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Authors

Gaspar, Fraser W
Jolivet, Daniel N
Wizner, Kerri
et al.

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Pre-Existing and New-Onset Depression and Anxiety Among Workers With Injury or Illness Work Leaves

Fraser W. Gaspar, PhD, Daniel N. Jolivet, PhD, Kerri Wizner, MPH,
Fred Schott, MS, and Carolyn S. Dewa, PhD

Objectives: To examine the influence of depression and/or anxiety on work leaves and the impact of work leaves on experiencing a new-onset depression and/or anxiety disorder. **Methods:** IBM's MarketScan® research databases were linked to investigate depressive and anxiety disorders in workers with a work leave due to an injury or non-mental health illness ($n = 467,930$) and without a work leave ($n = 2,764,447$). **Results:** The odds of a work leave within a year were 2.10 times higher (95%CI: 2.08–2.13) in individuals with depression and/or anxiety compared to those without. The odds of developing a new-onset depression and/or anxiety within a year was 4.21 times higher (95% CI: 4.14–4.27) in individuals with a work leave compared to those without. **Conclusion:** Depression and anxiety are both risk factors for and subsequent outcomes of injuries or illnesses that require a work leave.

Keywords: absence, anxiety, depression, disability, illnesses, injury, mental health, occupational, work leave

More than half of household heads in the United States (U.S.) will experience a work disability in their lifetime.¹ These temporary or permanent work leaves are often a significant financial burden on employers and employees.² Further, being out of work on disability can negatively affect employees' health and wellbeing.³

The majority of work leaves are due to non-mental health disorders, such as musculoskeletal disorders, and comprise between 66% to 87% of disability claims.^{4,5} However, there is a synergistic and interactive effect of mental health and physical conditions that strongly predicts disability.^{5–7} The two most common mental disorders are depressive and anxiety disorders with U.S. prevalence estimated at 5.9% and 6.3%, respectively.⁸ The relationship of depression and anxiety with injuries and work leaves is complex, as mental disorders can serve as both a risk factor for and subsequent outcome of injuries and work leaves.^{9,10}

Depression and anxiety can act as a risk factor for physical conditions through three pathways. First, people with mental health conditions are more likely to make poor lifestyle choices including poor diet,^{11–13} decreased physical activity^{13,14} (both of which are correlated with obesity^{15,16}), and tobacco use.¹³ These factors are associated with poor physical health including musculoskeletal disorders.^{17,18} Second, people with anxiety and depression are at elevated risk for accidental injuries,¹⁹ likely because of impaired focus and concentration, fatigue (particularly associated with sleep problems in depression), and slowed reaction times. Third, people dealing with depression and anxiety may ask their treatment provider to focus on their physical conditions as the cause of their disability leaves, rather than the mental conditions, due to the denial, shame, and stigma of their mental health condition.

There are at least two ways in which physical conditions contribute to anxiety and depressive conditions. First, people with physical conditions frequently experience mental health issues as they deal with pain, loss of function and reduced quality of life. One identified pathway for this is the relationship between pain and poor sleep quality, which can contribute to depression.²⁰ Second, people coping with pain tend to make lifestyle choices that increase their risk for anxiety and depression. For example, chronic pain is associated with poor quality diet²¹ and decreased physical activity,²² with resultant obesity,²³ all of which are associated with anxiety and depression.¹⁶

In this study, the relationship between depression and/or anxiety and work leaves was investigated. Specifically, we examine the influence of depression and/or anxiety on work leaves and work leaves impact on experiencing a new-onset depression and/or anxiety disorder. To our knowledge, this is one of the first research studies to use a large administrative database to look at the timing of depression and/or anxiety disorders and work leaves. This study focuses on non-occupational injuries and illness. This is prudent given a higher incidence and cost per covered worker than occupational leaves.²⁴

METHODS

This retrospective study analyzed claims occurring in 2008 through 2017 from the IBM® Watson™ MarketScan® Commercial Claims and Encounters (CCA) database and the MarketScan® Health and Productivity Management (HPM) database.²⁵ The MarketScan® databases are a convenience sample of employees with employer-provided health insurance covering over 260 employers with 40 health plans. The MarketScan® databases were obtained through a license agreement and only contain fully de-identified data sets designed to meet the criteria for a limited-use data set under the Health Insurance Portability and Accountability Act. Therefore, this research does not meet the definition of human subjects research²⁶ and was not reviewed by an institutional review board.

Short-term disability (STD) claims with the reason for disability being a non-occupational injury or non-mental health illness were included if their work leave started in the years 2009 to 2016. STD claims represent individuals who receive a portion of their salary while they are out of work. In 2018, 38% of civilian

From the MDGuidelines, ReedGroup Ltd., Westminster, Colorado (Dr Gaspar, Ms Wizner); The Standard Insurance Company, Portland, Oregon (Dr Jolivet); Council for Disability Awareness, Portland, Maine (Mr Schott); Department of Psychiatry and Behavioral Sciences, University of California, Davis, California (Dr Dewa).

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The authors report no conflicts of interest.

Clinical significance: Depression and anxiety are both risk factors for and subsequent outcomes of injuries or illnesses that require a work leave. All parties involved in disability management should understand the need for targeted screening and treatment of depression and anxiety.

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Address correspondence to: Fraser W. Gaspar, PhD, 10355 Westmoor Drive, Westminster, CO 80021 (fraser.gaspar@gmail.com).

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workers in the U.S. participated in an STD benefits program.²⁷ Injuries and illnesses not related to a behavioral health disorder were defined as claims with a primary diagnosis, coded in the database using the International Classification of Disease, Ninth and Tenth Revision, Clinical Modification (ICD-9-CM/ICD-10-CM).

Excluded claims were those attributed to the major diagnostic categories of Mental Disorders, Pregnancy and Childbirth, Conditions Originating in the Perinatal Period, Health Status and Contact with Health Services, or External Causes of Injury, Poisoning, Morbidity. The work leaves related to the major diagnostic categories of Pregnancy and Childbirth and Conditions Originating in the Perinatal Period were excluded as the study focused on injury or non-mental health illnesses versus pregnancy-related leaves. The work leaves in the major diagnostic categories of Health Status and Contact with Health Services, or External Causes of Injury, Poisoning, Morbidity were excluded as these codes are not diagnoses and the reason for the work leave is often obfuscated. Only an individual's first STD claim for an injury or illness was used in this analysis. Finally, an individual had to have healthcare eligibility in the 12-months before and after the start of their work leave. A flow diagram of the data cleaning steps is presented in Figure 1.

Depressive and anxiety disorder diagnoses were abstracted from the outpatient and inpatient medical records if the date of diagnosis was in the 12-months before or after the start of the work leave. The 12-month time period before the work leave was used to coincide with metrics from the National Survey on Drug Use and Health.²⁸ The 12-month time period after the work leave was used as most STD claims resolve within 12-months.⁴ Work leaves due to a depressive or anxiety disorder were also considered as diagnoses. Depressive disorders included mood disorders with depressive features (F06.31, F06.32, F06.34), major depressive disorder (F32.X excluding F32.8X and F33.X), and dysthymic disorder (F34.1). Anxiety disorders included agoraphobia (F40.0X), social phobias (F40.1X), and other panic disorders (F41.X, generalized anxiety disorder and panic disorder).

Pre-existing depression and anxiety were defined as being diagnosed with the disorder(s) in the 12-months prior to a work leave. New-onset depression and anxiety were defined as being diagnosed with the disorder(s) in the 12-months after the beginning of a work leave and not present in the 12-months prior. Identifying depression and other mental illnesses in administrative claims databases has limitations including the variability of recording comorbid depression codes in the medical records that can result in different rates of mental illness across health systems.²⁹ To

protect against false positive diagnoses and increase the probability of selecting a population with clinically recognizable depression or anxiety, individuals were considered to have depression or anxiety if their claims had 1) at least two diagnoses or 2) one diagnosis and at least one prescription for depression or anxiety.^{29,30}

Physical and behavioral health comorbidities were abstracted from the medical records if the date of diagnosis was in the 12-months before the work leave. Physical comorbidities were grouped using Quan et al's (2005) coding algorithm.³¹ Behavioral health comorbidities were grouped using the Agency for Healthcare Research and Quality's Clinical Classification Software (CCS) single level grouper.³² All comorbidities had to be noted twice in the medical claims to be considered present for an individual.

Depression and anxiety for individuals with a work leave ("cases") were compared to a population without a work leave ("controls"). To do this, all individuals in the CCAE database tracked in the years 2009 to 2016 were abstracted from the IBM MarketScan® database. A random date when an individual received outpatient care was selected as a reference point, analogous to the work leave start date. In the 12-months before and after the reference point, the control sample could not have an occupational or non-occupational work leave start and had to have disability insurance and health care eligibility.

The cases and controls were combined into a single dataset to run univariate and multiple variable regression models to test the influence of depression and/or anxiety on experiencing a work leave within a year and a work leave on experiencing a new-onset depression and/or anxiety disorder within a year. To test the influence of depression and/or anxiety on experiencing a work leave within a year, two exposure variables were tested in separate models: 1) a nominal variable indicating pre-existing depression only, anxiety only, and depression and anxiety and 2) a binary variable indicating pre-existing depression and/or anxiety. To test the influence of a work leave on experiencing a new-onset depression and/or anxiety disorder within a year, two outcome variables were tested in separate models: 1) a nominal variable indicating new-onset depression only, anxiety only, and depression and anxiety and 2) a binary variable indicating new-onset depression and/or anxiety. The nominal variable outcome models used multinomial logistic regression models, whereas the other models used logistic regression models.

The multiple variable regression models controlled for the following predictors available in the MarketScan® database: age, sex, year of reference date, employment industry (eg, manufacturing, retail, etc.), health plan type in year of reference date (eg, health maintenance organization, high deductible health plan, etc.), whether the employee was salaried (yes/no) or in a union (yes/no), whether the individual lived in a rural location, if mental health/substance abuse claims are covered in the health plan, and presence of hypertension, diabetes, obesity, hypothyroidism, or pulmonary comorbidity diagnoses in the year prior to the reference date. These comorbidities were ranked the top five comorbidities by frequency in the cases. The geographic location is captured using a metropolitan statistical area (MSA), core-based statistical area (CBSA), or default value indicating the workers' location is not within an MSA or CBSA. Individuals were classified as being urban if their geographic location was within an MSA or CBSA, and rural if their geographical location was outside an MSA or CBSA.

The generalizability of this study was assessed by comparing the study population to the population employed in the U.S.'s private workforce participating in STD insurance using Bureau of Labor Statistics (BLS) data. The characteristics available in the BLS data for comparison included whether employee was employed part or full-time (metric used to compare to our salaried variable), union membership, employment industry, and geographic region (see Supplemental Information for detailed

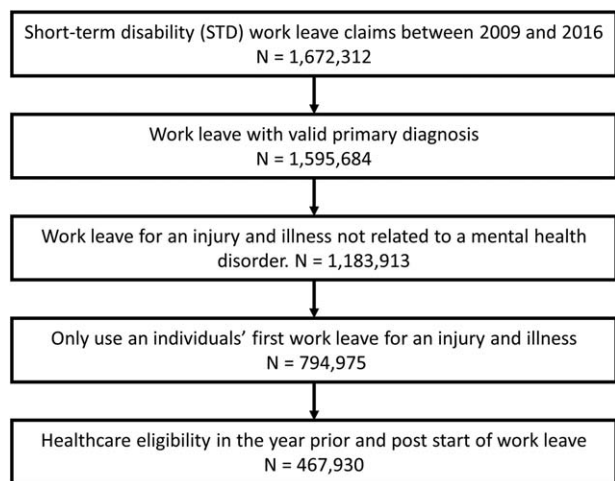


FIGURE 1. Flow diagram depicting the generation of the study population.

methodology, <http://links.lww.com/JOM/A795>).^{33–37} In addition, the study population with work leaves was compared to STD claims from the Integrated Benefit Institute (IBI)’s health and productivity benchmarking database in the years 2016 to 2018. IBI’s database is the largest database of STD claims in the U.S. and include claims from more than 41,000 private employer-sponsored disability insurance policies in 16 U.S. insurance carriers’ and third-party leave administrators’ books of business. The IBI data available for comparison included age, sex, employment industry, and the major diagnostic category of the work leave.

The presence of pre-existing and new-onset depression and anxiety were analyzed by the major diagnostic category and code category of the work leave. Due to the large sample size, a significance level of 0.01 was a priori set to determine statistical significance. Data management was performed in SQL Server 2012 and data cleaning and analyses were performed in R Version 3.6.1.³⁸

RESULTS

The study population consisted of 467,930 individuals who experienced a work leave and 2,764,447 individuals who did not experience a work leave in the years 2009 to 2016. Generally, compared to controls, individuals with a work leave tended to be older females, in the manufacturing of durable goods industry or the transportation, communications, or utilities industry, and insured by a preferred provider organization (Table 1 and Table S1, <http://links.lww.com/JOM/A799>).

The BLS population tended to have more salaried and fewer union workers (Table S2, <http://links.lww.com/JOM/A799>). Manufacturing was the most common employment industry in the study population, whereas services were the most common in BLS data. The geographic regions were generally consistent between the study population and BLS data. IBI’s population of individuals with work leaves tended to be older, more female, and have a higher percentage of individuals employed in the services industry than our cases; however, the leave diagnoses were similar (Table S3, <http://links.lww.com/JOM/A799>).

Pre-existing depression and/or anxiety occurred in 6.8% of the workers (cases and controls combined). Pre-existing depression and/or anxiety occurred in 12.1% of the cases versus 6.0% of the controls (Table S1, <http://links.lww.com/JOM/A799>). For cases and controls without pre-existing depression or anxiety, 8.4% of the cases experienced new-onset depression or anxiety versus 2.1% of the controls. In multiple variable regression models, the odds of a work leave within a year were 2.10 times higher (95%CI: 2.08–2.13) in individuals with depression and/or anxiety compared to those without (Table 2 and Table S4, <http://links.lww.com/JOM/A799>). Having both depression and anxiety raised the odds of a work leave within a year (OR: 3.10, 95% CI: 3.02–3.18), compared to depression only (OR: 1.90, 95% CI: 1.87–1.93) or anxiety only diagnoses (OR: 2.05, 95% CI: 2.02–2.09) (Table 2 and Table S5, <http://links.lww.com/JOM/A799>). Further, the odds of developing a

TABLE 1. Demographics of Individuals With a Work Leave (“Cases,” n = 467,930) and Without a Work Leave (“Controls,” n = 2,764,447)

Categories	Cases, n (%)	Controls, n (%)	Percent Difference*
Age (years)			
< 25	5146 (1.1%)	59,909 (2.2%)	-1.1%
25 to <35	66,878 (14.3%)	522,596 (18.9%)	-4.6%
35 to <45	115,681 (24.7%)	712,897 (25.8%)	-1.1%
45 to <55	159,623 (34.1%)	877,079 (31.7%)	2.4%
55 to ≤65	120,602 (25.8%)	591,966 (21.4%)	4.4%
Sex			
Female	224,311 (47.9%)	1,195,017 (43.2%)	4.7%
Male	243,619 (52.1%)	1,569,430 (56.8%)	-4.7%
Industry			
Agriculture	0 (0.0%)	6 (<0.1%)	<0.1%
Construction	349 (0.1%)	3520 (0.1%)	0.0%
Finance, insurance, real estate	78,289 (16.7%)	518,517 (18.8%)	-2.1%
Manufacturing, durable goods	151,099 (32.3%)	658,428 (23.8%)	8.5%
Manufacturing, nondurable goods	54,495 (11.6%)	282,339 (10.2%)	1.4%
Oil & gas extraction, mining	405 (0.1%)	45,628 (1.7%)	-1.6%
Retail trade	19,906 (4.3%)	158,396 (5.7%)	-1.4%
Services	36,979 (7.9%)	511,332 (18.5%)	-10.6%
Transportation, communications, utilities	126,358 (27.0%)	506,983 (18.3%)	8.7%
Wholesale	21 (<0.1%)	17,798 (0.6%)	0.6%
Missing	29 (<0.1%)	61,500 (2.2%)	2.2%
Health plan type			
Consumer-driven health plan	51,182 (10.9%)	297,496 (10.8%)	0.1%
Comprehensive	14,718 (3.1%)	68,560 (2.5%)	0.6%
Exclusive provider organization	6047 (1.3%)	33,401 (1.2%)	0.1%
High-deductible health plan	16,406 (3.5%)	184,336 (6.7%)	-3.2%
Health maintenance organization	49,741 (10.6%)	358,517 (13.0%)	-2.4%
Point-of-service plan	43,970 (9.4%)	240,586 (8.7%)	0.7%
Preferred provider organization	284,583 (60.8%)	1,557,212 (56.3%)	4.5%
Missing	51,182 (10.9%)	297,496 (10.8%)	0.1%
Salaried			
No	288,937 (61.7%)	945,974 (34.2%)	27.5%
Yes	127,649 (27.3%)	1,250,334 (45.2%)	-17.9%
Missing	51,344 (11.0%)	568,139 (20.6%)	-9.6%

Full comparison in Table S1, <http://links.lww.com/JOM/A799>.

*The percent difference is the percentage differences between the cases and controls.

TABLE 2. Results From Univariate and Multiple Variable Logistic Regression Models Testing the Influence of Depression and/or Anxiety on Experiencing a Work Leave Within a Year

Exposure*	Univariate		Multiple Variable†	
	OR (95% CI)	P-Value	OR (95% CI)	P-Value
Depression and/or anxiety	2.17 (2.15–2.19)	<0.0001	2.10 (2.08–2.13)	<0.0001
Depression only	2.06 (2.03–2.09)	<0.0001	1.90 (1.87–1.93)	<0.0001
Anxiety only	1.98 (1.95–2.01)	<0.0001	2.05 (2.02–2.09)	<0.0001
Depression and anxiety	3.16 (3.08–3.23)	<0.0001	3.10 (3.02–3.18)	<0.0001

CI, confidence interval; OR, odds ratio.

The referent exposure group were workers with no depression or anxiety in the year prior.

*Depression only, anxiety only, and depression and anxiety exposure variables were entered into one model, whereas depression and/or anxiety was an exposure variable in a separate model.

†Full results of multiple variable regression results presented in Supplemental Table S4–S5, <http://links.lww.com/JOM/A799>.

TABLE 3. Results From Univariate and Multiple Variable Multinomial and Logistic Regression Models Testing the Influence of a Work Leave on Experiencing New-Onset Depression and/or Anxiety Within a Year

Outcome*	Univariate		Multiple Variable†	
	OR (95% CI)	P-Value	OR (95% CI)	P-Value
Depression and/or anxiety	4.30 (4.24–4.36)	<0.0001	4.21 (4.14–4.27)	<0.0001
Depression only	3.89 (3.81–3.97)	<0.0001	3.63 (3.55–3.71)	<0.0001
Anxiety only	3.82 (3.74–3.91)	<0.0001	3.94 (3.85–4.03)	<0.0001
Depression and anxiety	9.05 (8.71–9.40)	<0.0001	9.06 (8.69–9.45)	<0.0001

CI, confidence interval; OR, odds ratio.

Workers with pre-existing depression or anxiety removed prior to analysis.

*The depression only, anxiety only, and depression and anxiety outcomes were tested as a nominal factor variable in a multinomial logistic regression model, whereas depression and/or anxiety was the outcome in a separate logistic regression model.

†Full results of multiple variable regression results presented in Supplemental Table S6–S7, <http://links.lww.com/JOM/A799>.

new-onset depression and/or anxiety within a year was 4.21 times higher (95% CI: 4.14–4.27) in individuals with a work leave compared to those without (Table 3 and Table S6, <http://links.lww.com/JOM/A799>). The odds of developing depression and anxiety within a year was 9.06 times higher (95%: 8.69–9.45) in individuals with a work leave than those without (Table 3 and Table S7, <http://links.lww.com/JOM/A799>).

Individuals experiencing a work leave due to an endocrine, nutritional, metabolic, or immunity disorder had the highest probability of pre-existing depression (13.7%, Fig. 2), whereas work leaves due to an ill-defined condition (eg, abdominal and pelvic pain, pain in throat and chest) had the highest probability of new-onset depression (7.9%). Individuals experiencing a work leave due to an ill-defined condition were most likely to have both pre-existing

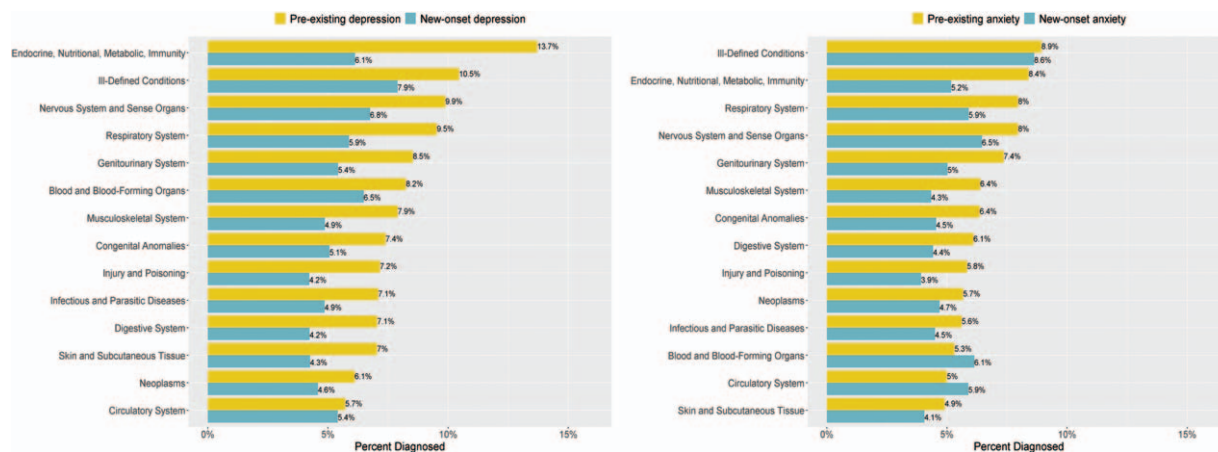


FIGURE 2. Percent of individuals on work leave by major diagnostic category with pre-existing or new-onset depression (left plot) and anxiety (right plot). New-onset percentages calculated from the study population without pre-existing depression or anxiety (n = 411,311).

and new-onset anxiety (8.9% and 8.6%, respectively). Experiencing new-onset anxiety was more likely than having pre-existing anxiety for individuals with a work leave due to a disorder of the blood and blood-forming organs (6.1% vs. 5.3%) and disorder of the circulatory system (5.9% vs. 5.0%).

When the code category of the work leave was considered, individuals experiencing a work leave for symptoms or signs involving cognitive function and awareness (25.9%), myositis (18.9%), and nausea and vomiting (18.8%) had the highest probability of pre-existing depression (Table S8, <http://links.lww.com/JOM/A795>). Individuals experiencing a work leave for irritable bowel syndrome (17.7%), vasomotor and allergic rhinitis (17.6%), and disorders of autonomic nervous system (16.3%) had the highest probability of pre-existing anxiety. New-onset depression was most common in individuals experiencing a work leave for myositis (16.4%), migraine (16.2%), and other headache syndromes (14.1%). New-onset anxiety was most common in individuals experiencing a work leave for abnormalities of heartbeat (18.3%), migraine (16.2%), and other headache syndromes (14.1%).

DISCUSSION

The results of this research highlight the intersection between work leaves and depression and anxiety. Depression and anxiety were risk factors for experiencing a future work leave. For those without depression or anxiety, work leaves were a risk factor for new-onset depression and anxiety. Further, the probability of individuals having pre-existing and new-onset depression or anxiety varied by the work leave diagnosis.

The World Health Organization (WHO) estimated the prevalence of depression and anxiety in the U.S. to be 5.9% and 6.3%, respectively,⁸ and the Substance Abuse and Mental Health Services Administration (SAMHSA) estimated that 7.2% of U.S. adults had at least one major depressive episode in the past year.²⁸ Our estimates of pre-existing depression (7.8%) and anxiety (6.4%) in cases are in line with WHO and SAMHSA estimates, and our estimates of pre-existing depression (3.8%) and anxiety (3.1%) in controls are below the WHO and SAMHSA estimates. It should be noted that the results reported in this study are *diagnosed* mental disorders, which are likely to be lower than the overall prevalence of mental disorders in the population.³⁹ For example, it is estimated that fewer than one-third of individuals with depression are identified by primary care physicians.³⁹

In a cohort study from the Netherlands, Louwerse et al (2018) found that approximately 10% of individuals with a work leave related to a physical injury/illness had a mental health disorder comorbidity.⁴⁰ Similarly, in our study, 12.1% of individuals on a work leave had pre-existing depression or anxiety. Of note, Louwerse et al. (2018) flagged all mental health disorder comorbidities versus just depression or anxiety in this study, and their mental health disorder comorbidities were noted at the medical disability assessment visit versus at any medical visit as in our study.

Our results that depression and anxiety were both risk factors for and subsequent outcomes of work leaves has important health policy implications. Clinicians treating the mental health of workers should be aware of the physiological risk factors that contribute to work leaves including diabetes, obesity, and hypertension and refer the patient to the appropriate health care provider or program. Further, when a worker needs a disability leave, clinicians and disability case managers should inform the worker that injuries or illnesses that require a work leave may place additional mental health strain. By discussing with the worker that they are at higher risk, the worker can self-assess their mental health throughout their healing process and, hopefully, the stigma of reporting a mental illness could be reduced. In addition, increased screening for depression and anxiety for those on work leave may be appropriate.

The probability of individuals having pre-existing and new-onset depression or anxiety varied by work leave diagnosis, indicating a relationship between the leave diagnosis and depression and anxiety. Given depression and, to a lesser extent, anxiety have been associated with poorer work disability outcomes,^{41,42} clinicians and nurse case managers could use the work leave diagnosis to prioritize the screening or triaging employees more likely to experience a depression or anxiety disorder.

The strengths of this research include using a large, integrated database that ties disability leaves with medical claims. Limitations of our study include specifying whether an individual had depression or anxiety using an administrative coding algorithm versus a standardized depression/anxiety screener. Previous research has shown variability in the sensitivity and specificity of diagnosing mental health disorders by the coding algorithm chosen.²⁹ The presence of depression and anxiety diagnoses in the medical claims of our study population may be influenced by the workers' coverage of mental health services including psychotherapy, as previous research has shown initial depression diagnoses were typically noted by mental health specialists including support therapists and psychiatrists.⁴³ However, our study population likely had some sort of mental health coverage, since 98% of individuals with an employer sponsored health plan had mental health coverage in 2009, prior to the Affordable Care Act which expanded behavioral health parity.⁴⁴ Our regression models could not properly control for overall healthcare service utilization, which is correlated with the presence of mental health disorders,⁴⁵ as healthcare utilization is a mediator between exposure and outcome in our study and could bias the results. Finally, our study population had some differing demographic characteristics than BLS data on private workers and IBI's benchmarking database, which indicates that future research is needed to confirm that the results presented in this study are generalizable to a population with different sociodemographic characteristics.

CONCLUSION

Depression and anxiety are both risk factors for and subsequent outcomes of injuries or illnesses that require a work leave. All parties involved in disability management should understand the need for targeted screening and treatment of depression and anxiety.

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