Scandinavian Journal of Public Health

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To cite this Article: Ostry, Aleck, Maggi, Stefania, Tansey, James, Dunn, James, Hershler, Ruth, Chen, Lisa, Louie, A. M. and Hertzman, Clyde, 'The impact of psychosocial work conditions on attempted and completed suicide among western Canadian sawmill workers', Scandinavian Journal of Public Health, 35:3, 265 - 271

URL: http://dx.doi.org/10.1080/14034940601048091

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ORIGINAL ARTICLE

The impact of psychosocial work conditions on attempted and completed suicide among western Canadian sawmill workers

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Abstract

Background: Using a large cohort of western Canadian sawmill workers (n=28,794), the association between psychosocial work conditions and attempted and completed suicide was investigated. Methods: Records of attempted and completed suicide were accessed through a provincial hospital discharge registry to identify cases that were then matched using a nested case control method. Psychosocial work conditions were estimated by expert raters using the demand–control model. Univariate and multivariate conditional logistic regression was used to estimate the association between work conditions and suicide. Results: In multivariate models, controlling for sociodemographic (marital status, ethnicity) and occupational confounders (job mobility and duration), low psychological demand was associated with increased odds for completed suicide, and low social support was associated with increased odds for attempted suicides. Conclusions: This study indicates that workers with poor psychosocial working conditions may be at increased risk of both attempted and completed suicide.

Key Words: Attempted suicide, Canada, completed suicide, psychosocial work conditions, sawmill workers

Introduction

National suicide rates differ widely. They tend to be higher in industrialized developed nations and, in Europe, the highest suicide rates are found in Russia and the Baltic states. Nordic and Eastern European countries also have somewhat higher suicide rates, while the southern parts of Europe have comparatively low rates. America and Asia generally have lower rates than most of the European countries [1].

While in many industrialized countries suicide is one of the three leading causes of death among young adults, recent investigations on suicide have focused mainly on adolescents and the elderly [1]. However, the risk of suicide peaks at ages 45 to 54 (declining at ages 55 to 74, and increasing again at ages over 75), both in Canada and worldwide, indicating that working-age populations are at risk of suicide [2,3].

In some nations suicide rates among employed working-age populations are increasing [5,6]. For example, in Japan, in 1999, sharp increases in the suicide rate occurred particularly among men in their forties and fifties and these appear mainly to have been due to “economic reasons” [6]. In Japan, the links between overwork [7] and suicide (karōjisatsu – work-related suicide) [8] have been investigated mainly among employed men.

For example, in a recent investigation Amagasa and colleagues [8] analyzed 22 insurance and legal reports filed by psychiatrists on employee suicides that were related to heavy workloads. Contributing causes in most of these suicides, as determined by consensus of a clinical epidemiologist and two psychiatrists, included: experience of personnel changes (19 cases), such as a promotion or transfer, low social support (18), high psychological demand (18), low decision latitude (17), and long working hours (19) cases. The authors

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(Accepted 4 October 2006)

ISSN 1403-4948 print/ISSN 1651-1905 online/07/030265-7 © 2007 Taylor & Francis
DOI: 10.1080/14034940601048091
concluded that long working hours, heavy workloads, and low social support may cause depression, which can lead to suicide.

While job strain was not implicated in suicides in this rather small-scale study, in a comprehensive review of the causes of karoshi ("death from overwork") in Japan, Nishiyama and Johnson [7] postulated job strain as the primary cause. However, despite these suggestive Japanese findings as well as strong evidence highlighting the link between unemployment and suicide, particularly among men [4,9–22], few studies have investigated the link between working conditions and suicide among employed workers [23–28].

Only one prospective cohort study has investigated the relationship between psychosocial work conditions and suicide [2]). In this study, a large US cohort of female nurses (n=94,110) was followed up for 14 years and their self-reported stress at work and at home was estimated using a four-point scale: minimal, light, high, and severe. After adjustment for age, smoking, coffee consumption, alcohol intake, and marital status, relative risks (RR) were elevated among women reporting both severe work stress (RR=1.9, 95% CI 0.8–4.7), and high exposure to both home and work stress demonstrated statistically significant positive association with completed suicide (RR=4.9, 95% CI 1.4–17.0).

The hypothesis that psychosocial working conditions are a significant determinant of health (including mental health), has been investigated using Robert Karasek's demand–control model [3,4]. According to this model, people who perform jobs with high psychological demand and low control (high-strain jobs) are more likely to develop symptoms of psychological stress than those working in jobs with low demand and high control. As well, according to Karasek’s model, workers exposed to low psychological demand and low control (so-called passive jobs) are at particular risk of developing a sense of learned hopelessness, which is one of the strongest predictors of completed suicide [29–31].

The purpose of this investigation was to extend the applications of the demand–control model to a study of the association between psychosocial working conditions in a cohort of Western Canadian sawmill workers in relation to attempted and completed suicide. Specifically, we tested the hypothesis that sawmill workers in jobs with low control and low psychological demand were at the greatest risk of attempted and completed suicide.

Material and methods

Participants

This study is based on a cohort of male sawmill workers for whom we have obtained data on history of unemployment, job mobility, psychosocial work conditions, health outcomes, and death records. The cohort was gathered, originally, in 1988 in order to conduct an occupational study on the effects of chlorophenol anti-sapstain exposure among British Columbia sawmill workers. Fourteen medium to large size (150–450 workers each) sawmills located mainly in British Columbian coastal communities were identified.

For the original study, research assistants screened personnel records (i.e. the file for each employee that contained personal information – such as birth date, marital status etc. – and a record of job start and end dates and job titles held while working at the mill) at each of the study mills to identify workers employed, for at least one year, in one of these mills at any time between 1950 and 1988. This cohort was updated in 1998 to extend work histories for cohort members and to add new cohort members who were hired between 1988 and 1998. A cohort of 28,794 male workers was enumerated consisting of eligible cohort members who worked at a study mill between 1950 and 1998. Personal identifying information for eligible workers (i.e. names, social insurance numbers, date of birth) and complete job-history records (consisting of job title and start and end dates for each job held by each worker) were abstracted from personnel records. A complete description of methods used to assemble this cohort can be found in Hertzman et al. [29].

From personnel records, we obtained age, marital status (at time of hiring), and ethnic status (classified as Caucasian, Sikh, or Chinese), duration of employment at a study mill, occupational status (manager, tradesman, skilled worker, unskilled worker), and number of episodes of unemployment. At each job change, mobility was characterized as upward, downward, or stable depending on whether the new job was respectively for more pay, less pay, or the same pay as the previous job.

Exposure variables

A shortened version of Karasek’s Job Content Questionnaire (JCQ) [30] was used to measure exposure in terms of control, psychological demand, physical demand, and co-worker social support (see Appendix). Retrospective estimates of job control, demands, noise, and social support were obtained in two ways:
1. Four job evaluators (two union and two management) with over 35 years’ experience in the BC sawmill industry completed a shortened version of Karasek’s Job Content Questionnaire (JCQ) retrospectively estimating all basic job titles in the sawmill industry prior to 1975 (for a complete description of these methods see Ostry et al. [31]).

2. A panel of senior workers in each study sawmill was randomly selected and asked to complete the shortened version of the JCQ for basic job titles in their sawmill for the time periods 1975 to 1985, and 1985 to 1998 (for a complete description of these methods see Ostry et al. [32]).

Estimates from job evaluators (for the period prior to 1975) and senior workers (for the period between 1975 and 1998) for control, psychological demand, physical demand, social support, and noise were then linked to the job history database in the sawmill cohort. In addition, exposure in terms of job mobility, unemployment experience, and exposure to control, psychological demand, physical demand, social support, and noise was determined for each year a worker was employed at a study sawmill. Exposures were based on the job title held at a given time by a worker and so were linked to the job history file for each worker on the basis of his job title.

**Outcome variables**

The cohort of 28,794 sawmill workers with information on work stress obtained by job evaluators and senior workers was probabilistically linked to the British Columbia Linked Health Database (BCLHDB) [30]. The BCLHDB consists of person-specific, longitudinal records on all residents of British Columbia. These files contain data on physician services, hospital discharges, drug prescriptions, long-term care services, mental health client registry, Work Compensation Board records, income assistance records, cancer incidence, deaths, cause of death, and births from 1985 to the present. The records are housed at the University of British Columbia’s Center for Health Services and Policy Research (CHSPR) and are managed jointly by the Center, the University, and the Ministry of Health. A Data Access Subcommittee consisting of health ministry personnel, staff from the BC Ministry of Information and Privacy, and CHSPR has been established to handle requests for linkage to the BCLHDB and to ensure that such requests meet scientific and ethical standards, are in the public interest, and conform with British Columbia’s Freedom on Information and Protection of Privacy Act. Each file is stored separately but has been indexed with an individual service-recipient-specific code so that the records of groups of individuals can be linked across files for specific research projects.

In British Columbia, complete hospital discharge records are available through the BCLHDB, including ICD9 codes for each diagnosis. A suicide case was defined as anyone with a hospital discharge or death record coded with ICD9 codes 950 to 950.9. We divided suicide cases into two dependent variables: suicide attempts (one or more) and completed suicides. From the hospital discharge database we were able to identify any suicide case (completed and attempted) that occurred between 1 January 1985 and 31 March 2001.

Between 1952 and 1985, 162 cohort members completed suicide and between 1985 and 2001, 127 workers attempted suicide. Sociodemographic and occupational characteristics of completed and attempted suicide cases and controls are given in Table I.

**Analysis**

Cases were identified from the cohort of 28,784 sawmill workers for each completed suicide and each attempted suicide. Using STTOCC (survival-time to case-control) on STATA 8.0, three controls were selected for each case matched on age. Controls were chosen randomly with replacement from the set at risk that comprised all the members of the cohort who worked in a study sawmill for at least one year. Thus, a control could be anyone at risk who also satisfied the above matching criteria.

Statistical analyses were conducted using conditional logistic regression on STATA 8.0. First, we conducted univariate analyses for each of the two outcomes: attempted and completed suicide. The purpose of these univariate models was to identify associations between duration of employment, number of episodes of unemployment, job mobility, control (i.e. decision latitude), psychological demand, physical demand, social support, and noise, and attempted and completed suicide.

Second, multivariate models were developed controlling for marital status, ethnicity, duration of employment at a study sawmill, and occupational status.

**Results**

Results from the univariate models show no association between marital status, ethnicity, job mobility,
duration of employment, type of occupation, physical demand, noise, and attempted suicide. However, duration of employment, job mobility, and type of occupation were significantly associated with completed suicide. In addition, control and psychological demand were significantly associated with both attempted and completed suicide, while social support was associated only with attempted suicide (Table II).

Results from the multivariate analysis show that after controlling for marital status, ethnicity, duration of employment at a study sawmill, job mobility, and occupational status, low psychological demand was associated with greater odds for completed suicide and low social support was associated with greater odds for attempted suicide (Table III).

Discussion

This study suggests that, after controlling for potential sociodemographic and occupational

duration of employment at a study sawmill, type of occupation, physi-

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Discussion

This study suggests that, after controlling for potential sociodemographic and occupational

Table I. Sociodemographic and occupational characteristics of cases and controls.

<table>
<thead>
<tr>
<th></th>
<th>Completed suicide</th>
<th></th>
<th>Attempted suicide</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Case n=162</td>
<td>Control n=486</td>
<td>Case n=127</td>
<td>Control n=381</td>
</tr>
<tr>
<td>Marital status (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unmarried</td>
<td>36</td>
<td>46.3</td>
<td>34.1</td>
<td>34.4</td>
</tr>
<tr>
<td>Married</td>
<td>64</td>
<td>53.7</td>
<td>55.9</td>
<td>56.0</td>
</tr>
<tr>
<td>Unstated</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>9.6</td>
</tr>
<tr>
<td>Ethnicity (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>92</td>
<td>93.9</td>
<td>93.1</td>
<td>93.3</td>
</tr>
<tr>
<td>Sikh</td>
<td>5.7</td>
<td>5.5</td>
<td>6.2</td>
<td>6.1</td>
</tr>
<tr>
<td>Chinese/Other Asian</td>
<td>2.3</td>
<td>.6</td>
<td>.7</td>
<td>.6</td>
</tr>
<tr>
<td>Occupational status at time of event (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager</td>
<td>5.3</td>
<td>1.2</td>
<td>4.4</td>
<td>2.2</td>
</tr>
<tr>
<td>Tradesman</td>
<td>23.6</td>
<td>22.7</td>
<td>21.3</td>
<td>17.2</td>
</tr>
<tr>
<td>Skilled</td>
<td>17.2</td>
<td>12.3</td>
<td>17.8</td>
<td>21.1</td>
</tr>
<tr>
<td>Unskilled</td>
<td>53.9</td>
<td>63.8</td>
<td>56.5</td>
<td>59.5</td>
</tr>
<tr>
<td>Average duration (years) of employment at a study sawmill (mean (SD))</td>
<td>6.9 (6.98)</td>
<td>5.5 (5.8)</td>
<td>7.5 (7.4)</td>
<td>6.5 (6.8)</td>
</tr>
</tbody>
</table>

Table II. Univariate results for attempted and completed suicides. (OR (95% CI) (p-value))*

<table>
<thead>
<tr>
<th></th>
<th>Completed suicide</th>
<th>Attempted suicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marital status a</td>
<td>0.97 (0.90, 1.06) (0.54)</td>
<td>0.98 (0.91, 1.06) (0.63)</td>
</tr>
<tr>
<td>Ethnicity b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sikh</td>
<td>0.97 (0.45,2.08) (0.96)</td>
<td>1.27 (0.68,2.36) (0.46)</td>
</tr>
<tr>
<td>Chinese</td>
<td>0.27 (0.03,2.11) (0.21)</td>
<td>0.43 (0.05,3.48) (0.43)</td>
</tr>
<tr>
<td>Occupational status at time of event c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tradesman</td>
<td>4.79 (1.04,21.99) (0.04)</td>
<td>0.76 (0.50,1.16) (0.20)</td>
</tr>
<tr>
<td>Skilled</td>
<td>3.62 (0.76,17.24) (0.11)</td>
<td>1.14 (0.77,1.69) (0.51)</td>
</tr>
<tr>
<td>Unskilled</td>
<td>6.17 (1.87,27.77) (0.02)</td>
<td>1.21 (0.87,1.68) (0.25)</td>
</tr>
<tr>
<td>Average duration (years) of employment at sawmill</td>
<td>0.95 (0.92,0.99) (0.01)</td>
<td>0.98 (0.95,1.00) (0.07)</td>
</tr>
<tr>
<td>Job mobility while employed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>0.64 (0.46,0.91) (0.01)</td>
<td>1.04 (0.77,1.42) (0.78)</td>
</tr>
<tr>
<td>Psychological demand</td>
<td>0.95 (0.90,1.00) (0.04)</td>
<td>0.96 (0.92,0.99) (0.03)</td>
</tr>
<tr>
<td>Physical demand</td>
<td>0.76 (0.67,0.85) (0.00)</td>
<td>0.90 (0.83,0.97) (0.01)</td>
</tr>
<tr>
<td>Social support</td>
<td>1.04 (0.73,1.50) (0.80)</td>
<td>0.89 (0.66,1.21) (0.46)</td>
</tr>
<tr>
<td>Noise</td>
<td>0.92 (0.75,1.13) (0.42)</td>
<td>0.84 (0.72,0.99) (0.04)</td>
</tr>
</tbody>
</table>

*aMarried=referent; bCaucasian=referent; cmanager=referent.
*p value bolded if statistically significant (<0.05).
confounders, low psychological demand was associated with increased odds for completed suicide among this cohort of sawmill workers. As well, low social support was associated with increased odds for attempted suicide.

The fact that two different aspects of the psychosocial working conditions are associated with attempted and completed suicide suggests that there may be different risk factors associated with attempted suicide and completed suicide.

The results of the present study help understand what specific working conditions may be associated with suicidal behaviors and contribute to the development of a theoretical framework explaining attempted and completed suicide. For example, we found that the lack of social support at the workplace was a risk factor for attempted suicide among male sawmill workers. However, lack of social support was not found to be a risk factor for completed suicide, which was instead associated with low levels of psychological demand.

The members of this sawmill worker cohort had to be employed for at least one year so that the most transient sawmill workers were excluded from the study. Nonetheless, some cohort members were employed consistently whereas others experienced periodic layoff and re-hiring at the study mills. Univariate analysis from this study indicated that those workers who experienced more periodic layoffs (i.e. those who were less well attached to the study sawmill workforce) had a greater risk of completed suicide but not of attempted suicide. This result is consistent with the literature, where unemployment is consistently found as a risk factor for suicide. It is possible that periodic layoffs (i.e. short but repeated periods of unemployment) may contribute significantly to the "cumulative burden" among vulnerable individuals, which, in conjunction with low psychological demand, could lead them to extreme suicidal behaviors such as completed suicide.

The findings of this study and the proposed explanation are in apparent contrast with the emerging literature on karoshi, which has raised the possibility that high psychological demands, resulting from lean production methods, may be associated with death from overwork, including suicides, in Japan. However, it can also be hypothesized that both low psychological demand and high psychological demand at the workplace are risk factors for completed suicide. This hypothesis is supported by the study that found a "U-shaped" association between severe work stress and minimal work stress and suicide among US nurses [28].

The strengths of this investigation include the rigorous longitudinal study design, and the use of objective measures of both the exposure and outcome variables. On the other hand, the results cannot be generalized to a female population, or a population with different demographic and occupational characteristics. An additional limitation arises because of the potential for exposure misclassification from the retrospective and objectively assessed exposures. This latter limitation would probably have attenuated any association between exposure and outcomes so that the results obtained in this investigation may in fact be an under-estimation of the relationship between psychosocial work exposures and these suicide outcomes. As well, the correlation between indirectly assessed and self-reported working conditions is much better for blue-collar workers than for white-collar workers, which may reduce the potential to apply these indirect assessment methods to white-collar workforces.

In summary, the results from the present study indicate that psychosocial working conditions may be important risk factors contributing to suicidal behaviors. Results from the present study also indicate that different psychosocial work conditions may be associated with attempted and completed suicide.
Acknowledgments

The authors gratefully acknowledge the Canadian Population Health Initiative for their funding for this project. Acknowledgment is also made to the Canadian Institute of Health Research and Michael Smith Foundation for Health Research for Dr Ostry’s salary support, and to the Canadian Institute of Health Research for Dr Maggi’s New Investigator Award.

References

Appendix: Thirteen-item questionnaire
(Raters responded to the 13 statements with one of the following answers. Strongly disagree, disagree, agree, strongly agree.)

(A) Items measuring control
1. The job required learning new things.
2. The job involved a lot of repetitive work.
3. The job required a high level of skill.
4. The job had a variety of tasks.
5. The worker had a lot to say about what happened on the job.
6. On this job, the worker had a lot of freedom to decide how to do the work.

(B) Items measuring psychological demands
7. The job did not involve an excessive amount of work.
8. The worker had enough time to get the job done.
9. The job was free from conflicting demands.

(C) Item measuring physical demand
10. The job required lots of physical effort.

(D) Items measuring co-worker social support
11. The worker could leave this job to talk with co-workers.
12. The worker could interact with co-workers while they worked.

(E) Item measuring noise
13. The job was noisy.