Observational Studies

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Associations of multiple (≥5) chronic conditions among a nationally representative sample of older United States adults with self-reported pain

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Abstract

Objectives: The association between an individuals' demographic and health characteristics and the presence of multiple chronic conditions is not well known among older United States (US) adults. This study aimed to identify the prevalence and associations of having multiple chronic conditions among older US adults with self-reported pain.
Methods: This retrospective, cross-sectional study used data from the 2017 Medical Expenditure Panel Survey. Study subjects were aged ≥50 years and had self-reported pain in the past four weeks. The outcome variable was multiple (≥5) chronic conditions (vs. <5 chronic conditions). Hierarchical logistic regression models were used to identify significant associations between demographic and health characteristics and multiple chronic conditions with significance indicated at an *a priori* alpha level of 0.05. The complex survey design was accounted for when obtaining nationally-representative estimates.
Results: The weighted population was 57,074,842 US older adults with pain, of which, 66.1% had ≥5 chronic conditions. In fully-adjusted analyses, significant associations of ≥5 comorbid chronic conditions included: age 50–64 vs. ≥65 years (adjusted odds ratio [AOR]=0.478, 95% confidence interval [CI]=0.391, 0.584); male vs. female gender (AOR=1.271, 95% CI=1.063, 1.519); white vs. other race (AOR=1.220, 95% CI=1.016, 1.465); Hispanic vs. non-Hispanic ethnicity (AOR=0.614, 95% CI=0.475, 0.793); employed vs. unemployed (AOR=0.591, 95% CI=0.476, 0.733); functional limitations vs. no functional limitations (AOR=1.862, 95% CI=1.510, 2.298); work limitations vs. no work limitations (AOR=1.588, 95% CI=1.275, 1.976); little/moderate vs. quite a bit/extreme pain (AOR=0.732, 95% CI=0.599, 0.893); and excellent/very good (AOR=0.375, 95% CI=0.294, 0.480) or good (AOR=0.661, 95% CI=0.540, 0.810) vs. fair/poor physical health.
Conclusions: Approximately 38 million of the 57 million US older adults with pain in this study had ≥5 chronic conditions in 2017. Several characteristics were associated with multiple chronic conditions, which may be important for health care professionals to consider when working with patients to manage their pain.

This study was approved by The University of Arizona Institutional Review Board (2006721124, June 12, 2020).

Keywords: comorbidity; health care surveys; multiple chronic conditions; pain.

Introduction

The proportion of older adults in the population is increasing globally and within the United States (US), in part due to increasing life expectancy [1]. This leads to a corresponding increase in the prevalence of multiple chronic conditions among older adults [2–4]. Data from the National Health Interview Survey (NHIS) indicated that the prevalence of multiple chronic conditions (i.e., ≥1 chronic condition) among US adults was 21.8% in 2001 and had increased to 26.0% in 2010 [5], while another study also using NHIS data indicated the prevalence of multiple chronic conditions was 25.5% in 2012 [5]. Recent estimates indicate that over half (52%) of US adults have at least one chronic condition, and approximately 27% had ≥2 chronic conditions in 2018 [6]. The presence of multiple chronic

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conditions in an individual, particularly among older adults, is an important public health topic given that chronic conditions can lead to functional impairment in later-life, which is a significant determinant of healthcare resource use such as medical and social services [7, 8], and mortality [9].

Pain, defined by the International Association for the study of pain (IASP) as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" [10], is also prevalent, ranging from 24 to 72% in previous studies [11–13]. Pain can have detrimental effects on an individual's quality of life [10] and is often reported as an underlying disability among older adults [14]. Pain can be burdensome to manage, as individuals often have to use several strategies to manage pain [15, 16].

Various demographic characteristics such as age, gender, and race have been shown to be associated to various degrees with pain [17], however the association of a more comprehensive set of personal characteristics on pain among individuals with pain and chronic conditions is not well known. Further research to assess the association between individual characteristics and multimorbidity among older adults is therefore needed, in order to determine appropriate clinical and public health policy needs [18–20]. The objective of this study was to determine the characteristics associated with the presence of multiple (≥5) chronic conditions among community-dwelling older United States adults with self-reported pain.

Methods

Study design and data source

This study employed a retrospective, cross-sectional design, and utilized the most current data from the 2017 Medical Expenditure Panel Survey (MEPS) Household Component. MEPS uses the sampling framework from the previous years' National Health Interview Survey and involves a panel design to collect five rounds of data over two years. The MEPS 2017 full-year consolidated data file includes data for each person in the households surveyed, such as demographics, employment and income details, health insurance coverage, health conditions and health status, healthcare utilization and costs, and access and satisfaction with healthcare. This file also provides weighting variables to calculate nationally representative estimates of the non-institutionalized US population [21, 22].

Eligibility criteria

Eligible subjects were community-dwelling adults alive for the full year, age ≥50 years, and had pain in the past four weeks (determined by a response of "a little bit", "moderate", "quite a bit", or "extreme", when asked: "during the past four weeks, pain interfered with normal work outside the home and housework") [23, 24].

Variables

Variables were organized into one of five categories according to Andersen's Behavioral Model (predisposing, enabling, personal health practices, external environmental, need factors) [25].

Predisposing factors included: age (50–64, ≥65 years); gender (male, female); ethnicity (Hispanic, non-Hispanic); and race (white, other).

Enabling factors included: education completed (high school or less, more than high school); employment status (employed, unemployed); income level (poor/near poor/low income [<200% federal poverty level], middle/high income [≥200% federal poverty level]); insurance coverage (private, public, uninsured); and marital status (married, other).

Personal health practices included: exercise status (yes, no) and current smoker status (yes, no).

The only external environmental factor was census region (Northeast, Midwest, South, West).

Need factors included: instrumental activity of daily living limitations (yes, no); activity of daily living limitations (yes, no); functional limitations (yes, no); work limitations (yes, no); pain severity (little/moderate, quite a bit/extreme); perceived mental health status (excellent/very good, good, fair/poor); and perceived physical health status (excellent/very good, good, fair/poor) [23, 24].

Outcome variable

The outcome variable in this study was chronic conditions. The list of chronic conditions included: angina, arthritis, asthma, cancer, chronic bronchitis, coronary heart disease, diabetes, joint pain, emphysema, hypercholesterolemia, hypertension, myocardial infarction, other unspecified heart disease, and stroke. These conditions are collected in MEPS due to their relatively high prevalence in the population and the availability of generally accepted clinical standards for managing these conditions. For every subject, the presence of each condition was determined, summed, and then dichotomized as either multiple (≥5) or few (<5) chronic conditions for analysis. Five conditions was chosen as the threshold for groups because it allowed comparison of individuals with several conditions vs. those with few chronic conditions, and allowed better balanced groups compared to a threshold of, for example, two conditions (which may also be defined as multiple chronic conditions, yet highly prevalent among this population of older adults with pain) [23, 24].

Data analysis

Data for the two groups were summarized and compared using chi-square tests. Hierarchical logistic regression models assessed the association of each variable with ≥5 chronic conditions, with <5 conditions serving as the reference group. This process started with the predisposing group of variables and then adding further groups of variables from least modifiable to most modifiable factors (i.e., enabling, personal health practices, external environmental, and need factors) to successive models. An alpha level of 0.05 was set *a*

priori. Analyses were conducted using SAS Studio (SAS institute Inc., Cary, NC, USA).

Results

Figure 1 outlines the subject selection process. From the 31,880 subjects available in the 2017 MEPS dataset, 5,076 were eligible for this study (≥5 chronic conditions=1,766, <5 chronic conditions=3,310). This represented a weighted population of 57,074,842, of which 19,372,008 or 33.9% (95% confidence interval [CI]=32.2, 35.6) had ≥5 chronic conditions and 37,702,833 or 66.1% (95% CI=64.4, 67.8%) had <5 chronic conditions.

Table 1 outlines the characteristics of study subjects. Approximately half (51%) the subjects were aged ≥65 years, and the majority were: female (55%), non-Hispanic (90%), white (81%), educated beyond high school (51%), unemployed (61%), had middle/high income (68%), private insurance coverage (61%), married (57%), had no IADLs (91%), no ADLs (95%), no functional limitations (61%), no work limitations (73%), little/moderate severity pain (75%), excellent/very good perceived mental health (52%), excellent/very good/good perceived physical health (73%), did not do regular exercise (58%), and did not smoke (85%). The most common census region was the south (38%). There were differences between those who had ≥5 chronic conditions and those who had <5 chronic conditions for all characteristics ($p<0.05$) except gender ($p=0.5578$), race ($p=0.5296$), and smoking status ($p=0.2949$).

Table 2 reports the weighted percentage of subjects who had each type of chronic condition. The most common chronic conditions were hypertension (87.4%, 95% CI=85.9%, 88.9%), joint pain (71.4%, 95% CI=69.7%, 73.1%), arthritis (62.1%, 95% CI=60.3%, 63.8%), and hypercholesterolemia (57.0%, 95% CI=55.3%, 58.8%).

Table 3 displays the results of the hierarchical logistic regression analyses and indicates the factors that were predictors of ≥5 chronic conditions. Results are presented for each level of the analysis (i.e., models 1–5). In the fully adjusted analysis (model 5), all of the predisposing factors were predictors of a subject having ≥5 chronic conditions; those aged ≥65 years (vs. 50–64 years), males (vs. females), non-Hispanic (vs. Hispanic ethnicity), and white (vs other race) were associated with greater odds of having ≥5 chronic conditions. Employment status was the only enabling factor associated with ≥5 chronic conditions; those who were unemployed (vs. employed) were associated with greater odds of having ≥5 chronic conditions.

Among need factors, functional and work limitations were associated with higher likelihood of having ≥5 chronic conditions, while little/moderate pain severity (vs. quite a bit/extreme pain severity), and excellent/very good and good (vs. fair/poor) perceived physical health status were associated with lower likelihood of having ≥5 chronic conditions.

None of the personal health practices or external environmental factors were predictors of ≥5 chronic conditions. The fully adjusted logistic regression model had a Wald statistic of <0.0001 and a c-statistic of 0.758.

Discussion

This study first reports the prevalence of multiple chronic conditions and then the associations of multiple chronic conditions among the increasing community-dwelling older adult US population.

Published prevalence estimates of multiple chronic conditions vary widely due to variations in definitions and measurements, population characteristics, study sample sizes, and sampling methods [26]. The current study used nationally representative data of the community-dwelling US older adult population with self-reported pain, and found that the overall prevalence of multiple (≥5) chronic conditions was 33.9% (95% CI=32.2, 35.6). That approximately one-third of the community-dwelling US older adult

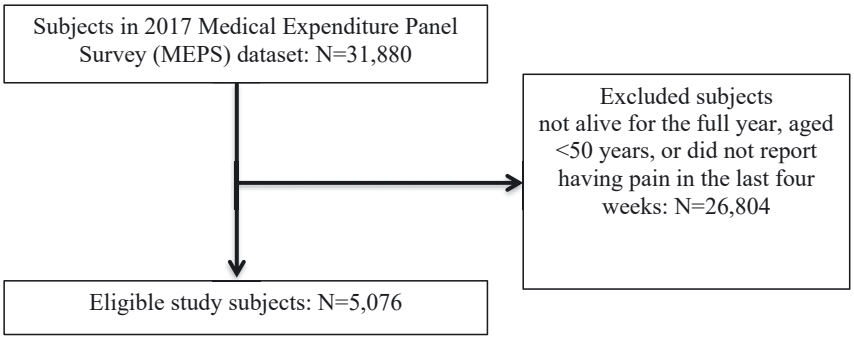

Figure 1: Subject selection process.

Table 1: Characteristics of United States older adults (age ≥50 years) with self-reported pain in the past four weeks stratified by ≥5 chronic conditions vs. <5 chronic conditions.

Variables	Total (weighted n=57,074,842) Weighted % (95% confidence interval)	≥5 chronic conditions (weighted n=19,372,008) Weighted % (95% confidence interval)	<5 chronic conditions (weighted n=37,702,833) Weighted % (95% confidence interval)	p-Value
Predisposing factors				
Age, years				<0.0001
50–64	49.0 (47.0, 51.0)	34.9 (31.8, 38.0)	56.2 (54.0, 58.5)	
≥65	51.0 (49.0, 53.0)	65.1 (62.0, 68.2)	43.8 (41.5, 46.0)	
Gender				0.5578
Male	44.8 (43.5, 46.1)	45.5 (42.7, 48.3)	44.4 (42.7, 46.2)	
Female	55.2 (53.9, 56.5)	54.5 (51.7, 57.3)	55.6 (53.8, 57.3)	
Ethnicity				0.0001
Hispanic	10.1 (8.8, 11.4)	7.5 (5.9, 9.1)	11.4 (9.8, 13.0)	
Non-Hispanic	89.9 (88.6, 91.2)	92.5 (90.9, 94.1)	88.6 (87.0, 90.2)	
Race				0.5296
White	81.1 (79.5, 82.7)	81.7 (79.4, 83.9)	80.9 (79.0, 82.7)	
Other	18.9 (17.3, 20.5)	18.3 (16.1, 20.6)	19.1 (17.3, 21.0)	
Enabling factors				
Education completed				<0.0001
High school or less	49.3 (47.2, 51.3)	53.8 (50.8, 56.9)	46.9 (44.6, 49.2)	
More than high school	50.7 (48.7, 52.8)	46.2 (43.1, 49.2)	53.1 (50.8, 55.4)	
Employment status				<0.0001
Employed	39.0 (36.8, 41.2)	19.9 (17.0, 22.9)	48.8 (46.4, 51.1)	
Unemployed	61.0 (58.8, 63.2)	80.1 (77.1, 83.0)	51.2 (48.9, 53.6)	
Income level				<0.0001
Poor/near poor/low income	32.2 (30.3, 34.2)	41.0 (37.6, 44.4)	27.7 (25.8, 29.7)	
Middle/high income	67.8 (65.8, 69.7)	59.0 (55.6, 62.4)	72.3 (70.3, 74.2)	
Insurance coverage				<0.0001
Private	61.0 (59.1, 62.9)	52.8 (49.5, 56.0)	65.2 (63.2, 67.2)	
Public	35.4 (33.6, 37.3)	44.8 (41.6, 48.0)	30.6 (28.7, 32.5)	
Uninsured	3.6 (2.9, 4.2)	2.5 (1.6, 3.4)	4.1 (3.3, 4.9)	
Marital status				<0.0001
Married	57.2 (55.1, 59.2)	51.2 (48.0, 54.4)	60.2 (57.9, 62.6)	
Other	42.8 (40.8, 44.9)	48.8 (45.6, 52.0)	39.8 (37.4, 42.1)	
Need factors				
IADL				<0.0001
Yes	9.1 (8.1, 10.2)	15.6 (13.5, 17.7)	5.8 (4.8, 6.9)	
No	90.9 (89.8, 91.9)	84.4 (82.3, 86.5)	94.2 (93.1, 95.2)	
ADL				<0.0001
Yes	5.1 (4.4, 5.8)	8.6 (7.0, 10.1)	3.4 (2.6, 4.1)	
No	94.9 (94.2, 95.6)	91.4 (89.9, 93.0)	96.6 (95.9, 97.4)	
Functional limitation				<0.0001
Yes	39.3 (37.5, 41.1)	60.4 (57.5, 63.2)	28.5 (26.5, 30.5)	
No	60.7 (58.9, 62.5)	39.6 (36.8, 42.5)	71.5 (69.5, 73.5)	
Work limitation				<0.0001
Yes	26.8 (25.1, 28.6)	44.9 (41.9, 48.0)	17.5 (15.9, 19.1)	
No	73.2 (71.4, 74.9)	55.1 (52.0, 58.1)	82.5 (80.9, 84.1)	
Pain severity				<0.0001
Little/moderate	75.0 (73.3, 76.8)	61.3 (58.1, 64.5)	82.1 (80.4, 83.7)	
Quite a bit/extreme	25.0 (23.2, 26.7)	38.7 (35.5, 41.9)	17.9 (16.3, 19.6)	
Perceived mental health status				<0.0001
Excellent/very good	52.0 (50.1, 53.9)	41.2 (38.2, 44.3)	57.6 (55.4, 59.8)	
Good	33.5 (31.8, 35.3)	37.9 (35.0, 40.8)	31.3 (29.3, 33.3)	
Fair/poor	14.5 (13.3, 15.6)	20.9 (18.7, 23.1)	11.2 (10.0, 12.4)	

Table 1: (continued)

Variables	Total (weighted n=57,074,842) Weighted % (95% confidence interval)	≥5 chronic conditions (weighted n=19,372,008) Weighted % (95% confidence interval)	<5 chronic conditions (weighted n=37,702,833) Weighted % (95% confidence interval)	p-Value
Perceived physical health status				<0.0001
Excellent/very good	35.5 (33.9, 37.2)	21.0 (18.8, 23.2)	43.0 (40.9, 45.1)	
Good	37.5 (35.9, 39.0)	37.4 (34.6, 40.2)	37.5 (35.5, 39.4)	
Fair/poor	27.0 (25.5, 28.5)	41.6 (39.0, 44.3)	19.5 (17.9, 21.1)	
Personal health practices factors				
Exercise				<0.0001
Yes	41.9 (40.0, 43.7)	33.7 (31.1, 36.2)	46.1 (43.8, 48.4)	
No	58.1 (56.3, 60.0)	66.3 (63.8, 68.9)	53.9 (51.6, 56.2)	
Smoker				0.2949
Yes	14.9 (13.8, 16.0)	15.7 (13.9, 17.5)	14.5 (13.0, 15.9)	
No	85.1 (84.0, 86.2)	84.3 (82.5, 86.1)	85.5 (84.1, 87.0)	
External environmental factors				
Census region				0.0073
Northeast	18.2 (16.5, 19.8)	16.8 (14.5, 19.1)	18.9 (17.0, 20.7)	
Midwest	22.1 (20.3, 23.9)	21.9 (19.0, 24.8)	22.2 (20.3, 24.1)	
South	38.2 (36.1, 40.3)	42.0 (38.4, 45.6)	36.3 (34.0, 38.6)	
West	21.5 (19.7, 23.4)	19.3 (16.4, 22.1)	22.7 (20.7, 24.7)	

Analysis based on an unweighted sample of n=5,076 (≥5 chronic conditions n=1,766; <5 chronic conditions n=3,310) United States adults alive during the calendar year 2017, age ≥50 years, with self-reported pain in the past four weeks. Statistically significant differences between groups based on chi-square tests. IADL, instrumental activities of daily living; ADL, activities of daily living.

Table 2: Weighted percentage of each chronic condition present among older United States adults (age ≥50 years) with pain in the past four weeks.

Chronic condition	Weighted percentage (95% confidence interval)
Hypertension	87.4 (85.9, 88.9)
Joint pain	71.4 (69.7, 73.1)
Arthritis	62.1 (60.3, 63.8)
Hypercholesterolemia	57.0 (55.3, 58.8)
Diabetes	24.1 (22.6, 25.6)
Other heart disease/ condition	22.3 (20.7, 24.0)
Cancer	22.2 (20.7, 23.7)
Asthma	14.5 (13.4, 15.6)
Coronary heart disease	13.6 (12.4, 14.8)
Myocardial infarction	9.6 (8.6, 10.6)
Stroke	9.4 (8.5, 10.3)
Emphysema	6.4 (5.6, 7.3)
Angina	5.7 (4.9, 6.5)
Chronic bronchitis	4.7 (4.0, 5.4)

Analysis based on an unweighted sample of n=5,076 (≥5 chronic conditions n=1,766; <5 chronic conditions n=3,310) United States adults alive during the calendar year 2017, age ≥50 years, with self-reported pain in the past four weeks.

population with pain also have at least five other chronic conditions indicates the scale of the healthcare challenge to help these individuals manage all of their conditions, including pain, and obtain optimal health outcomes.

This study then found several factors were statistically associated with multiple chronic conditions among older community-dwelling US adults with self-reported pain, which are each addressed below.

All of the predisposing factors (age, gender, ethnicity, race) were statistically associated with multiple chronic conditions in the fully adjusted analyses. These findings add to the literature that assesses the association of such factors among older adults with pain. For instance, community-dwelling US adults aged 50–64 years with pain had lower odds of having multiple chronic conditions compared to adults who were ≥65 years. This finding is consistent with other studies reporting strong associations between age and multiple chronic conditions [27–29]. However, this phenomenon is not limited to community-dwelling older adults in the US; for example, a study from Canada reported the prevalence of multiple chronic conditions increased with age among middle-aged adults [30].

Table 3: Predictive characteristics of ≥5 chronic conditions among older United States adults (age ≥50 years) with pain in the past four weeks from hierarchical logistic regression analyses.

Effect	Model 1 AOR (95% CI)	Model 2 AOR (95% CI)	Model 3 AOR (95% CI)	Model 4 AOR (95% CI)	Model 5 AOR (95% CI)
Predisposing factors					
Age 50–64 vs. ≥65 years	**0.421 (0.361, 0.490)**	**0.658 (0.549, 0.789)**	**0.636 (0.527, 0.767)**	**0.637 (0.528, 0.767)**	**0.478 (0.391, 0.584)**
Male vs. female sex	1.070 (0.921, 1.243)	**1.209 (1.031, 1.419)**	**1.280 (1.085, 1.509)**	**1.278 (1.084, 1.507)**	**1.271 (1.063, 1.519)**
Hispanic vs. non-Hispanic	**0.664 (0.521, 0.844)**	**0.586 (0.459, 0.748)**	**0.577 (0.453, 0.734)**	**0.592 (0.463, 0.757)**	**0.614 (0.475, 0.793)**
White vs. other race	1.018 (0.861, 1.205)	**1.199 (1.012, 1.421)**	**1.214 (1.021, 1.443)**	**1.225 (1.029, 1.459)**	**1.220 (1.016, 1.465)**
Enabling factors					
Up to high school vs. higher than high school education completed		1.097 (0.940, 1.280)	1.097 (0.939, 1.281)	1.085 (0.927, 1.269)	1.009 (0.854, 1.193)
Employed vs. unemployed employment status		**0.360 (0.294, 0.441)**	**0.373 (0.304, 0.458)**	**0.372 (0.303, 0.457)**	**0.591 (0.476, 0.733)**
Poor/near poor/low income vs. middle/high income		**1.278 (1.067, 1.531)**	**1.271 (1.062, 1.520)**	**1.250 (1.047, 1.492)**	1.083 (0.898, 1.307)
Private vs. uninsured health insurance coverage		1.019 (0.645, 1.611)	1.034 (0.649, 1.648)	1.057 (0.654, 1.709)	1.068 (0.625, 1.826)
Public vs. uninsured health insurance coverage		1.125 (0.717, 1.765)	1.127 (0.715, 1.775)	1.165 (0.730, 1.860)	0.965 (0.570, 1.635)
Married vs. other marital status		**0.804 (0.679, 0.951)**	**0.802 (0.673, 0.957)**	**0.801 (0.670, 0.956)**	0.914 (0.761, 1.098)
Personal health practices factors					
Exercise yes vs. no			**0.666 (0.575, 0.772)**	**0.670 (0.578, 0.777)**	0.888 (0.760, 1.038)
Smoker yes vs. no			1.106 (0.908, 1.346)	1.098 (0.900, 1.338)	0.989 (0.809, 1.209)
External environmental factors					
Northeast vs. West census region				0.994 (0.787, 1.254)	1.040 (0.818, 1.323)
Midwest vs. West census region				1.149 (0.921, 1.433)	1.094 (0.861, 1.391)
South vs. West census region				**1.247 (1.005, 1.548)**	1.191 (0.948, 1.496)
Need factors					
IADL limitation yes vs. no					1.160 (0.816, 1.648)
ADL limitation yes vs. no					0.803 (0.520, 1.241)
Functional limitation yes vs. no					**1.862 (1.510, 2.298)**
Work limitation yes vs. no					**1.588 (1.275, 1.976)**
Little/moderate vs. quite a bit/extreme pain severity					**0.732 (0.599, 0.893)**
Excellent/very good vs. fair/poor perceived mental health status					1.069 (0.815, 1.401)
Good vs. fair/poor perceived mental health status					1.043 (0.821, 1.324)
Excellent/very good vs. fair/poor perceived physical health status					**0.375 (0.294, 0.480)**
Good vs. fair/poor perceived physical health status					**0.661 (0.540, 0.810)**

Logistic regression analysis based on an unweighted sample of n=5,076 (≥5 chronic conditions n=1,766; <5 chronic conditions n=3,310) United States adults alive during the calendar year 2017, age ≥50 years, with self-reported pain in the past four weeks. The reference group was <5 chronic conditions. Model 1 was adjusted for predisposing factors, model 2 was adjusted for predisposing and enabling factors, model 3 was adjusted for predisposing, enabling, and personal health practices factors, model 4 was adjusted for predisposing, enabling, personal health practices, and external environmental factors, model 5 was adjusted for predisposing, enabling, personal health practices, external environmental, and need factors. The models had the following c-statistics: Model 1=0.613, Model 2=0.678, Model 3=0.692, Model 4=0.694, Model 5=0.758. All models had a Wald value of p<0.0001. AOR, adjusted odds ratio; 95% CI, 95% confidence interval; IADL, instrumental activities of daily living; ADL, activities of daily living. **Bold** indicates the characteristic is a significant predictor of ≥5 chronic conditions.

The current study found males, Whites, and non-Hispanics had greater odds of having multiple chronic conditions than females, other races, and Hispanics respectively. The associations of these variables with chronic conditions differs in the literature, for example, one previous study among US adults aged 20 years and older found that the prevalence of multiple chronic conditions was greater among those aged ≥65 years vs. those aged 45–65 and 20–44 years, greater among women than men, and greater among Whites and Blacks than those who were Hispanic or another race [31]. Furthermore, another study found that the prevalence and mortality of chronic conditions varies between genders and races in the US population, for example, there are more cases of women admitted to hospital with asthma than men, and a higher mortality rate from asthma among non-Hispanic Blacks [32]. While it is not possible to modify these predisposing factors, it can nevertheless be useful to know how they are associated with the presence of multiple chronic conditions among older adults and may assist healthcare professionals when considering the holistic care of these patients and reducing health disparities.

Employment status was the only enabling factor associated with multiple chronic conditions in the current study. Older employed community-dwelling US adults had lower odds of multiple chronic conditions than those who were unemployed. This finding supports previous studies that found a relationship between employment status and multiple chronic conditions, specifically departure from the workforce due to multiple chronic conditions [33–35]. This finding therefore supports the notion that those with multiple chronic conditions may be unable to work. The association of employment status and multiple chronic conditions may also be explained, at least partially, by resiliency, which is associated with work engagement behaviors among older workers [34].

Several need factors were associated with multiple chronic conditions. The presence of functional and work limitations was associated with greater odds of multiple chronic conditions. A similar study using 2017 MEPS data found that older adults with pain and fewer chronic conditions had a lower likelihood of reporting functional limitations than those with ≥5 chronic conditions [36]. This finding also corresponds with previous work that found individuals with more chronic conditions become functionally impaired earlier than persons with fewer chronic conditions [37]. This finding adds to existing evidence of the association between the prevalence of limitations and multiple chronic conditions among older adults with pain, and given that both limitations and multiple chronic conditions are associated with poorer health outcomes, could be a good factor to target for healthcare interventions in order to improve health outcomes.

In terms of pain severity, the current study found that community-dwelling US older adults who reported little/moderate pain had lower odds of having multiple chronic conditions than those who reported quite a bit/extreme pain. This is an unsurprising finding given that individuals with pain generally suffer from poorer health compared to those who do not have pain [38–40]. Recent studies from Europe have described how older adults with multimorbidity also have chronic persistent pain [41, 42], while another study from Canada using data from 2006 to 2016 found that each additional comorbid condition was associated with an 8% increase in the odds of reporting pain [43].

Finally, community-dwelling US older adults who reported their health as excellent/very good/good had lower odds of having multiple chronic conditions than those who described their health as fair/poor. This finding concurs with a European study that found increased number of comorbid conditions was associated with a greater likelihood of an individual reporting fair or poor health [44]. Similar findings have been reported in recent studies from Brazil [45], Canada [46], and Denmark [47], thus this study adds data for the US older adult population with pain. These aforementioned need factors may be the easiest modifiable targets for healthcare interventions to improve chronic condition management, pain management, and ultimately health outcomes in this population.

The findings from this study provide additional evidence that greater efforts are needed to help manage and improve the health of older adults with pain from both a clinical and public health perspective. For example, greater interdisciplinary coordination between healthcare professionals may help improve pain management among this population. In addition, perhaps a greater emphasis on disease prevention and health promotion efforts may help prevent or reduce the prevalence of pain among older adults. Finally, from a research perspective, further work is needed that incorporates patient populations with multiple diagnoses that can affect pain, in order to improve our understanding of the factors that influence pain, how to prevent pain, and how to manage pain in these populations.

This study had some limitations. First, multiple chronic conditions were defined as ≥5 conditions, whereas alternative definitions may have led to different results. Second, two of the conditions included are well-known pain diagnoses (arthritis and joint pain), which may have influenced the association between chronic conditions and pain. Third, this study did not account for how well the conditions were controlled (i.e., it only accounted for the presence of the condition). Fourth, data were self-reported,

which may have over- or under-estimated the true prevalence of chronic conditions and pain. Finally, this was a cross sectional study that was unable to ascertain causality (i.e., only statistical associations could be identified). Future studies using prospective or longitudinal designs are warranted to assess this relationship over time.

Conclusion

In conclusion, this study provides insight into the prevalence of multiple chronic conditions among a nationally representative sample of older US adults, and identifies individual factors that are significant predictors of multiple chronic conditions in this population. The results from this study re-affirms the need for further attention to older adult's health care, which is increasingly important given population growth among older adults nationally and globally.

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