Occupational Medicine 2005;**55**:66–68
doi:10.1093/occmed/kqi020

SHORT REPORT

Unusual job activities as a risk factor for occupational injuries

Gerald McGwin Jr[1,2,3], Allison J. Taylor[2,3], Paul A. MacLennan[3] and Loring W. Rue III[1,3]

Background Based upon our clinical observation, many job-related injuries occur as a consequence of workers performing a task or engaging in an activity for which they have not been trained.

Methods A case-crossover study was used to evaluate unusual job tasks, unusual tools and unusual work locations as triggers for occupational injuries. Data on work activities on the day of the injury and 7 days prior to injury were collected via in-person interview.

Results All the 33 subjects enrolled were male, 23 were white and 10 were black, with a mean age of 34.9 years. The most common mechanisms of injury were falls and burns. The most common injuries were fractures and closed head injuries. Unusual job tasks [odds ratio (OR) 27.0, 95% confidence interval (CI) 3.1–235.3] and unusual tools (OR 13.3, 95% CI 1.4–125.4) were associated with the injury.

Conclusions Workers should be extra cautious and they should be provided with training for new tasks and new tools.

Introduction

Based upon our clinical observations and prior research, many job-related injuries occur as a consequence of workers performing tasks for which they have not been trained. This observation is supported by a limited research [1–3,7], most of which had focused on a single type of injury (i.e. hand). The question remains as to whether unusual work tasks are associated with other types of injuries.

The purpose of this study was to evaluate the feasibility of conducting a case-crossover study at an academic trauma and burn centre and in doing so to investigate associations between workplace injuries and performing unusual activities, working in unusual locations, and using unusual tools, including tools that are defective or malfunctioning.

[1]Section of Trauma, Burns, and Surgical Critical Care, Division of General Surgery, Department of Surgery, School of Medicine, University of Alabama at Birmingham, Birmingham, AL, USA.

[2]Department of Epidemiology and International Health, School of Public Health, University of Alabama at Birmingham, Birmingham, AL.

[3]Center for Injury Sciences at the University of Alabama at Birmingham, Birmingham, AL.

Correspondence to: Dr Gerald McGwin Jr, Center for Injury Sciences, 120 Kracke Building, 1922 7th Avenue South, University of Alabama at Birmingham, Birmingham, AL 35294-0016, USA. Tel: +205 975 3030; fax: +205 975 3040; e-mail: mcgwin@uab.edu

Methods

A case-crossover design was chosen to evaluate unusual job tasks as a risk factor for occupational injury, as the exposures of interest are transient in nature. In a case-crossover design, cases serve as their own control, with risk factors of interest measured coincident with the occurrence of the outcome of interest (case), as well as at a time or times in the past when the same outcome of interest had not occurred (control) [4,5]. Patients admitted to the Trauma and Burn Centers at the University of Alabama at Birmingham (UAB) between July and November of 2001 for injuries sustained in the course of their employment were eligible for enrolment in the study. The Institutional Review Board of the institution approved the study protocol, questionnaire and consent form. Informed consent was obtained at the time of the interview.

The hazard period was considered to be the exact moment of the injury and the 15 min preceding it. Control periods were each day of the prior seven calendar days on which the subject was engaged in employment. Therefore, the number of control periods per subject varied depending on the number of days worked during the preceding 7 days. Information was collected for all work activities on the day of injury and each of the 7 days prior to injury, including whether any activities, tasks,

tools or work locations were considered 'unusual'. Each subject was queried as to what work task he (all subjects were male) was performing at the time of injury, whether that was one of the work tasks he usually performs and whether there was anything different or unusual about the way he was doing the task at the time of injury. In addition to these questions specific to the time of injury, information was collected from each subject on each task performed on the day of injury and on the seven preceding days. For each task, the subject was asked whether or not it was unusual. Each subject was then asked to specify, which, if any, of the tasks performed that day was performed by using an unusual tool or material or in an unusual location.

Conditional logistic regression was used to calculate odds ratios (ORs) with 95% confidence intervals (CIs) and accompanying *P*-values for the risk of injury associated with unusual work tasks, unusual tools and unusual work locations. Using this approach, work days prior to the day on which the subject was injured (i.e. hazard period) are treated as controls; thus, each individual serves as their own control. The analytical approach compares the likelihood of unusual work tasks, unusual tools and unusual work locations during the hazard period to the control periods.

Results

During the study period a total of 848 patients were admitted to the Trauma and Burn Centers at UAB, of which 52 patients sustained injuries while at work and 33 patients were enrolled in the study. Of the subjects not enrolled, 13 were discharged from the hospital before they could be interviewed, five refused, and for one subject the questionnaire was not sufficiently complete for study inclusion. With respect to age, gender, race and injury severity, subjects who were and were not enrolled in the study were similar. The 33 injured patients (cases) contributed 155 control time periods, representing an average of 4.9 non-injury (control) time periods for each case (range 2–7). Of the 33 enrolled subjects, 23 were white and 10 were black, with a mean age of 34.9 years. All the subjects were male. The occupations represented were diverse, with two subjects each who were pipe fitters, steel furnace operators, roofers, cable television technicians, roofers and truck drivers. Four subjects were laborers. Each of the other subjects were engaged in different occupations. Among the diverse industries represented were steel, automotive repair, chemicals, oil refining, mining, construction and textile manufacture. The most common mechanisms of injury were falls from height (41%) and burns (18%) and electrical injuries (15%). Fractures, burns and closed head injuries were the most common injuries.

The frequency of primary exposures during case and control time periods are presented in Table 1. Performing an unusual job task was associated with a significantly increased risk of being injured on the job (OR 27.0, 95% CI 3.1–235.3, $P = 0.003$). Similarly, the use of a tool that was unusual, performed differently (e.g. broken, malfunctioning), or was shaped differently from the subjects' usual tools was also associated with a significantly increased risk of injury (OR 13.3, 95% CI 1.4–125.4, $P = 0.02$). There were insufficient data to evaluate unusual location as a risk factor.

Discussion

This study demonstrated a highly elevated risk of injury associated with the performance of an unusual job task. Few studies have addressed unusual job tasks as a risk factor for occupational injury; however, the studies by Hertz and Emmett [2] and by Sorock *et al.* [3,7] found significant associations between the unusual job tasks and the hand injuries. Saari and Lahtela reported that in studies of three industries in Finland, more than half the injuries occurred in the course of tasks performed less than once per day [1].

This study has several strengths and limitations. The case-crossover design allowed cases to serve as their own controls. This was particularly advantageous, because the study subjects were not limited to a particular occupation or type of injury. The subjects' inability to recall accurately the timing, frequency and duration of transient exposures may result in recall bias [5] that may in turn result in overestimating exposures to transient risks immediately prior to the injury and a risk of underestimating exposure during control periods [6]. Additionally, it was not always possible to interview subjects immediately following injury and the possibility of recall bias increased as interviews were further removed in time from the injurious event. This may have compromised subjects' ability to recall accurately unusual tasks, tools and locations during the control period that would bias results away from the null. All but six were interviewed within 4 days; however, three subjects were interviewed 50 days or more after admission. When the analyses were run excluding these subjects, the results were largely unchanged. Subjects who were not enrolled in the study, either because they

Table 1. Frequency of primary exposures

	Case ($n = 33$)	Control ($n = 155$)
Unusual task, *n* (%)	5 (15.2)	1 (0.7)
Unusual tool, *n* (%)	4 (12.1)	2 (1.3)
Unusual location, *n* (%)	2 (6.2)	0 (0.0)

refused the interview or were discharged from the hospital before an interview could be conducted, were similar to those enrolled and thus selection bias is unlikely. Finally, the small sample size represents an important limitation of this study primarily due to its impact on the precision of our measures of association. However, the lower bound of both 95% CIs indicate the presence of an association that is at least moderate in strength.

The purpose of this study was two-fold; to evaluate the feasibility of conducting a study of this nature in the setting of a trauma and burn center and to investigate the relationship between the workplace injuries and the unusual job situations. With respect to the former, we believe a study of this type can be effectively conducted in such a setting. However, as noted above, specific emphasis should be placed on enrolling patients and collecting information prior to discharge. With respect to the latter purpose, consistent with prior work, the use of unusual job tasks and unusual tools represents an increased risk of injuries to workers.

Acknowledgements

The authors would like to thank Dr Gary Sorock *et al.* of Liberty Mutual Research Center for Safety and Health, Hopkinton, Massachusetts for providing the data collection instrument developed for use in their study of occupational hand injuries for use in developing the questionnaire used in this study [5].

References

1. Saari JD, Lahtela J. Work conditions and accidents in three industries. *Scand J Work Environ Health* 1981;**7:**97–105.
2. Hertz RP, Emmett EA. Risk factors for occupational hand injury. *J Occup Med* 1986;**18:**36–41.
3. Sorock G, Lombardi D, Hauser R, Eisen R, Herrick R, Mittleman M. A case-crossover study of occupational traumatic hand injury: methods and initial findings. *Am J Ind Med* 2001;**39:**171–179.
4. Maclure M. The case-crossover design: a method for studying transient effects on the risk of acute events. *Am J Epidemiol* 1991;**133:**144–153.
5. Sorock G, Lombardi D, Gabel C, Smith G, Mittleman M. Case-crossover studies of occupational trauma: methodological caveats. *Inj Prev* 2001;**7:**I38–I42.
6. Redelmeier D, Tbshirani R. Interpretation and bias in case-crossover studies. *J Clin Epidemiol* 1997;**50:**1281–1287.
7. Sorock GS, Lombardi DA, Hauser R, Eisen EA, Herrick RF, Mittleman MA. A case-crossover study of transient risk factors for occupational acute hand injury. *Occup Environ Med* 2004;**61:**305–311.