

# Predictors of pain severity among community-dwelling older adults with pain in the United States

## Findings from a cross-sectional, retrospective study using 2017 Medical Expenditure Panel Survey

David R. Axon, PhD, MPharm, MS, MRPharmS<sup>a,b,\*</sup> , Darlena Le, BS<sup>a</sup>

### Abstract

The purpose of this study was to determine predictors of pain severity among older United States (US) adults with pain.

This cross-sectional, retrospective study utilized 2017 Medical Expenditure Panel Survey data. Eligible participants were alive for the calendar year, aged  $\geq 50$  years, and reported pain in the past 4 weeks. Hierarchical logistic regression models, adjusting for the survey design, were used to identify significant predictors of pain severity (i.e., extreme/quite a bit or moderate/little pain).

An estimated 14,250,534 adults aged  $\geq 50$  with pain reported extreme/quite a bit of pain. Many variables were associated with extreme/quite a bit of pain, including: age 50 to 64 vs  $\geq 65$  years (adjusted odds ratio [AOR] = 1.49, 95% confidence interval [95% CI] = 1.22–1.82); males vs females (AOR = 0.80, 95% CI = 0.67–0.95); white race vs others (AOR = 0.75, 95% CI = 0.61–0.92); married vs other marital status (AOR = 1.31, 95% CI = 1.08–1.57); income  $< 200\%$  vs  $\geq 200\%$  federal poverty level (AOR = 1.30, 95% CI = 1.06–1.60); employed vs unemployed (AOR = 0.47, 95% CI = 0.37–0.60); limitation vs no limitation (AOR = 2.64, 95% CI = 2.09–3.33); 0, 1, 3, or 4 vs  $\geq 5$  chronic conditions (AOR ranged from 0.39 for 0 conditions to 0.77 for 4 conditions); excellent/very good or good vs fair/poor perceived physical health status (AOR ranged from 0.28 for excellent/very good to 0.40 for good); smokers vs non-smokers (AOR = 1.56, 95% CI = 1.27–1.93); exercise versus no exercise (AOR = 0.74, 95% CI = 0.62–0.88); and South vs West census region (AOR = 1.34, 95% CI = 1.04–1.74).

This study found several characteristics could predict pain severity among older US adults who reported extreme/quite a bit of pain. These characteristics may guide specific areas of focus to improve patients' pain management.

**Abbreviations:** AOR = adjusted odds ratio, 95% CI = 95% confidence interval, MEPS = Medical Expenditure Panel Survey, US = United States US.

**Keywords:** Medical Expenditure Panel Survey, older adults, pain severity, pain intensity

Editor: Flavio Palmieri.

Dr. Axon has received research funding from the American Association of Colleges of Pharmacy, Arizona Department of Health Services, Pharmacy Quality Alliance, Merck & Co., and Tabula Rasa Health Care Group outside of this study.

The authors have no conflicts of interests to disclose.

The datasets generated during and/or analyzed during the current study are publicly available.

<sup>a</sup> Department of Pharmacy Practice & Science, <sup>b</sup> Center for Health Outcomes and Pharmaco-economic Research, University of Arizona College of Pharmacy, Tucson, Arizona.

\* Correspondence: David R. Axon, Department of Pharmacy Practice & Science, University of Arizona College of Pharmacy, 1295 N Martin Ave, PO Box 210202, Tucson 85721, Arizona (e-mail: axon@pharmacy.arizona.edu).

Copyright © 2021 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial License 4.0 (CCBY-NC), where it is permissible to download, share, remix, transform, and buildup the work provided it is properly cited. The work cannot be used commercially without permission from the journal.

How to cite this article: Axon DR, Le D. Predictors of pain severity among community-dwelling older adults with pain in the United States: findings from a cross-sectional, retrospective study using 2017 Medical Expenditure Panel Survey. *Medicine* 2021;100:20(e26011).

Received: 29 January 2021 / Received in final form: 20 April 2021 / Accepted: 30 April 2021

<http://dx.doi.org/10.1097/MD.00000000000026011>

## 1. Introduction

The prevalence of pain among United States (US) adults was estimated at 126 million according to the 2012 National Health Interview Survey.<sup>[1]</sup> Pain can be defined as “an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.”<sup>[2]</sup> Pain is a relevant concern particularly for the aging US adult population. One in 5 Americans is projected to be at least 65 years old by 2030.<sup>[3]</sup> For this age population, it was also found that 18.7 million adults were affected by pain in a 2011 National Health and Aging Trends Study.<sup>[4]</sup> As the population of aging US adults increasingly expands,<sup>[5]</sup> the numbers of individuals affected by pain will consequently grow as well.

Pain severity plays an important role in determining quality of life. For older patients, those suffering from the highest pain intensity reported being less satisfied with life.<sup>[6]</sup> Pain severity also affects medication usage. In a recent study, it was determined that it was more likely for older adults affected by moderate to severe pain to take at least 1 analgesic medication (49%) compared to individuals with mild pain (11%).<sup>[7]</sup> Additional influential factors of pain severity are higher rates of side effects due to medications, complex pain manifestations, and underreporting of pain.<sup>[8]</sup>

Moreover, pain severity can have broader implications on direct costs to the economy. Albeit out of date, a previous Medical Expenditure Panel Survey (MEPS) study found that individuals with moderate or severe pain incurred higher healthcare spending.<sup>[8]</sup> The increased healthcare spending underscores the importance of optimizing pain treatment for patients.

Previous studies on pain severity have focused on economic outcomes, medication usage, and impact on specific medical conditions (e.g., patients with dry eye disease).<sup>[9]</sup> However, since pain is subjective (i.e., everyone perceives it differently),<sup>[8]</sup> research is warranted to investigate the factors that can influence perceived pain severity. This information may help improve the identification of vulnerable populations at risk for experiencing greater pain severity and allow for better prognosis and pain management outcomes.

The objective of this study was to determine the predictors of pain severity among older US adults (those aged 50 years or older) affected by pain.

## 2. Methods

### 2.1. Data source, study design, and subject eligibility

MEPS is carried out by the Agency for Healthcare Research and Quality using a sub-sample of the National Health Interview Survey from the previous year. Five interview rounds are conducted over a two-year period to collect data on, among other things, demographic characteristics, healthcare expenditure and utilization, health conditions, and health status. Due to oversampling of disabled and minority groups and application of appropriate analytical weighting variables, MEPS can produce nationally-representative estimates of the US non-institutionalized population.<sup>[10]</sup> This cross-sectional, retrospective study was approved by The University of Arizona Institutional Review Board and used the MEPS full-year consolidated data file (the most current data available at the time of the study) from the 2017 MEPS household component.<sup>[11]</sup> Subjects eligible for inclusion in the study were those alive for the calendar year, age  $\geq 50$  years, and reported having pain in the past 4 weeks as indicated by the subjects' response to the question "During the past 4 weeks, pain interfered with normal work outside the home and housework". Subjects were deemed to have pain if they reported any of the following responses to this item: a little bit, moderately, quite a bit, or extremely. Subjects who reported they did not have pain were excluded from the study.<sup>[12,13]</sup>

### 2.2. Dependent variable

Pain severity served as the dependent variable in this study, which was categorized as extreme/quite a bit of pain or moderate/little pain using the pain item described above.<sup>[12,13]</sup>

### 2.3. Independent variables

Five groups of variables, organized by the Behavioral Model of Health Services Use, served as the independent variables.<sup>[14]</sup>

Predisposing factors consisted of: age (50–64,  $\geq 65$ ); gender (male, female); race (white, other); and ethnicity (Hispanic, non-Hispanic).

Enabling factors consisted of: marital status (married, other); poverty status ( $< 200\%$  federal level,  $\geq 200\%$  federal poverty level); employment status (employed, unemployed); education status (less than high school, up to high school, higher than high

school); and health insurance coverage status (private, public, uninsured).

Need factors included: any limitations (yes, no); chronic health conditions (summed from the following list of prevalent conditions: angina, arthritis, asthma, cancer, chronic bronchitis, coronary heart disease, diabetes, joint pain, emphysema, hypercholesterolemia, hypertension, myocardial infarction, other unspecified heart disease, stroke; categorized as 0, 1, 2, 3, 4,  $\geq 5$ ); perceived physical health status (excellent/very good/good, fair/poor); and perceived mental health status (excellent/very good/good, fair/poor).

The 2 personal health practice factors were current smoker (yes, no) and regular exercise (yes, no), while the only external environmental factor was region (South, Northeast, Midwest, West).<sup>[12,13]</sup>

## 2.4. Data analysis

This study first compared the subject characteristics between those who reported extreme/quite a bit of pain and those who reported moderate/little pain using Chi-Squared tests. Then, hierarchical logistic regression models assessed statistically significant predictors of extreme/quite a bit of pain, with moderate/little pain as the reference group. The initial model included only predisposing factors; additional groups of factors were added to subsequent models until the final model that included predisposing, enabling, need, personal health practices, and external environmental factors was assessed. Significance was determined using an *a priori* alpha level of 0.05. The study groups were developed and analyzed using SAS University Edition (SAS institute Inc., Cary, NC, USA).

## 3. Results

A total of 5076 subjects were included in this study, of which 1424 reported extreme/quite a bit of pain and 3652 reported moderate/little pain. From a weighted population of 57,074,842 individuals, 25.0% (95% confidence interval [CI]=23.2%, 26.7%) reported extreme/quite a bit of pain and 75.0% (95% CI=73.3%, 76.8%) reported moderate/little pain.

The majority of individuals in the study had the following characteristics: age  $\geq 65$  years, female, white race, non-Hispanic, married,  $\geq 200\%$  federal poverty level, unemployed, higher than high school education, private health insurance coverage, any limitations,  $\geq 4$  chronic health conditions, excellent/very good/good physical and mental health, not current smokers, and no regular exercise. The most common census region was the south. Significant differences were identified between individuals who reported extreme/quite a bit of pain and those who reported moderate/little pain for all characteristics except age ( $P=.28$ ) and ethnicity ( $P=.94$ ). See Table 1 for further details.

Among the predisposing factors, those aged 50 to 64 years were approximately 1.5 times more likely to report extreme/quite a bit of pain compared to those aged  $\geq 65$  years (adjusted odds ratio [AOR]=1.49, 95% CI=1.22, 1.82). Males (vs females) and White (vs other) race were associated with lower likelihood of reporting extreme/quite a bit of pain (AOR=0.80, 95% CI=0.67, 0.95 and AOR=0.75, 95% CI=0.61, 0.92 respectively).

Among the enabling factors, those who were married (versus other marital status) and those below 200% of the federal poverty level (vs those above the 200% federal poverty level) were approximately 1.3 times more likely to report extreme/quite

**Table 1**  
**Characteristics of United States older adults (age ≥50years) with self-reported pain in the past 4 weeks, stratified by pain severity.**

Factors	Total (Weighted N = 57,074,842) Weighted % (95% CI)	Extreme/quite a bit pain (Weighted N = 14,250,534) Weighted % (95% CI)	Moderate/little pain (Weighted N = 42,824,307) Weighted % (95% CI)	P
Predisposing factors:				
Age (yr)				.28
50, 64	49.0 (47.0, 51.0)	47.5 (44.2, 50.8)	49.5 (47.2, 51.8)	
≥65	51.0 (49.0, 53.0)	52.5 (49.2, 55.8)	50.5 (48.2, 52.8)	
Gender				<.01
Male	44.8 (43.5, 46.1)	40.8 (37.9, 43.8)	46.1 (44.5, 47.6)	
Female	55.2 (53.9, 56.5)	59.2 (56.2, 62.1)	53.9 (52.4, 55.5)	
Race				<.01
White	81.1 (79.5, 82.7)	76.2 (73.4, 79.0)	82.8 (81.1, 84.5)	
Other	18.9 (17.3, 20.5)	23.8 (21.0, 26.6)	17.2 (15.5, 18.9)	
Ethnicity				.94
Hispanic	10.1 (8.8, 11.4)	10.0 (7.8, 12.2)	10.1 (8.7, 11.5)	
Non, Hispanic	89.9 (88.6, 91.2)	90.0 (87.8, 92.2)	89.9 (88.5, 91.3)	
Enabling factors:				
Marital status				<.01
Married	57.2 (55.1, 59.2)	49.9 (46.6, 53.3)	59.6 (57.3, 61.8)	
Other	42.8 (40.8, 44.9)	50.1 (46.7, 53.4)	40.4 (38.2, 42.7)	
Poverty status				<.01
<200% federal poverty level	32.2 (30.3, 34.2)	50.0 (46.5, 53.5)	26.3 (24.4, 28.2)	
≥200% federal poverty level	67.8 (65.8, 69.7)	50.0 (46.5, 53.5)	73.7 (71.8, 75.6)	
Employment status				<.01
Employed	39.0 (36.8, 41.2)	17.1 (14.6, 19.5)	46.3 (43.7, 48.8)	
Unemployed	61.0 (58.8, 63.2)	82.9 (80.5, 85.4)	53.7 (51.2, 56.3)	
Education status				<.01
Less than high school	16.2 (14.8, 17.7)	25.0 (21.6, 28.4)	13.3 (12.0, 14.7)	
Up to high school	33.0 (31.4, 34.6)	35.1 (32.2, 38.0)	32.3 (30.5, 34.2)	
Higher than high school	50.7 (48.7, 52.8)	39.9 (36.4, 43.4)	54.3 (52.1, 56.5)	
Health insurance coverage status				<.01
Private	61.0 (59.1, 62.9)	43.7 (40.1, 47.3)	66.8 (64.8, 68.8)	
Public	35.4 (33.6, 37.3)	52.7 (49.3, 56.1)	29.7 (27.7, 31.6)	
Uninsured	3.6 (2.9, 4.2)	3.6 (2.4, 4.8)	3.6 (2.9, 4.2)	
Need factors:				
Any limitation				<.01
Yes	50.8 (48.9, 52.7)	79.4 (76.6, 82.3)	41.2 (39.2, 43.3)	
No	49.2 (47.3, 51.1)	20.6 (17.7, 23.4)	58.8 (56.7, 60.8)	
Chronic health conditions				<.01
0	4.9 (4.1, 5.7)	1.4 (0.7, 2.0)	6.0 (5.0, 7.1)	
1	10.1 (9.1, 11.1)	4.1 (3.1, 5.2)	12.1 (10.9, 13.4)	
2	15.6 (14.3, 17.0)	12.1 (9.8, 14.4)	16.8 (15.2, 18.4)	
3	18.9 (17.6, 20.1)	13.7 (11.6, 15.8)	20.6 (19.0, 22.1)	
4	16.6 (15.4, 17.7)	16.1 (13.9, 18.2)	16.7 (15.3, 18.2)	
≥5	33.9 (32.2, 35.6)	52.6 (49.1, 56.1)	27.7 (25.9, 29.5)	
Perceived physical health status				<.01
Excellent/very good	35.5 (33.9, 37.2)	14.5 (12.4, 16.6)	42.5 (40.6, 44.5)	
Good	37.5 (35.9, 39.0)	31.0 (28.0, 33.9)	39.6 (37.7, 41.5)	
Fair/poor	27.0 (25.5, 28.5)	54.5 (51.0, 58.0)	17.8 (16.3, 19.3)	
Perceived mental health status				<.01
Excellent/very good	52.0 (50.1, 53.9)	31.7 (28.5, 34.9)	58.8 (56.7, 60.9)	
Good	33.5 (31.8, 35.3)	39.8 (36.3, 43.3)	31.4 (29.4, 33.5)	
Fair/poor	14.5 (13.3, 15.6)	28.5 (25.6, 31.4)	9.8 (8.7, 10.9)	
Personal health practices factors:				
Current smoker				<.01
Yes	14.9 (13.8, 16.0)	22.4 (19.9, 24.9)	12.4 (11.2, 13.6)	
No	85.1 (84.0, 86.2)	77.6 (76.1, 80.1)	87.6 (86.4, 88.8)	
Regular exercise				<.01
Yes	41.9 (40.0, 43.7)	28.7 (25.8, 31.5)	46.3 (44.2, 48.3)	
No	58.1 (56.3, 60.0)	71.3 (68.5, 74.2)	53.7 (51.7, 55.8)	
External environmental factors:				
Census region				<.01
South	38.2 (36.1, 40.3)	45.0 (41.0, 49.1)	35.9 (33.6, 38.3)	
Northeast	18.2 (16.5, 19.8)	17.0 (13.8, 20.1)	18.6 (16.7, 20.4)	
Midwest	22.1 (20.3, 23.9)	19.8 (16.7, 22.8)	22.9 (20.8, 24.9)	
West	21.5 (19.7, 23.3)	18.2 (15.5, 20.9)	22.6 (20.5, 24.7)	

Based on 5076 (un-weighted) United States older adults (age ≥50years) with self-reported pain in the past 4weeks who were alive during the calendar year 2017.

% = percentage, CI = confidence interval.

Differences between the extreme/quite a bit of pain (un-weighted n=1,424) and the moderate/little pain (un-weighted n=3652) groups were determined using Chi-Squared tests.

a bit of pain (AOR = 1.31, 95% CI = 1.08, 1.57 and AOR = 1.30, 95% CI = 1.06, 1.60 respectively). Compared to those who were unemployed, the employed were less likely to report extreme/ quite a bit of pain (AOR = 0.47, 95% CI = 0.37, 0.60).

Among the need factors, those who reported having any limitation (versus no limitation) were approximately 2.6 times more likely to report extreme/quite a bit of pain (AOR = 2.64, 95% CI = 2.09, 3.33). Subjects with 0, 1, 3, or 4 (vs  $\geq 5$ ) chronic conditions were associated with lower likelihood of reporting extreme/quite a bit of pain (AOR ranged from 0.39 for 0 conditions to 0.77 for 4 conditions). Subjects who perceived their physical health status as excellent/very good or good (versus fair/poor) were also associated with less likelihood of reporting extreme/quite a bit of pain (AOR ranged from 0.28 for excellent/very good to 0.40 for good).

Both personal health practice factors were associated with pain severity; those who were smokers were approximately 1.6 times more likely to report extreme/quite a bit of pain than non-smokers (AOR = 1.56, 95% CI = 1.27, 1.93), while those who reported doing regular exercise were less likely to report extreme/ quite a bit of pain than those who did not do regular exercise (AOR = 0.74, 95% CI = 0.62, 0.88).

For the external environmental factor, those living in the South versus West census region were associated with approximately 1.3 times the likelihood of report extreme/quite a bit of pain (AOR = 1.34, 95% CI = 1.04, 1.74).

The logistic regression model had a c-statistic of 0.80 and Wald statistic of  $< 0.01$ . See Table 2 for further details.

#### 4. Discussion

This study sought to identify the predictors of pain severity for a national sample of older US adults ( $\geq 50$  years) with pain, in order to address this knowledge gap in the literature. The key finding of this study was that need factors, in particular perceived physical health status, were the strongest predictors of quite a bit/extreme pain severity. Other significant predictive factors included age, gender, race, marital status, poverty status, employment status, limitation status, number of chronic health conditions, smoker status, regular exercise status, and census regions. The multitude of factors that are predictive of pain severity gives insight into the characteristics that may affect pain, highlights the complexity of pain as a condition, and suggests it is important for health care providers to be holistic when working with patients to manage their pain.

This study also reported on the prevalence of pain severity among older US adults. A previous study in 2011 found that approximately 19 million US adults aged 65 years or older had pain.<sup>[4]</sup> Our study expands on this finding; approximately 14 million adults aged 50 years or older had extreme or quite a bit of pain, and a further 43 million had moderate or a little bit of pain. This result emphasizes the vulnerability of the older adult population to pain, and the need to conduct more studies to investigate pain severity.

Most existing studies focus on identifying predictors of pain intensity for people with specific medical conditions such as radiographic knee osteoarthritis, temporomandibular disorder, and dysmenorrhea.<sup>[15–17]</sup> There is little literature available on predictive characteristics of pain, therefore this study provides valuable updated information on the predictors of pain severity among a national sample of US older adults. The findings from this study are discussed and related to the limited available literature forthwith.

**Table 2**

**Predictors of quite a bit/extreme pain severity among older United States adults (age  $\geq 50$  years) with pain in the past 4 weeks.**

Predictor variables	Adjusted odds ratio	95% Confidence interval
Predisposing factors:		
Age (yr)		
50–64 vs $\geq 65$	1.49	(1.22, 1.82)
Gender		
Male vs female	0.80	(0.67, 0.95)
Race		
White vs other	0.75	(0.61, 0.92)
Ethnicity		
Hispanic vs non-Hispanic	0.93	(0.70, 1.22)
Enabling factors:		
Marital status		
Married vs. other	1.31	(1.08, 1.57)
Poverty status		
$< 200\%$ vs $\geq 200\%$ federal poverty level	1.30	(1.06, 1.60)
Employment status		
Employed vs unemployed	0.47	(0.37, 0.60)
Education status		
Less than high school vs higher than high school	1.24	(0.94, 1.62)
Up to high school vs higher than high school	1.05	(0.86, 1.29)
Health insurance coverage status		
Private vs uninsured	0.90	(0.56, 1.45)
Public vs uninsured	1.13	(0.71, 1.79)
Need factors:		
Any limitation		
Yes vs no	2.64	(2.09, 3.33)
Chronic health conditions		
0 vs $\geq 5$	0.39	(0.21, 0.71)
1 vs $\geq 5$	0.47	(0.33, 0.67)
2 vs $\geq 5$	0.77	(0.56, 1.05)
3 vs $\geq 5$	0.65	(0.50, 0.86)
4 vs $\geq 5$	0.77	(0.61, 0.99)
Perceived physical health status		
Excellent/very good vs. fair/poor	0.28	(0.21, 0.38)
Good vs fair/poor	0.40	(0.32, 0.51)
Perceived mental health status		
Excellent/very good vs fair/poor	0.81	(0.61, 1.06)
Good vs fair/poor	0.99	(0.76, 1.28)
Personal health practices factors:		
Current smoker		
Yes vs no	1.56	(1.27, 1.93)
Regular exercise		
Yes vs no	0.74	(0.62, 0.88)
External environmental factors:		
Census region		
South vs. West	1.34	(1.04, 1.74)
Northeast vs West	1.06	(0.74, 1.52)
Midwest vs West	1.04	(0.77, 1.40)

Based on 5076 (un-weighted) United States older adults (age  $\geq 50$  years) with self-reported pain in the past 4 weeks who were alive during the calendar year 2017. The reference group for the dependent variable in the binomial logistic regression was moderate/little pain (N = 3652). The model had a Wald statistic of  $P < .01$  and a c-statistic of .80. Bold indicates the variable was a statistically significant predictor of extreme/quite a bit of pain.

Among the predisposing factors explored in this study, age was the most significant predictor of pain severity. Compared to adults aged 65 years and older, those who were 50 to 64 years old had higher odds of reporting quite a bit/extreme pain. Reasons to explain this finding are unknown and warrant further investigation. Possible explanations may be that adults aged 65 years and older are likely retired, and thus are able to avoid activities that



may induce pain in the workplace or have more time to manage their pain and health generally. For example, one study reported that in contrast to younger or middle-aged adults with chronic pain, those over 60 years regularly utilized several pain coping strategies such as seeking social support and activity pacing.<sup>[18]</sup>

In addition to age, the predisposing factors of gender and race were also predictors of pain severity, with males (vs females) and white race (vs other race) having lower odds of reporting quite a bit/extreme pain severity. Previous research has identified both gender and racial disparities in pain management practices, which may account for the differences observed in pain severity for these characteristics. To illustrate gender bias, a previous study of physicians and medical students in the United Kingdom reported males experience more pain and females tend to exaggerate their pain.<sup>[19]</sup> As a result, females may be undertreated and susceptible to suffering from greater pain severity. To illustrate racial bias, another study revealed that the supporting of false beliefs about biological differences between White and Black Americans gave rise to medical students and residents providing less accurate treatment recommendations for Black Americans.<sup>[20]</sup> The potential underlying causes of gender and racial disparities in pain (and healthcare generally) therefore need to be addressed in future work.

Among the enabling factors, an income of less than 200% of the federal poverty level and those who were unemployed were found to be predictive of greater pain intensity. This may be because those who have severe pain are less able to work or work fewer hours than those with less or no pain. This suggestion is supported by a previous study using 2008 MEPS data determined that, compared to people without pain, those with moderate pain worked 291 fewer hours and those with severe pain worked 717 fewer hours annually.<sup>[8]</sup> Those who were married were also more likely to report quite a bit or extreme pain, yet reasons for this are unknown and therefore warrant investigation in future research.

Several need factors were associated with pain severity. The strongest predictor in this study was perceived physical health status. This parallels the findings of previous research in a Chinese population that also found self-rated physical health was a predictor of pain severity.<sup>[21]</sup> Another study found that lower pain intensity among individuals with chronic pain was associated with better self-perception of health.<sup>[22]</sup> Interestingly, however, perceived mental health status was not associated with pain severity. Although further research would be welcome on this topic, it is clear that one's perception of health status is important and should be incorporated into discussions with patients about their pain management. By learning more about individuals' perceptions of their health status, healthcare providers can better understand the needs of individuals with pain to help optimize health outcomes.

Another strong predictor of pain severity was the presence of a limitation. This is a logical finding, given that limitations may be due to pain, and is supported by the findings of a previous study that reported pain intensity was a significant predictor of activities of daily living issues.<sup>[23]</sup>

Furthermore, those with 0, 1, 3, or 4 (vs  $\geq 5$ ) chronic health conditions had lower odds of reporting quite a bit or extreme pain. It is estimated that about 80% of the older adult population are affected by 1 chronic condition.<sup>[24]</sup> For instance, patients with diabetes may experience neuropathic pain<sup>[25]</sup> while those with cancer may experience bone pain.<sup>[26]</sup> Thus, it makes sense that people with more chronic health conditions are more likely to be

affected by pain. The number and types of chronic conditions should therefore be considered when assessing pain severity among older US adults.

Following on from the need factors, both personal health practices factors were predictors of pain severity. The association between lack of exercise and being a smoker on greater pain severity complements our finding of the association between number of chronic health conditions and pain severity. Smoking is known to be detrimental to one's health as it causes heart disease, lung diseases, and diabetes among many others.<sup>[27]</sup> The many chronic diseases that smoking can give rise to may be a plausible explanation for why participants in this study, who were current smokers, were more likely to experience severe pain.

Several limitations were present in the current study. Since this was a cross-sectional, retrospective study, a cause-and-effect relationship cannot be determined. This MEPS study also relies on self-reported data; thus, recall bias may potentially occur. Pain is also subjective<sup>[8]</sup>; therefore, self-reported pain severity level among participants may be subject to variability. Finally, due to data limitations, it was not possible to differentiate and explore the impact of different pain types on pain severity.

In summary, this study expands on existing studies by identifying significant predictors of pain severity for a nationally representative sample of older adults (aged  $\geq 50$  years). One key finding was that need factors such as perceived physical health status, limitations, and chronic health conditions, were most strongly associated with pain severity. The findings from this study are important for healthcare professionals to consider when helping US older adults to manage their pain, and may provide useful guidance for researchers to target specific personal characteristics that are associated with pain for future research. Future work is needed to explore reasons for some of these findings, and to investigate how different types of pain can influence pain severity or explore pain severity in other populations in addition to the older US adult population.

## Author contributions

**Conceptualization:** David Rhys Axon, Darlena Le.

**Data curation:** David Rhys Axon.

**Formal analysis:** David Rhys Axon.

**Investigation:** David Rhys Axon.

**Methodology:** David Rhys Axon, Darlena Le.

**Project administration:** David Rhys Axon.

**Resources:** David Rhys Axon.

**Software:** David Rhys Axon.

**Supervision:** David Rhys Axon.

**Validation:** David Rhys Axon, Darlena Le.

**Visualization:** David Rhys Axon, Darlena Le.

**Writing – original draft:** David Rhys Axon, Darlena Le.

**Writing – review & editing:** David Rhys Axon, Darlena Le.

## References

- [1] Nahin R. Estimates of pain prevalence and severity in adults: United States, 2012. *J Pain* 2015;16:769–80.
- [2] Raja S, Carr D, Cohen M, et al. The revised International Association for the Study of Pain definition of pain. *Pain* 2020;161:1976–82.
- [3] RHIhub. Demographic changes and aging population [Rural Health Information Web site]. Available at <https://www.ruralhealthinfo.org/toolkits/aging/1/demographics>. Accessed July 10, 2020.
- [4] Patel K, Guralnik J, Dansie E, et al. Prevalence and impact of pain among older adults in the United States: findings from the 2011 National Health and Aging Trends study. *Pain* 2013;154:2649–57.

- [5] Mather M, Jacobsen L, Pollard K. Population bulletin: aging in the United States [PRB Web site]. December 2015. Available at: <https://www.prb.org/wp-content/uploads/2016/01/aging-us-population-bulletin-1.pdf>. Accessed July 21, 2020.
- [6] Stompor M, Grodzicki T, Stompor T, et al. Prevalence of chronic pain, particularly with neuropathic component, and its effect on overall functioning of elderly patients. *Med Sci Monit* 2019;25:2695–701.
- [7] Nawai A, Leveille S, Shmerling R, et al. Pain severity and pharmacologic pain management among community-living older adults: the MOBILIZE Boston study. *Aging Clin Exp Res* 2017;29:1139–47.
- [8] Institute of Medicine (US) Committee on Advancing Pain Research, Care and Education. Relieving pain in America: a blueprint for transforming prevention, care, education, and research [US Pain Foundation Web site]. 2011. Available at: <https://www.uspainfoundation.org/wp-content/uploads/2016/01/IOM-Full-Report.pdf>. Accessed June 14, 2020.
- [9] Satitpitakul V, Kheirkhah A, Crnej A, et al. Determinants of ocular pain severity in patients with dry eye disease. *Am J Ophthalmol* 2017;179:198–204.
- [10] Agency for Healthcare Research and Quality. Survey background [Medical Expenditure Panel Survey Web site]. Available at: [https://meps.ahrq.gov/mepsweb/about\\_meps/survey\\_back.jsp](https://meps.ahrq.gov/mepsweb/about_meps/survey_back.jsp). Accessed May 9, 2020.
- [11] Agency for Healthcare Research and Quality. Download data files, documentation, and codebooks. Available at: [https://meps.ahrq.gov/mepsweb/data\\_stats/download\\_data\\_files.jsp](https://meps.ahrq.gov/mepsweb/data_stats/download_data_files.jsp). Accessed May 9, 2020.
- [12] Agency for Healthcare Research and Quality. MEPS HC-201 2017 full year consolidated data file [Medical Expenditure Panel Survey Web site]. Available at: [https://meps.ahrq.gov/data\\_stats/download\\_data/pufs/h201/h201doc.pdf](https://meps.ahrq.gov/data_stats/download_data/pufs/h201/h201doc.pdf). Accessed May 9, 2020.
- [13] Agency for Healthcare Research and Quality. MEPS HC-201 2017 full year consolidated data codebook [Medical Expenditure Panel Survey Web site]. Available at: [https://meps.ahrq.gov/data\\_stats/download\\_data/pufs/h201/h201cb.pdf](https://meps.ahrq.gov/data_stats/download_data/pufs/h201/h201cb.pdf). Accessed May 9, 2020.
- [14] Andersen R. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav* 1995;36:1–10.
- [15] Pan F, Tian J, Aitken D, et al. Predictors of pain severity trajectory in older adults: a 10.7-year follow-up study. *Osteoarthritis Cartilage* 2018;26:1619–26.
- [16] Kapos F, Look J, Zhang L, et al. Predictors of long-term temporomandibular disorder pain intensity: an 8-year cohort study. *J Oral Facial Pain Headache* 2018;32:113–222.
- [17] Helwa H, Mitaeb A, Al-Hamshri S, et al. Prevalence of dysmenorrhea and predictors of its pain intensity among Palestinian female university students. *BMC Womens Health* 2018;18:18.
- [18] Molton I, Jensen M, Ehde D, et al. Coping with chronic pain among younger, middle-aged, and older adults living with neurological injury and disease. *J Aging Health* 2008;20:972–96.
- [19] Schafer G, Prkachin K, Kaseweter K, et al. Health care providers' judgments in chronic pain: the influence of gender and trustworthiness. *Pain* 2016;157:1618–25.
- [20] Hoffman K, Trawalter S, Axt J, et al. Racial bias in pain assessment and treatment recommendations, and false beliefs about biological differences between blacks and whites. *Proc Natl Acad Sci U S A* 2016;113:4296–301.
- [21] Liu X, Xiao S, Zhou L, et al. Different predictors of pain severity across age and gender of a Chinese rural population: a cross-sectional survey. *BMJ Open* 2018;8:e020938.
- [22] Pereira L, Vasconcelos P, Souza L, et al. Prevalence and intensity of chronic pain and self-perceived health among elderly people: a population-based study. *Rev Lat Am Enfermagem* 2014;22:662–9.
- [23] Stamm T, Pieber K, Crevenna R, et al. Impairment in the activities of daily living in older adults with and without osteoporosis, osteoarthritis and chronic back pain: a secondary analysis of population-based health survey data. *BMC Musculoskelet Disord* 2016;17:139.
- [24] Centers for Disease Control and Prevention. Healthy aging at a glance, 2011: helping people to live long and productive lives and enjoy a good quality of life [CDC Stacks Web site]. May 2011. Available at: <https://stacks.cdc.gov/view/cdc/22022>. Accessed June 12, 2020.
- [25] Shillo P, Sloan G, Grejg M, et al. Painful and painless diabetic neuropathies: what is the difference? *Curr Diab Rep* 2019;19:32.
- [26] Zajackowska R, Kocot-Kepska M, Leppert W, et al. Bone pain in cancer patients: mechanisms and current treatment. *Int J Mol Sci* 2019;20:6047.
- [27] Centers for Disease Control and Prevention. Health effects [Smoking & Tobacco Use Web site]. April 28, 2020. Available at: [https://www.cdc.gov/tobacco/basic\\_information/health\\_effects/](https://www.cdc.gov/tobacco/basic_information/health_effects/). Accessed July 2, 2020.