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Psychological Distress and Occupational Injury: Findings from the National Health Interview Survey 2000-2003

Jaeyoung Kim

Department of Environmental Health, Harvard School of Public Health

Objectives : This study examined whether serious psychological distress (SPD) is associated with occupational injury among US employees.

Methods : The employed population aged 18-64 years was examined (n=101,855) using data from the National Health Interview Survey (NHIS) 2000-2003. SPD was measured using the Kessler 6-item Psychological Distress Scale (K-6), a screening scale designed to identify persons with serious mental illness. The predicted marginal prevalence of psychological distress and occupational injury with the adjusted odds ratio were estimated using multiple logistic regression analyses.

Results : The age-adjusted 3-month prevalence of occupational injury was 0.80±0.12% in workers with SPD, which was 37% greater than in workers without SPD (0.58 ±0.03%). The odds of occupational injury in workers with SPD were higher compared to workers without SPD (OR=1.34, 95% CI=0.93-1.92), after controlling for sex, age, race, education, occupation, and activity limitation by at least one medical condition. Male, service and blue collar occupation, and activity limiation by co-morbidity showed significantly higher odds of occupational injury for workers with SPD.

Conclusions : The findings suggest that SPD accounts for an increased likelihood of occupational injury among US employees. A further longitudinal study is needed to differentiate the mechanism or causal pathways linking individual injury risk at the workplace, SPD, and socioeconomic factors.

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Key words : Occupational health, Injuries, Risk factors, Psychological distress, Mental health, K-6

INTRODUCTION

Any one who works for a living can be a potential victim of a work-related injury. It is estimated that 11.7 per 100 people, or 4.4 cases per 100 equivalent full-time workers, experience occupational injuries annually [1], which translates into approximately one worker injured at the workplace every 5 seconds in the US [2]. Since the 1990s, many studies have reported the association of work-related stress, job demands, and safety culture of the workplace with occupational injury occurrence [3-9]. However, these studies did not fully capture the various psychosocial aspects of occupational injuries, including individual mental health problems, such as depressive symptoms and serious psychological distress (SPD). Recently, researchers have recognized and understood the role of psychological factors in the occurrence of unintentional injury [10-13], but this same understanding has not yet entered the occupational health context. Exploring the impact of psychological risk factors on occupational injuries may extend the scope of occupational mental health policy [14].

Serious psychological distress is nonspecific, multiple psychiatric symptoms that can constitute a mental illness "severe enough to cause moderate to serious impairment in social, occupational, or school functioning" [15]. SPD is measured using the Kessler 6-item Psychological Distress Scale (K-6), a measure of nonspecific psychological distress that is sensitive to discriminating community DSM-IV cases from non-cases in the general population [15,16]. Population surveys have reported that certain levels of SPD imply that the respondents have coexisting mental disorders [17]. In particular, major depressive episodes, phobia, anxiety, and depression were mental health problems that substantially overlapped with SPD [18]. SPD may be understood as a screening tool for identifying serious mental illness needing treatment rather than a specific disease; hence it can be more relevant for planning effective intervention in the workplace.

Numerous studies have documented various effects of SPD on working life. Most often, it has been examined as a sequel to a traumatic event. The depressive feature of SPD may result in increased susceptibility to pain and reduced stress tolerance. Workers with depressive symptoms and dysthymia were disabled longer and had higher rates of recurrence. Depressive symptoms and dysthymia affect work productivity, sickness absence, and work limitations due to disability, and may even lead to withdrawal from the labor force [19-24]. However, relatively few

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Corresponding author : Jaeyoung Kim (677 Huntington Avenue, Boston. MA 02115, USA Tel : 1-617-497-4578, Fax : 1-617-384-8994, E-mail : jaeykim@hsph.harvard.edu)

studies have addressed SPD as a risk factor for unintentional injury [12,13,25]. The potential mechanism of how SPD plays a role in occupational injury or is partially associated with occupational injury is not clear. In this respect, this study examined whether SPD is associated with an increased risk of occupational injury using a nationally representative sample survey. The distribution of SPD by the nature of the injury and the impact of SPD on occupational injury risk across sociodemographic subgroups were examined.

METHOD

I. Data Sources

The study population in this analysis was drawn from the National Health Interview Survey (NHIS) [26], which is a nationally representative sample of the United States (US) civilian non-institutionalized population. It is a cross-sectional health survey conducted by the National Center for Health Statistics(NCHS), which is part of the US Centers for Disease Control and Prevention(CDC). Using a multistage complex design, it collects health-related information from a nationally representative sample of households. Each year, members of 43,000 households are interviewed in person, yielding data on more than 100,000 persons in all 50 states. The response rate was approximately 90% of the eligible samples.

Here this study used the Sample Adult and Injury Episode components from the 2000-2003 NHIS. Approximately one-third of the sampled adults above age 18 were asked more detailed questions about individual health behavior and health conditions. The sample adult component involved 32,374, 33,326, 31,044, and 30,852 interviews in 2000 to 2003, respectively. The data for the 4 years were combined to obtain a stable estimate with sufficient sample size. From the initially eligible 127,596 adults sampled over 4 years, 103,865 respondents between 18 and 65 years of age who reported full-time work during the previous 12 months were selected as the study group. Of these, 1,750 workers whose injury or psychological distress information was not available were excluded (1.68% of the initially eligible employees). If employees had missing information regarding a particular variable, they were excluded from that particular analysis. The final study population was 101,855. Its weighted number was 162,880,394, representing the working adults population aged 18 to 64 years in the US (approximately 165 million).

II. Measures

The study outcome was the experience of occupational injury in the previous 3 months. Injuries in the NHIS include any accidental or non-accidental injury requiring medical attention or at least a half-day of restricted activity, including bed days, work-loss days, or cut-down days. Each injury episode involved International Classification of Diseases (ICD) codes 800-999 and impairment(X-codes) due to accidents or injuries. Occupational injury was identified if the answer to the question, "what were you doing when the injury happened?" was "working at a paid job."

Serious psychological distress during the previous month was measured using K-6, which was developed for screening persons with mental health problems severe enough to cause moderate to serious impairment in social or occupational functioning that requires treatment. K-6 is one of the screening tools commonly used to measure the current level of serious psychological distress or depression in the general population, and consists of six items: questions beginning with "how often in the past month did you feel…" with specific symptoms including "nervous," "hopeless," "restless," "sad or depressed," "tired out for no good reason," and "worthless." Respondents self-report on a scale from 0 ("none of the time") to 4 ("all of the time"), and the scores of each item are summed to obtain a total score with a total range of 0 to 24. If the score is ≥ 13 or greater, respondents are considered to have serious psychological distress. The reliability and validity of K-6 for screening nonspecific psychological distress and depression in various populations have been reported [15].

Other covariates were also examined to assess the association between psychological distress and occupational injury as a potential confounder: sociodemographic variables such as age, gender, education, occupation, body mass index, heavy drinking, and co-morbidity with functional limitation. In addition to SPD, NHIS captured depression, anxiety, and emotional problems from the response to the question "What conditions or health problems cause you limitations of activity?" This was intended to connect more serious depression to functional disability. The categorization of sociodemographic factors was as follows:

Education: less than high school; high school graduate; some college; college or higher.

Annual household income: less than $20,000; more than $20,000.

Occupation: white collar; service worker; farm worker; blue collar; not in the labor force.

Body mass index(BMI): underweight (<18.5); normal (18.5 - 24.99); overweight [25-30]; obese (≥30).

III. Statistical Methods

This study described respondents' characteristics with and without SPD summarized by the raw frequency, weighted percentages, and standard error. The distributions of major demographics and injury-related characteristics between workers who had and did not have SPD were examined.

Effects of the association were presented using the age-adjusted rate and predicted marginal prevalence of occupational injury in the SPD group. The 2000 US Census population was used as the standard population for age adjustment. Predicted marginal

prevalence is one way of direct standardization that adjusts the occupational injury rate by all independent risk factors except SPD. Here, the predicted marginal rate of occupational injury in SPD workers is the weighted mean across the entire study population, under the assumption that every worker is distressed psychologically, but it holds all of the other characteristics the same between the two groups. Therefore, any observed difference in occupational injury rates between SPD and non-SPD workers can be interpreted as exclusively due to the existence of SPD. Several studies have suggested using the predicted marginal prevalence rather than the traditional odds ratio when presenting population survey results [27-29]. The predicted marginal prevalence may convey the scale of the outcome of interest, and consequently helps to interpret the magnitude of the effect or difference more easily without comparing it to a reference group. Other methods for estimating the predicted marginal rate can be found elsewhere [29].

A multiple logistic regression model was used to estimate the effects of SPD on the probability of having an occupational injury. Two regression models were considered to determine the likelihood of occupational injury as a function of the SPD controlling for appropriate covariates, such as age, gender, race, income, co-morbidity, education, occupation, obesity, smoking, and drinking. One was a bivariate logistic regression model in which the main independent variable was SPD. This model examined each individual potential covariate in turn, testing the correlation to estimate the extent of change to the model. The other was a multivariable model considering all covariates found to be significant in the bivariate regression process to build a final model, which was then used to predict the odds of experiencing an occupational injury because of SPD during the survey period, while adjusting for potential covariates.

All analyses were performed using SAS version 9.1 and SAS-Callable SUDAAN version 9.0 [30], which accounted for the complex survey sample design. The Taylor Linearization Method was used to estimate variance. All p-values were two-sided. A significant association between an exposure and the outcome was declared when its p-value was less than 0.05.

Table 1. Demographic characteristics of study population (working adults aged 18 to 64 years, from 2000 to 2003)

Selected characteristics	No psychological distress (N=95,261)		Psychological distress (N=6,634)	
	Unweighted frequency	Weighted percent(%)±S.E.	Unweighted frequency	Weighted percent(%)±S.E.
Sex*				
Male	44,133	49.63±0.18	46,458	38.70±0.71
Female	52,631	50.36 ±0.18	57,187	61.29±0.71
Age*				
18-24	12,818	15.78±0.15	797	14.42±0.22
25-34	23,106	21.94±0.15	1,346	18.35±0.54
35-44	25,022	25.57±0.15	1,770	25.26±0.61
44-54	20,976	22.15±0.15	1,771	25.95±0.63
55-64	14,842	14.55±0.12	1,197	15.99±0.50
Race				
White	61,088	71.36	4,127	70.05
Black	13,811	11.85	1,074	12.84
Other	21,865	16.78	1,680	17.09
Education*				
Less than high school	15,440	14.02±0.12	2,114	28.07±0.64
High school graduate	24,071	26.11±0.16	1,637	25.71±0.64
Some college	31,935	33.59±0.17	2,317	34.94±0.69
College or higher	24,288	26.25±0.16	747	11.26±0.45
Household income, $*				
Below 20,000	20,117	15.75±0.12	3,330	38.60±0.68
Above 20,000	71,199	84.24±0.12	3,273	61.39±0.68
Occupational class*				
White collar	42,523	60.01±0.21	1,587	49.65±1.05
Service group	10,109	13.24±0.14	685	20.41±0.83
Farm workers	1,668	2.23±0.06	72	2.23±0.31
Blue collar	16,684	24.52±0.18	796	27.70±0.97
Job tenure (year) *				
(Mean ± SD)	95,221	7.25±0.03	6,634	5.22±0.12
Marriage*				
Married	54,206	65.90±0.17	2,788	53.01±0.71
Divorces, widowed, separated	17,943	11.83±0.09	2,341	24.70±0.55
Never married	24,077	22.25±0.15	1,722	22.28±0.59
Drinking *				
Never	30,827	32.08±0.17	2,012	28.96±0.65
Former	17,513	18.16±0.14	1,714	25.43±0.63
Current	41,972	45.69±0.18	2,582	39.66±0.71
Binge drinking†	3,893	4.05±0.07	405	5.94±0.33
Smoking *				
Never	17,415	18.70±.034	1,152	17.67±0.55
Former	55,132	56.76±0.38	2,648	37.33±0.70
Current †	23,187	23.77±0.75	3,040	45.01±0.71
BMI(kg/m^2) §*				
(Mean ± SD)		30.25±0.05		30.96±0.23
Obesity‖	25,925	25.92±0.16	2,439	34.56±0.68
Activity limitation by co-morbidity	21,943	22.53±0.15	4,493	65.72±0.68

* All p<0.001 except race
† Binge drinking is person who had 12+ drinks in his/her life time, and 12+ drinks in 1 year AND (male) >14 drinks per week in past year OR (female) >7 drinks per week in past yr. (Average consumption).
† Current smoker: has smoked at least 100 cigarettes in their lifetime and currently smoke everyday or someday.
§ BMI is body mass index based on self-reported height and weight.
‖ Obesity was defined as BMI of 30 or greater

RESULTS

Of the 101,855 people studied, 6,634 had SPD, and 618 episodes of occupational injury were reported by working adults aged 18 to 64 years between 2000 and 2003 (unweighted). When weighted, 5.85% of the workers had SPD in the preceding 30 days, and 0.58% of the workers reported an occupational injury in the previous 3 months. The mean K-6 score

Table 2. Age-adjusted injury rate and work-related characteristics for workers aged 18 to 64 of NHIS 2000-2003

	No psychological distress		Psychological distress	
	Unweighted frequency(n)	Weighted percent(%)±S.E.	Unweighted frequency(n)	Weighted percent(%)±S.E.
Age-adjusted 3 month prevalence				
Non-occupational injury	1,503	1.54±0.05	247	3.32±0.26
Occupational injury	534	0.58±0.03	54	0.80±0.12
Lost work day experience† (mean±s.e.)		4.13±0.07		13.76±0.79
Paid Sick leave use		45.44±1.04		58.19±0.21
Nature of Injury*				
Open wounds	102	19.64±1.70	8	16.43±5.20
Fractures	53	8.26±1.07	5	12.29±5.16
Sprain & strains	160	30.75±2.08	9	12.83±3.79
Burns	13	2.21±0.65	2	5.74±3.90
Contusions	29	4.43±0.88	4	6.75±2.51
Foreign bodies	11	1.87±0.33	2	3.54±2.46
Injury to internal organs	6	0.89±0.39	1	2.56±2.52
Superficial injuries	19	3.21±0.76	1	2.32±2.29
Nerves	2	0.26±0.21	1	2.91±0.39
Dislocations	13	2.95±0.88	1	1.25±1.25
Crushing injury	10	1.98±0.60	0	-
Amputation of limbs	1	0.28±0.28	0	-
Poisonings	1	2.96±0.72	0	-
Toxic effects	18	0.40±0.28	0	-
Other/unspecified	103	19.65±1.98	21	33.33±6.64
Body part				
Skull & brain	8	1.44±0.57	1	2.56±2.52
Upper extremity	193	36.29±2.17	20	40.12±7.21
Lower extremity incl.hip fracture	146	26.67±2.03	19	32.80±6.32
Foreign body	11	1.87±0.33	7	11.68±2.97
Spine & back	53	10.05±1.59	4	5.59±3.09
Face & neck	27	4.18±0.81	2	3.68±0.50
Thorax/abdomen/pelvis	11	1.66±0.52	2	3.54±2.46
Toxic effect	19	3.16±0.74	0	-
Other body region	72	14.43±1.69	9	15.23±3.80

* $p<0.05$, † mean number of lost work day in past year

was 17.64 with a range of 13 to 24 among workers with SPD, while it was 6.77 (range 3 to 12) in the non-SPD group.

Selected demographic characteristics of the study populations with and without SPD are shown in Table 1. As expected, workers with and without SPD showed substantial differences in the distribution of demographic characteristics. Psychologically distressed workers were more likely to be female (61.29%), slightly older(25.95% for ages 45-54), and with less than a high school education (28.07%) than workers without SPD. They were also more likely to live with an annual income below $20,000(38.60%), tended to be divorced, widowed, or separated (24.70%), and included a higher proportion of current smokers(45.01%) and obese individuals (34.56%). The distribution of race/ethnicity did not differ significantly between the two groups. Regarding job-related factors, a higher proportion of workers in service occupations and with shorter job tenure had SPD.

Another substantial difference between the SPD and non-SPD groups was co-morbidity status. Of the workers with SPD, 65% had at least one health condition that limited their functional activity versus only 22.53% of non-SPD respondents. The mean number of co-morbidities among workers with and without SPD was 1.31 and 0.29, respectively. In both groups, 90% of the conditions limiting activities were chronic. The distribution of co-morbid conditions between SPD and non-SPD workers differed significantly. In SPD workers, the proportion of co-morbid conditions was in the order depression(24.29%), back pain (16.55%), and musculoskeletal disorders (11.13%), while the non-SPD workers had higher proportions of back pain(24.97%), arthritis(17.27%), and fractures(14.27%). Other conditions, such as cardiovascular and respiratory problems, cancer, and obesity, were distributed similarly regardless of SPD (data not shown).

Table 2 presents the age-adjusted injury rates and selected injury-related characteristics by SPD. Workers with SPD had a higher prevalence of injury over the previous 90 days. Overall, 0.80% of workers with SPD experienced occupational injuries compared to 0.58% of non-SPD workers. With SPD, workers had more lost workdays(13.76 days) and paid sick leave. There were minor differences in occupational injury types in workers with and without SPD, although there were too few occupational injury cases to yield a meaningful comparison. Those with SPD were more likely to suffer fractures, burns, and contusions. Sprains and strains, open wounds, and fractures accounted for more than half of the injuries in both groups. The distribution of body parts injured did not differ significantly between the two groups.

Table 3 presents the bivariate and multivariate odds ratios(ORs) and their confidence intervals for the association between SPD and occupational injury. The predicted marginal prevalence of occupational injury rates in each subgroup is presented together with the OR. The results suggested that workers with SPD were 36% more likely to experience occupational injuries than workers who did not have SPD. The predicted margin of occupational injury prevalence for both groups was 0.78 and 0.58%, respectively. The association between SPD and occupational injury experience was marginally significant in the bivariate analysis (OR=1.36, 95% CI=1.00-1.83). Variables that had significant positive associations with the risk of occupational injury in the bivariate analysis were male gender (OR=2.21), age 18-44 (OR=1.64), education (high school; OR=1.44), occupation (service group; OR=2.69, blue collar; OR=4.10), and current smoker (OR=1.63). Among health conditions, activity limitation due to any health condition had approximately two times greater odds, including 1.55 for depression, 2.4 for back

pain, and 2.7 for fracture (data not shown).

Before building the final model, the individual covariate was tested with the correlation and extent of change in the estimate in the bivariate model. The final model was built using the likelihood ratio test, which yielded a set of SPD, age, gender, race, education, occupation, and activity limitation. Smoking, obesity, current drinking, and income were excluded from the final model because they did not show significant associations in the bivariate model or had virtually no effect on the estimate in the multivariate model. SPD was kept in the model as the main independent variable in this study. SPD increased the risk of occupational injury by 34% after controlling for gender, age, race, education, occupation, and activity limitation due to any condition (OR=1.34, 95% CI=0.93-1.92). All other risk factors indicated an increased risk for occupational injury, including age, gender, race, education, occupation, and activity limitation due to any health condition. In addition, the likelihood ratio test was used to examine whether the effect of SPD on an occupational injury was modified by activity limitation due to any health condition. The interaction between activity limitation and SPD was not significant.

Table 3. Bivariate and multivariate analysis of risk factors for occupational injury among US workers aged 18 to 64, 2000-2003

Risk factor	Bivariate		Multivariate	
	Predicted marginal prevalence (%)	Odds ratio (95% C.I.)	Predicted marginal prevalence (%)	Odds ratio (95% C.I.)
Serious psychological distress				
No	0.58±0.03	1.00	0.74±0.04	1.00
Yes	0.78±0.01	1.36 (1.00, 1.83)	0.98±0.01	1.34 (0.93, 1.92)
Gender				
Female	0.37±0.03	1.00	0.61±0.06	1.00
Male	0.82±0.05	2.21 (1.79, 2.74)	0.85±0.05	1.40 (1.09, 1.79)
Race				
White	0.68±0.04	1.00	0.87±0.05	1.00
Black	0.39±0.07	0.57 (0.40, 0.83)	0.49±0.01	0.56 (0.37, 0.85)
Other	0.34±0.04	0.49 (0.37, 0.65)	0.41±0.06	0.47 (0.34, 0.64)
Age				
55-64	0.39±0.06	1.00	0.82±0.05	1.00
45-54	0.56±0.06	1.43 (1.00-2.03)	0.65±0.01	1.05 (0.73, 1.51)
18-44	0.64±0.04	1.64 (1.19, 2.27)	0.62±0.01	1.32 (0.94, 1.86)
Education				
Less than high school	0.52±0.07	1.00	0.58±0.01	1.00
High school	0.75±0.07	1.44 (1.06, 1.94)	0.86±0.01	1.31 (0.94, 1.82)
Some college	0.71±0.06	1.36 (1.00, 1.85)	0.76±0.01	1.16 (0.83, 1.62)
College or higher	0.30±0.04	0.57 (0.39, 0.83)	0.66±0.01	0.88 (0.57, 1.38)
Income				
Above 20,000	0.50±0.01	1.00		
Below 20,000	0.62±0.04	1.23 (0.97, 1.55)		
Occupation				
White collar	0.37±0.04	1.00	0.39±0.04	1.00
Service group	1.01±0.01	2.69 (2.02, 3.60)	1.06±0.01	2.77 (1.99, 3.86)
Farm worker	0.84±0.03	2.27 (1.09, 4.73)	0.83±0.03	2.15 (1.02, 4.56)
Blue collar	1.51±0.01	4.10 (3.25, 5.17)	1.35±0.01	3.53 (2.70, 4.61)
Job tenure				
More than 1 year	0.54±0.04	1.00		
1 year or less	0.64±0.04	1.19 (0.98, 1.45)		
Marital status				
Married	0.57±0.04	1.00		
Non-married	0.63±0.05	1.12 (0.92, 1.37)		
Drink				
Never	0.65±0.05	1.00		
Former	0.57±0.07	0.87 (0.65, 1.18)		
Current	0.54±0.04	0.83 (0.67, 1.03)		
Binge drinking	0.78±0.18	1.34 (0.84, 1.24)		
Smoking				
Never or former	0.51±0.03	1.00		
Current	0.83±0.07	1.63 (1.31, 2.02)		
Obesity	0.66±0.06	1.18 (0.95, 1.46)		
Activity limitation				
No limitation at all	0.48±0.03	1.00	0.05±0.04	1.00
By co-morbidity	0.90±0.08	1.88 (1.53, 2.31)	1.33±0.01	2.24 (1.83, 2.86)

DISCUSSION

This study examined the association between SPD and occupational injury among US employees aged 18-64 years using a nationally representative sample. SPD was associated with a 34% increased risk of occupational injury, and the effect estimate was not substantially attenuated by adjusting covariates, including activity limitation by any health condition. The pattern of greater odds of occupational injury in workers with SPD compared to non-SPD workers was consistent, although the 95% confidence interval contained the null value in occupational injury. Binge drinking and obesity were not significantly associated with the odds of occupational injury, while current smoking was. Gender, occupational class (service group and blue collar) significantly increased the odds by up to 4.10 times compared to non-SPD workers. Overall, the odds of occupational injury were increased for psychologically distressed workers compared to non-SPD workers. These findings showed that having SPD is associated with a higher risk of occupational injury with limited statistical power.

This result needs to be interpreted with caution. First, NHIS is a cross-sectional survey, so that it did not differentiate whether SPD had existed before the occupational injury or whether it was a subsequent result. In reality, occupational injury may cause SPD as a provoking agent, and SPD can increase the likelihood of an occupational injury. The results of this study assumed that the direction of interest was one way: SPD causes a risk of occupational injury. This assumption is based on several explanations. One is that studies reported that the NHIS respondents mostly remembered injury episodes within 5 weeks, and these were more likely to be minor acute injuries. Warner et al. suggested assuming a 5-

week recall period in estimating the annual prevalence, rather than 3 months [31]. Since the nature of SPD, especially depression, is chronic and episodic, while the injury is often acute, it is more likely that either injury and SPD co-existed simultaneously within 1 month or pre-existing chronic SPD had an impact on the acute occupational injury. Another explanation comes from studies evaluating the effectiveness of K-6 as a way of screening for the 12-month prevalence of mental illness, as well as the current prevalence in the general population [32,33]. Generally, K-6 is an effective indicator of the presence of mood and anxiety disorders and could measure both the current and 1-year prevalence with areas under the curve(AUC) of 0.866. Therefore, these study results may have better implications for the direction from SPD to occupational injury rather than occupational injury to SPD, although they are not mutually exclusive.

Second, the predicted rate of occupational injury in this study was lower than the current estimated prevalence in the general US population. This is due to possible recall bias from self-reported data. The underestimation of the injury rate in the 3-month reference period at NHIS has been pointed out, although it was not expected to be differential when reporting occupational injury and SPD [34]. Studies found that respondents were more likely to remember an injury episode within 5 weeks, and suggested using a 5-week recall period when estimating annual prevalence, rather than 3 months [31,34]. The predicted marginal prevalence of occupational injury in this study was similar to, that from other population-based sources of injury data under this assumption. However, a relatively small number of occupational injuries and not enough job detail information limited the analysis, making it difficult to examine the differential effect of SPD on occupational injury by gender, nature of injury, or for a specific occupation.

Lastly, the lack of data on several potential risk factors may limit the ability to detect a relationship between SPD and occupational injury. For example, this study found no association between the effect of current drinking on the risk of occupational injury in workers with and without SPD, which may be partly due to insufficient ability to capture the intensity of alcohol intake, rather than the lack of a true association. Another example is that NHIS does not include any medical history that might indicate whether respondents had an injury before SPD prior to the interview. Since a history of mental illness is one of the strongest predictors for the risk of developing SPD, this lack of information may bias the result toward the null.

Despite these limitations, this study found suggestive evidence of an association of SPD with occupational injury. Of the covariates, occupational class consisting of service and blue collar workers had the strongest effect, and this tendency did not change with the multivariate adjustment including co-morbidity. While most previous studies examining the association between SPD and injury reported mixed evidence, this finding is consistent with previous reports of an elevated risk of injury for persons with SPD. Besides occupational class and gender, activity limitation by co-morbidity consistently increased the odds of occupational injury in workers with SPD. The effect of co-morbidity on the odds of an occupational injury varied with the medical condition. Not surprisingly, workers with more severe conditions, e.g., a missing limb or fracture, had a higher likelihood of getting an occupational injury than workers with less severe conditions, such as hypertension or obesity. However, adjusting for limited activity by co-morbid condition did not substantially attenuate the association between SPD and occupational injury, suggesting that a coexisting health condition may not explain the larger part of the association between SPD and occupational injury. Although there was insufficient statistical power, the findings of a positive association suggest that SPD is related to increasing the risk of an occupational injury.

Mental illness such as depression may lead to a traumatic event. Several researchers have identified pre-existing mental health problems as an individual risk factor for unintentional injury [11,12,25,35]. Peeler and Tollerud [25] reported a pilot study exploring the relationship between pre-existing depression and subsequent occupational injuries. They suggested that depression might serve as a precursor to occupational injury for women. Wan et al. [35] found that individuals with mental illness had twice the rate of unintentional injury and 4.5 times the odds of injury recurrence; in that study, mental illness was a more robust predicator of injury than substance abuse. Poole et al. [12] also pointed out the recurrent tendency of both intentional and unintentional injuries and found that injury victims have a higher tendency of psychopathology, although the diagnosis of disease depended on the nature of the injury. Dewa et al. [36] explained that untreated mood disorder can impair cognitive function and increase accident proneness, and demographic social factors are associated with poor safety.

Some studies have suggested a mechanism by which SPD plays a role in increasing the risk of unintentional injury. One of the suggested mechanisms is that SPD causes injury through 1) the adverse effects of SPD treatment, such as psychiatric medication, including fatigue, sleeping disturbance, and cognitive impairment [10,37,38]; or 2) the symptoms of SPD itself, such as drowsiness, lack of concent-ration, and loss of interest [12]. Another explanation is that some of the individual behaviors related to SPD may also be related to behaviors that cause occupational injury. For example, SPD may increase work-related stressors [39], but may also influence occupational injuries through associations with smoking habits, excess alcohol use, weight problems, or the use of psychotropic drugs

[40]. Clarifying the pathway between occupational injury and SPD, and quantifying the reciprocal relationship remains a challenge.

This study had the advantage of adding suggestive evidence of an association between SPD and occupational injury using a nationally representative sample. In addition, this study estimated the predictive marginal prevalence rate of occupational injury and SPD among employees in the US, which has a broader spectrum and is easier to understand. By examining the association between SPD and occupational injury specifically, these findings suggested that workers with SPD have higher odds of occupational injury. This study addresses the need for further analyses using longitudinal data that will explore the reciprocal relationship between SPD and occupational injury. These findings can have practical implications for managing mental health problems at the workplace by addressing the need to intervene with appropriate tools for recognizing workers at risk for SPD and occupational injury. Early intervention and treatment of workers with SPD reduces the economic burden of SPD and will benefit work productivity and have more general social benefits. Occupational health policy in the workplace should consider the potential impact of SPD, and should note the need for intervention policies to improve mental health and prevent further occupational injuries.

An association between SPD and occupational injury prevalence was observed. These findings suggest that SPD increased the likelihood of occupational injury in US employees aged 18-64 by 34%, after adjusting for age, gender, race, education, occupation and activity limitation by any medical condition. Further longitudinal research is needed to differentiate the mechanism or causal pathways linking individual injury risk at the workplace, SPD, and socioeconomic factors.

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