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

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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.3,4

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.5,6 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 obesity15,16), and tobacco use.13 These factors are associated with poor physical health including musculoskeletal disorders.7,18 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 providers to focus on their physical conditions over 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 diet17 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 (CCAE) 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
workers in the U.S. participated in an STD benefits program. 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. The 12-month time period after the work leave was used as most STD claims resolve within 12-months.

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FIGURE 1. Flow diagram depicting the generation of the study population.
methodology, http://links.lww.com/JOM/A795).\textsuperscript{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.\textsuperscript{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 (19.8%) | -4.6%            |
| 35 to <45                       | 115,681 (24.7%) | 712,897 (28.8%) | -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%)      | 3,520 (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%            |

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

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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% CI: 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 depression and anxiety (9.06 times higher, 95% CI: 8.69–9.45).

**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

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Univariate</th>
<th>P-Value</th>
<th>Multiple Variable†</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression and/or anxiety</td>
<td>4.30 (4.24–4.36)</td>
<td>&lt;0.0001</td>
<td>4.21 (4.14–4.27)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Depression only</td>
<td>3.89 (3.81–3.97)</td>
<td>&lt;0.0001</td>
<td>3.63 (3.55–3.71)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Anxiety only</td>
<td>3.82 (3.74–3.91)</td>
<td>&lt;0.0001</td>
<td>3.94 (3.85–4.03)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Depression and anxiety</td>
<td>9.05 (8.71–9.40)</td>
<td>&lt;0.0001</td>
<td>9.06 (8.69–9.45)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

CI, confidence interval; OR, odds ratio.
*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 S6–S7, http://links.lww.com/JOM/A799.

**FIGURE 2.** Percent of individuals on work leave by major diagnostic category with pre-existing or new-onset depression and/or anxiety (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 circula-
tory system (5.9% vs. 5.0%).

When the code category of the work leave was considered, individuals experiences 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 indi-
viduals 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 indi-
viduals having pre-existing and new-onset depression or anxiety
varied by the work leave diagnosis.

The World Health Organization (WHO) estimated the pre-
valence of depression and anxiety in the U.S. to be 5.9% and 6.3%,
respectively, 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. 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 (5.8%) 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. For example, it is estimated
that fewer than one-third of individuals with depression are identi-
ﬁed by primary care physicians.

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. Similarly, in our study, 12.1% of individuals on a
work leave had pre-existing depression or anxiety. Of note, Lou-
werse 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 have 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, indi-
cating 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, 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 standard-
ized depression/anxiety screener. Previous research has shown vari-
ability in the sensitivity and specificity of diagnosing mental health
disorders by the coding algorithm chosen. The presence of depres-
son 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.
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 Afford-
able Care Act which expanded behavioral health parity. Our
regression models could not properly control for overall healthcare
service utilization, which is correlated with the presence of mental
health disorders, 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 IHI’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 subse-
quent 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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