

Prevalence Rates of Arthritis Among U.S. Older Adults with Varying Degrees of Depression:
Findings from the 2011-2014 National Health and Nutrition Examination Survey

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Abstract

Objective: Arthritis and depressive symptoms often interact and negatively influence one another to worsen mental and physical health outcomes. Better characterization of arthritis rates among older adults with different levels of depressive symptoms is an important step toward informing mental health professionals of the need to detect and respond to arthritis and related mental health complications. The primary objective is to determine arthritis rates among U.S. older adults with varying degrees of depression.

Methods: Using National Health and Nutrition Examination Survey (NHANES) 2011-2014 data ($N=4,792$), we first identified participants aged ≥ 50 years. Measures screened for depressive symptoms and self-reported doctor-diagnosed arthritis. Weighted logistic regression models were conducted.

Results: Prevalence of arthritis was 55.0%, 62.9%, and 67.8% in participants with minor, moderate and severe depression, respectively. In both unadjusted and adjusted regression

models, a significant association between moderate depression and arthritis persisted. There were also significant associations between minor and severe depression with arthritis.

Conclusions: Arthritis is commonly reported in participants with varying degrees of depression.

This study highlights the importance of screening for and treating arthritis-related pain in older adults with depressive symptoms and the need for future geriatric psychiatry research on developing integrated biopsychosocial interventions for these common conditions.

Keywords: depressive symptoms; depression; arthritis; older adults; elderly; epidemiology

Key points:

- Self-reported doctor-diagnosed arthritis is highly prevalent among older adults with varying severity levels of depression.
- Mental health care providers should provide regular arthritis-related pain assessments and evidence-based treatments for co-occurring arthritis among older adults with or at risk for clinically relevant depression.
- The findings from this study implicate the need to develop and test integrated biopsychosocial interventions for these common conditions.

Introduction

Arthritis is a highly prevalent, costly, and often disabling chronic condition in older adults. Prevalence of doctor-diagnosed arthritis is more common with older age, rising from 24.3% in adults more than 45 years old to 47.4% in adults ages 65 and older in the United States.¹ Arthritis is among the leading reasons for seeking health care, with total U.S. national health expenditures related to arthritis exceeding \$81 billion per year.² It also remains a major cause of functional disability and rates of arthritis-attributable activity limitation are high and

increasing over time. Forty-three percent of adults with arthritis reported arthritis-attributable activity limitation in 2015, an increase of almost 20% from 2002.³ The functional disability related to arthritis can be explained in part by a lack of evidence-based therapies to restore cartilage loss and the limited number of effective and safe therapies for the treatment of the physical components of pain.⁴ In addition, many patients with arthritis have multiple co-morbid medical conditions including obesity, heart disease, kidney disease, and diabetes, which can limit treatment options given the possibility for adverse drug-drug interactions.³

The clinical burden of arthritis is also due, in part, to the lack of effective treatments for the affective-emotional dimensions of chronic pain.⁵ Emotional disturbance such as any depressive symptoms and mild-to-moderate depression are even more prevalent than major depression in later life.⁶ The consequences of less severe depressive symptoms in older adults with arthritis are similar to those of major depression, including increased pain and functional impairment, which in turn, negatively affect treatment outcomes and heighten mortality risk.⁷⁻¹¹ As such, it is important to consider the potential health impacts of different levels of depressive symptoms. Depression is highly prevalent yet one of the most under-treated and poorly understood psychosocial factors related to arthritis,¹² with nearly half of older adults with both chronic pain and depression receiving either inadequate or no mental health care.¹³

Although depression and arthritis are well-documented comorbidities,¹⁴⁻¹⁶ the epidemiology of arthritis among older adults with depression is not established. Furthermore, arthritis rates among older adults with varying levels of depressive symptoms has received little

attention.^{17,18} The opposing trends are known, with prevalence rates of depression in U.S. adults aged 45 and older with arthritis estimated to be 18%.¹⁹ However, most previous studies have focused on arthritis patients from small, clinic-based samples,^{13,20-25} limiting knowledge of co-occurring arthritis and depression in the broader population.

The biopsychosocial model of chronic pain conceptualizes the physical as well as psychosocial factors (e.g., depressive symptoms) of arthritis,²⁶ which often interact and negatively influence one another to worsen health outcomes.^{27,28} Depressive symptoms, including minor-to-moderate depression, are linked to greater functional disability, higher health care utilization, increased suicidal ideation, and heightened rates of mortality.⁶ Better characterization of arthritis rates among older adults with different degrees of depressive symptoms is an important step toward informing mental health professionals of the need to detect and respond to arthritis and related mental health disorders.

The main purpose of this paper is to describe recent, U.S. national-level estimates of arthritis rates among community-dwelling adults over age 50 with varying levels of depressive symptoms. More specifically, the aims of the current study are to: (1) determine the prevalence of arthritis in older adults with minor, moderate, and severe depression (defined below); and (2) examine the rates of arthritis among older adults with varying severity of depression as compared to older adults without depressive symptoms. Given that psychiatry services for older adults are often complicated by various biopsychosocial factors that impact long-term function including treatment outcomes, these estimates of co-occurring arthritis among older adults with varying

degrees of depression can inform mental health professionals in primary care and specialty care services and establish priorities for resource allocation.

Methods

Survey Description

The National Health and Nutrition Examination Survey (NHANES) data were fielded by the U.S. National Center for Health Statistics, a part of the Centers for Disease Control and Prevention, and surveys have been conducted annually since 1999. The NHANES is a cross-sectional survey representative of the civilian, noninstitutionalized U.S. population. The survey is a complex, multistage, stratified design, and oversamples minorities and older adults. Interviews and examinations were performed by trained staff with automated data collection. Questions were directed to the respondent or if necessary to their proxy. Other information on sampling, study design, and components are described at <http://www.cdc.gov/nchs/nhanes>. To obtain an adequate sample size for the planned cross-sectional analyses, we combined NHANES data from two recent waves, i.e., 2011-2012 and 2013-2014 waves. Ethics approval for this study with de-identified data was not required in accordance with the policy of [blinded].

Study Population

A total of 11,539 participants 18 years of age and older were sampled and interviewed. Of those interviewed, we excluded participants <50 years of age ($N=6,272$) and any participants who did not have depression scores and arthritis information, which allowed us to examine arthritis rates in older adults with varying degrees of depressive symptoms. We used the cutoff of

50 years as a designation for “older adults” in this study. Previous literature on aging and mental health has defined the threshold for “older” to begin at age 50 or 55 to account for the early development of functional impairment in this population.²⁹ Other exclusions were based on true missing data from either depression or arthritis-related questions, which resulted in a final analytic sample of 4,792 participants aged 50 years and older.

Primary Variables

For the main outcome (self-report of doctor-diagnosed arthritis), we identified participants who answered yes to the question “Has a doctor ever told you have arthritis?” Depressive symptoms were assessed by the Patient Health Questionnaire (PHQ-9). The PHQ-9 is a 9-item screening instrument that asks about the frequency of symptoms of depression over the past 2 weeks.^{30,31} Total PHQ-9 scores range from 0 to 27. We defined PHQ-9 total scores with the ranges of 0 and ≤ 4 as *no depression* and ≥ 5 and ≤ 9 as *minor depression*. *Moderate depression* was classified with the range of ≥ 10 and ≤ 14 ,³² which is consistent with clinically relevant depression process and outcome performance measures recommended by the National Quality Forum.³³ In addition, those with PHQ-9 scores ≥ 15 were categorized as having *severe depression*, suggesting the presence of major depression for which active treatment with pharmacotherapy and/or psychotherapy is recommended.³¹

Sociodemographic and Health Covariates

Interviewers ascertained participants’ birthdates, gender, race/ethnicity status, and educational attainment by self-report through the initial screening questionnaire. Gender was

categorized as: 1 = male, 0 = female. Race/ethnicity was classified as a categorical variable with 1=non-Hispanic white and 0= non-Hispanic black, Hispanic-American, or other. Educational attainment was categorized as: 1 = more than high school education, 0 = less than high school education.

Smoking status was established by responses to: “Do you now smoke cigarettes?” Participants who answered “some days” or “every day” were classified as current smokers (1 = currently smokes, 0 = does not currently smoke). Participants with a current history of drinking were ascertained with the following question: “In the past 12 months, on how many days did you have 4 (female)/5 (male) or more drinks of any alcoholic beverage?” Participants who answered ≥ 1 were classified as having a recent binge drinking episode (1 = binge drinking, 0 = no binge drinking). Sedentary behavior time was classified into mean tertile units in minutes. Participants were first prompted with a definition of activities involving sedentary behavior. Participants then answered with time in minutes to: “How much time do you usually spend sitting on a typical day?”

We defined obesity as a $BMI \geq 30 \text{ kg/m}^2$. Body mass index (BMI) was calculated as weight (kg) divided by height (m) squared. All body measurements and procedures were performed on the right side of the body, except where casts, amputations, or other factors prevented the assessment. Weight was measured on an electronic digital scale calibrated in kilograms. Height was measured with a stadiometer in meters.

Participants were classified as having diabetes mellitus through an affirmative response

to the question: “Have you ever been told by a doctor or health professional that you have diabetes or sugar diabetes?” Hypertension was identified by asking: “Have you ever been told by a doctor or other health professional that you had hypertension, also called high blood pressure?” Heart disease was ascertained by an affirmative response to: “Has a doctor or other health care professional ever told you had congestive heart failure, coronary heart disease, angina, or heart attack?”

Statistical Analyses

Sociodemographic and health characteristics were analyzed using frequencies, percentages, means, and standard errors. Mobile Examination Center sample weights and the appropriate home-examined sample design variables (strata, primary sampling unit) were used in the analysis to account for the complex survey design (including oversampling) and survey nonresponse, and were post-stratified to obtain nationally representative estimates of the U.S. civilian non-institutionalized population using the R package *survey* (). Prevalence rates were analyzed using frequencies, with statistical testing performed using t-tests with an α -level of < 0.05 denoting statistical significance. Adjusted odds ratios (OR) and 95% confidence intervals (CI) were calculated using four different multiple logistic regression models for arthritis diagnosis outcome (referent=no arthritis) by minor depression (categorical variable using PHQ-9 score range of ≥ 5 to ≤ 9), moderate depression (categorical variable using PHQ-9 score range of ≥ 10 to ≤ 14), and severe depression (categorical variable using PHQ-9 score range of ≥ 15). For depression categories, no depression (PHQ-9 score range of ≥ 0 to ≤ 4) was the reference group.

For model adjustment, sociodemographic and health covariates were selected based on prior arthritis and depression research.³⁴⁻³⁸ The first model was unadjusted (Model 1); the second included age and gender (Model 2); the third included Model 2 covariates and race, education, smoking status, binge drinking, and sedentary behavior (Model 3); and the fourth included all the covariates and obesity, diabetes, hypertension, and heart disease (Model 4). Adjusted ORs with a 95% CI not including the value of one were considered statistically significant. Analyses were conducted using R (version 3.3.2; The R Foundation for Statistical Computing).

Results

Our analytic sample included 2,483 women and 2,309 men aged 50 years and older, as indicated in Table 1. Participant mean age was 64.5 years (SE±9.3). Less than half, 2,096 (43.7%) participants, identified themselves as non-Hispanic white, and approximately half of the participants (51.1%) reported fewer than 12 years of education. Over one-quarter, 749 (27.0%) participants, reported a recent binge drinking episode, and 799 (33.6%) were classified as current smokers. The average time spent each day in sedentary behavior was 394 minutes (SE±198.4) or 6.57 hours. With respect to medical co-morbidities, 1,896 (39.3%) of participants were classified as having obesity, 1,035 participants (22.5%) had diabetes mellitus, 2,714 (56.7%) had hypertension, and 339 (7.1%) had heart disease.

Insert Table 1

Arthritis prevalence rates in the total sample and in the various depression subgroups are shown in Table 2. The prevalence rates are further stratified by age categories. For the total sample, 2,094 participants (43.7%) reported doctor-diagnosed arthritis, with arthritis rates increasing with age and highest in the 70-79 year (51.5%) and 80+ year (57.1%) categories. Arthritis rates were lowest in participants with no depression, with 1345 (38.2%) non-depressed individuals with self-reported doctor-diagnosed arthritis. For the subgroup with minor depression, 413 out of 754 (55.0%) participants reported having a diagnosis of arthritis. Within the minor depression category, prevalence rates of depression were similar across the various age subgroups (15.5% to 15.9%). However, prevalence rates of arthritis in minor depression increased between 50-59 and 60-69 years (44.7% to 57.9%) and remained similar across the age categories. In total, 195 out of 310 (62.9%) and 141 out of 208 (67.8%) participants with moderate and severe depression, respectively, reported an arthritis diagnosis. With increasing age categories, moderate-to-severe depression rates showed a progressive decline, from 6.5% and 4.3% to 5.4% and 2.9%, respectively. Across the age categories, arthritis rates among those with moderate-to-severe depression increased between 50-59 and 60-69 years (from 53.1% and 59.6% to 69.2% and 73.7%, respectively) and stabilized in advancing age categories.

Insert Table 2

Figures 1 and 2 present the score distribution of depressive symptoms in persons with and without arthritis. There was a significant difference between individuals with (versus those without) arthritis (mean PHQ-9 score = 4.6 vs. 2.6; $p < .001$).

Insert Figure 1

Insert Figure 2

As presented in Table 3, all of the unadjusted models for varying degrees of depressive symptoms were significantly associated with arthritis diagnosis as the outcome. After adjusting for sociodemographic and health characteristics, minor depression remained significantly associated with arthritis in Models 1, 2, and 3 (ORs: 1.10-1.12; CIs: 1.02-1.18). Moderate depression was associated with arthritis in all adjusted models (ORs: 1.24-1.27; CIs: 1.12-1.40). Severe depression was associated with arthritis in the Models 1 and 2 (ORs: 1.21-1.22; CIs=1.08-1.36).

Insert Table 3

Post Hoc Test

To examine whether there were significant differences between the associations for: (1) the minor depression category with arthritis outcome and (2) moderate-to-severe depression categories (Clinical depression; PHQ-9 total scores ≥ 10) with arthritis outcome, we performed comparison models. In an unadjusted model, clinical depression (referent: minor depression) had a significant association with arthritis (OR: 1.26; CI: 1.19-1.33). With age and gender adjustments, clinical depression remained significantly associated with arthritis (OR: 1.26; CI: 1.19-1.32). After controlling for age and gender, in addition to race, education, smoking status, binge drinking, and sedentary behavior, clinical depression persisted in the significant association with arthritis (OR: 1.24; CI: 1.11-1.38). Finally, after adjusting for all of the previous covariates and obesity, diabetes, hypertension, and heart disease, clinical depression remained significantly associated with arthritis (OR: 1.21; CI: 1.09-1.34).

Discussion

This study examined recent, U.S. national-level estimates of arthritis among community-dwelling adults over the age of 50 years with minor depression, moderate depression, and severe depression. A secondary objective was to examine the rates of arthritis among older adults with varying severity of depression as compared to older adults without depressive symptoms.

Overall, we found higher arthritis prevalence rates of 55.0%, 62.9%, and 67.8% in participants with minor, moderate and severe depression, respectively. The findings endorse the importance of considering arthritis and depressive symptoms as frequently co-occurring physical and psychosocial issues for older adults.

Similar to previous research,³⁹ arthritis prevalence was high in adults ≥ 50 years (43.7%) and rates increased across age categories and was highest (51.5% to 57.1%) in groups aged ≥ 70 years. Arthritis rates were lowest in participants ≥ 50 years with no depression (38.2%). For participants with varying depression severity, arthritis rates ranged from 53.1% to 73.7% and demonstrated the largest increase in prevalence between 50-59 and 60-69 years, remaining similar across advancing age groups. Our findings on arthritis rates in older adults with depressive symptoms are analogous to other cross-sectional, population-based surveys on the higher rates of depression (18%) among U.S. adults 45 years and older with arthritis.¹⁹

Consistent with our expectations, we also found that higher rates of arthritis were reported by older adults with various degrees of depression compared to those without sub-clinical and clinical levels of depressive symptoms. This pattern is consistent with other studies on associations between arthritis and depression in older adults.⁴⁰⁻⁴² Notably, there were significant associations between moderate depression and arthritis, even after adjusting for age, gender, race, education, smoking status, binge drinking, sedentary behavior, obesity, diabetes, hypertension, and heart disease. These findings suggest that moderate depression and arthritis tend to co-occur among older adults, independent of other factors that are known contributors to

both depression and arthritis. There were also associations between minor depression and arthritis in all models, with the exception for the model including medical co-morbidities. Finally, there were unadjusted and age- and gender-adjusted associations between severe depression and arthritis. Interestingly, however, the severe depression-arthritis links did not remain significant after adjusting for other sociodemographic and health characteristics. One possible explanation for the lack of significance after adjustments is that the size of the severe depression subsample may have limited statistical power and reduced the ability to ascertain associations. Another reason may be that this finding suggests that other sociodemographic and health characteristics may be equally or more important than severe depression to the increased likelihood of arthritis diagnosis. For instance, older adults with multiple chronic conditions have been shown to be more likely to also report doctor-diagnosed arthritis.⁴³

A post hoc test indicated there were significant differences between the associations for minor depression with arthritis and the associations for moderate-to-severe depression with arthritis in both unadjusted and adjusted models. There are several potential reasons for the significantly greater association between higher prevalence of arthritis and increasing severity of depression.⁴⁴ First, arthritis and disability in older adults have been well-established as major risk factors for depression in older adults,⁶ which indicates there may be a bidirectional relationship between these physical and mental health conditions. However, research has also indicated that persons with a history of major depression often report higher levels of pain even prior to the onset of arthritis.⁴⁵ Second, higher arthritis prevalence and depression severity may be associated

with greater frequency in cognitive distortions such as catastrophizing about potential treatment and rehabilitation outcomes.⁴⁶ Third, the association between depression and arthritis may be linked to poorer coping strategies including reduced physical activity and behavioral inactivation—both risk factors for depression and arthritis.⁴⁷ Finally, it is possible that a common biological mechanism such as neuroimmune dysregulation resulting in inflammation may be associated with the onset and worsening of both arthritis^{48,49} and depression.^{50,51} Given that the NHANES dataset does not include self-report measures on cognitive-behavioral coping strategies or immune dysfunction biomarkers, future studies would benefit from exploring the shared relationships between these biopsychosocial variables with depressive symptoms and arthritis using other large population-based samples.

Although it is well established that clinicians should screen for depressive symptoms in patients with clinically relevant pain from arthritis, the reverse may not hold true. In light of the current study's findings on high rates of arthritis among older adults with depression and elevated depressive symptoms, it may be important to screen for and treat both common conditions in older adults with or at risk for depression in primary care, specialty pain care, and mental health and behavioral health clinics. Because there are numerous adverse health consequences of depressive symptoms alone and without the added burden of arthritis, the findings from this study imply that it may be critical for mental health care providers to provide regular arthritis-related pain assessments and evidence-based treatments for co-occurring arthritis in older adults with or at risk for depression. Addressing arthritis in mental health treatment and behavioral

medicine may also help to reduce the overlapping cognitive, behavioral, and somatic symptoms in older adults with depressive symptoms and arthritis, which may be difficult for providers to disentangle through brief screening procedures and treat through conventional depression care.⁴⁴

While this is one of the few studies to investigate arthritis rates in older adults with varying degrees of depression,^{17,18} there are several limitations to consider. First, we used cross-sectional data, limiting our ability to draw conclusions about the causality or direction of associations. The use of longitudinal data to examine other time points and better understand the trajectories of arthritis and depression in older adults are needed. We were also limited to self-reported measures of depression and arthritis, which may be subject to reporting and measurement bias. The assessment of arthritis did not distinguish between types of arthritis (e.g., osteoarthritis, rheumatoid, inflammatory). Survey weights were used with analyses to reduce sampling bias, yet some biases likely remain due to the nature of sampling within difficult-to-reach older populations (e.g., persons with severe mental illness). Finally, this study did not address other relevant physical and psychosocial factors related to depression and arthritis, including physical factors like pain severity and functional disability,^{40,41} other psychological factors such as anxiety, anger, trauma, or psychosis,⁴² or social factors including family, friend, and significant other support.^{52,53} Receipt of pharmacological treatments (e.g., prescription opioid use) or non-pharmacological interventions (e.g., cognitive-behavioral therapy for pain) for arthritis and other chronic pain conditions was also not assessed. Subsequent work should explore how such physical, psychosocial, and treatment factors may interact to shape

associations between depression and arthritis in later life.

Conclusion

This study works toward building a foundation for a better understanding of the relationship between arthritis and varying levels of depressive symptoms among older adults.

Drawing from a nationally representative dataset, these findings shed light on the high prevalence of arthritis among older adults with varying degrees of depression compared to the significantly lower arthritis rates among older adults without depressive symptoms.

Understanding that depressive symptoms and arthritis may be interlinked in older adults is critical when making decisions for health care budget allocation to ensure availability and access to appropriate services. To provide streamlined care and cost-effective care, future research in geriatric psychiatry is needed to develop and test pilot integrated biopsychosocial strategies and interventions targeting both arthritis and depressive symptoms for delivery by mental health professionals in primary care and specialty care services.

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Table 1. Sociodemographic and Health Characteristics of Cohort

Variable	Total sample (n=4,792)
Mean age (mean years \pm SD)	64.5 \pm 9.3
50-59	1,594 (33.3)
60-69	1,689 (35.2)
70-79	949 (19.8)

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≥ 80	560 (11.7)
Female sex	2,483 (51.8)
Race	---
Non-Hispanic White	2,096 (43.7)
Non-Hispanic Black	1,187 (24.8)
Hispanic-American	945 (19.7)
Other	744 (11.8)
Current smoker	799 (33.6)
Recent binge drinking episode	749 (27.0)
Education	---
<12 years	2,451 (51.1)
>12 years	2,341 (48.9)
Sedentary Behavior (mean min. \pm SD)	394.0 \pm 198.4
Obesity	1,856 (39.3)
Comorbidities	---
Diabetes mellitus	1,035 (22.5)
Hypertension	2,714 (56.7)
Heart disease	339 (7.1)

Note. Means \pm standard deviations are presented for continuous variables, counts (weighted percentages) for categorical variables.

Obesity is defined as a BMI ≥ 30 kg/m²

Table 2. Arthritis Rates in Total Sample and Depression Subgroups

Sample characteristics	Overall Cohort (≥50 years)	50-59 years	60-69 years	70-79 years	80+ years
Number of participants from total sample	4,792 (100)	1,594 (33.3)	1,565 (32.7)	887 (18.5)	560 (11.7)
Arthritis in participants from total sample	2,094 (43.7)	520 (32.6)	695 (44.4)	457 (51.5)	320 (57.1)
Number of participants with no depression	3520 (73.5)	1135 (23.7)	1130 (23.6)	682 (14.2)	426 (8.9)
Arthritis in participants with no depression	1345 (38.2)	292 (25.7)	418 (37.0)	324 (47.5)	235 (55.2)
Number of participants with minor depression	754 (15.7)	257 (15.5)	242 (15.5)	141 (15.9)	88 (15.7)
Arthritis in participants with minor depression	413 (55.0)	115 (44.7)	140 (57.9)	88 (62.4)	54 (61.4)
Number of participants with moderate depression	310 (6.5)	113 (7.1)	117 (7.5)	41 (4.6)	30 (5.4)
Arthritis in participants with moderate depression	195 (62.9)	60 (53.1)	81 (69.2)	28 (68.3)	20 (66.7)
Number of participants with severe depression	208 (4.3)	89 (5.6)	76 (4.9)	23 (2.6)	16 (2.9)

Arthritis in participants with severe depression	141 (67.8)	53 (59.6)	56 (73.7)	17 (74.0)	11 (68.8)
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Note. Arthritis=self-reported doctor-diagnosed arthritis. PHQ-9 scores for no depression=0-4, minor depression=5-9, moderate depression=10-14, and severe depression \geq 15-19. Prevalence rates are presented as counts (weighted prevalence).

Table 3. Regression Models for Varying Degrees of Depression by Arthritis Outcome, Weighted Estimates

		Model 1	Model 2	Model 3	Model 4	
		Odds ratios (95% CI)				
Rate (%)						
No Depression	3,520 (73.5)	referent				
Analysis based on 3 Depression Categories	Minor Depression	754 (15.7)	OR 1.12 (1.08-1.18)	OR 1.12 (1.07-1.17)	OR 1.10 (1.02-1.18)	OR 1.06 (0.99-1.13)
	Moderate Depression	310 (6.5)	OR 1.26 (1.18-1.36)	OR 1.26 (1.17-1.35)	OR 1.27 (1.14-1.40)	OR 1.24 (1.12-1.37)
	Severe Depression	208 (4.3)	OR 1.21 (1.08-1.36)	OR 1.22 (1.11-1.34)	OR 1.16 (0.99-1.36)	OR 1.12 (0.97-1.30)

Note. Arthritis outcome=self-reported doctor-diagnosed arthritis (referent=no arthritis diagnosis). PHQ-9 scores for no depression=0-4, minor depression=5-9, moderate depression=10-14, and severe depression \geq 15. For the logistic regression models, values bolded do not include a value of "one" in the confidence intervals and are considered statistically significant at $p < .05$.

Model 1: Unadjusted.

Model 2: Adjusted for age and gender.

Model 3: Model 2 covariates, race, education, smoking status, binge drinking, sedentary behavior.

Model 4: Model 3 covariates, obesity, diabetes, hypertension, heart disease.

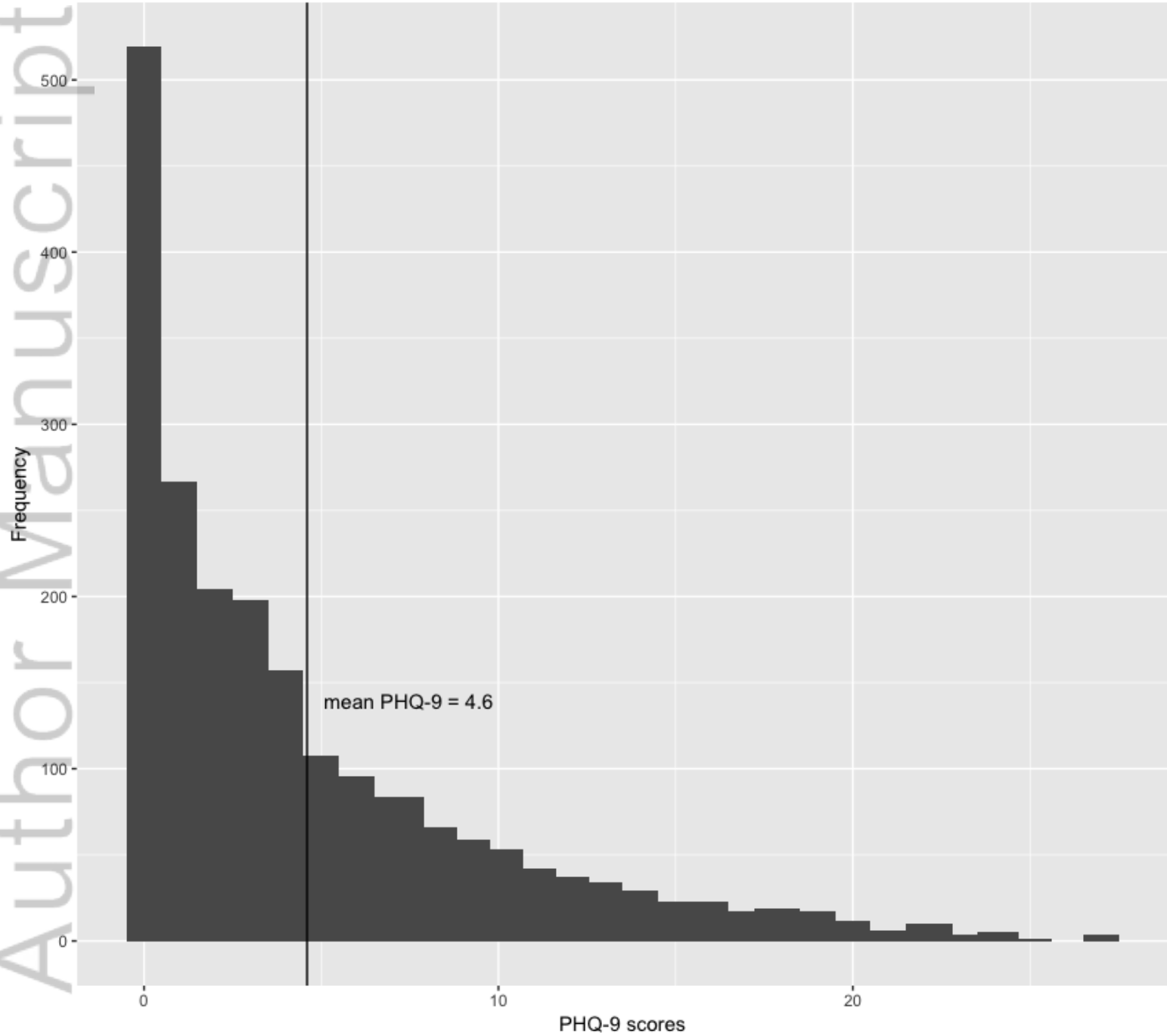
Figure 1.

Note. PHQ-9 scores represent the average scores for depression. PHQ-9 scores for no depression=0-4, minor depression=5-9, moderate depression=10-14, and severe depression \geq 15.

Figure 2.

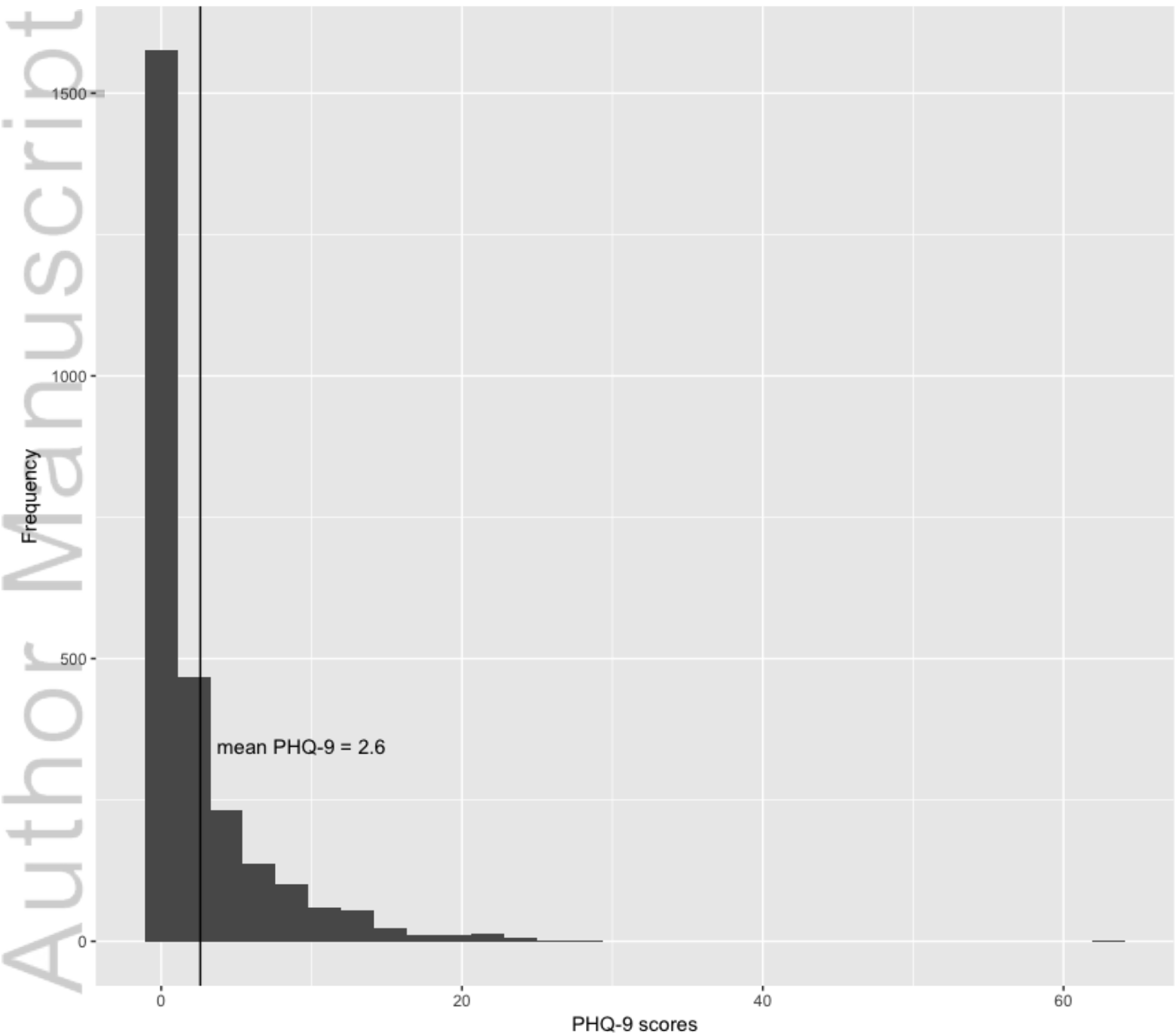
Note. PHQ-9 scores represent the average scores for depression. PHQ-9 scores for no depression=0-4, minor depression=5-9, moderate depression=10-14, and severe depression \geq 15.

Figure 1: Histogram of PHQ-9 scores for people with arthritis



GPS_4971_F1.tiff

Figure 2: Histogram of PHQ-9 scores for people without arthritis



GPS_4971_F2.tiff