

BMJ Open Assessing healthcare expenditures of older United States adults with pain and poor versus good mental health status: a cross-sectional study

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ABSTRACT

Objectives This study aimed to determine if differences exist in healthcare expenditures of older United States (US) adults with pain based on self-reported mental health status, which is important to know given the prevalence of pain and poor mental health in the USA.

Design This was a cross-sectional study.

Setting US Medical Expenditure Panel Survey (MEPS) interviews.

Participants US adults aged ≥ 50 years, with self-reported pain in the past 4 weeks and positive healthcare expenditure in the 2018 Medical Expenditure Panel Survey (MEPS). The independent variable was poor versus good mental health status.

Primary and secondary outcome measures Descriptive statistics compared demographic characteristics (using chi-square tests) and mean healthcare expenditures (using t-tests) between groups. Adjusted linear regression models with logarithmically-transformed expenditures compared differences in: total; inpatient; outpatient; emergency room; office-based; prescription medications and other expenditures. Analyses accounted for the complex MEPS design and were weighted to produce nationally-representative results. The a priori alpha level was 0.05.

Results The weighted population included 57 134 711 older US adults with self-reported pain (14.4% poor mental health, 85.6% good mental health). Compared with individuals with good mental health, individuals with poor mental health had higher unadjusted total expenditures (US\$20 231 vs US\$13 379, $p < 0.0001$), higher prescription medication expenditures (US\$5924 vs US\$3610, $p < 0.0001$) and higher other expenditures (US\$4833 vs US\$2285, $p < 0.0001$). In adjusted multivariable linear regression models, there were no differences in expenditures between those with poor mental health and those with good mental health status.

Conclusions There were no statistically significant differences in adjusted annual (2018) positive healthcare expenditures among older US adults with pain and poor versus good mental health status.

INTRODUCTION

Pain and poor mental health are highly prevalent, detrimental conditions that have a considerable burden on the healthcare system, economy and quality of life. The

Strengths and limitations of this study

- Strengths of the study include a large nationally representative sample of older United States (US) adults, which produced findings generalisable to the non-institutionalised US population.
- Another study strength was the ability to produce weighted estimates that represented 57 million older US adults.
- Limitations of the study include the inability to draw a cause-and-effect relationship due to the cross-sectional study design.
- Another study limitation was the use of self-reported data that may have been subject to recall bias, although this was minimised by the panel design of regular interviews.
- A further study limitation was that there are various definitions for pain, thus the definition of pain used in this study may produce different results from studies that used other definitions.

prevalence of pain among United States (US) adults ranges from 100 million to 126 million. Pain is also among the most frequently reported reasons for seeking medical care and can be burdensome to manage.¹⁻⁴ Prior research has found approximately two-thirds of adults experience lower back pain at some time.⁵ Other studies have found pain is significantly associated with older age (adults aged ≥ 50 years old (adjusted OR 2.03, 95% CI 1.48 to 2.78)), with a reported prevalence as high as 55%.⁵⁻⁷ With a growing population of older US adults, pain management exerts significant annual economic costs estimated at US\$560 to US\$635 billion (in 2010 US\$).^{1,8} Prior research has found 20% of Americans experience poor mental health in a given year and 50% are diagnosed with mental illness during their lifetime.^{9,10} Poor mental health status as a result of depression and anxiety exerts a global economic cost of US\$1 trillion (in 2013 US\$) per year due to lost productivity.¹¹

Prior research has found, with a high prevalence of co-occurrence, a bidirectional relationship between pain (regardless of aetiology) and poor mental health.^{12 13} The pathophysiological association between the physical and psychological symptoms is thought to be due to inter-related neural pathways.^{12 14} A study by WHO found patients with self-reported pain had approximately three times the odds of reporting anxiety or depressive disorders.¹⁵ Previous research findings have also identified that the prevalence of depressive or mood disorders can exceed 50% in patients with pain such as fibromyalgia.^{12 16 17} Meanwhile, other studies have found patients with depression were more likely to report pain and other physical problems compared with those with no mental health disorders.^{18 19}

There are many pharmacological and non-pharmacological approaches that can be used to manage or treat pain and mental health disorders, including antidepressant medications (eg, serotonin-norepinephrine reuptake inhibitors, tricyclic antidepressants),²⁰ psychological strategies (eg, cognitive behavioural therapy, counselling, therapy)^{21–23} and physical strategies (eg, exercise, massages).^{24 25} However, despite the variety of pharmacological and non-pharmacological management strategies, pain and poor mental health remain highly prevalent in the USA.²⁶

Prior research has explored the relationship between healthcare expenditures and pain²⁷ and the relationship between healthcare expenditures in specific populations of older adults with pain, including those with multiple chronic conditions and those with common comorbid conditions such as hypertension and hypercholesterolemia.^{28 29} Another recent study has explored the relationship between healthcare expenditures and general health status among older adults with pain.³⁰ However, little is known about the healthcare expenditures among an older US adult population with self-reported pain and poor mental health status. Therefore, this study sought to identify if differences exist in healthcare expenditures between those with poor mental health and those with good mental health among a nationally representative sample of adults aged ≥ 50 years with pain in the USA.

METHODS

Study data and design

Conducted on behalf of the Agency for Healthcare Research and Quality, the Medical Expenditure Panel Survey (MEPS) collects data in five interview rounds over a 2-year period and uses the sampling framework from the previous years' National Health Interview Survey. Survey participants provide oral informed consent before data are collected. One of the main MEPS components is the MEPS household component (MEPS-HC). MEPS-HC collates self-reported data on personal demographic characteristics, health conditions and health status and healthcare expenditures (among other things) for each household member surveyed. MEPS staff supplement

MEPS-HC data with data collected from the MEPS medical provider component (MEPS-MPC). MEPS-MPC healthcare expenditure data are typically more precise than MEPS-HC healthcare expenditure data; this process therefore improves the quality of healthcare expenditure data. MEPS healthcare expenditure data include the sum of annual payments for healthcare services made directly, out-of-pocket, by private insurance, by Medicaid, by Medicare and by other sources, but exclude payments for indirect payments not related to specific medical events and over-the-counter drugs. This cross-sectional study used the publicly-available 2018 full-year consolidated data file. These were the most recent data available at the time of the study and included data from interview rounds 3, 4 and 5 of survey panel 22 and interview rounds 1, 2 and 3 of survey panel 23.^{31 32}

Eligibility

Subjects in the MEPS 2018 full-year consolidated data file were eligible for inclusion in this study if they were alive for the full calendar year, at least 50 years of age and had pain in the last 4 weeks. Pain was defined using responses to the pain question available in MEPS that asked: 'During the past 4 weeks, pain interfered with normal work outside the home and housework'. Respondents who indicated: 'a little bit', 'moderately', 'quite a bit' or 'extremely' were included, while those who indicated 'not at all' were excluded.^{33 34} The analyses also only included subjects with positive healthcare expenditures (ie, those who used the healthcare system).

Dependent variable

The primary dependent variable in this study was total annual positive healthcare expenditures for eligible subjects in 2018. Secondary outcomes included the following specific categories of healthcare expenditures: inpatient expenditures; outpatient expenditures; emergency room expenditures; office-based expenditures; prescription medication expenditures and other expenditures. Inpatient expenditures were inclusive of all hospital inpatient visits. Inpatient, emergency room and outpatient expenditures were inclusive of all facility expenses and payments made to physicians for services provided but billed separately. Outpatient and office-based expenditures included visits to physicians and non-physician providers. Prescription medication expenditures included those associated with initial and refill out-of-pocket and third-party expenses. Home health expenditures included care provided by self-employed people as well as home health agencies, hospitals and nursing homes. Other healthcare expenditures included equipment and services such as glasses and contact lenses, vision aids, dental expenditures, ambulances, disposable supplies, other long-term equipment, home health expenditures for care provided by self-employed people as well as home health agencies, hospitals and nursing homes.^{33 34}

Independent variable

The independent variable in this study was perceived mental health status. This was defined using responses to a question that asked survey participants to rate their mental health as 'poor', 'fair', 'good', 'very good' or 'excellent'. Respondents who indicated: 'poor' or 'fair' were deemed to have poor mental health, while those who indicated 'good', 'very good' or 'excellent' were deemed to have good mental health.^{33 34}

Control variables

Potential confounding variables that were controlled for in adjusted analyses included: age (50–64, ≥65 years); gender (male, female); race (white, other); ethnicity (Hispanic, non-Hispanic); marital status (married, other); education completed (up to high school, higher than high school); employment status (employed, unemployed); income (poor/near poor/low income, middle/high income); health insurance (private, public, uninsured), pain severity (quite a bit/extreme, little/moderate); limitation (yes, no); number of chronic conditions from the following list: angina, arthritis, asthma, cancer, chronic bronchitis, coronary heart disease, diabetes, emphysema, hypercholesterolemia, hypertension, joint pain, myocardial infarction, other unspecified heart disease, stroke (≥5, 0–4); perceived health status (excellent/very good/good, fair/poor); smoking status (smoker, non-smoker); frequent exercise status (yes, no) and census region (Northeast, Midwest, South, West).^{33 34}

Data analysis

The demographic and descriptive characteristics of the two groups (poor and good mental health status) were compared using chi-square tests, while the mean annual healthcare expenditures of the two groups were compared using t-tests. Adjusted linear regression models were constructed to assess differences in healthcare expenditures between the poor mental health group and good mental health group. The assumptions of linear regression (no multicollinearity, homoscedasticity, independent observations, normality and linearity) were assessed. Due to the non-linear nature of the healthcare expenditure data, the data were logarithmically-transformed for analysis. Semilogarithmic equations were then used to calculate the per cent difference in healthcare expenditures between the two groups.³⁵ Analyses were conducted using PROC SURVEY commands in SAS University (SAS Institute, Cary, NC, USA). Analyses were weighted appropriately to obtain nationally-representative estimates and to account for the MEPS complex survey design. Variance estimates were calculated using the Taylor-series linearisation method. Given the large sample size, a conservative alpha level of 0.001 was used to determine statistical significance. This report was prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.³⁶

Patient and public involvement

No patients involved.

RESULTS

This study sample included 5123 eligible individuals, which represented a weighted population of 57 134 711 older US adults with pain in the past 4 weeks. Of these, 14.4% (95% CI 13.3% to 15.4%) perceived their mental health as poor and 85.6% (95% CI 84.6% to 86.7%) perceived their mental health as good.

The majority of individuals in the study had the following characteristics: aged ≥65 years (51.6%), female (55.7%), white race (80.9%), non-Hispanic (90.6%), married (56.7%), higher than high school education completed (55.0%), unemployed (60.2%), middle/high income (69.0%), private health insurance (57.6%), little/moderate pain severity (74.6%), limitations (50.8%), 0–4 chronic conditions (75.8%), excellent/very good/good perceived physical health status (73.4%), non-smokers (84.0%), no frequent exercise (58.0%). The most common census region was the South (38.4%). There were significant differences between individuals who reported poor mental health and those who reported good mental health for all characteristics ($p < 0.05$) except age ($p = 0.7658$), gender ($p = 0.4035$), race ($p = 0.9024$) and region ($p = 0.2997$) (table 1).

Individuals with poor mental health status had higher descriptive (unadjusted) total healthcare expenditures compared with those with good mental health status (US\$20 231 vs US\$13 379, $p < 0.0001$). Prescription medication and other expenditures were also higher in the poor mental health group versus the good mental health group (US\$5924 vs US\$3610, $p < 0.0001$ and US\$4833 vs US\$2285, $p < 0.0001$, respectively). There were no statistical differences between groups for the remaining healthcare expenditure categories (table 2).

In adjusted multivariable linear regression models, there were no significant differences in healthcare expenditures between those with poor mental health and those with good mental health status for any category of healthcare expenditures (table 3).

DISCUSSION

The key finding from this cross-sectional study was that there were no statistically significant differences in the 2018 healthcare expenditures of older US adults with self-reported pain between individuals with poor perceived mental health and those with good perceived mental health, after adjusting for potential confounding variables. Prior research using MEPS data found that healthcare expenditures were 105% higher among older US adults (aged ≥50 years old) with pain who were prescribed opioids compared with those who were not.³⁷ Another MEPS study found healthcare expenditures were 55% lower among older US adults (aged ≥50 years old) with pain with excellent health status versus those with poor

Table 1 Demographic and descriptive characteristics of older United States adults (aged ≥ 50 years) with self-reported pain in the past 4 weeks, stratified by poor mental health and good mental health

Variables	Total (Unweighted n=5123; Weighted n=57 134 711)		Poor mental health (Unweighted n=822; Weighted n= 8 216 719)		Good mental health (Unweighted n=4301; Weighted n= 48 917 992)		p
	Weighted %	95% CI	Weighted %	95% CI	Weighted %	95% CI	
Age (years)							0.7658
50–64	48.4	46.5 to 50.4	47.9	44 to 51.8	48.5	46.5 to 50.6	
≥ 65	51.6	49.6 to 53.5	52.1	48.2 to 56	51.5	49.4 to 53.5	
Gender							0.4035
Male	44.3	43 to 45.7	42.7	38.5 to 46.8	44.6	43.1 to 46.1	
Female	55.7	54.3 to 57	57.3	53.2 to 61.5	55.4	53.9 to 56.9	
Race							0.9024
White	80.9	79.2 to 82.7	80.8	77.5 to 84	81	79.2 to 82.7	
Other	19.1	17.3 to 20.8	19.2	16 to 22.5	19	17.3 to 20.8	
Ethnicity							<0.0001
Hispanic	9.4	7.7 to 11.2	16	11.7 to 20.3	8.3	6.9 to 9.8	
Non-Hispanic	90.6	88.8 to 92.3	84	79.7 to 88.3	91.7	90.2 to 93.1	
Marital status							<0.0001
Married	56.7	54.8 to 58.6	45.7	41 to 50.4	58.5	56.6 to 60.5	
Other	43.3	41.4 to 45.2	54.3	49.6 to 59	41.5	39.5 to 43.4	
Education completed							<0.0001
Up to high school	45	42.8 to 47.2	60.8	56 to 65.5	42.3	40.2 to 44.5	
Higher than high school	55	52.8 to 57.2	39.2	34.5 to 44	57.7	55.5 to 59.8	
Employment status							<0.0001
Employed	39.8	37.3 to 42.4	17	13.7 to 20.4	43.6	40.8 to 46.4	
Unemployed	60.2	57.6 to 62.7	83	79.6 to 86.3	56.4	53.6 to 59.2	
Income							<0.0001
Poor/near poor/low income	31	28.9 to 33	51.4	46.8 to 56.1	27.5	25.4 to 29.6	
Middle/high income	69	67 to 71.1	48.6	43.9 to 53.2	72.5	70.4 to 74.6	
Health insurance							<0.0001
Private	57.6	55.3 to 59.8	36.8	32.1 to 41.5	61.1	58.7 to 63.5	
Public	39.4	37.2 to 41.6	60	55.5 to 64.5	35.9	33.6 to 38.3	
Uninsured	3	2.4 to 3.7	3.2	1.4 to 5	3	2.4 to 3.6	
Pain severity							<0.0001
Quite a bit/extreme	25.3	23.8 to 26.9	48.7	44.3 to 53	21.4	19.8 to 23	
Little/moderate	74.7	73.1 to 76.2	51.3	47 to 55.7	78.6	77 to 80.2	
Limitation							<0.0001
Yes	50.8	48.7 to 53	79.7	76.3 to 83.1	46	43.7 to 48.2	
No	49.2	47 to 51.3	20.3	16.9 to 23.7	54	51.8 to 56.3	
Number of chronic conditions							<0.0001
≥ 5	24.2	22.5 to 25.9	36.3	32.3 to 40.2	22.2	20.4 to 23.9	
0–4	75.8	74.1 to 77.5	63.7	59.8 to 67.67	77.8	76.1 to 79.6	
Perceived health status							<0.0001
Excellent/very good/ good	73.4	71.7 to 75.1	26.1	22.3 to 29.9	81.3	79.7 to 82.9	

Continued

Table 1 Continued

Variables	Total (Unweighted n=5123; Weighted n=57 134 711)		Poor mental health (Unweighted n=822; Weighted n= 8 216 719)		Good mental health (Unweighted n=4301; Weighted n= 48 917 992)		p
	Weighted %	95% CI	Weighted %	95% CI	Weighted %	95% CI	
Fair/poor	26.6	24.9 to 28.3	73.9	70.1 to 77.7	18.7	17.1 to 20.3	
Smoking status							<0.0001
Smoker	16	14.7 to 17.3	22.2	18.6 to 25.8	15	13.7 to 16.3	
Non-smoker	84	82.7 to 85.3	77.8	74.2 to 81.4	85	83.7 to 86.3	
Frequent exercise status							<0.0001
Yes	42	40 to 44.1	28.8	25.1 to 32.5	44.2	42.1 to 46.4	
No	58	55.9 to 60	71.2	67.5 to 74.9	55.8	53.6 to 57.9	
Census region							0.2997
Northeast	17.2	15.3 to 19.2	17.1	13.6 to 20.6	17.2	15.3 to 19.2	
Midwest	22	19.9 to 24.1	19.9	16.6 to 23.2	22.3	20.1 to 24.6	
South	38.4	36.3 to 40.6	41.7	37.6 to 45.7	37.9	35.6 to 40.1	
West	22.4	20.4 to 24.4	21.3	17.9 to 24.8	22.5	20.4 to 24.7	

Differences between the poor and good mental health groups based on chi-square tests.

health.³⁰ However, our study findings indicate this is not the case in a population of older US adults with both pain and poor mental health.

There are several possible explanations for the findings of our study, including poor healthcare-seeking behaviour resulting from the aggregated barriers of healthcare disparities such as healthcare literacy, stigma and cost; and the financial preferences of pharmacological therapy rather than the underutilised, non-pharmacological therapy.²¹ Forty-five per cent of the individuals in this study had a high school education or less, some of whom may therefore have low health literacy. Low health literacy has been associated with limited access to healthcare services, poor

utilisation of preventative care services, increased risk of experiencing worse health outcomes and higher lifetime healthcare expenditures.^{38–42} Similarly, stigma associated with mental health contributes to a low perceived need for medical assistance. Much of the media's portrayal of mental illnesses has focused on extreme variants—as a result, the more common mild-moderate cases of mental illness may be overlooked and patients may not consider their condition serious enough to seek help.⁴³ Prior research has found mental health stigma to be associated with negative outcomes such as reduced income, employment and budgetary-allocation.⁴⁴

Table 2 Descriptive healthcare expenditures of older United States adults (aged ≥50 years) with self-reported pain in the past 4 weeks, stratified by poor mental health and good mental health

Healthcare expenditures	Poor mental health (Unweighted n=822)		Good mental health (Unweighted n=4301)		p
	Mean (US\$)	SE	Mean (US\$)	SE	
Total	20 231	1252	13 379	476	<0.0001
Inpatient	22 290	3312	21 341	1467	0.7876
Outpatient	4123	722	3489	225	0.3965
Emergency room	1301	112	1585	96	0.0547
Office-based	3706	366	3607	146	0.7987
Prescription medications	5924	532	3620	186	<0.0001
Other	4833	486	2285	107	<0.0001

Analyses based on 5123 (unweighted) older United States adults (aged ≥50 years) alive during the calendar year 2018 with self-reported pain in the past 4 weeks, but only include those who had positive healthcare expenditures for each healthcare expenditure category. Total n=4965; Inpatient n=826; Outpatient n=1912; Emergency room n=1233; Office-based n=4718; Prescription medications n=4669; Other n=3674.

Differences between the poor and good mental health groups based on t-tests.

**Table 3** Adjusted intercepts and parameter estimates for poor mental health compared with good mental health in older United States adults (aged ≥ 50 years) with self-reported pain in the past 4 weeks, using logged positive healthcare expenditures

Healthcare expenditure	Beta	SE	Significance
Total			
Poor mental health	0.03	0.07	0.7099
Good mental health	Reference		
Inpatient			
Poor mental health	-0.09	0.16	0.5661
Good mental health	Reference		
Outpatient			
Poor mental health	0.05	0.11	0.6438
Good mental health	Reference		
Office-based			
Poor mental health	-0.11	0.07	0.1292
Good mental health	Reference		
Emergency room			
Poor mental health	0.02	0.12	0.8891
Good mental health	Reference		
Prescription medications			
Poor mental health	-0.10	0.09	0.2438
Good mental health	Reference		
Other			
Poor mental health	0.13	0.09	0.1493
Good mental health	Reference		

Analyses based on 5123 (unweighted) older United States adults (aged ≥ 50 years) alive during the calendar year 2018 with self-reported pain in the past 4 weeks, but only include those who had positive healthcare expenditures for each healthcare expenditure category.

Total n=4904; Inpatient n=817; Outpatient n=1895; Emergency room n=1220; Office-based n=4667; Prescription medications n=4613; Other n=3636.

Differences modelled between the poor mental health group (unweighted n=822) and good mental health group (unweighted n=4301, reference group).

Models adjusted for the following variables: age, gender, race, ethnicity, marital status, education completed, employment status, income, health insurance, pain severity, limitation, number of chronic conditions, perceived health status, smoking status, frequent exercise status and census region.

Financial costs have proven consequential to pursuing healthcare services regardless of income; however, the principal reasons may vary between socioeconomic groups.⁴⁵ While the Affordable Care Act has done much to reduce healthcare costs for low-income patients, financial barriers-to-access (such as lack of transport, child-care and work schedule) put low-income patients at a higher risk for poor mental health and longer hospitalisation periods.⁴⁵⁻⁴⁹ This may be explained by previous research findings that patients with low-income, when compared with high-income patients, were more likely to hold negative attitudes towards mental health treatment and demonstrate poor adherence to therapy.⁵⁰ An alternative explanation for the higher rates of poor mental health and longer hospitalisation periods in low-income population groups may be variance in the quality of the services available.⁵⁰ Consequently, underdiagnosed or mismanaged diseases can make it difficult for individuals

to maintain employment.^{49 50} While healthcare services are generously covered through public insurances (such as Medicare and Medicaid), for patients with private insurance, fear of paying higher 'premiums' or re-occurring 'co-pays' for treatment, can dissuade patients from obtaining preventative-care health services.^{51 52} This may be the case in our study where the majority (57.6%) had private health insurance. Overall, these barriers prevent older adults in need of healthcare services from obtaining assistance and demonstrate the need for greater budgetary allocations to facilitate outreach projects and healthcare providers to serve low-income patients.⁴⁵ We suggest that new public education initiatives and strategies to overcome such barriers are needed to improve the recognition of mental illness, improve health literacy and reduce the stigma associated with mental health.^{42 43}

The clinical decision-making process for mental health treatment can vary based on the patient's medical history

and medication risk-related adverse events.²¹ The preference of healthcare insurers for pharmacological therapy over non-pharmacological therapy may also explain why there were no differences in expenditures between mental health status in our study. Pharmacological therapy plays an imperative role for appropriately indicated therapy. Research has found medication classes such as serotonin-norepinephrine reuptake inhibitors and tricyclic antidepressants to be efficacious in treating both pain and poor mental health.²⁰ Research has also observed a transition from non-pharmacological therapy towards antidepressant monotherapy regimens.⁵³ Insurance coverage for antidepressant therapy has increased, although prescription drugs can account for two-thirds of out-of-pocket spending for mental healthcare.^{45–46} In contrast, limitations in insurance coverage or having to pay additional out-of-pocket spending (that may vary by insurance type, facility type, provider rates) for non-pharmacological, psychotherapy services may deter patients from seeking mental healthcare and be detrimental to optimal therapy outcomes.^{54–56} Non-pharmacological, psychotherapy strategies (eg, cognitive behavioural therapy, behavioural therapy, problem-solving therapy) present several advantages such as avoiding adverse effects, or treating patients with poor coping strategies, environmental stressors or lack of social support.^{21–23} However, the limitations of non-pharmacological therapy intrinsically lie in its cost for both healthcare providers and patients. Given the lack of regulation and standardisation for non-pharmacological services, ‘low’ insurance reimbursement rates may disincentivise providing these services.⁵⁷ Additionally, non-pharmacological therapies may present a delayed onset of action for efficacy and take several weeks before observing any clinical improvements.⁵³ Despite its limitations, psychotherapy in combination with medications (compared with medication use alone) has demonstrated superiority in both treatment adherence and clinical response.^{58–59} It is imperative that all patients have access to high quality care given the increasing number of older adults with concurrent pain and poor mental health.⁸

Limitations of this study include the inability to draw a cause-and-effect relationship due to the study design and those inherent to the use of self-reported data. While one concern is recall bias, to minimise its effects, MEPS interviews are conducted at regular 4–5 months intervals. This study used the only self-reported pain variable included in the MEPS dataset; however, several other definitions of pain exist. The findings from this study might have differed if an alternative definition of pain had been used. Furthermore, the severity and sequence of diseases status was unable to be discerned from MEPS data. In addition, some individuals with self-reported pain and poor mental health may not meet clinical criteria for intervention. Finally, the analyses only included those with positive healthcare expenditures, thus those who did not have evidence of using the healthcare system were excluded. Analyses involving

alternative statistical approaches (eg, two-part models of generalised linear models) would be needed to include these excluded individuals. However, strengths of this study are the use of a large nationally representative sample to produce findings that are generalisable to the non-institutionalised population. Future longitudinal research is needed to identify any differences in healthcare expenditures between individuals with poor versus good mental health in the long term.

CONCLUSION

This is the first study to investigate healthcare expenditures in older US adults with concurrent poor perceived mental health and self-reported pain. This study found no significant differences in positive healthcare expenditures between poor and good perceived mental health status among older US adults with pain. Reasons to explain these findings are offered along with suggestions for future research, which will be important to help improve our understanding of perceived mental health status in the ever-increasing older adult population.

Contributors Conceptualisation, DRA and JC; methodology, DRA; software, DRA; validation, DRA and JC; formal analysis, DRA; investigation, DRA; resources, DRA; data curation, DRA; writing—original draft preparation, DRA and JC; writing—review and editing, DRA; visualisation, DRA and JC.; supervision, DRA; project administration, DRA; funding acquisition, DRA; guarantor.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants but The University of Arizona Institutional Review Board deemed human subjects review was not required for this study (Protocol 2006721124; 12 June 2020 exempted this study). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available in a public, open access repository. All data used in this study are publicly available from the MEPS website: https://www.meps.ahrq.gov/mepsweb/data_stats/download_data_files_detail.jsp?cboPufNumber=HC-209.

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