Suicidality 6 Years After Occupational Injury

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ABSTRACT

Objective: Suicide attempts can result from traumatic events, including those caused by occupational injury. However, literature on the long-term prevalence rates of suicidality after occupational injury is relatively lacking. This study investigated the long-term prevalence of suicidality after occupational injury.

Methods: Between February 1 and August 31, 2009, 4,403 workers in Taiwan sustained occupational injuries and were hospitalized for 3 days or longer. Surveys were conducted at 3 and 12 months after occupational injury, and 2,308 workers responded to either survey. They were invited to join the follow-up at 6 years after occupational injury, using the Brief Symptom Rating Scale (BSRS-5), Posttraumatic Symptom Checklist (PTSC), and 1 question on suicidal ideation. Workers with a high score on the BSRS-5 or PTSC were invited to participate in an in-depth psychiatric evaluation using the Chinese version of the Mini-International Neuropsychiatric Interview (MINI).

Results: The estimated MINI-diagnosed suicidality rates at 3 months, 12 months, and 6 years after occupational injury were 5.4%, 4.8%, and 9.5%, respectively. Injured workers who reported that the injury majorly affected their physical appearance, experienced additional occupational injury requiring hospitalization for > 3 days, had unstable employment, and had lower income in the past 1 year than that before occupational injury had a higher risk of suicidal ideation. Injury majorly affecting the physical appearance, unstable employment, and lower income than that before occupational injury were the most crucial factors. These factors accounted for 12.7%, 13.2%, and 19.0% of suicidal ideation among the injured workers.

Conclusions: The suicidality rate increased at 6 years after occupational injury. The relevant factors for suicidal ideation were injury severity and work instability. Periodic monitoring of psychological and physical health and economic stability are warranted.

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Of the 3 billion workers worldwide, more than 317 million workers are estimated to be absent from work for longer than 3 days because of the occurrence of injury at work.[1] After occupational injury, 8.3% of workers develop suicidal ideation.[2] Moreover, 2.1% to 9.2% of injured workers develop mental disorders.[3,4]

Suicide is the 14th leading cause of death, accounting for 1.4% of all deaths worldwide.[5] More than 800,000 people have completed suicide every year, and more than half of this population are aged between 15 and 44 years.[6] Mental disorders are a risk factor for suicide.[7] The pooled relative risks for suicide are estimated to be 19.9, 12.6, 7.6, 5.7, and 2.7 for major depressive disorder, schizophrenia, anorexia nervosa, bipolar disorder, and anxiety disorder, respectively. Overall, mental disorders and substance abuse are responsible for two-thirds of all suicides in China, India, and Taiwan.[8] Other identified risk factors include having a lower education level, being unmarried, having lower social support, and experiencing recent or long-term negative life events, such as financial problems and serious physical problems.[9,10]

Suicidality covers a broad range of conditions including suicidal ideation, suicide plans, suicide attempts, and completed suicide. The first 3 conditions can be considered warning signs for completed suicide.[11,12] Injury contributes to suicidality.[13] A previous study found that 8.3% to 11.0% of workers exhibit suicidal ideation within 1 year after occupational injury.[2] However, longer term follow-up studies of suicidality after occupational injury have been relatively lacking despite the finding that the consequences of occupational injury may persist for many years.[3,4,14] Therefore, the current study surveyed workers at 3 months, 12 months, and 6 years after they sustained occupational injury and estimated their Mini-International Neuropsychiatric Interview (MINI)–diagnosed[24,25] suicidality rates. The risk factors for suicidal ideation at 6 years after injury were also determined.

METHODS

Study Subjects

In Taiwan, a total of 4,403 workers were hospitalized for 3 days or longer and received occupational inpatient compensation from labor insurance between February 1 and August 31, 2009. We recruited them and followed up their psychological symptoms at 3 and 12 months. Those who completed the questionnaire at 3 or 12 months participated in a survey at 6 years after occupational injury. A total of 2,308 injured workers completed the

Clinical Points

- Suicidality is a consequence of traumatic events, yet insufficient attention has been paid to occupationally injured workers. The fact that a certain proportion of workers develop suicidal ideation within 1 year after occupational injury deserves more serious attention.
- Our study investigating long-term suicidality after occupational injury by using a structured clinical interview found suicidality rates of 5.4% at 3 months, 4.8% at 1 year, and 9.5% at 6 years.
- In the care of patients sustaining occupational injury, precautions against suicidality are warranted for at least several years.

questionnaire at 3 or 12 months. A total of 593 workers were excluded because they were deceased or unreachable; thus, 1,715 workers were included in the survey at 6 years.

This study was approved by the Research and Ethical Committee of the National Taiwan University Medical Center. Only workers who consented to participate in the study completed the questionnaire survey. Oral informed consent was also obtained before each MINI interview.

Procedure

Each survey was divided into 2 stages. In the first stage, a self-administered questionnaire was mailed to the workers to investigate their demographics, work instability, injury severity, psychological symptoms (5-item Brief Symptom Rating Scale [BSRS-5][19] and Posttraumatic Symptom Checklist [PTSC]),[17] and suicidal ideation. Those who had high scores on the BSRS-5 or PTSC in the first stage were candidates for the second-stage phone interview. Psychiatrists or trained nurses used the Taiwanese version of MINI to conduct the second-stage phone interview with the candidates; once the candidates had provided oral consent, the phone interview was arranged within 4 weeks after they returned the questionnaire.

Not all individuals who have suicidal ideation will go on to make suicidal plan or attempts.[15] In this study, we used the MINI interview for clinical diagnosis of suicidality. However, because it was impossible to interview all participants by MINI, we used PTSC and BSRS-5 to identify workers with severe psychological symptoms and invite them to participate in the MINI interview.

Measurements

Individual characteristics. At 3 months, 12 months, and 6 years, we assessed the workers' age, sex, marital status, education level, adverse life events within the follow-up period (divorce, personal and family illness, traffic accident, litigation, and bankruptcy), and work status at the time of the questionnaire survey.

Injury severity. The following severity indicators of occupational injury were assessed at 3 and 12 months: (1) the length of hospital stay (days) immediately after the injury and (2) the severity (nil, minor, and major) of bodily deformity defined by the worker's answer (nil; yes, but not apparent; yes, and apparent to people) to the question whether the injury caused defects in bodily appearance. At 6 years, the length of hospital stay (days) immediately after the injury occurring in 2009 was obtained mainly from the questionnaire administered at 3 months after the injury. Moreover, whether the injury affected the physical appearance was obtained mainly from the questionnaire administered at 12 months after the injury.

Work-related data at 6 years after occupational injury. Whether the workers experienced additional occupational injuries requiring hospitalization for longer than 3 days was assessed at 6 years. "What kind of work contract have you had for the past 1 year?" was used to determine long-term work stability. Long-term full-time employment was categorized as stable employment, and short-term, causal, and temporary employments were categorized as unstable employment. "What is your current monthly income as a percentage of your income before the occupational injury in 2009?" was also used to assess the income after occupational injury in comparison with that before the injury. *Reduced income* was defined as a current monthly income less than that before occupational injury.

Posttraumatic Symptom Checklist. The PTSC is a 3-item checklist for PTSD symptoms in the past 1 week. Each item was corresponding to the *DSM-IV* symptom of PTSD, namely intrusive recollection, avoidant/numbing, and hyperarousal.[16] These items are "Has encountering a reminder of the injury event caused physical discomfort (including sweating, tremor, racing heart, tachypnea, nausea, or diarrhea)," "Have you been unable to have sad or happy feeling after this event," and "Have you become easily startled after this event?" Each item was rated on a 5-point Likert scale, ranging from 0 (no) to 4 (very severe).[17,18] Respondents were asked to refer to the occupational accident in 2009.

5-Item Brief Symptom Rating Scale. BSRS-5 is a 5-item and self-reported questionnaire. It was derived from the Symptom Checklist-90–Revised (SCL-90R) and the 50-item Brief Symptom Rating Scale (BSRS-50). The full scale contained the following psychopathology: feeling tense (anxiety), blue (depression), easily annoyed or irritated (hostility), and inferior to others (interpersonal sensitivity) and trouble falling asleep (insomnia). Each item was a 5-point scale as follows: 0, not at all; 1, a little bit; 2, moderately; 3, quite a bit; 4, extremely. Total score ranged from 0 to 20, with higher scores indicating severer psychological symptoms, and the best cutoff point of BSRS-5 to identify psychiatric cases was set at equal to or greater than 6.[19] The validity and reproducibility of the BSRS-5 were previously examined for Taiwanese people. The internal consistency coefficients of the BSRS-5 ranged from 0.77 to 0.90.[19] The test-retest reliability coefficient was 0.82, and the rate of accurate classification of the BSRS-5 ranged from 76.3% to 82.6% when the cutoff point was 5/6.[19,20] BSRS-5 has been used as a screening instrument for suicidal ideation among different populations in Taiwan.[21,22]

Suicidal ideation. The question "Do you have thoughts of ending your life?" in the BSRS-50[23] was used to assess suicidal ideation. The item was rated on the aforementioned 5-point

scale. Workers who scored more than 0 were defined as having suicidal ideation. The item was added at the end of BSRS-5 and was applied in previous surveys.[21,22]

Taiwanese version of the MINI. In this study, we used the suicide module of the MINI[24,25] to assess the prevalence rate of suicidality in the past month. This module uses specific questions to assess suicidal ideation, suicide plans, and suicide attempts within the past month and lifetime suicide attempts. The Taiwanese version of MINI, which was developed by the Taiwanese Society of Psychiatry according to the English version of MINI 5.0, is widely used in Taiwan.[26,27] The suicide module of the MINI has been documented as a valid screening tool for the risk of suicidality.[28]

Statistical Analyses

Descriptive statistics were used to analyze the distribution of the covariates and suicidal ideation and to estimate the prevalence rate of suicidality in the past month among participants. The prevalence rates of suicidality after occupational injury were estimated by multiplying the percentage of the high scores in BSRS-5 or PTSC by the percentage of workers with MINI-diagnosed suicidality among those who participated in the MINI interviews.

Logistic regression was performed to examine the association between predictors and suicidal ideation. The significant variables in the logistic regression model were included in the multiple logistic regression model. In the aforementioned models, we then calculated 95% confidence intervals (CIs) for odds ratios (ORs). CIs that did not include 1.0 were considered statistically significant. In addition, the Poisson log-linear regression model was performed to calculate the relative risk ratios (RRs), and the adjusted RR (aRR) was calculated after adjusting for significant variables. Population attributable risks (PARs) were calculated to determine the proportion of workers with suicidal ideation that would be prevented if the risk factors were absent. The following expression was adapted for PAR calculation: [(Incidence in the total population) – (Incidence in the nonexposed group)/(Incidence in the total population)].[29] JMP 10.0 was used as an overall statistical package for data analyses.[30]

Table 1. Characteristics of Injured Workers Who Completed the Questionnaire at 3 Months, 12 Months, and 6 Years After Occupational Injury[a]

	Time of Survey After Occupational Injury		
Variable	3 Months (N = 2,001)	12 Months (N = 1,233)	6 Years (N = 570)
Age, mean ± SD, y	42.0 ± 12.2	42.6 ± 11.8	47.7 ± 11.1
Age			
≤ 29 y	386 (19.3)	214 (17.3)	21 (3.6)
30–44 y	765 (38.2)	456 (37.0)	197 (34.6)
45–59 y	743 (37.1)	476 (38.6)	254 (44.6)
≥ 60 y	107 (5.3)	87 (7.1)	98 (17.2)
Gender			
Female	539 (26.9)	352 (28.5)	186 (32.6)
Male	1,462 (73.1)	881 (71.5)	384 (67.4)
Marital status			
Single	585 (29.2)	324 (26.2)	124 (21.8)
Married	1,253 (62.6)	814 (66.1)	395 (69.3)
Divorced/separated/widowed	163 (8.2)	95 (7.7)	51 (8.8)
Education			
Elementary school or below	238 (11.9)	143 (11.6)	57 (10.0)
Junior high school	409 (20.4)	231 (18.7)	94 (16.5)
High school	853 (42.6)	537 (43.6)	239 (41.9)
College or above	501 (25.1)	322 (26.1)	180 (31.6)
Adverse life event within the follow-up period			
Yes	197 (9.8)	206 (16.7)	379 (66.5)
No	1,804 (90.2)	1,027 (83.3)	191 (33.5)
Length of hospital stay immediately after injury in 2009, mean ± SD, d	8.9 ± 8.9	9.8 ± 11.6	9.4 ± 10.7
Whether this injury affected physical appearance			
No	601 (30.0)	463 (37.6)	180 (31.6)
Yes, minor	907 (45.3)	535 (43.4)	270 (47.4)
Yes, major	493 (24.7)	235 (19.0)	120 (21.0)
Work status at questionnaire survey			
Employed	1,149 (57.4)	970 (78.7)	484 (85.0)
Unemployed	852 (42.6)	263 (21.3)	86 (15.0)
PTSC level[b]			
None	1,687 (84.3)	1,096 (88.9)	470 (82.5)
Severe or higher	314 (15.7)	137 (11.1)	100 (17.5)
BSRS-5[b]			
< 6	1,424 (71.2)	930 (75.4)	342 (60.0)
≥ 6	577 (28.8)	303 (24.6)	228 (40.0)
Meet the criteria of MINI interview[b]			
No	1,365 (68.2)	910 (73.8)	327 (57.4)
Yes	636 (31.8)	323 (26.2)	243 (42.6)
Suicidal ideation			
No	1,834 (91.7)	1,097 (89.0)	476 (83.5)
Yes	167 (8.3)	136 (11.0)	94 (16.5)

[a]Values are number (percentage) unless otherwise indicated.
[b]"The proportion of severe or higher PTSC level," "BSRS-5 ≥ 6," and "meet the criteria of MINI interview" were highest in the 6-year survey; "suicidal ideation" at 3 surveys significantly increased across all 3 survey results ($P < .0001$).
Abbreviations: BSRS-5 = 5-item Brief Symptom Rating Scale, MINI = Mini-International Neuropsychiatric Interview, PTSC = Posttraumatic Symptom Checklist.

RESULTS

The participants' recruitment and the prevalence rate of suicidal ideation at 3 and 12 months after occupational injury are described in a previous study.[2] Briefly, of the 4,403 injured workers requiring hospitalization for longer than 3 days, 2,001 and 1,233 workers participated in the surveys at 3 and 12 months after occupational injury. Only those who completed either the 3- or the 12-month survey (n = 1,715) were included in the 6-year survey. There were 852 (42.6%), 263 (21.3%), and 86 (15.0%) workers who did not return to work at 3 months, 12 months, and 6 years after occupational injury. Suicidal ideation was reported by 8.3%, 11.0%, and 16.5% of participants at 3 months, 12 months, and 6 years after occupational injury, respectively. Higher scores for either the BSRS-5 or PTSC was found in 31.8%, 26.2%, and 42.6% of participants at 3 months, 12 months, and 6 years after the injury, respectively. These participants were the candidates of the second stage of the survey involving the MINI phone interview (Table 1).

Table 2 depicts the estimated MINI-diagnosed suicidality rates at different stages of the survey. The response rates of the MINI were 20.3%, 30.7%, and 55.6% at 3 months, 12 months, and 6 years after occupational injury, respectively. The estimated MINI-diagnosed suicidality rates were 5.4%, 4.8%, and 9.5% at

Table 2. Rates of MINI-Diagnosed Suicidality, as Estimated by Multiplying Percentage With Suicidality Among MINI-Interviewees by Percentage of Participants Fulfilling Criteria for MINI Interview, at 3 Months, 12 Months, and 6 Years After Occupational Injuries

Time of Survey After Occupational Injury	MINI Interviewees		% Fulfilling Criteria for MINI Interview[a]	Estimated Rates % (95% CI)
	No. With Suicidality/ No. Completed MINI Interview	% (95% CI)		
3 months	22/129	17.1 (11.5–24.5)	31.8	5.4 (3.7–7.8)
12 months	18/99	18.2 (11.8–26.9)	26.2	4.8 (3.1–7.0)
6 years	31/135	22.3 (16.7–30.7)	42.6	9.5 (7.1–13.1)

[a]Severe or higher Posttraumatic Symptom Checklist level or 5-item Brief Symptom Rating Scale scores ≥ 6 in first-tier questionnaire survey.
Abbreviation: MINI = Mini-International Neuropsychiatric Interview.

Table 3. Crude Odds Ratios and Relative Risk of Potential Factors for Having Suicidal Ideation at 6 Years After Occupational Injury (N = 570)

Variable	Subjects (%)	% With Suicidal Ideation	OR (95% CI)	RR (95% CI)
All participants	570 (100)	16.5		
Age				
≤ 29 y	21 (3.6)	23.8	Reference	Reference
30–44 y	197 (34.6)	14.7	0.5 (0.2–1.8)	0.8 (0.5–1.2)
45–59 y	254 (44.6)	16.9	0.7 (0.2–2.1)	0.9 (0.6–1.4)
≥ 60 y	98 (17.2)	17.4	0.7 (0.2–2.3)	1.0 (0.6–1.5)
Gender				
Female	186 (32.6)	15.6	Reference	Reference
Male	384 (67.4)	16.9	1.1 (0.7–1.8)	1.1 (0.7–1.6)
Marital status				
Married	395 (69.3)	15.7	Reference	Reference
Single	124 (21.8)	17.7	1.2 (0.7–2.0)	1.0 (0.7–1.5)
Divorced/separated/widowed	51 (8.8)	19.6	1.3 (0.6–2.7)	1.1 (0.7–1.8)
Education				
High school or above	419 (73.5)	15.5	Reference	Reference
Middle school or lower	151 (26.5)	19.2	1.3 (0.8–2.1)	1.2 (0.8–1.8)
Adverse life event within the follow-up period				
No	191 (33.5)	11.5	Reference	Reference
Yes	379 (66.5)	19.0	1.8 (1.1–3.0)	1.6 (1.1–2.6)
Family member requiring care				
No	418 (73.3)	14.4	Reference	Reference
Yes	152 (26.7)	22.4	1.7 (1.1–2.7)	1.6 (1.1–2.3)
Length of hospital stay immediately after injury in 2009, d				
< 8	353 (61.9)	17.6	Reference	Reference
≥ 8	217 (38.1)	14.8	0.8 (0.5–1.3)	0.8 (0.6–1.2)
Whether this injury affected physical appearance				
No	180 (31.6)	13.3	Reference	Reference
Yes, minor	270 (47.4)	13.3	1.0 (0.6–1.8)	0.7 (0.5–1.0)
Yes, major	120 (21.0)	28.3	2.6 (1.4–4.7)	1.9 (1.4–2.6)
Additional occupational injury requiring > 3 days hospitalization				
No	495 (86.8)	14.3	Reference	Reference
Yes	75 (13.2)	30.7	2.6 (1.5–4.6)	2.1 (1.4–3.2)
Employment status at the year before questionnaire survey				
Stable employment	372 (65.3)	11.0	Reference	Reference
Retired	32 (5.6)	18.8	19 (0.7–4.5)	1.0 (0.5–1.8)
Unstable employment	166 (29.1)	28.1	3.2 (2.0–5.1)	1.8 (1.2–2.6)
Reduced salary in the past 1 year as compared to that before occupational injury				
No	360 (63.2)	9.4	Reference	Reference
Yes	210 (36.8)	28.6	3.8 (2.4–6.1)	3.0 (2.1–4.4)

3 months, 12 months, and 6 years after occupational injury, respectively (Table 2).

Table 3 depicts the potential risk factors and their crude ORs for suicidal ideation among workers who participated in the 6-year survey. Two-thirds experienced a major adverse life event within the follow-up period, and 26.7% had a family member requiring care. The mean hospital stay immediately after injury was 9.4 days (SD = 10.7) in 2009, and among 21.0% of the participants, the injury had majorly affected their physical appearance. In addition, 13.2% of the participants experienced additional occupational accident(s) requiring hospitalization for longer than 3 days. Approximately 30% of

Table 4. Association Between Suicidal Ideation and Sociodemographic and Injury Factors Using Binomial Log-Linear Regression for Adjusted Odds, Adjusted Relative Risk (aRR), and Adjusted Population Attributable Risk (aPAR)[a]

Variable	Prevalence[b] (%)	aRR[a]	aPAR[a]
Adverse life event within the follow-up period			
No	33.5	Reference	
Yes	66.5	1.1 (0.8–1.4)	…
Family member requiring care			
No	73.3	Reference	
Yes	26.7	1.2 (0.9–1.5)	…
Whether injury affected physical appearance			
No	31.6	Reference	
Yes, minor	47.4	0.8 (0.6–1.1)	…
Yes, major	21.0	1.7 (1.2–2.4)**	12.7
Additional occupational injury requiring > 3 days of hospitalization			
No	86.8	Reference	
Yes	13.2	1.4 (1.0–1.9)*	4.9
Employment status at the year before questionnaire survey			
Stable employment	65.3	Reference	
Retired	5.6	0.8 (0.4–1.4)	…
Unstable employment	29.1	1.5 (1.0–2.3)*	13.2
Reduced salary in the past 1 year as compared to that before occupational injury			
No	63.2	Reference	
Yes	36.8	1.6 (1.2–2.2)**	19.0

[a]Mutually adjusted and adjusted for above variables.
[b]Percentage of participants.
*$P < .05$.
**$P < .01$.

the workers had unstable employment within 1 year before the questionnaire survey, and nearly 37% had lower income in the past 1 year than that before occupational injury. At 6 years after the injury, elevated ORs for suicidal ideation were found for workers who experienced an adverse life event within the follow-up period, had a family member requiring care, reported that the injury majorly affected their physical appearance, experienced additional severe occupational injury, had an unstable employment contract, or had lower income in the past 1 year than that before occupational injury.

After adjustment for potential variables, the following factors were significant: reporting that the injury majorly affected the physical appearance, experiencing additional occupational injury requiring hospitalization for longer than 3 days, having an unstable employment contract, and having lower income in the past 1 year than that before occupational injury. The adjusted PARs (aPARs) for each factor were 12.7, 4.9, 13.2, and 19.0, respectively (Table 4).

DISCUSSION

This study was the first to investigate long-term suicidality after occupational injury by using a structured clinical interview. The estimated MINI-diagnosed suicidality rates were 5.4%, 4.8%, and 9.5% at 3 months, 12 months, and 6 years after occupational injury, respectively. These results suggested that suicidality does not improve with time but remains a vital issue after occupational injury. In addition, the current study also identified the risk factors for suicidal ideation at 6 years after occupational injury, namely, an injury majorly affecting the physical appearance, additional occupational injury requiring hospitalization for longer than 3 days, unstable employment, and reduced income after injury. According to the PAR estimation, the contributions of these factors to suicidal ideation were 12.7%, 4.9%, 13.2%, and 19.0%, respectively.

Traumatic events contribute to suicidal ideation, suicide attempts, and completed suicides.[31–33] Such effects can last for many years after the events. Bryant et al[34] followed up patients who experienced traumatic events in Australia at 3 months, 12 months, and 24 months after the injury. They reported that the prevalence rates of patients' MINI-diagnosed suicidality were relatively stable at approximately 6%.[34] However, they found that at different time points of follow-up, different people suffered from that condition. March et al[35] compared patients with major traumatic injury with the general population in Canada and found elevated ORs (3.3; 95% CI, 2.0–5.5) for completed suicides and suicide attempts in patients who experienced traumatic events during a follow-up period of approximately 4.5 years. The workers in Taiwan compensated for permanent occupational disability caused by the amputation of the upper or lower extremities had increased standardized mortality ratios (SMRs) for intentional self-harm (SMR = 4.5; 95% CI, 2.2–8.2).[36] The aforementioned findings are comparable with those of the current study, which found that at 6 years after occupational injury, 10% of workers developed MINI-diagnosed suicidality, which is approximately 1.6 times that of the population surveyed using MINI at 3 years after an earthquake.[37] Our findings could not be compared to the general population because of the lack of MINI surveys in the background population of Taiwan. Moreover, when the workers were asked the question "Do you have thoughts of ending your life?" to assess suicidal ideation, 16% were found to have suicidal ideation, compared with 2.4% in the general population.[21] Notably, the observed rates of MINI-diagnosed suicidality and suicidal ideation at 6 years after occupational injury were higher than those observed at 3 months (5.4% and 8.3%, respectively) and 12 months (4.8% and 11.0%, respectively). We found that, contrary to the general belief that patients recover from psychological trauma with time, workers who sustained occupational injury actually had more problems with suicidality after several years.

To identify the risk factors for suicidal ideation, we examined the relationship between suicidal ideation at 6 years after occupational injury and personal, traumatic, and occupational factors. In addition to injury severity and the major effect of the injury on the physical appearance, unstable employment and reduced income were the crucial predictors of suicidal ideation. The RR for suicidal ideation was 1.5 (95% CI, 1.0–2.3) in 29.1% of participants who reported having unstable employment, compared with those

who had stable employment. Many studies have reported that unemployment can increase suicidal ideation,[38–40] but few studies have investigated the effect of unstable employment on suicidal ideation. According to the 1998 National Health and Nutrition Examination Survey, in Korea, women with unstable employment were found to have a higher risk for suicidal ideation than those with stable employment.[41] However, such a finding was not observed for men. Depressive symptoms were found to be more prevalent in those with temporary employment than in those with stable employment.[42,43] Because depressive symptoms are strong risk factors for suicide,[40,44] our findings of increased suicidal ideation can be explained by poor mental health related to unstable employment.

In this study, 36.8% of participants had reduced income at 6 years after the injury. Reduced income was found to be a risk factor for suicidal ideation, with an RR of 1.6 (95% CI, 1.2–2.2). Many studies have shown that lower levels of income are associated with higher risk of suicidal ideation.[40,45,46] However, few studies have assessed the association between reduced income and suicidal ideation. A US survey of 1,617 people randomly sampled from Iowa found an association between reduced income and suicidal ideation.[47] The financial strain of the reduced income may increase the risk of suicide through the mechanisms of poor mental health.[48] Because workers may have reduced income[49] or low income growth[50] after occupational injury, the role of the reduced income in suicidal ideation may be more considerable than generally believed.

The current study found that at 6 years after occupational injury, injuries majorly affecting the physical appearance and additional occupational injuries requiring hospitalization for longer than 3 days were related to suicidal ideation. These results are similar to those of previous studies.[31,33] In addition, at 3 months after occupational injury, we found that the major effect of the injury on the physical appearance is a crucial risk factor for suicidal ideation.

Our study has some major strengths. First, the longitudinal study design enabled the understanding of the effect of occupational injury on suicidality, particularly when injured workers have presumably reached a medically stable condition. Second, the consecutive selection of participants from the National Labor Insurance database increased the national representativeness of the study sample. Third, we investigated the occurrence of suicidality by using structured instruments, and all assessments were performed by psychiatrists or trained nurses, thus providing more objective and reliable results.

Although this survey has some strengths, some factors limit the interpretation of our findings. First, the relatively low response rate (one-third of the targeted population) poses a concern regarding the representativeness of the intended study subjects. However, no differences were observed in gender, age, hospital stay, and effect on physical appearance between participants and nonparticipants (data not shown). Thus, we believe that participant selection was probably unbiased. Second, estimating suicidality prevalence rates by multiplying the prevalence rates obtained through MINIs with the percentage of workers with high BSRS-5 scores or positive suicidal ideation may be overly simplified. This approach was based on the assumption that BSRS-5 and suicidal ideation serve as a screening tool for suicidality. Previous studies have demonstrated that BSRS-5 and suicidal ideation are suitable screening tools for suicidality.[21,22,51,52] Therefore, we believe that our 2-tiered approach could have provided a reasonably accurate estimate. Third, the screen instruments (BSRS-5 and suicidal ideation) examine subjects' mental condition only in the past 1 week and may miss identifying those with normal BSRS-5 scores and negative suicidal ideation during the questionnaire survey period; we did not further assess the potential false negative results of these instruments for identifying those with MINI-diagnosed suicidality. In addition, 18 deceased workers were excluded from the final analysis. According to the Taiwan Personal Information Protection Act,[53] the researchers have no right to access any information of the deceased, though some workers may die due to suicide. We may therefore underestimate the suicidality rate in this study. Fourth, the influence of suicidal ideation and psychiatric history before occupational injury might be risk factors for suicide after the injury. In this study, only psychiatric history before the injury was assessed at the 3 and 12 months' surveys post injury. In this population, only 2.6% of subjects (n = 15) had psychiatric history (data not shown) and their psychological symptom scores were not different from those without psychiatric history before occupational injury. Fifth, in this study, we did not ask injured workers' actual income due to concern for protection of personal information. We did, however, use the binary variable (having reduced income) to assess the impact of the reduction in income on suicidal ideation. This may have led to an underestimation of the impact of actual decrease in salary on suicidal ideation.

In conclusion, this study suggested that injured workers have a higher risk of suicidality at 6 years after occupational injury than at 3 months and 12 months after injury. Injury severity, work instability, and reduced income are the risk factors for suicidal ideation. Future studies should develop effective strategies for minimizing suicidality after occupational injury and for the early detection of high-risk workers.

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