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Associations of Self-reported Musculoskeletal Pain and Depressive Symptoms among U.S. Healthcare Workers

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Abstract

Healthcare workers are prone to develop musculoskeletal pain because of the physical demands of their profession. While neck and back pain are believed to have a relationship with depression symptomatology, few studies have assessed this relationship among healthcare workers. The purposes of this study were to identify the: prevalence of musculoskeletal pain and depressive symptoms among healthcare workers; association between musculoskeletal pain and depressive symptoms; and the association between musculoskeletal pain and severity of depressive symptomatology among those with self-reported depressive symptoms. Data from 1,205 healthcare workers in the 2018 National Health Insurance Survey were analyzed. In Phase 1, a logistic regression model was fitted to assess the relationship between self-reported neck and back pain and depressive symptoms. Then, in Phase 2, a logistic regression model was fitted for participants with self-reported depressive symptoms ($n=501$) to identify associations of neck and back pain with the severity of depressive symptomatology. About 74.9% of the study participants were female, 42.7% aged 41-64 years, 34.5% reported musculoskeletal pain, while 41.7% reported depressive symptoms. Low back pain was the most prevalent body pain (18.7%). Healthcare workers with neck pain only ($OR=2.11$, $P=0.047$), low back pain only ($OR=2.19$, $P=0.047$) could benefit from multi-faceted public health interventions to simultaneously improve their musculoskeletal pain and depressive symptoms (e.g., ergonomic evaluation, stress management, one-on-one or group counseling).

Keywords

Musculoskeletal pain, neck pain, back pain, depressive symptoms, healthcare workers

Acknowledgements/Disclaimers/Disclosures

The authors have no conflict of interest.

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Associations of Self-Reported Musculoskeletal Pain and Depressive Symptoms among U.S. Healthcare Workers

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Abstract

Healthcare workers are prone to develop musculoskeletal pain because of the physical demands of their profession. While neck and back pain are believed to have a relationship with depressive symptoms, few studies have assessed this relationship among healthcare workers. The purposes of this study were to identify the: prevalence of musculoskeletal pain and depressive symptoms among healthcare workers; association between musculoskeletal pain and depressive symptoms; and the association between musculoskeletal pain and severity of depressive symptomatology among those with self-reported depressive symptoms. Data from 1,205 healthcare workers in the 2018 National Health Insurance Survey were analyzed. In Phase 1, a logistic regression model was fitted to assess the relationship between self-reported neck and back pain and depressive symptoms. Then, in Phase 2, a logistic regression model was fitted for participants with self-reported depressive symptoms ($n=501$) to identify associations of neck and back pain with the severity of depressive symptomatology. About 74.9% of the study participants were female, 42.7% aged 41-64 years, 34.5% reported musculoskeletal pain, while 41.7% reported depressive symptoms. Low back pain was the most prevalent body pain (18.7%). Healthcare workers with neck pain only ($OR=2.11$, $P=0.002$), low back pain only ($OR=2.19$, $P<0.001$), and both neck and back pain ($OR=2.49$, $P<0.001$) were significantly more likely to report depressive symptoms. Reporting co-occurring neck and low back pain was associated with higher severity of depressive symptomatology ($OR=2.54$, $P=0.003$). Healthcare workers could benefit from multi-faceted public health interventions to simultaneously improve their musculoskeletal pain and depressive symptoms (e.g., ergonomic evaluation, stress management, one-on-one or group counseling).

Key words: musculoskeletal pain, neck pain, back pain, depressive symptoms, healthcare workers

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Background

Musculoskeletal pain is a common work-related health issue affecting components of the musculoskeletal system (El-Tallawy et al., 2021). Personal, physical, and

occupational factors contribute to the occurrence of musculoskeletal pain (Caneiro et al., 2021; Yasobant & Rajkumar, 2014). Occupational factors associated with musculoskeletal pain include the frequency and duration of performing tasks,

maintaining awkward or static postures, performing repetitive tasks, and performing heavy lifting (Campbell et al., 2021; van der Molen et al., 2021; Humayun et al., 2021; Soygar & Ozer, 2018; Vijendren et al., 2016).

Between 43% and 68% of healthcare workers experience musculoskeletal pain (Shaikh et al., 2021), with pain most frequently cited in the lower back, shoulder, neck, and upper extremities (Dong et al., 2019; Fernandes et al., 2018; Luan et al., 2018). Low back pain is the most prevalent type of musculoskeletal pain (Joseph et al., 2020; Krishnan et al., 2021) and is one of the leading causes of disability in the United States (Mokdad et al., 2018).

Depression is characterized by persistent sadness and a lack of interest in previously enjoyed activities (World Health Organization, 2023). According to the National Institute for Occupational Safety and Health (2024), healthcare workers are prone to mental health conditions such as depression, and more than 20 million US healthcare workers are impacted by mental health conditions. Sexton and Adair (2019) found that 37.2% of healthcare workers in the United States reported symptoms of depression. Zhang and colleagues (2023) reported a depression symptom prevalence of 22% among healthcare workers in the Northeastern part of the United States. Factors associated with depression include challenges with heavy workloads, inadequate sleep, and burnout (De Hert, 2020; Murthy, 2022). Depression medication use is indicated for the management of major depressive disorder and may be indicative of the severity of depressive symptoms (Fournier et al., 2010).

The experiences of healthcare workers with musculoskeletal pain and depression have been reported in the literature (Alkan et al., 2017; Demou et al., 2018; Melkevik et al., 2018; Zhang et al., 2020), with additional

studies conducted during the COVID-19 pandemic (Arca et al. 2021; Aydin & Atiç, 2023). Alkan and colleagues (2017) reported prevalence rates of low back (24.1%) and neck (20.9%) pain among healthcare workers. Further, 18.2% of healthcare workers were reported to have depression. Demou and colleagues (2018) found that low back pain was the most frequently reported type of musculoskeletal pain, and low back pain resulted in the highest number of days lost at work. Melkevik and colleagues (2018) study among healthcare workers found that about 18% of participants self-reported co-occurring body pain and depression, with reports of pain in one or more body parts, and medium-to-high level of depressive symptomatology. A study to examine the experience of musculoskeletal pain and depression among nurses in the United States reported 36% musculoskeletal pain and 14.5% depression prevalence, respectively (Zhang et al., 2020). Further, the body parts with the most common pain reports were in the low back (63%), shoulder (42.4%), neck (50.6%), wrist/forearm (24.2%), knee (35%) and ankle/feet (39.3%).

A study focused on musculoskeletal pain and depression experiences of healthcare workers during the COVID-19 pandemic revealed that about 94.9% of healthcare workers reported musculoskeletal pain, while 83.5% reported depression (Arca, et al., 2021). Furthermore, 7.4% reported neck pain in the “last 12 months,” and 61.4% reported upper back pain in the “last 12 months”. Back and neck pain were the most common musculoskeletal pain reports among healthcare workers during the COVID-19 pandemic (Aydin & Atic, 2023).

To further examine the health of healthcare workers and the relationship between pain and depressive symptoms, the purposes of this study were to answer the following research questions:

- 1) What is the prevalence of self-reported musculoskeletal pain and depressive symptoms among healthcare workers?
- 2) What is the association between self-reported musculoskeletal pain and other contributory factors on self-reported depressive symptoms within the healthcare professions?
- 3) Among healthcare workers with any depressive symptoms, is there a relationship between types of musculoskeletal pain felt and the severity of depressive symptomatology?

Methods

Study Design, Participants, and Procedures

This study used data from the Integrated Public Use Microdata Series (IPUMS) 2018 National Health Interview Survey (NHIS), a cross-sectional household interview survey (Ruggles et al., 2024). The NHIS survey collected data from non-institutionalized civilians living in the United States using a probability sampling design to achieve representative sampling from United States households and non-institutional group

quarters (National Center for Health Statistics, 2019). The survey instrument collected information about a wide spectrum of topics such as health status, healthcare access, healthcare utilization, health behaviors, and health conditions and limitations, including musculoskeletal pain experiences (NCHS, 2023). Institutional review board approval was not obtained for this study using publicly available secondary data.

Study Phases

This study was conducted in two phases with sequentially performed data analyses. Data from the Sample Adult File included a national sample of 72,831 study participants ages 18-85 years. Of these participants, Phase 1 analyses included healthcare workers with direct contact with patients. Then, Phase 2 analyses included only Phase 1 participants who self-reported having any depressive symptoms. More details about Phases 1 and 2 of this study are described below.

Phase 1: The inclusion criteria for Phase 1 were that all participants needed to be healthcare workers who had direct contact with healthcare patients and no missing

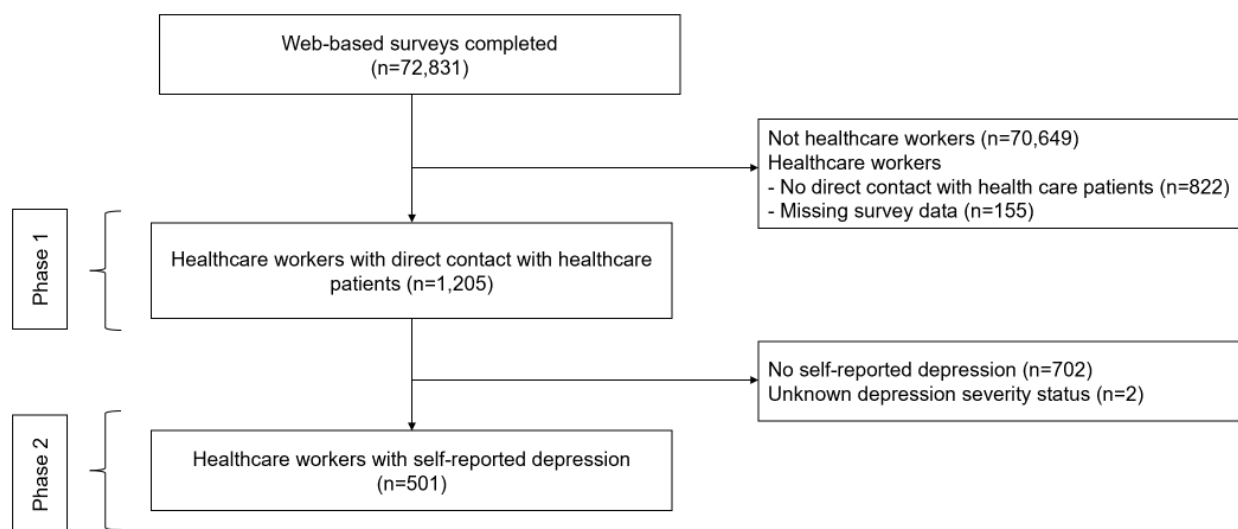


Figure 1: Flowchart showing the study phases

survey data on variables of interest. There were 1,205 study participants included in Phase 1 analyses based on this inclusion criterion.

Phase 2: Phase 2 of the study included only those from Phase 1 who self-reported having any depressive symptoms (i.e., selected response other than “never” to the depression frequency question) and had complete data for items about depression medication and severity of depressive symptomatology. Based on this criterion, the sample size for the second phase was 501 participants. Figure 1 shows the participant selection for analyses based on the purposes of this study.

Measures

Dependent variables: The dependent variables used in this two-phase study were related to depressive symptoms, respectively. As described below, self-reported depressive symptoms was the dependent variable for Phase 1. Then, among those who reported depressive symptoms, the Phase 2 dependent variable was severity of depressive symptomatology.

Self-reported depressive symptoms: In Phase 1, to assess depression, participants were asked, “How often do you feel depressed? Would you say daily, weekly, monthly, a few times a year, or never?” This variable was described as “depressive symptoms” by the authors and dichotomized based on the frequency distribution to be “never” and “a few times a year/monthly/weekly/daily.”

Severity of depressive symptomatology: In Phase 2, participants were asked, “Thinking about the last time you felt depressed, how depressed did you feel? Would you say a little, a lot, or somewhere in between?” This variable was described as “severity of depressive symptomatology” by the authors and dichotomized based on the frequency

distribution to be “a little” and “somewhere between a little and a lot/a lot.”

Independent variables: The independent variables used in this study included information about healthcare workers’ musculoskeletal pain and sociodemographics.

Musculoskeletal pain: Participants were asked to self-report if they had neck and low back pain separately. Both items used “yes” or “no” responses. These items were used independently for analyses as “only neck pain” and “only low back pain.” Then, these variables were combined to create a 4-category pain variable to indicate if the healthcare provider had “no pain,” “neck pain only,” “low back pain only,” and “both neck and low back pain.”

Depression medication: In Phase 2, participants were asked, “Do you take medication for depression?” Response choices included “no” and “yes.”

Sociodemographics: The sociodemographic variables included were age, sex, ethnicity, race, marital status, household income, and body mass index (BMI). The continuous age variable was recoded into categories of “18-25,” “26-40,” “41-64,” and “≥65” years. Sex was coded as “male” or “female”. Ethnicity was coded as “Hispanic” or “non-Hispanic”. Race was coded as “White only,” “Black or African American only,” “Asian only,” and “American Indian/Alaska Native” (AIAN) combined with those from multiple races. Marital status was coded as “married and partnered,” “single,” and “divorced/separated/widowed.” The income measure used the total combined household income variable, and classified income as “\$0-\$34,999,” “\$35,000-\$74,999,” “\$75,000-\$99,999,” and “\$100,000 and over.” Body mass index (BMI) was coded as “underweight/normal” weight (BMI <25), “overweight” (BMI ≥25 and <30), and “obese” (BMI ≥30). The underweight and

normal weight BMI were combined because there were few underweight participants compared with the other BMI groups, making them insufficient for analysis.

Statistical Analysis

Data were analyzed in two phases using SPSS version 29 (IBM Corporation). Descriptive statistics were used for all the variables of interest in both study phases. In Phase 1, the study variables were compared across depression status. In Phase 2, among only those reporting depression, study variables were compared across depression severity. In Phases 1 and 2, Pearson's Chi-square tests were used to assess the distribution of study characteristics across the categorical variables of interest.

The dependent variables in both study phases were dichotomous, thus binary logistic regression analysis was performed. In Phase 1, all the regression models adjusted for age, sex, ethnicity, race, marital status, household income, and BMI. In Phase 2, the regression models adjusted for age, sex, ethnicity, race, marital status, household income, BMI and depression medication use. The predictor variables were assessed for multicollinearity. Given all associations had variance inflation factor scores of less than 1.5, all the predictor variables were included in the respective logistic regression models. In Phase 1, logistic regression models were fitted to assess the association of musculoskeletal pain types on depressive symptoms. Not having depressive symptoms served as the referent group for this model. In Phase 2, a logistic regression model was fitted using only participants with self-reported depressive symptoms to estimate the relationship between musculoskeletal pain and the severity of depressive symptomatology. In this phase, the logistic regression model assessed the relationship between musculoskeletal pain and the

severity of depressive symptomatology (reporting "a little" severity of depressive symptomatology served as the referent category).

Results

Phase 1 Results

Table 1 provides details about the Phase 1 study sample. Most study participants were ages 41-64 years (42.7%), female (74.9%), non-Hispanic (88.5%), White (74.8%), and married or partnered (57.1%). Over one-third of participants were underweight or normal weight (36.7%). In terms of musculoskeletal pain, 65.5% of participants reported no pain, 6.3% reported neck pain only, 18.7% reported low back pain only, and 9.5% reported both neck and low back pain. Among these study participants, 58.3% reported "never" feeling depressive symptoms, 28.2% reported feeling depressive symptoms "a few times a year," 8.6% reported feeling depressive symptoms "monthly," and 4.9% reported feeling depressive symptoms "weekly." Overall, 41.7% of participants self-reported any depressive symptoms.

When comparing Phase 1 sample characteristics by depressive symptoms, significantly larger proportions of healthcare workers who reported pain (i.e., neck only, low back only, and both neck and low back) also reported depressive symptoms ($\chi^2=43.28$, $P<0.001$).

Table 2 reports findings from the logistic regression models that assessed the associations of musculoskeletal pain and self-reported depressive symptoms. Participants with neck pain only (OR=2.11, $P=0.002$), low back pain only (OR=2.19, $P<0.001$), and both neck and low back pain (OR=2.49, $P<0.001$) were significantly more likely to self-report depression.

Table 1: Sample characteristics of healthcare workers (n=1,205)

	Total	Depressive Symptoms		X^2	P
	n (%)	No (n=702)	Yes (n=503)		
Age				0.13	0.988
18-25	133 (11.0%)	76 (10.8%)	57 (11.3%)		
26-40	472 (39.2%)	274 (39.0%)	198 (39.4%)		
41-64	514 (42.7%)	302 (43.0%)	212 (42.1%)		
>64	86 (7.1%)	50 (7.1%)	36 (7.2%)		
Sex				0.67	0.414
Male	302 (25.1%)	182 (25.9%)	120 (23.9%)		
Female	903 (74.9%)	520 (74.1%)	383 (76.1%)		
Ethnicity				0.31	0.580
Non-Hispanic	1066 (88.5%)	618 (88.0%)	448 (89.1%)		
Hispanic	139 (11.5%)	84 (12.0%)	55 (10.9%)		
Race				4.35	0.226
White only	901 (74.8%)	514 (73.2%)	387 (76.9%)		
Black (Black/African American) only	173 (14.4%)	101 (14.4%)	72 (14.3%)		
Asian only	90 (7.5%)	61 (8.7%)	29 (5.8%)		
AIAN and other races	41 (3.4%)	26 (3.7%)	15 (3.0%)		
Marital Status				0.53	0.766
Married & partnered	688 (57.1%)	407 (58.0%)	281 (55.9%)		
Single	296 (24.6%)	169 (24.1%)	127 (25.2%)		
Divorced, separated & Widowed	221 (18.3%)	126 (17.9%)	95 (18.9%)		
BMI				4.24	0.120
Underweight and normal weight	442 (36.7%)	266 (37.9%)	176 (35.0%)		
Overweight	383 (31.8%)	231 (32.9%)	152 (30.2%)		
Obese	380 (31.5%)	205 (29.2%)	175 (34.8%)		
Income				6.92	0.075
\$0-34,999	239 (19.8%)	125 (17.8%)	114 (22.7%)		
\$35,000-74,999	329 (27.3%)	188 (26.8%)	141 (28.0%)		
\$75,000-99,999	167 (13.9%)	96 (13.7%)	71 (14.1%)		
\$100,000 and over	470 (39.0%)	293 (41.7%)	177 (35.2%)		
Pain types				43.28	<0.001
No pain	789 (65.5%)	513 (73.1%)	276 (54.9%)		
Neck pain only	76 (6.3%)	36 (5.1%)	40 (8.0%)		
Back pain only	225 (18.7%)	103 (14.7%)	122 (24.3%)		
Neck and back pain	115 (9.5%)	50 (7.1%)	65 (12.9%)		

Footnote: IPUMS NHIS, 2018. X^2 = Pearson's Chi square; P = P-value; American Indian and Alaska Native (AIAN).

Table 2: Associations of musculoskeletal pain with depressive symptoms among healthcare workers who provide direct patient care (n=1,205)

	B	S.E.	P	OR	Lower 95% CI	Upper 95% CI
No pain	-	-	-	1.00	-	-
Neck pain only	0.75	0.24	0.002	2.11	1.31	3.40
Low back pain only	0.79	0.16	<0.001	2.19	1.61	2.99
Neck and low back pain	0.91	0.21	<0.001	2.49	1.65	3.75

Footnote: IPUMS NHIS, 2018. B=Beta score; S.E.= Standard Error; P= P-value; OR= Odds ratio; CI=Confidence Interval. Adjustment made for: Age, sex, ethnicity, race, marital status, level of education, BMI, and income.

Phase 2 Results

Phase 2 analyses included the subsample of 501 participants who had direct patient contact and self-reported depressive symptoms. Table 3 provides details about this subsample by self-reported severity of depressive symptomatology. Of these healthcare workers with self-reported depressive symptoms, 8.0% reported neck pain only, 24.2% reported low back pain only, and 13.0% reported both neck and low back pain. Among participants with self-reported severity of depressive symptomatology, 55% reported their level of depression reported as “a little,” 35.3% as “somewhere between a little and a lot,” and 9.2% as “a lot”. About 44.5% reported their severity of depressive symptomatology to be “between a little and a lot” or “a lot,” and 19.2% of participants reported depression medication use. A significantly larger proportion of non-White healthcare workers with depressive symptoms ($\chi^2=14.57$, $P=0.032$) reported having more severity of depressive symptomatology “between a little and a lot” or “a lot”). A significant proportion of healthcare workers with depressive symptoms who used depression medication had more severity of depressive symptomatology ($\chi^2=13.81$, $P<0.001$).

Table 4 reports findings from the logistic regression model explaining the relationship

between musculoskeletal pain and severity of depressive symptomatology among participants who self-reported depressive symptoms. Healthcare workers with depressive symptoms who had neck and low back pain (OR=2.54, $P=0.003$) were more likely to report higher levels of severity of depressive symptomatology.

Discussion

This study assessed the relationship between self-reported musculoskeletal pain and depressive symptoms and the severity of depressive symptomatology among healthcare workers. Those with direct patient contact who reported neck, low back, and a combination of neck and low back pain were at risk of having depressive symptoms (Table 2). This supports a finding from previous research that identified an association between the effects of challenging workplace conditions on the mental health of healthcare workers who have direct patient contact (Zhang et al., 2020). Further, people with more than one pain type (neck and low back pain) had the highest odds of reporting depressive symptoms, compared with those who only had pain in the neck or the low back. This demonstrates the effect of physical pain on mental health (Hannerz et al., 2021) and supports findings from previous studies that showed a relationship between multisite

Table 3: Sample characteristics of healthcare workers who have depressive symptoms (n=501)

	Total	Severity of Depressive Symptomatology		X^2	P
	n (%)	A little (n=278)	Between a little and a lot (n=223)		
Age				9.20	0.027
18-25	57 (11.4%)	30 (10.8%)	27 (12.1%)		
26-40	198 (39.5%)	95 (34.2%)	103 (46.2%)		
41-64	211 (42.1%)	131 (47.1%)	80 (35.9%)		
>64	35 (7.0%)	22 (7.9%)	13 (5.8%)		
Sex				0.26	0.611
Male	120 (24.0%)	69 (24.8%)	51 (22.9%)		
Female	381 (76.0%)	209 (75.2%)	172 (77.1%)		
Ethnicity				1.00	0.317
Non-Hispanic	446 (89.0%)	244 (87.8%)	202 (90.6%)		
Hispanic	55 (11.0%)	34 (12.2%)	21 (9.4%)		
Race				6.61	0.085
White only	385 (76.8%)	219 (78.8%)	166 (74.4%)		
Black (Black/African American) only	72 (14.4%)	33 (11.9%)	39 (17.5%)		
Asian only	29 (5.8%)	20 (7.2%)	9 (4.0%)		
AIAN and other races	15 (3.0%)	6 (2.2%)	9 (4.0%)		
Marital Status				14.57	<0.001
Married & partnered	281 (56.1%)	170 (61.2%)	111 (49.8%)		
Single	127 (25.3%)	52 (18.7%)	75 (33.6%)		
Divorced, separated & Widowed	93 (18.6%)	56 (20.1%)	37 (16.6%)		
BMI				3.32	0.190
Underweight and normal weight	176 (35.1%)	104 (37.4%)	72 (32.3%)		
Overweight	151 (30.1%)	87 (31.3%)	64 (28.7%)		
Obese	174 (34.7%)	87 (31.3%)	87 (39.0%)		
Income				2.70	0.441
\$0-34,999	114 (22.8%)	60 (21.6%)	54 (24.2%)		
\$35,000-74,999	140 (27.9%)	77 (27.7%)	63 (28.3%)		
\$75,000-99,999	70 (14.0%)	45 (16.2%)	25 (11.2%)		
\$100,000 and over	177 (35.3%)	96 (34.5%)	81 (36.3%)		
Number of pain types				7.47	0.058
No pain	275 (54.9%)	161 (57.9%)	114 (51.1%)		
Neck pain only	40 (8.0%)	22 (7.9%)	18 (8.1%)		
Low back pain only	121 (24.2%)	69 (24.8%)	52 (23.3%)		
Neck and low back pain	65 (13.0%)	26 (9.4%)	39 (17.5%)		
Depression medication				13.81	<0.001
No	405 (80.8%)	241 (86.7%)	164 (73.5%)		
Yes	96 (19.2%)	37 (13.3%)	59 (26.5%)		

Footnote: IPUMS NHIS, 2018. X^2 = Pearson's Chi square; P= P-value; American Indian and Alaska Native (AIAN).

Table 4: Associations of musculoskeletal pain with the severity of depressive symptomatology among healthcare workers with depressive symptoms (n=501)

	B	S.E.	P	OR	Lower 95% CI	Upper 95% CI
No pain	-	-	-	1.00	-	-
Neck pain only	0.23	0.37	0.540	1.26	0.60	2.61
Low back pain only	0.05	0.24	0.837	1.05	0.65	1.70
Neck and low back pain	0.93	0.31	0.003	2.54	1.37	4.69

Footnote: IPUMS NHIS, 2018. B=Beta score; S.E.= Standard Error; P= P-value; OR= Odds ratio; CI=Confidence Interval. Adjustment made for: Age, sex, ethnicity, race, marital status, level of education, BMI, income and depression medication use.

pain, more severe musculoskeletal pain, and depression (Kroenke et al., 2011; Neupane et al., 2020). Perception of pain from multiple body parts is associated with more discomfort, evidenced by mood affectation such as more severe cases of depression (Trivedi, 2004; Kleiber et al., 2005). Evidence also shows there is an increased risk of depressive symptoms with more reported musculoskeletal pain (Hannerz et al., 2021).

Low back pain only was associated with a higher severity of depressive symptomatology compared with neck pain only, and neck and low back pain combined (Table 3). Back pain is the most common musculoskeletal condition, a leading cause of disability (World Health Organization, 2023b), and contributes significantly to absenteeism, reduced productivity, and early retirement (Russo et al., 2024; Schofield et al., 2011; Schofield et al., 2012). Given the personal and economic effects of back pain, healthcare workers, especially those in direct contact with patients, would benefit from workplace interventions and wellness activities to reduce their risk for back pain.

Healthcare workers who used depression medication were more likely to have more severe depressive symptomatology (Table 3). Depression medication use could be an indicator of the severity of depressive symptomatology (Fournier et al., 2010). This finding may suggest that healthcare workers

with severe depressive symptoms may require depression medication titration or a different type of psychotropic medication based on their specific needs. This may also suggest that these healthcare workers were underutilizing non-pharmaceutical therapies such as psychological therapy or a combination of pharmacological and non-pharmacological treatments. Although 44.5% of Phase 2 participants reported more severe depressive symptomatology, only 19.2% used depression medication. This may be indicative of prescribing barriers in that an individual needs to have a diagnosis of major depressive disorder and meet a minimum of 5 of 9 criteria for depression to be prescribed depression medication (Marx et al., 2023). These findings highlight the need for more mental health services available to healthcare workers, who should be encouraged to seek appropriate treatments and therapies to meet their mental health needs.

In the current study, there was a higher prevalence of musculoskeletal pain among female healthcare workers compared with male healthcare workers (Table 1). This supports the findings of previous studies that female healthcare workers are more predisposed to musculoskeletal pain compared with their male counterparts (Higgins et al., 2017; Dahlhamer et al., 2018). Further, Wijnhoven and colleagues (2007) found a higher prevalence of musculoskeletal pain, particularly neck pain

among female healthcare providers, compared with male healthcare providers. This could possibly be due to underreported pain and depression by the men (Bird & Reiker, 2008; Samulowitz et al., 2018; Smith & Hebdon, 2023) and/or reduced healthcare utilization (Call & Shafer, 2018). Contrary to the previously stated research findings, a study by Hooftman and colleagues (2009) found that men are more vulnerable to work-related musculoskeletal conditions, compared with their women counterparts. This could be because physical work exposures such as heavier workload compared with female colleagues, use of improper techniques to perform tasks at work, and not taking the required rests breaks in between tasks (Biswas et al., 2022).

Musculoskeletal pain and depression are co-morbid conditions that impact the health and life of patients (Zhang et al., 2020). Literature shows a bi-directional relationship between musculoskeletal pain and depression, where one can cause the other and vice versa (Hawker, 2017; Hannerz et al., 2021; Hooten, 2016). A reduction in depressive symptomatology could reduce the perception of musculoskeletal pain (Scott et al., 2016). While depression medication works to exert more mental wellness, healthcare providers can work on ways to improve and reduce their musculoskeletal pain experience. Depression-focused interventions such as workplace wellness activities including physical activity interventions (Center for Disease Control and Prevention, 2020), like the Program to Encourage Active, Rewarding Lives (PEARLS), could be adapted to the healthcare worker population to improve their mental health status (Smith et al., 2023).

Musculoskeletal pain and depression are comorbid conditions (Zhang et al., 2020) that increase the risk of having long-term sickness absence and other untoward effects (Melkevik et al., 2018). This study suggests

that pain may drive depressive symptoms, but unless it is multisite pain, it does not drive the severity of depressive symptomatology. More awareness may be needed about the association of musculoskeletal pain and depressive symptoms, which may help foster conversation between patients-providers, and lead to preferable interventions selected for preventive or curative use. Healthcare workers would benefit from workplace solutions to reduce their risk of having musculoskeletal pain and/or depressive symptoms.

To preserve the health of healthcare workers, multi-level interventions are recommended to address different physical and mental health risk factors (Albanesi et al., 2022). Suggestions to improve the physical health of healthcare workers include the provision of workplace facilities that fit tasks of healthcare workers to the worker such as ergonomic resources (e.g., furniture or equipment that improve worker posture) to reduce stress and strain on the body and automated procedures (e.g., patient lift assist, lift hoists) (Fray & Davis, 2023; Gilchrist & Pokorná, 2021; Johnson et al., 2023; Vinstrup et al., 2020; Wiggermann et al., 2021). Other useful strategies include providing safety-related trainings to educate healthcare workers about the proper postures to maintain while performing tasks and encouraging short breaks between procedures, exercise, and physical activity (Alqhtani et al., 2023; Jakobsen et al., 2015; Khansa et al., 2018). Further, the needs of healthcare workers can be met by offering workplace wellness programs and establishing workplace policies that substitute risky tasks with equally effective and less risky tasks (Asuquo et al., 2021). To specifically improve the mental health of healthcare workers, readily available, accessible, and affordable mental health resources should be made available to healthcare workers. It is important that these

mental health services are equitably made available to all healthcare workers in the workplace, with goals to provide culturally competent and comprehensive mental health resources.

Strengths and Limitations

This study has strengths and limitations. A major strength of this study is that it provides data from a representative sample of healthcare workers in the United States. Second, it focuses on studying musculoskeletal pain and depressive symptoms among healthcare workers, a topic of significant importance to have healthy healthcare providers available to treat patients. Third, it provides pre-COVID-19 data about the musculoskeletal pain and depression-related experiences of healthcare workers. For a more complete understanding of the pain experience, the dataset used in the current study included a variable related to neck pain, which is unique and not included in the more recent NHIS datasets. However, this study has some limitations. The 2018 NHIS dataset used in this study was not the most recent NHIS dataset, which may limit the representativeness of healthcare workers' musculoskeletal pain and depressive symptom experiences, especially considering the strains introduced during the COVID-19 pandemic (Arca et al., 2021; Fernandez et al., 2021; Sahebi et al., 2021; Wolf et al., 2023).

Self-reported data were used in this study. Due to the subjective nature of self-reported data, this could result in information or reporting bias. The temporality of the exposure and outcome variables cannot be ascertained, and a causal relationship between musculoskeletal pain and depression cannot be determined because cross-sectional data were used for this study. The depression variable was a single self-reported item, and not a validated screener like the Patient Health Questionnaire (PHQ) (Virkkunen et

al., 2022), which limited the ability to identify objectively measured depression or depression diagnoses among participants.

This study will benefit from future research. A longitudinal study to assess the relationships between musculoskeletal pain and depressive symptoms among healthcare workers would be advantageous because it would provide insights about possible causal relationships between these variables of interest. Healthcare workers would benefit from tailored mental health and depression interventions, and wellness activities to reduce their risk for musculoskeletal pain.

Implications for Health Behavior Research

This study identified that healthcare workers who had direct contact with patients and co-occurring musculoskeletal pain and depressive symptoms had higher odds of having more severity of depressive symptomatology. Because musculoskeletal pain and depression are common co-morbid conditions with negative health and work-related consequences (Roughan et al., 2021; Russo et al., 2024; Schofield et al., 2011; Schofield et al., 2012), this study suggests the need for more workplace policies and mental health resources for these high-paced healthcare workers. Study findings may guide policy- and practice-based studies to introduce tailored workplace interventions to alleviate physical and mental health pressures in clinical settings. Examples of potential interventions to implement and evaluate include, but are not limited to, (1) required work breaks and use of vacation time among employees; (2) flexible and shared caseload schedules to prevent burnout; (3) ergonomic training and equipment provision; (4) incentivization for participation in wellness programs; and (5) easy access to worksite counsellors and mental health professionals (on-site, off-site, and/or virtual). Each of

these interventions may show promise to alleviate the physical and mental health burdens placed on healthcare workers in direct contact with patients, which may prevent or help manage musculoskeletal pain and depressive symptomatology.

Conclusion

Healthcare workers are essential workers who provide specialized care. Based on occupational exposures, they are prone to physical, mental, and psychological workplace stressors that could result in musculoskeletal pain and/or depressive symptoms. This study found significant relationships between musculoskeletal pain and depressive symptoms among healthcare workers, and multisite musculoskeletal pain and the severity of depressive symptomatology. Musculoskeletal pain and depressive symptoms have a ripple effect on healthcare workers, their families, communities, and the clients to which they provide services. It could also negatively impact the quality of life lived by healthcare workers. Healthcare workers would benefit from personal and workplace interventions that would reduce their risk of developing musculoskeletal pain and/or depressive symptoms.

Discussion Questions

What is the relationship between musculoskeletal pain and depressive symptoms, and the severity of depressive symptomatology among healthcare workers?

Our paper highlights some recommendations to reduce the occurrence of musculoskeletal pain and depressive symptoms among healthcare workers. What recommendations do you propose to improve the physical and mental health of healthcare workers?

References

- Albanesi, B., Piredda, M., Bravi, M., Bressi, F., Gualandi, R., Marchetti, A., Facchinetti, G., Ianni, A., Cordella, F., Zollo, L., & De Marinis, M. G. (2022). Interventions to prevent and reduce work-related musculoskeletal injuries and pain among healthcare professionals. A comprehensive systematic review of the literature. *Journal of Safety Research*, 82, 124-143.
<https://doi.org/10.1016/j.jsr.2022.05.004>
- Alqhtani, R. S., Ahmed, H., Alshahrani, A., Khan, A. R., & Khan, A. (2023). Effects of whole-body stretching exercise during lunch break for reducing musculoskeletal pain and physical exertion among healthcare professionals. *Medicina*, 59(5), 910.
<https://doi.org/10.3390/medicina59050910>
- Alkan, B. M., Fidan, F., Tosun, A., Atalay, S., Bozkurt, S., Aksekili, H., & Akkuş, G. U. Ö. A. S. (2017). Musculoskeletal disorders, quality of life and depression in healthcare workers. *Ege Journal of Medicine*, 56(1):24-28. Retrieved from <https://egetipdergisi.com.tr/en/download/article-file/350896>
- Arca, M., Dönmezgil, S., and Durmaz, E.D. (2021). The Effect of the COVID-19 pandemic on anxiety, depression, and musculoskeletal system complaints in healthcare workers. *Work*, 69(1), 47–54.
<https://doi.org/10.3233/WOR-205014>
- Asuquo, E. G., Tighe, S. M., & Bradshaw, C. (2021). Interventions to reduce work-related musculoskeletal disorders among healthcare staff in nursing homes; An integrative literature review. *International Journal of Nursing Studies Advances*, 3, 100033.
<https://doi.org/10.1016/j.ijnsa.2021.100033>

- Aydin, A. & Atiç, R. (2023). Negative Effects of the COVID-19 Pandemic on the Musculoskeletal System and Depression in Healthcare Professionals. *Journal of Back and Musculoskeletal Rehabilitation*, 36(6), 1273–1283. <https://doi.org/10.3233/BMR-220229>
- Bird, C.E. & Rieker, P.P. (2008). *Gender and health: The effects of constrained choices and social policies*. Cambridge University Press. DOI: 10.7249/CB412
- Biswas, A., Harbin, S., Irvin, E., Johnston, H., Begum, M., Tiong, M., Apedaile, D., Koehoorn, M., & Smith, P. (2022). Differences between men and women in their risk of work injury and disability: a systematic review. *American Journal of Industrial Medicine*, 65(7), 576-588. <https://doi.org/10.1002/ajim.23364>
- Call, J. B., & Shafer, K. (2018). Gendered manifestations of Depression and help seeking among men. *American Journal of Men's Health*, 12(1), 41–51. <https://doi.org/10.1177/1557988315623993>
- Caneiro, J. P., Bunzli, S., & O'Sullivan, P. (2021). Beliefs about the body and pain: the critical role in musculoskeletal pain management. *Brazilian Journal of Physical Therapy*, 25(1), 17-29. <https://doi.org/10.1016/j.bjpt.2020.06.003>
- Campbell, E. V., Muniraj, T., Aslanian, H. R., Laine, L., & Jamidar, P. (2021). Musculoskeletal pain symptoms and injuries among endoscopists who perform ERCP. *Digestive Diseases and Sciences*, 66(1), 56-62. <https://doi.org/10.1007/s10620-020-06163-z>
- Center for Disease Control. (2020, February 27). Depression Interventions. Retrieved from <https://www.cdc.gov/workplacehealthpromotion/health-strategies/depression/interventions/programs.html>
- Dahlhamer, J., Lucas, J., Zelaya, C., Nahin, R., Mackey, S., DeBar, L., Kerns, R., Von Korff, M., Porter, L. & Helmick, C. (2018). Prevalence of chronic pain and high-impact chronic pain among adults—United States, 2016. *MMWR. Morbidity and Mortality Weekly Report*, 67(36), 1001–1006. <http://dx.doi.org/10.15585/mmwr.mm6736a2>
- De Hert, S. (2020). Burnout in healthcare workers: prevalence, impact and preventative strategies. *Local and Regional Anesthesia*, 13, 171–183. <https://doi.org/10.2147/LRA.S240564>
- Demou, E., Smith, S., Bhaskar, A., Mackay, D. F., Brown, J., Hunt, K., Vargas-Prada, S., & Macdonald, E. B. (2018). Evaluating sickness absence duration by musculoskeletal and mental health issues: a retrospective cohort study of Scottish healthcare workers. *BMJ Open*, 8(1), e018085. <https://doi.org/10.1136/bmjopen-2017-018085>
- Dong, H., Zhang, Q., Liu, G., Shao, T., & Xu, Y. (2019). Prevalence and associated factors of musculoskeletal disorders among Chinese healthcare professionals working in tertiary hospitals: a cross-sectional study. *BMC Musculoskeletal Disorders*, 20(1), 175. <https://doi.org/10.1186/s12891-019-2557-5>
- El-Tallawy, S. N., Nalamasu, R., Salem, G. I., LeQuang, J. A. K., Pergolizzi, J. V., & Christo, P. J. (2021). Management of musculoskeletal pain: An update with emphasis on chronic musculoskeletal pain. *Pain and Therapy*, 10(1), 181-209. <https://doi.org/10.1007/s40122-021-00235-2>
- Fernandes, C. S., Couto, G., Carvalho, R., Fernandes, D., & Ferreira, P. (2018). Self-reported work-related musculoskeletal disorders among health professionals at a hospital in Portugal.

- Revista Brasileira de Medicina do Trabalho*, 16(3), 353.
<https://doi.org/10.5327/Z1679443520180230>
- Fernandez, R., Sikhosana, N., Green, H., Halcomb, E. J., Middleton, R., Alananzeh, I., Trakis, S., & Moxham. (2021). Anxiety and depression among healthcare workers during the COVID-19 pandemic: a systematic umbrella review of the global evidence. *BMJ Open*, 11(9), e054528. doi: 10.1136/bmjopen-2021-054528 Fournier, J. C., DeRubeis, R. J., Hollon, S. D., Dimidjian, S., Amsterdam, J. D., Shelton, R. C., & Fawcett, J. (2010). Antidepressant drug effects and depression severity: a patient-level meta-analysis. *JAMA*, 303(1), 47-53.
<https://doi.org/10.1001/jama.2009.1943>
- Fray, M., & Davis, K. G. (2023). Effectiveness of safe patient handling equipment and techniques: a review of biomechanical studies. *Human Factors*, 0(0) 1-40.
<https://doi.org/10.1177/00187208231211842>
- Gilchrist, A., & Pokorná, A. (2021). Prevalence of musculoskeletal low back pain among registered nurses: Results of an online survey. *Journal of Clinical Nursing*, 30(11-12), 1675–1683.
<https://doi.org/10.1111/jocn.15722>
- Hannerz, H., Holtermann, A., & Madsen, I. E. H. (2021). Musculoskeletal pain as a predictor for depression in the general working population of Denmark. *Scandinavian Journal of Public Health*, 49(6), 589-597.
<https://doi.org/10.1177/1403494819875337>
- Hawker G. A. (2017). The assessment of musculoskeletal pain. *Clinical and Experimental Rheumatology*, 35 Suppl 107(5), 8–12. PMID: 28967361.
<https://www.clinexprheumatol.org/>
- Higgins, D. M., Fenton, B. T., Driscoll, M. A., Heapy, A. A., Kerns, R. D., Bair, M. J., Carroll, C., Brennan, P. L., Burgess, D. J., Piette, J. D., Haskell, S. G., Brandt, C. A., & Goulet, J. L. (2017). Gender differences in demographic and clinical correlates among veterans with musculoskeletal disorders. *Women's Health Issues*, 27(4), 463–470.
<https://doi.org/10.1016/j.whi.2017.01.008>
- Hooftman, W. E., van der Beek, A. J., Bongers, P. M., & van Mechelen, W. (2009). Is there a gender difference in the effect of work-related physical and psychosocial risk factors on musculoskeletal symptoms and related sickness absence?. *Scandinavian Journal of Work, Environment & Health*, 35(2), 85–95. DOI: 10.5271/sjweh.1316
- Hooten, W. M. (2016, July). Chronic pain and mental health disorders: Shared neural mechanisms, epidemiology, and treatment. In *Mayo Clinic Proceedings* (Vol. 91, No. 7, pp. 955-970).
<https://doi.org/10.1016/j.mayocp.2016.04.029>
- Humayun, A., Memon, P. I., Rahman, A. A. U., Siyal, F. J., Siddiqui, M. I., & Pirzado, S. (2021). Physical & Postural determinants of musculoskeletal disorders among dental healthcare professionals. *Journal of Pharmaceutical Research International*, 33(16), 37-41.
 DOI:10.9734/JPRI/2021/v33i1631294
- Jakobsen, M. D., Sundstrup, E., Brandt, M., Jay, K., Aagaard, P., & Andersen, L. L. (2015). Effect of workplace- versus home-based physical exercise on musculoskeletal pain among healthcare workers: a cluster randomized controlled trial. *Scandinavian Journal of Work, Environment & Health*, 41(2), 153–163.
<https://doi.org/10.5271/sjweh.3479>
- Johnson, K., Swinton, P., Pavlova, A., & Cooper, K. (2023). Manual patient handling in the healthcare setting: A

- scoping review. *Physiotherapy*, 120, 60-77.
<https://doi.org/10.1016/j.physio.2023.06.003>
- Joseph, L., Standen, M., Paungmali, A., Kuisma, R., Silitertpisan, P., & Pirunsan, U. (2020). Prevalence of musculoskeletal pain among professional drivers: A systematic review. *Journal of Occupational Health*, 62(1), e12150.
<https://doi.org/10.1002/1348-9585.12150>
- Khansa, I., Khansa, L., Westvik, T. S., Ahmad, J., Lista, F., & Janis, J. E. (2018). Work-related musculoskeletal injuries in plastic surgeons in the United States, Canada, and Norway. *Plastic and Reconstructive Surgery*, 141(1), 165e-175e.
<https://doi.org/10.1097/PRS.00000000000003961>
- Kleiber, B., Jain, S., & Trivedi, M. H. (2005). Depression and pain: Implications for symptomatic presentation and pharmacological treatments. *Psychiatry (Edmont (Pa. : Township))*, 2(5), 12–18.
- Krishnan, K. S., Raju, G., & Shawkataly, O. (2021). Prevalence of work-related musculoskeletal disorders: Psychological and physical risk factors. *International Journal of Environmental Research and Public Health*, 18(17), 9361.
<https://doi.org/10.3390/ijerph18179361>
- Kroenke, K., Wu, J., Bair, M. J., Krebs, E. E., Damush, T. M., & Tu, W. (2011). Reciprocal relationship between pain and depression: A 12-month longitudinal analysis in primary care. *The Journal of Pain*, 12(9), 964–973.
<https://doi.org/10.1016/j.jpain.2011.03.003>
- Luan, H. D., Hai, N. T., Xanh, P. T., Giang, H. T., Van Thuc, P., Hong, N. M., & Khue, P. M. (2018). Musculoskeletal disorders: Prevalence and associated factors among district hospital nurses in Haiphong, Vietnam. *Biomed Research International*, 2018, 3162564.
<https://doi.org/10.1155/2018/3162564>
- Marx, W., Penninx, B. W., Solmi, M., Furukawa, T. A., Firth, J., Carvalho, A. F., & Berk, M. (2023). Major depressive disorder. *Nature Reviews. Disease Primers*, 9(1), 44.
<https://doi.org/10.1038/s41572-023-00454-1>
- Melkevik, O., Clausen, T., Pedersen, J., Garde, A. H., Holtermann, A., & Rugulies, R. (2018). Comorbid symptoms of depression and musculoskeletal pain and risk of long term sickness absence. *BMC Public Health*, 18(1), 981.
<https://doi.org/10.1186/s12889-018-5740-y>
- Murthy, V. H. (2022). Confronting health worker burnout and well-being. *New England Journal of Medicine*, 387(7), 577-579.
<https://doi.org/10.1056/NEJMp2207252>
- National Center for Health Statistics. (2019, June). Survey description, National Health Interview Survey, 2018. Hyattsville, Maryland. 2019. Retrieved from https://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2018/srvydesc.pdf
- National Center for Health Statistics. Centers for Disease Control and Prevention. Surveys and Data Collection Systems. (2023, December 21). Retrieved from <https://www.cdc.gov/nchs/surveys.htm>
- National Institute for Occupational Safety and Health. (2024, May 3). Health Worker Mental Health. Retrieved from <https://www.cdc.gov/niosh/newsroom/feature/health-worker-mental-health.html>
- Neupane, S., Lallukka, T., Pietiläinen, O., Rahkonen, O., & Leino-Arjas, P. (2020). Trajectories of multisite musculoskeletal

- pain in midlife: Associations with common mental disorders. *European Journal of Pain*, 24(2), 364-373. <https://doi.org/10.1002/ejp.1492>
- Mokdad, A. H., Ballestros, K., Echko, M., Glenn, S., Olsen, H. E., Mullany, E., ... & US Burden of Disease Collaborators. (2018). The state of US health, 1990-2016: burden of diseases, injuries, and risk factors among US states. *Jama*, 319(14), 1444-1472. doi:10.1001/jama.2018.0158
- Roughan, W. H., Campos, A. I., García-Marín, L. M., Cuéllar-Partida, G., Lupton, M. K., Hickie, I. B., Medland, S. E., Wray, N. R., Byrne, E. M., Ngo, T. T., Martin, N. G., & Rentería, M. E. (2021). Comorbid chronic pain and depression: Shared risk factors and differential antidepressant effectiveness. *Frontiers in Psychiatry*, 12, 643609. <https://doi.org/10.3389/fpsy.2021.643609>
- Ruggles, S., Flood, S., Sobek, M., Backman, D., Chen, A., Cooper, G., Richards, S., Rodgers, R., and Schouweiler, M. IPUMS USA: Version 15.0 [National Health Interview Survey 2018 Dataset]. Minneapolis, MN: IPUMS, 2024. <https://doi.org/10.18128/D010.V15.0>
- Russo, F., Di Tecco, C., Russo, S., Petrucci, G., Vadalà, G., Denaro, V., & Iavicoli, S. (2024). Importance of an integrated assessment of functional disability and work ability in workers affected by low back pain. *Safety and Health at Work*, 15(1), 66-72. <https://doi.org/10.1016/j.shaw.2023.11.004>
- Sahebi, A., Nejati-Zarnaqi, B., Moayedi, S., Yousefi, K., Torres, M., & Golitaleb, M. (2021). The prevalence of anxiety and depression among healthcare workers during the COVID-19 pandemic: An umbrella review of meta-analyses. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, 107, 110247. <https://doi.org/10.1016/j.pnpbp.2021.110247>
- Samulowitz, A., Gremyr, I., Eriksson, E., & Hensing, G. (2018). "Brave Men" and "Emotional Women": A theory-guided literature review on gender bias in health care and gendered norms towards patients with chronic pain. *Pain research & management*, 2018, 6358624. <https://doi.org/10.1155/2018/6358624>
- Sexton, J. B., & Adair, K. C. (2019). Forty-five good things: A prospective pilot study of the Three Good Things well-being intervention in the USA for healthcare worker emotional exhaustion, depression, work-life balance and happiness. *BMJ Open*, 9(3), e022695. <https://doi.org/10.1136/bmjopen-2018-022695>
- Schofield, D. J., Shrestha, R. N., Percival, R., Callander, E. J., Kelly, S. J., & Passey, M. E. (2011). Early retirement and the financial assets of individuals with back problems. *European Spine Journal*, 20(5), 731-736. <https://doi.org/10.1007/s00586-010-1647-8>
- Schofield, D. J., Shrestha, R. N., Percival, R., Passey, M. E., Callander, E. J., & Kelly, S. J. (2012). The personal and national costs of early retirement because of spinal disorders: Impacts on income, taxes, and government support payments. *The Spine Journal*, 12(12), 1111-1118. <https://doi.org/10.1016/j.spinee.2012.09.036>
- Scott, E. L., Kroenke, K., Wu, J., & Yu, Z. (2016). Beneficial effects of improvement in depression, pain catastrophizing, and anxiety on pain outcomes: A 12-month longitudinal analysis. *The Journal of Pain*, 17(2), 215-222. <https://doi.org/10.1016/j.jpain.2015.10.011>

- Shaikh, S., Siddiqui, A. A., Alshammary, F., Amin, J., & Agwan, M. A. S. (2021). Musculoskeletal disorders among healthcare workers: Prevalence and risk factors in the Arab World. *Handbook of Healthcare in the Arab World*, First edition, pp. 2899-2937. DOI:10.1007/978-3-319-74365-3_129-1
- Smith, G.D. & Hebdon, H. Mental health help-seeking behaviour in men. (2023). *Journal of Advanced Nursing*, 80 (3) 851 - 853. <https://doi.org/10.1111/jan.15869>
- Smith, M. L., Steinman, L. E., Montoya, C. N., Thompson, M., Zhong, L., & Merianos, A. L. (2023). Effectiveness of the Program to Encourage Active, Rewarding Lives (PEARLS) to reduce depression: A multi-state evaluation. *Frontiers in Public Health*, 11, 1169257. <https://doi.org/10.3389/fpubh.2023.1169257>
- Soylar, P., & Ozer, A. (2018). Evaluation of the prevalence of musculoskeletal disorders in nurses: A systematic review. *Medicine Science*, 7(3), 479-85. doi: 10.5455/medscience.2017.06.8747
- Trivedi, M. H. (2004). The link between depression and physical symptoms. *Primary care companion to the Journal of Clinical Psychiatry*, 6(Suppl 1), 12–16.
- van der Molen, H. F., Visser, S., Alfonso, J. H., Curti, S., Mattioli, S., Rempel, D., Roquelaure, Y., Kuijer, P. P. F. M., & Tamminga, S. J. (2021). Diagnostic criteria for musculoskeletal disorders for use in occupational healthcare or research: A scoping review of consensus- and synthesised-based case definitions. *BMC Musculoskeletal Disorders*, 22(1), 1-9. <https://doi.org/10.1186/s12891-021-04031-z>
- Vijendren, A., Yung, M., Sanchez, J., & Duffield, K. (2016). Occupational musculoskeletal pain amongst ENT surgeons-are we looking at the tip of an iceberg?. *The Journal of Laryngology and Otology*, 130(5), 490-496. <https://doi.org/10.1017/S0022215116001006>
- Vinstrup, J., Jakobsen, M. D., Madeleine, P., & Andersen, L. L. (2020). Biomechanical load during patient transfer with assistive devices: Cross-sectional study. *Ergonomics*, 63(9), 1164-1174. <https://doi.org/10.1080/00140139.2020.1764113>
- Virkkunen, T., Husu, P., Tokola, K., Parkkari, J., & Kankaanpää, M. (2022). Depressive symptoms are associated with decreased quality of life and work ability in currently working health care workers with recurrent low back pain. *Journal of Occupational and Environmental Medicine*, 64(9), 782–787. <https://doi.org/10.1097/JOM.00000000000002586>
- Wiggermann, N., Zhou, J., & Kumpar, D. (2020). Proning Patients with covid-19: A review of equipment and methods. *Human factors*, 62(7), 1069–1076. <https://doi.org/10.1177/0018720820950532>
- Wijnhoven, H. A., de Vet, H. C., & Picavet, H. S. J. (2007). Sex differences in consequences of musculoskeletal pain. *Spine*, 32(12), 1360-1367.
- Wolf, L., Maier, P., Deibert, P., Schmal, H., & Kubosch, E. J. (2023). Influence of the COVID-19 pandemic on musculoskeletal complaints and psychological well-being of employees in public services - A cohort study. *Journal of Personalized Medicine*, 13(10), 1478. <https://doi.org/10.3390/jpm13101478>
- World Health Organization. (2023, March 31). Depressive disorder (depression). Retrieved from <https://www.who.int/news-room/fact-sheets/detail/depression>
- World Health Organization. (2023, June 19). Low Back Pain. Retrieved from

<https://www.who.int/news-room/fact-sheets/detail/low-back-pain>

Yasobant, S., & Rajkumar, P. (2014). Work-related musculoskeletal disorders among health care professionals: A cross-sectional assessment of risk factors in a tertiary hospital, India. *Indian Journal of Occupational and Environmental Medicine*, 18(2), 75.

<https://doi.org/10.4103/0019-5278.146896>

Zhang, Y., ElGhaziri, M., Nasuti, S., & Duffy, J. F. (2020). The comorbidity of musculoskeletal disorders and depression: Associations with working conditions among hospital nurses. *Workplace Health & Safety*, 68(7), 346-354. doi: 10.1177/2165079919897285

Zhang, Y., Dugan, A. G., El Ghaziri, M., Siddique, S., & Punnett, L. (2023). Work-family conflict and depression among healthcare workers: The role of sleep and decision latitude. *Workplace Health & Safety*, 71(4), 195–205. <https://doi.org/10.1177/21650799221139998>