Construction Workers Struggle With a High Prevalence of Mental Distress, and This Is Associated With Their Pain and Injuries

Henrik Borsting Jacobsen, PsyD, Alberto Caban-Martinez, DO, MPH, PhD, Lynn C. Onyebeke, MSc, Glorian Sorensen, MPH, PhD, Jack T. Dennerlein, PhD, and Silje Endresen Reme, PsyD, PhD

Objectives: We aimed to investigate how mental distress was associated with pain and injuries in a convenience sample of construction workers. **Methods:** A cross-sectional, mental health assessment was conducted in a convenience sample of construction workers ($N = 172$). A subsample participated in a clinical interview ($n = 10$). We used a cutoff (1.50 or greater) on Hopkins Symptom Checklist–25 to determine substantial mental distress and determined associations with pain and injury outcomes. **Results:** The prevalence of substantial mental distress was 16% in the workers. This was supported by follow-up clinical interviews where 9 of 10 workers fulfilled the criteria for a mental disorder. Substantial mental distress was associated with both injury rate and self-reported pain. **Conclusion:** This pilot study strongly suggests the need for rigorous studies on construction worker mental health and how it affects their work and well-being.

With more than 11 million workers, the construction industry represents one of the largest industries in the United States[1] The industry faces several occupational health challenges, and when compared with other industries, it has a significantly higher rate of work-related injuries[2,3] and very high prevalence of both acute and chronic musculoskeletal pain.[2,4] The consequences of injuries in construction workers are often severe, and in 2010, the construction industry had the highest number of fatal occupational injuries of all US industries.[5] Studies on both construction workers and other working populations have demonstrated that mental distress is strongly associated with both musculoskeletal pain[6,7] and work-related injuries.[8] Yet, little is known about the prevalence of mental health problems in construction workers. There are only a few existing studies on the subject, and those have large differences regarding the prevalence of mental distress, how mental distress is assessed, and how accessible treatment is for the worker.[2,9,10]

Mental distress has been shown to be highly comorbid with pain in worker populations, with participants reporting comorbidities as high as 50%.[11,12] In construction workers, the most frequently reported musculoskeletal complaint is low back pain.[2,9] Back injury/pain is often chronic in these workers, because almost 40% of construction workers older than 50 years report chronic back pain.[4] The interplay between mental distress and pain has been shown to have a salient role in creating chronicity.[12]

According to an earlier study in Chinese construction workers, the risk of work-related injuries increased more than twofold when they reported depressive symptoms.[8] This coincides with studies showing that mental distress has a negative influence on the workers' attitudes regarding safety and engaging in unsafe behavior.[13] A novel study also demonstrated that the relationship has a bidirectional element, where injured workers were 45% more likely to be treated for depression than noninjured workers.[14] The study investigated several occupations and found that the relative effect was even higher for men than for women.[14]

Studies on large populations in several countries have highlighted untreated mental disorders as one of the most important risk factors for suicide.[15,16] Internationally, construction workers have been found to have significantly higher suicide rates when compared with other workers.[17–19] A study conducted in Australia reported the suicide rate in the country's construction workforce to be more than twice as high as in the general male population.[18] Not being able to properly describe the prevalence and consequences of mental distress in construction workers is alarming, considering previous studies reporting high suicide rate and additional burdens psychological factors could have on the workers' health and well-being.

In this pilot study, we conducted a two-phase workplace mental health assessment to (1) describe the prevalence of substantial mental distress in a convenience sample of New England construction workers; (2) describe the prevalence of mental disorders through a structured diagnostic interview in a subsample of these workers; and (3) examine the relationship between self-reported musculoskeletal pain, interference from pain, workplace injuries, and substantial mental distress. We hypothesized that higher levels of musculoskeletal pain, interference from pain, and more workplace injuries would be associated with higher mental distress.

METHODS

Overall Assessment Procedure

In August 2012, we conducted a mental health assessment of construction workers at four major construction sites in greater New England by using a two-phase research design. In the first phase, we recruited 172 workers from four worksites to complete a questionnaire assessing psychological distress, depression, anxiety, somatization, job satisfaction, musculoskeletal pain, negative health behaviors (ie, tobacco and alcohol consumption), and workplace injuries by using standardized and validated measures. The second phase involved a 20-minute individual interview session (structured psychiatric interview) with a selection ($n = 10$) of the construction workers whose questionnaire scores suggested mental illness. The Harvard School of Public Health Office of Human Research Administration approved the study protocol, recruitment materials, scripts, and questionnaires.

From the Harvard School of Public Health (Drs Jacobsen, Caban-Martinez, Sorensen, Dennerlein, and Reme and Ms Onyebeke), Northeastern University (Dr Dennerlein), and Dana-Farber Cancer Institute (Dr Sorensen), Boston, Mass; Uni Health (Dr Reme), Uni Research, Bergen, Norway; and Norwegian University of Science and Technology (Dr Jacobsen), Trondheim, Norway.

This work was supported by a grant from the National Institute for Occupational Safety and Health (U19 OH008861) for the Harvard School of Public Health Center for Work, Health and Well-being, and a grant from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (grant T32 AR055885) to the Clinical Orthopedic and Musculoskeletal Education and Training Program at Brigham and Women's Hospital, Harvard Medical School and Harvard School of Public Health, and the Liberty Mutual Harvard School of Public Health Program for Occupational Safety and Health.

The authors declare no conflicts of interest.

Address correspondence to: Henrik Borsting Jacobsen, PsyD, Departments of Public Health and Circulation and Medical Imaging, Faculty of Medicine, NTNU, PO Box 8905, MTFS, 7491 Trondheim, Norway (henrik.b.jacobsen@ntnu.no).

DOI: 10.1097/JOM.0b013e31829c76b3

Recruitment and Participation

The construction worksites used in this study were identified in cooperation with a construction company and selected on the basis of their geographical location and the maximum number of workers accessible. In collaboration with the environmental health and safety officer at each of the four construction worksites, our study team approached all available workers on-site during their 15-minute morning or 45-minute lunch break. In that time, we provided information about the study, invited them to participate, and gathered informed consent. The team was informed about how many workers who were on-site and matched the number of surveys accordingly. Every worker on-site was given the opportunity to complete a survey. Those workers who were not able to complete the survey during the morning breakfast break were instructed that they could keep the survey and continue completing it during their lunch break. All completed and noncompleted surveys were collected solely by the study team members, and workers completed their own surveys independently without the management being present. At the four construction sites, we handed out a total of 178 surveys. Five workers declined participation, making the available number of workers 183. Of the 178 surveys handed out, the research team collected 172, and 6 surveys were destroyed because they were not collected by the research team directly. The completion rate across all four construction sites was approximately 90%. The last question on the survey invited workers to participate in a brief follow-up telephone interview by providing their contact information. The interview was scheduled within 2 weeks after their on-site survey.

All study participants who completed the phase 1 questionnaire on-site received a $5 gift card as well as a drawstring book bag. The bag was filled with educational materials on mental health and free local resources for emergency and ad hoc mental health clinical services. The participants were aware that they would receive both the bag and the gift card before filling out the questionnaire. The bag included self-help materials to increase mental health literacy and information regarding mental health care that was readily available for the workers at the time of participation. Workers who participated and completed the telephone psychiatric interview were provided an additional $10 gift card. Among the 172 completed rapid mental health surveys, 45% were willing and interested in being followed up by telephone to participate in the interview. Only participants whose score suggested mental illness were eligible for participation in the interview. Of these participants, 59% were willing and interested in being followed up, and 63% of them completed the interview.

Outcome

Mental distress was measured with the Hopkins Symptom Checklist (HSCL).[20] This scale measured anxiety, somatization, and depressive symptoms. Respondents were asked: "To what extent have you been bothered with the following symptoms the last 14 days, including today?" The scale consists of 25 items assessing the presence and intensity of anxiety, somatization, and depressive symptoms, with each item containing a response alternative ranging from 1 (not bothered) to 4 (extremely bothered). The scale is summed and divided by the number of items, yielding an average score used for determining mental distress, ranging from 1 to 4. The standard cutoff score is equal to or larger than 1.50 (for male respondents) and was used to identify cases of potential mental illness, as in previous studies.[21]

Covariates

In the first phase, the questionnaire contained both the HSCL-25 [20] and the Kessler 6 severe psychological distress scale.[22,23] The Kessler 6 scale queries respondents in the following six domains over the past 30 days: sad, nervous, restless/fidgety, hopeless, everything an effort, and worthless, yielding a score range of 0 to 24. Cases of severe psychological distress were defined by having a score greater than or equal to 13, as used in previous studies.[24] To assess whether the worker had access to mental health care, the questionnaire contained the items: "Was there a time in the past 12 months when you needed to see a mental health professional but could not because of cost? [Yes or No]." "Was there a time in the past 12 months when you felt that you might need to see a professional because of problems with your emotions, nerves, or use of alcohol or drugs, but didn't go? [Yes or No]." "Did you ever get a prescription or medicine for your emotion, nerves, or mental health (or substance use) from any type of professional? [Yes or No]"

In addition, the survey in phase 1 contained items addressing both musculoskeletal pain and work-related injuries. Musculoskeletal pain was assessed by a modified Nordic questionnaire [25] asking: "During the past 3 months, have you had pain or aching in any of the areas shown on the diagram?" Using an anatomic diagram as a reference, respondents identified body areas in which they experienced pain: lower back, shoulder, wrist or forearm, knee, neck, ankle or feet, and none of the earlier. For each body area they referenced, they were recorded as having pain in that area and having musculoskeletal pain. To assess workplace injuries, the questionnaire also asked whether the workers were injured at the job site in the last 30 days and whether they had experienced any of the following injuries at work in the past month: strain/sprain/torn ligament, dislocation, amputation, cut/laceration, broken bone/fracture, scrape/abrasion, burn/blister/scald/welding flash, bruise/contusion, or some other type of injury. If they checked a type of injury or that they were injured at the job site in the last 30 days, it was indicative that they had an injury.

To assess other potential covariates, the survey contained validated questions about smoking habits and alcohol consumption and other sociodemographic variables (age, gender, race, ethnicity, marital status, educational training, household income, and health insurance status). On the basis of survey response, we categorized their smoking status as current, former, and never smokers.

For phase 2, describing the different types of disorders in this population, this study used a structured diagnostic interview. The structured interview consisted of the Mini-International Neuropsychiatric Interview 6.0 (M.I.N.I.), a brief structured diagnostic interview for the major Axis I psychiatric disorders in the *Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition)* and the *International Classification of Diseases, Tenth Revision*. The M.I.N.I is a short structured diagnostic interview, developed by psychiatrists in the United States and Europe. It is based on "yes" and "no" answers and covers 16 Axis I disorders and 1 Axis II disorder (antisocial personality disorder). In the multiaxial system of the *Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition)*, Axis I disorders include all major mental disorders, while Axis II include personality disorders. The M.I.N.I interview usually takes 15 to 20 minutes and has high reliability and validity.[26,27]

DATA ANALYSIS

We defined the prevalence of substantial mental distress by using a cutoff of 1.50 or greater on the workers' HSCL-25 score. In bivariate analyses, continuous variables were expressed as mean ± the standard error of the mean and categorical variables as frequency and percentage. Characteristics of workers who had substantial mental distress were compared with that of those who did not have the same, using the independent sample *t* test or Mann-Whitney *U* test (continuously measured characteristics) or Pearson's chi-squared test or Fisher exact chi-squared test for two groups (categorical measures). *P* value of less than 0.05 was considered statistically significant for all tests. Data from the structured interview were reported descriptively, using the clinical cutoff for diagnoses in the M.I.N.I.

To investigate the association between substantial mental distress and musculoskeletal pain, work-related injury and work interference from pain, the following variables were dichotomized and

used as independent variables: any injury, four or more injuries, low back pain, the number of pain sites, and pain interfering with work. Multivariate logistic regression models were built to investigate associations between substantial mental distress and the independent variables while controlling for gender, age, and education. Covariates were determined a priori. The variables that were significant ($P < 0.05$) in bivariate analyses were included in the multivariate model. Odds ratios are reported with 95% confidence intervals. All analyses were performed by using the PASW statistical package (for Windows, release 18.0; PASW, Inc).

RESULTS

Characteristics of the Sample

Of the 172 participants in the study, most were white (94.3%), male (93.5%), with a high school or General Education Development degree (46%), and a household income of more than $75,000 (55.2%). The participants had a mean age of 41.0 years (SD = 10.7 years). A total of 128 participants (74.4%) reported having some kind of musculoskeletal pain during the last 3 months, including low back, shoulder, wrist/forearm, knee, neck, and ankle/feet pain. Seventy-two (41.9%) of the population reported one or more injuries at work during the last month (Table 1).

Prevalence of Substantial Mental Distress

The prevalence of substantial mental distress in this population was 15.7%, using the chosen cutoff on HSCL-25 (1.50 or greater). As measured by the Kessler 6, 4.7% reported scoring more than the cutoff (13 or greater) on severe psychological distress. Of the participants scoring more than the cutoff on substantial mental distress, 41% reported that they had not sought professional help in the last year, despite their own identified need to do so.

Bivariate analyses, using a cutoff on HSCL-25 scores, demonstrated a significant association ($P < 0.05$) between having substantial mental distress and reporting low back pain and wrist/forearm pain (Table 1). They also showed a significant association between having substantial mental distress and reporting two or more pain sites. Pain in the neck, shoulder, wrist/forearm, knee, or ankle/feet were not significantly associated with substantial mental distress. The group means showed a significant difference ($P < 0.05$) between groups with/without substantial mental distress on the average number of pain sites (Table 1), with a higher average in the group with substantial mental distress.

Whether or not the worker had been injured on the job site during the last 30 days and how many different types of work-related injuries were experienced in the last 30 days were both significantly associated with substantial mental distress ($P < 0.05$).

Bivariate analyses showed no significant associations between substantial mental distress and age, gender, education, income, or any other demographic variables. *Health behavior* was defined as smoking and/or alcohol consumption. There were no significant differences between the group with substantial mental distress and the group without substantial mental distress on the average number of cigarettes smoked per day or the average number of days per week with alcohol consumption (Table 1).

Describing Mental Disorders

Nine of the 10 workers interviewed with the structured, diagnostic interview (M.I.N.I) fulfilled the criteria for at least one psychiatric diagnosis. The M.I.N.I interview lasted, on average, 29 minutes (range: 15 to 60 minutes). The most common diagnoses were depression, panic disorder, and generalized anxiety, but the range covered personality disorders, eating disorders, suicide risk, and substance abuse as well as mood disorders (for specifics, see Table 2). Of 10 workers, 2 reported a clinically significant suicide risk and 4 did not seek professional help even though they felt the need to do so. There were no significant differences on any variables (demographics, pain, injury, health behavior, and psychological distress) between those who participated in the M.I.N.I. interview and those who scored more than the cutoff but did not take part in the interview.

Associations Between Work-Related Injuries, Pain Outcomes, and Mental Distress

We dichotomized and analyzed in separate logistic regression models the independent variables: (1) any injury; (2) four or more injuries; (3) low back pain; (4) two or more pain sites; and (5) pain interfering with work, given the moderate to high correlation ($r \leq 0.46$) between the independent variables in a relatively small n. Covariates age, gender, and education were selected a priori to control for sociodemographic differences. After controlling for selected covariates, having two or more pain sites, low back pain, and experiencing four or more injuries were significantly associated with substantial mental distress. Nevertheless, incident of any injury and pain interfering with work were not significantly associated with substantial mental distress, but they both displayed clear trends (see Table 3 for details).

DISCUSSION

The goal of this pilot study was threefold. We wanted to document the prevalence of substantial mental distress in a sample of construction workers and then describe the prevalence of mental disorders in a subsample by using a diagnostic interview. Last, we wanted to investigate whether self-reported musculoskeletal pain and injuries are associated with mental distress. The results in this study indicate that the prevalence of substantial mental distress was 16%. Of the workers who reported substantial mental distress on the rapid mental health screening, 10 workers were followed up for a psychiatric interview by phone. Nine of 10 met the criteria for one or several psychiatric diagnoses. This indicates that the rapid mental health screening used in this study is able to identify construction workers with mental disorders. Furthermore, having substantial mental distress was associated with low back pain, multiple pain sites, and higher frequency and range of work-related injuries.

The prevalence of substantial mental distress in our population is almost twice as high as previously reported in the general male population.[28] Using a somewhat different measurement scale, data from the male population in the United States have shown that the 12-month prevalence of affective disorders and anxiety disorders are approximately 8% and 11%, respectively.[28] Affective disorders are consistently found to be one of the most important risk factors for suicide attempts and ideation.[29] International studies of construction workers have documented the suicide rate being more than twice that of the normal population.[30] Earlier studies have also shown that more than a fifth of the suicides in the construction industry were associated with an untreated or undiagnosed mental disorder.[18] Our results show that of the 16% who reported substantial mental distress, as much as 41% had felt the need to seek help without doing so.

In this study, there were 10 workers who completed the psychiatric interview, of which, 2 workers had a clinically significant suicide risk and 4 did not seek help even though they had a sense they should. A diagnosis of major depression was identified in six of the workers (Table 2), a disorder that is strongly associated with increased suicide risk, particularly in men.[29,31] One possible explanation for this gender-specific relationship is highlighted in earlier studies. It emphasizes the lack of acknowledgment and legitimacy of mental disorders from both medical professionals and the sufferer himself.[29] In addition, comorbid substance abuse was present in two of the workers reporting depression, and this combination is strongly associated with both suicide attempts and suicidal ideation.[31]

The high prevalence of substantial mental distress and lack of treatment in this population is of concern. This high prevalence might

TABLE 1. Sociodemographic, Health, and Work Characteristics of Construction Workers ($N = 172$) With and Without Substantial Mental Distress (HSCL ≥ 1.50), Collected From Four Greater New England Construction Sites, August 2012

	Total Workers		Workers With Substantial Mental Distress		Workers Without Substantial Mental Distress		
Characteristics	***n****	**%**	***n****	**%**	***n****	**%**	***P***
Total	172	100	27	15.7	139	84.3	
Psychological distress†							
High risk (score $\geq$ 13)	7	4.2	4	57.1	3	42.9	0.84
Low risk (score $\leq$ 12)	159	95.8	23	14.5	136	85.5	
Demographics							
Job satisfaction							
Somewhat or not too satisfied	81	48.5	16	19.7	65	80.2	0.235
Very satisfied	86	51.5	10	11.6	76	88.4	
Income							
<$ 75,000 or not sure	74	44.8	13	17.6	61	82.4	0.148
≥$75,000	91	55.2	12	13.2	79	86.8	
Gender							
Male	157	93.5	23	14.6	134	85.4	0.669
Female	11	6.5	2	18.2	9	81.8	
Education							
Less than high school	9	5.5	8	88.8	1	11.2	0.645
High school or GED	75	46.0	66	88.0	9	12.0	
Some college	50	30.7	40	80.0	10	20.0	
College degree or more	29	17.8	25	86.2	4	13.8	
Race							
White	149	94.3	24	16.1	125	83.9	0.877
Black or African American	8	5.1	1	12.5	7	83.5	
Other	1	0.6	0	0	1	100	
Ethnicity							
Hispanic	7	4.2	0	0	7	100	0.430
Non-Hispanic	159	95.8	25	15.7	134	84.3	
Musculoskeletal pain							
Lower back	82	48	**18**	**22.0**	**64**	**78.0**	**0.038**
Shoulder	72	42.1	13	18.1	59	81.9	0.528
Wrist/forearm	41	24.0	**13**	**31.7**	**28**	**68.3**	**0.030**
Knee	52	30.4	10	19.2	42	80.8	0.495
Neck	42	24.6	8	19.0	34	81.0	0.477
Ankle/feet	48	28.1	37	22.9	11	77.1	0.160
Two or more pain sites	85	49.7	**20**	**23.5**	**65**	**76.5**	**0.006**
Injuries							
Injured at job site in last 30 days	19	11.3	**8**	**42.1**	**11**	**57.9**	**0.004**
≥2 types of injury during last month	40	23.4	**11**	**27.5**	**29**	**72.5**	**0.027**
≥4 types of injury during last month	14	8.2	**6**	**42.9**	**8**	**57.1**	**0.011**
Unmet health care							
Needing professional help, but not seeking it	22	13.1	**11**	**50.0**	**11**	**50.0**	**<0.0001**
Smoking							
Past	50	30.7	8	16.3	41	83.7	0.997
Current	31	19.0	5	16.1	26	83.9	
Never	82	50.3	13	15.9	69	84.1	
Mean Comparisons	**Total Mean**	**Total SD**	**Mean**	**SD**	**Mean**	**SD**	***P***
Number of pain sites	2.0	1.8	**2.7**	**1.8**	**1.8**	**1.8**	**0.022**
Number of days with alcohol use during last 30 days	3.2	1.9	3.6	1.8	3.1	1.9	0.33
Average number of cigarettes per day	11.6	9.6	14.2	8.6	11.0	9.8	0.36
Age, yr	41.0	10.7	39.0	9.0	41.2	10.9	0.34
Body mass index	29.8	4.7	30.3	5.6	29.7	4.5	0.60

*Items may not add to 172 because of item nonresponse. Percentages are calculated columnwise in the total category and rowwise in the with/without mental distress columns.

†As measured by Kessler 6.

HSCL, Hopkins Symptom Checklist.

TABLE 2. Diagnoses From the M.I.N.I Structural Interview Collected From 10 Construction Workers Participating in the Workplace Mental Health Assessment Pilot Study, August 2012

Participant Number (Age Range, 21–49 yr)	Number of Diagnoses	M.I.N.I. Diagnoses
1	0	None
2	1	GAD
3	1	PME
4	1	C-MDD
5	1	CPD
6	1	P-MDD
7	3	C-MDD, GAD, and suicide risk (low)
8	4	P-MDD, PME, past panic disorder, and antisocial personality
9	7	C-MDD, PME, CPD, generalized social phobia, PTSD, alcohol dependency, and GAD
10	9	P-MDD, suicide risk (low), PME, current agoraphobia, PTSD, alcohol dependency, alcohol abuse, and bulimia

C-MDD, current major depression; CPD, current panic disorder; GAD, generalized anxiety disorder; M.I.N.I.; Mini-International Neuropsychiatric Interview; P-MDD, past major depression; PME, past manic episode; PTSD, posttraumatic stress disorder.

indicate a lack of social support and coping strategies when it comes to dealing with substantial mental distress. Possible reasons for this lack of help-seeking behavior could involve stigmatization and fear of losing their job. Earlier studies have shown that an increase in literacy in construction workers regarding suicide and mental health symptoms and providing much needed treatment is liable to yield effects on both suicide attempts and suicides.[30]

Our results add to the well-established link between substantial mental distress and low back pain.[11] The results from this study show an association between substantial mental distress, low back pain, and the number of pain sites, which is in accordance with numerous other studies on chronic and multisite pain.[11,32,33] In cases where the pain is accompanied by mental distress, there is a severe exacerbating of function and disability.[11] There is little doubt that psychological factors are instrumental in both causing and preventing disability from chronic pain, although the causal links still are somewhat unclear.[34] Shoulder, neck, and upper and lower extremity pain were not significantly associated with substantial mental distress in our study. Previous studies have argued that the underlying mechanisms in medically unexplained, chronic nonmalignant pain are similar regardless of location.[35] The diverging results in our study suggest otherwise.

Nevertheless, an important fact in this study is that the frequency of low back pain among the workers was much higher than neck, upper extremity, or lower extremity pain. The lack of associations might therefore be because of the lack of statistical power. Shoulder pain was almost as prevalent as low back pain, but shoulder pain is often caused by specific disorders (impingements or other) with a clear physiological substrate.[36] This might give the participant a physiological cause and interpretation with "higher" medical validity than an unexplained, diffuse low back symptom. Such an interpretation might reduce the participant's report of mental distress if he or she attributes his or her exacerbated mental state to the pain, thus limiting the vicious cycle often accompanying medically unexplained symptoms. This has previously been demonstrated in a study investigating the difference in mental distress between shoulder pain and low back pain.[37]

The findings in this study support earlier statements regarding a pressing need for effective interventions,[2] and these interventions need to target and increase knowledge of psychological factors in chronic pain, particularly in construction workers. Several studies have tried to amend the high prevalence of chronic pain in construction workers, with increased focus on ergonomics and assistive devices.[38,39] A Cochrane review, including two studies on construction workers, recently described several major interventions targeting lifting and assistive devices. These were specifically designed to prevent chronic low back pain but showed no or little effect.[40] A multitude of clinical studies have highlighted the importance of psychological factors in both treatment and prevention of chronic pain and back injuries.[12,32,41]

Our findings show a strong association between having substantial mental distress and increased frequency of injuries. There are several possible pathways that can explain this association. One mechanism may be that substantial mental distress influences safety behavior and inadvertently affect the injury rate.[8,13] A second mechanism could be intentional self-harm, where the worst-case scenario is suicide. In our sample, the workers with substantial mental distress seem to experience both more injuries and a larger range of injuries, but more studies are needed to understand the mechanisms in this relationship.

The recent finding that workers who experience injuries are more at risk of developing depression [14] also raises a question of directionality. If the worker is at higher risk for injuries, it could be a possible confounder when he or she reports mental distress and injuries. A previous injury might have led to a depression, which in turn causes substantial mental distress and more injuries. The worker's report of substantial mental distress is then attributed as an underlying cause in the injuries.

Regardless of the unclear directionality, an intervention targeting psychological factors that has the potential to prevent disability, reduce injuries, alleviate mental distress, and reduce health care costs in more than 11 million workers certainly warrants a rigorously designed large-scale study. Construction workers are generally considered to be a low-income group with a high frequency of temporary work status,[2] both of which have been independently associated with a higher risk of mental distress.[42] The high rate of musculoskeletal pain and occupational injuries might, in part, be explained by mental distress,[8,13] but more knowledge about mental distress and disorders, and how it relates to work-related pain and injuries in the construction industry is needed. A better understanding of the prevalence and consequences of mental distress in the construction industry could help design better interventions, which again would have consequences for pain and injuries.[2,3] Such an intervention should integrate a focus on suicide prevention, increasing literacy about mental health, and highlight the importance of seeking help for mental disorders.

LIMITATIONS

This pilot study was intended to generate hypotheses for further investigation, and the analysis has several limitations, which will now be considered. The study population is small ($N = 172$), which somewhat limits the generalizability of the findings. Nevertheless, the mean age of participants in this study is lower than that in earlier studies on construction workers[2,3] and is therefore more reflective of the worker population. The study is also cross-sectional in nature, and we cannot infer any causal links or directionality between the variables studied. Still, the current associations are very strong and are of interest, regardless of direction. The population is a convenience sample, and a selection bias can therefore not be excluded, but with a completion rate close to 100%, the data collected have less likelihood of being subject to any major bias. The participants

TABLE 3. Multivariate Associations Between Pain, Workplace Injuries, and Mental Distress (More Than Cutoff Versus Less Than Cutoff*) Among Construction Workers Participating in a Rapid Mental Health Assessment, August 2012

Substantial Mental Distress* Models												
	Adjusted Associations			Adjusted Associations			Adjusted Associations			Adjusted Associations			Adjusted Associations	
Independent Variables	**OR (95% CI)**	***P*†**	**Independent Variables**	**OR (95% CI)**	***P*†**	**Independent Variables**	**OR (95% CI)**	***P*†**	**Independent Variables**	**OR (95% CI)**	***P*†**	**Independent Variables**	**OR (95% CI)**	***P*†**
Any injury	2.29 (0.90–5.79)	0.08	**4 or more injuries**	**4.83 (1.36–17.20)**	**0.02**	**Any low back pain**	**2.59 (1.03–6.56)**	**0.04**	**2 or more pain sites**	**3.06 (1.19–7.89)**	**0.02**	Pain interfering with work	2.38 (0.94–6.03)	0.07
Gender (M: 1 vs F: 2)	1.53 (0.28–8.50)	0.62	Gender (M: 1 vs F: 2)	1.38 (0.26–7.26)	0.70	Gender (M: 1 vs F: 2)	0.93 (0.18–4.87)	0.75	Gender (M: 1 vs F: 2)	1.19 (0.23–6.22)	0.83	Gender (M: 1 vs F: 2)	1.45 (0.25–8.21)	0.69
Age, yr	0.99 (0.95–1.04)	0.65	Age, yr	0.99 (0.95–1.04)	0.75	Age, yr	0.98 (0.94–1.02)	0.42	Age, yr	0.99 (0.95–1.03)	0.61	Age, yr	0.98 (0.94–1.03)	0.46
Education (GED: 0 vs college: 1)	(0.66–4.27)	0.28	Education (GED: 0 vs college: 1)	1.43 (0.57–3.58)	0.44	Education (GED: 0 vs college: 1)	1.43 (0.57–3.54)	0.44	Education (GED: 0 vs college: 1)	1.48 (0.59–3.68)	0.40	Education (GED: 0 vs college: 1)	1.51 (0.59–3.85)	0.29

*Substantial mental distress was dichotomized and defined as being greater than 1.50 on HSCL.
†Significant *P* values are given in bold.
CI, confidence interval; GED, General Education Development; HSCL, Hopkins Symptom Checklist; OR, odds ratio.

in this study were mainly white men with a high school degree and a reasonably good financial status and are not representative of all US construction workers; they are most likely healthier than minority low-wage cohorts. Sociodemographic status is often highlighted as an important risk factor for substantial mental distress, pain, and injuries in many worker populations. Hence, the associations seen in this study are most likely an underestimation of the outcomes selected. Future studies should include minorities and workers from other parts of the country to get a representative view of the entire construction industry. In addition, the study relied on self-report injury data and further investigations might benefit from comparing these measures with other data, such as official injury registry.

CONCLUSION

This is the first comprehensive investigation of mental distress among construction workers. By using a rapid self-administered mental health screening, we were able to document substantial mental distress in 16% of the workers, a much higher prevalence than in the general male population. This was supported by follow-up clinical interviews where 9 of 10 workers fulfilled the criteria for a mental disorder. The results also indicate that substantial mental distress is associated with both injury rate and self-reported pain. This pilot study strongly suggests the need for additional rigorous studies on construction worker mental health and how this affects their work and well-being. It is most likely an underreporting population, struggling with a high prevalence of substantial mental distress, and they are unwilling or afraid to seek professional help for their mental problems. This study also suggests the need for increased treatment options, literacy, and acceptance of mental disorders in this high-risk worker population.

ACKNOWLEDGMENTS

The authors thank the construction workers and the construction firm for collaborating with them on this study.

REFERENCES

1. Lehtola MM, van der Molen HF, Lappalainen J, et al. The effectiveness of interventions for preventing injuries in the construction industry: a systematic review. *Am J Prev Med.* 2008;35:77–85.
2. Dong XS, Wang X, Daw C, Ringen K. Chronic diseases and functional limitations among older construction workers in the United States: a 10-year follow-up study. *J Occup Environ Med.* 2011;53:372–380.
3. Schwatka NV, Butler LM, Rosecrance JR. An aging workforce and injury in the construction industry. *Epidemiol Rev.* 2012;34:156–167.
4. Dong XS, Wang X, Fujimoto A, Dobbin R. Chronic back pain among older construction workers in the United States: a longitudinal study. *Int J Occup Environ Health.* 2012;18:99–109.
5. US Bureau of Labor Statistics. Fatal occupational injuries and Workers' Memorial Day. In: US Bureau of Labor Statistics, ed. *The Bureau of Labor Statistics Census of Fatal Occupational Injuries*. Washington, DC: US Bureau of Labor Statistics; 2012.
6. Demyttenaere K, Bonnewyn A, Bruffaerts R, Brugha T, De Graaf R, Alonso J. Comorbid painful physical symptoms and depression: prevalence, work loss, and help seeking. *J Affect Disord.* 2006;92:185–193.
7. Kessler RC, Greenberg PE, Mickelson KD, Meneades LM, Wang PS. The effects of chronic medical conditions on work loss and work cutback. *J Occup Environ Med.* 2001;43:218–225.
8. Zheng L, Xiang H, Song X, Wang Z. Nonfatal unintentional injuries and related factors among male construction workers in central China. *Am J Ind Med.* 2010;53:588–595.
9. Peterson JS, Zwerling C. Comparison of health outcomes among older construction and blue-collar employees in the United States. *Am J Ind Med.* 1998;34:280–287.
10. Marchand A. Mental health in Canada: are there any risky occupations and industries? *Int J Law Psychiatry.* 2007;30:272–283.
11. Von Korff M, Crane P, Lane M, et al. Chronic spinal pain and physical–mental comorbidity in the United States: results from the National Comorbidity Survey Replication. *Pain.* 2005;113:331–339.
12. Pincus T, Burton AK, Vogel S, Field AP. A systematic review of psychological factors as predictors of chronicity/disability in prospective cohorts of low back pain. *Spine*. 2002;27:E109–E120.
13. Siu OL, Phillips DR, Leung TW. Safety climate and safety performance among construction workers in Hong Kong. The role of psychological strains as mediators. *Accid Anal Prev.* 2004;36:359–366.
14. Asfaw A, Souza K. Incidence and cost of depression after occupational injury. *J Occup Environ Med.* 2012;54:1086–1091.
15. Phillips MR, Yang G, Zhang Y, Wang L, Ji H, Zhou M. Risk factors for suicide in China: a national case–control psychological autopsy study. *Lancet.* 2002;360:1728–1736.
16. Qin P, Agerbo E, Mortensen PB. Suicide risk in relation to socioeconomic, demographic, psychiatric, and familial factors: a national register-based study of all suicides in Denmark, 1981–1997. *Am J Psychiatry.* 2003;160:765–772.
17. Andersen K, Hawgood J, Klieve H, Kolves K, De Leo D. Suicide in selected occupations in Queensland: evidence from the state suicide register. *Aust N Z J Psychiatry.* 2010;44:243–249.
18. Heller TS, Hawgood JL, De Leo D. Correlates of suicide in building industry workers. *Arch Suicide Res.* 2007;11:105–117.
19. De Looper M, Magnus P. *Australian Health Inequalities: 2 Trends in Male Mortality by Broad Occupational Group*. Canberra, Australia: Australian Institute of Health and Welfare; 2005.
20. Rickels K, Garcia CR, Lipman RS, Derogatis LR, Fisher EL. The Hopkins Symptom Checklist. Assessing emotional distress in obstetric–gynecologic practice. *Prim Care.* 1976;3:751–764.
21. Ventevogel P, De Vries G, Scholte WF, et al. Properties of the Hopkins Symptom Checklist–25 (HSCL-25) and the Self-Reporting Questionnaire (SRQ-20) as screening instruments used in primary care in Afghanistan. *Soc Psychiatry Psychiatr Epidemiol.* 2007;42:328–335.
22. Kessler RC, Barber C, Beck A, et al. The World Health Organization Health and Work Performance Questionnaire (HPQ). *J Occup Environ Med.* 2003;45:156–174.
23. Kessler RC, Andrews G, Colpe LJ, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol Med.* 2002;32:959–976.
24. Furukawa TA, Kessler RC, Slade T, Andrews G. The performance of the K6 and K10 screening scales for psychological distress in the Australian National Survey of Mental Health and Well-Being. *Psychol Med.* 2003;33:357–362.
25. Kuorinka I, Jonsson B, Kilbom A, et al. Standardized Nordic Questionnaires for the analysis of musculoskeletal symptoms. *Appl Ergon.* 1987;18:233–237.
26. Sheehan DV, Lecrubier Y, Sheehan KH, et al. The Mini-International Neuropsychiatric Interview (M.I.N.I.): the development and validation of a structured diagnostic psychiatric interview for *DSM-IV* and *ICD-10*. *J Clin Psychiatry.* 1998;59(suppl 20):22–33;quiz 34–57.
27. Sheehan DV, Lecrubier Y, Sheehan KH, et al. The validity of the Mini International Neuropsychiatric Interview (MINI) according to the SCID-P and its reliability. *Eur Psychiatry.* 1997;12:232–241.
28. Kessler RC, McGonagle KA, Zhao S, et al. Lifetime and 12-month prevalence of *DSM-III-R* psychiatric disorders in the United States: results from the National Comorbidity Survey. *Arch Gen Psychiatry.* 1994;51:8.
29. Blair-West GW, Cantor CH, Mellsop GW, Eyeson-Annan ML. Lifetime suicide risk in major depression: sex and age determinants. *J Affect Disord.* 1999;55:171–178.
30. Gullestrup J, Lequertier B, Martin G. MATES in construction: impact of a multimodal, community-based program for suicide prevention in the construction industry. *Int J Environ Res Public Health.* 2011;8:4180–4196.
31. Dhossche DM, Meloukheia AM, Chakravorty S. The association of suicide attempts and comorbid depression and substance abuse in psychiatric consultation patients. *Gen Hosp Psychiatry.* 2000;22:281–288.
32. Hoogendoorn WE, van Poppel MN, Bongers PM, Koes BW, Bouter LM. Systematic review of psychosocial factors at work and private life as risk factors for back pain. *Spine.* 2000;25:2114–2125.
33. Reme SE, Tangen T, Moe T, Eriksen HR. Prevalence of psychiatric disorders in sick listed chronic low back pain patients. *Eur J Pain.* 2011;15:1075–1080.
34. Nicholas MK, Linton SJ, Watson PJ, Main CJ. Early identification and management of psychological risk factors (yellow flags) in patients with low back pain: a reappraisal. *Phys Ther.* 2011;91:737–753.
35. Turk DC, Okifuji A. Psychological factors in chronic pain: evolution and revolution. *J Consul Clin Psychol.* 2002;70:678–690.

36. van Rijn RM, Huisstede BM, Koes BW, Burdorf A. Associations between work-related factors and specific disorders of the shoulder—a systematic review of the literature. *Scand J Work Environ Health.* 2010;36: 189–201.
37. Van Der Windt DA, Kuijpers T, Jellema P, Van Der Heijden GJ, Bouter LM. Do psychological factors predict outcome in both low-back pain and shoulder pain? *Ann Rheum Dis.* 2007;66:313–319.
38. Choi SD. A study of trade-specific occupational ergonomics considerations in the U.S. construction industry. *Work.* 2012;42:215–222.
39. Choi SD. Safety and ergonomic considerations for an aging workforce in the US construction industry. *Work.* 2009;33:307–315.
40. Verbeek JH, Martimo KP, Kuijer PPFM, Karppinen J, Viikari-Juntura E, Takala EP. Proper manual handling techniques to prevent low back pain, a Cochrane systematic review. *Work.* 2012;41:2299–2301.
41. Main CJ, Kendall NAS, Hasenbring MI. Screening of psychosocial risk factors (yellow flags) for chronic back pain and disability. *From Acute to Chronic Back Pain: Risk Factors, Mechanisms, and Clinical Implications*. Oxford University Press; 2012:203.
42. Krieger N, Kaddour A, Koenen K, et al. Occupational, social, and relationship hazards and psychological distress among low-income workers: implications of the 'inverse hazard law'. *J Epidemiol Community Health.* 2011;65:260—2s72.

