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

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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 ≥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 ≥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 ≥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 ≥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 ≥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

1. Introduction

The prevalence of pain among United States (US) adults was estimated at 126 million according to the 2012 National Health Interview Survey. Pain can be defined as “an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.”[2] 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.[3] 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.[4] As the population of aging US adults increasingly expands,[5] 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.[6] 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%).[7] Additional influential factors of pain severity are higher rates of side effects due to medications, complex pain manifestations, and underreporting of pain.[8]
Moreover, pain severity can have broader implications on direct costs to the economy. At the outset of a previous Medical Expenditure Panel Survey (MEPS) study found that individuals with moderate or severe pain incurred higher healthcare spending. \[8\] 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). \[9\] However, since pain is subjective (i.e., everyone perceives it differently), \[8\] 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. \[10\] 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. \[11\] 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. \[12,13\]

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. \[12,13\]

2.3. Independent variables

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

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). \[12,13\]

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 (\(P=0.28\)) and ethnicity (\(P=0.94\)). 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
| Factors                                      | Total (Weighted N = 57,074,842) | Extreme/quite a bit pain (Weighted N = 14,250,534) | Moderate/little pain (Weighted N = 42,824,307) | P       |
|---------------------------------------------|---------------------------------|----------------------------------------------------|-------------------------------------------------|---------|
| Weighted % (95% CI)                         | Weighted % (95% CI)             | Weighted % (95% CI)                                 |                                                 |         |
| **Predisposing factors:**                   |                                 |                                                    |                                                 |         |
| Age (yr)                                    | 50, 64                          | 51.0 (50.3, 51.6)                                  | 47.5 (45.2, 50.8)                                | .28     |
|                                            | ≥65                             | 51.0 (49.0, 53.0)                                  | 52.5 (49.2, 55.8)                                | <.01    |
| Gender                                      | Male                            | 44.8 (43.5, 46.1)                                  | 40.8 (37.9, 43.8)                                | .94     |
|                                            | Female                          | 55.2 (53.9, 56.5)                                  | 59.2 (56.2, 62.1)                                | <.01    |
| Race                                        | White                           | 81.1 (79.5, 82.7)                                  | 76.2 (73.4, 79.0)                                | <.01    |
|                                            | Other                           | 18.9 (17.3, 20.3)                                  | 23.8 (21.0, 26.6)                                | .94     |
| Ethnicity                                   | Hispanic                        | 10.1 (8.8, 11.4)                                   | 10.0 (7.8, 12.2)                                 | .94     |
|                                            | Non-Hispanic                    | 89.9 (88.6, 91.2)                                  | 90.0 (87.8, 92.2)                                | .94     |
| **Enabling factors:**                       |                                 |                                                    |                                                 |         |
| Marital status                              | Married                         | 57.2 (55.1, 59.2)                                  | 49.9 (46.6, 53.3)                                | <.01    |
|                                            | Other                           | 42.8 (40.8, 44.8)                                  | 50.1 (46.7, 53.4)                                | <.01    |
| Poverty status                              | <200% federal poverty level     | 32.2 (30.3, 34.2)                                  | 50.0 (46.5, 53.5)                                | <.01    |
|                                            | ≥200% federal poverty level     | 67.8 (65.8, 69.7)                                  | 50.0 (46.5, 53.5)                                | <.01    |
| Employment status                           | Employed                        | 39.0 (36.8, 41.2)                                  | 17.1 (14.6, 19.5)                                | <.01    |
|                                            | Unemployed                      | 61.0 (58.8, 63.2)                                  | 82.9 (80.5, 85.4)                                | <.01    |
| Education status                            | Less than high school           | 16.2 (14.8, 17.7)                                  | 25.0 (21.6, 28.4)                                | .94     |
|                                            | Up to high school               | 33.0 (31.4, 34.6)                                  | 35.1 (32.2, 38.0)                                | .94     |
|                                            | Higher than high school         | 50.7 (48.7, 52.8)                                  | 39.9 (36.4, 43.4)                                | .94     |
| Health insurance coverage status            | Private                         | 61.0 (59.1, 62.9)                                  | 43.7 (40.1, 47.3)                                | <.01    |
|                                            | Public                          | 35.4 (33.6, 37.3)                                  | 52.7 (49.3, 56.1)                                | <.01    |
|                                            | Uninsured                       | 3.6 (2.8, 4.2)                                     | 3.6 (2.4, 4.8)                                   | .94     |
| **Need factors:**                           | Any limitation                  | 50.8 (48.9, 52.7)                                  | 79.4 (76.6, 82.3)                                | <.01    |
|                                            | No                              | 49.2 (47.3, 51.1)                                  | 20.6 (17.7, 23.4)                                | <.01    |
| Chronic health conditions                   | 0                               | 4.9 (4.1, 5.7)                                     | 1.4 (0.7, 2.0)                                   | .94     |
|                                            | 1                               | 10.1 (9.1, 11.1)                                   | 4.1 (3.1, 5.2)                                   | .94     |
|                                            | 2                               | 15.6 (14.3, 17.0)                                  | 12.1 (9.8, 14.4)                                 | .94     |
|                                            | 3                               | 18.9 (17.6, 20.1)                                  | 13.7 (11.6, 15.8)                                | .94     |
|                                            | 4                               | 16.6 (15.4, 17.7)                                  | 16.1 (13.9, 18.2)                                | .94     |
|                                            | ≥5                              | 33.9 (32.2, 35.6)                                  | 52.6 (49.1, 56.1)                                | .94     |
| Perceived physical health status            | Excellent/very good             | 35.5 (33.9, 37.2)                                  | 14.5 (12.4, 16.6)                                | <.01    |
|                                            | Good                            | 37.5 (35.9, 39.0)                                  | 31.0 (28.0, 33.9)                                | <.01    |
|                                            | Fair/poor                       | 27.0 (25.5, 28.5)                                  | 54.5 (51.0, 58.0)                                | <.01    |
| Perceived mental health status              | Excellent/very good             | 52.0 (50.1, 53.9)                                  | 31.7 (28.5, 34.9)                                | <.01    |
|                                            | Good                            | 33.5 (31.8, 35.3)                                  | 39.8 (36.3, 43.3)                                | <.01    |
|                                            | Fair/poor                       | 14.5 (13.3, 15.6)                                  | 28.5 (25.6, 31.4)                                | <.01    |
| Personal health practices factors:          | Current smoker                  | 14.9 (13.8, 16.0)                                  | 22.4 (19.9, 24.9)                                | <.01    |
|                                            | No                              | 85.1 (84.0, 86.2)                                  | 77.6 (76.1, 80.1)                                | <.01    |
| Regular exercise                            | Yes                             | 41.9 (40.0, 43.7)                                  | 28.7 (25.8, 31.5)                                | <.01    |
|                                            | No                              | 58.1 (56.3, 60.0)                                  | 71.3 (68.5, 74.2)                                | <.01    |
| External environmental factors:             | Census region                   | 38.2 (36.1, 40.3)                                  | 45.0 (41.0, 49.1)                                | <.01    |
|                                            | South                           | 38.2 (36.1, 40.3)                                  | 45.0 (41.0, 49.1)                                | <.01    |
|                                            | Northeast                       | 18.2 (16.5, 19.8)                                  | 17.0 (13.8, 20.1)                                | <.01    |
|                                            | Midwest                         | 22.1 (20.3, 23.9)                                  | 19.8 (16.7, 22.8)                                | <.01    |
|                                            | West                            | 21.5 (19.7, 23.3)                                  | 18.2 (15.5, 20.9)                                | <.01    |

Based on 5076 (un-weighted) United States older adults (age ≥50 years) with self-reported pain in the past 4 weeks 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 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).

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 (≥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. 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. 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**

| Predictor variables                      | Adjusted odds ratio | 95% Confidence interval |
|-----------------------------------------|---------------------|-------------------------|
| Predisposing factors:                   |                     |                         |
| Age (yr)                                |                     |                         |
| 50–64 vs ≥65                            | 1.49                | (1.22, 1.82)            |
| Gender                                  |                     |                         |
| Male vs female                          | 0.80                | (0.67, 0.96)            |
| Race                                    |                     |                         |
| White vs other                          | 0.75                | (0.61, 0.92)            |
| Ethnicity                               |                     |                         |
| Hispanic vs non-Hispanic                | 0.93                | (0.70, 1.22)            |
| Need factors:                           |                     |                         |
| Any limitation                          | 2.64                | (2.09, 3.33)            |
| Chronic health conditions               |                     |                         |
| 0 vs ≥5                                 | 0.39                | (0.21, 0.71)            |
| 1 vs ≥5                                 | 0.47                | (0.33, 0.67)            |
| 2 vs ≥5                                 | 0.77                | (0.56, 1.05)            |
| 3 vs ≥5                                 | 0.65                | (0.50, 0.86)            |
| 4 vs ≥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          | 0.81                | (0.61, 1.06)            |
| Excellent/very good vs fair/poor        | 0.99                | (0.76, 1.28)            |
| Personal health practices factors:      |                     |                         |
| Current smoker                          | 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 ≥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<0.01 and a c-statistic of 0.80. 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.\[18]\n
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.\[19]\n
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 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.\[20]\n
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.\[8]\n
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.\[21]\n
Another study found that lower pain intensity among individuals with chronic pain was associated with better self-perception of health.\[22]\n
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.\[23]\n
Furthermore, those with 0, 1, 3, or 4 (vs ≥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.\[24]\n
For instance, patients with diabetes may experience neuropathic pain\[25]\n
while those with cancer may experience bone pain.\[26]\n
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.\[27]\n
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\[28]\n
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 ≥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.

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