings. Only one measure was appropriate to assess men's domestic gender role beliefs, but it lacked extensive validity or reliability information. Further, although consistent with previous studies [47,48], the measure used to assess somatic amplification had poor reliability. This may have contributed to the weak association (i.e., small magnitude) between somatic amplification and pain medication use, which is an additional limitation of the present study. Further, somatic amplification was assessed about nine years before all other variables, and this prolonged length of time may have influenced the small magnitude. Future studies could use a more reliable measure of somatic amplification and reduce the length of time between variable assessments to better capture the influence of somatic amplification. Additionally, we recommend that researchers use more comprehensive measures of gender role beliefs to better capture the complexity and different domains of gender roles. In addition, all measures were self-reported. The accuracy of self-reported measures can be subject to recall and social desirability biases [69]. Men also frequently under-report prescription pain medication use [1], possibly influencing our results. A multidimensional approach could provide aid in the reduction of these limitations. For example, future studies could assess others' (e.g., friends, spouse, doctor) reports in addition to individual reports of prescription pain medication use behaviors. Researchers are encouraged to conduct experimental studies or intervention studies to expand upon the present study's findings. For example, cognitive-behavioral-based interventions could prove effective in promoting healthy prescription pain medication use in men through modifying their gender role beliefs [61]. Furthermore, it is important to note that our findings pertain to prescription pain medication use. Although inferences can be made, our results do not describe opioids or prescription pain medication abuse, misuse, or adherence behaviors. Studies that expand upon our study by examining medication abuse, misuse, and adherence may help untangle the complex processes that lead to the varying use of prescription pain medications among men with chronic pain, and how and for whom use behaviors should be more of a concern.

Despite the study's limitations, our findings make an important contribution to the literature in five ways. First, we examined domestic gender role beliefs and prescription pain medication use in men with naturally occurring pain as opposed to focusing on gender differences or men's responses to induced or imagined pain. Findings suggest that men's domestic gender role beliefs, through their influence on the mediated relationship of somatic amplification and pain interference, contribute to the quantity of prescription pain medications they consume. Second, our findings go beyond a simple linear relationship to find empirical evidence to support a complex longitudinal moderated mediation relationship. In other words, this study not only examined predictors of prescription pain medication use in

men with chronic pain but also tried to describe how varying levels of use occurred and for whom increased use would be of greater concern. Third, the findings suggest that domestic gender role beliefs may play a role in the complex processes that lead to varying use of pain medications in men with chronic pain. Fourth, the results suggest that men with higher levels of traditional domestic gender role beliefs may be at greater risk of using more prescription pain medications, thus highlighting concerns regarding the dangers associated with excessive use (e.g., misuse). Finally, our moderated mediation model provides a good starting point in focusing on variables related to prescription pain medication use behaviors that result from men's perception of physical stimuli and social constructs.

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