



Geographic variation in work injuries: a multilevel analysis of individual-level data and area-level factors within Canada

Sara Morassaei BSc^{a,*}, F. Curtis Breslin PhD^{a,b,c}, Selahadin A. Ibrahim MSc^a, Peter M. Smith PhD^{a,b,d}, Cameron A. Mustard ScD^{a,b}, Benjamin C. Amick III PhD^{a,e}, Ketan Shankardass PhD^{f,g}, Jeremy Petch PhD^h

^a Institute for Work & Health, Toronto, Ontario, Canada

^b Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada

^c School of English and Liberal Studies, Seneca College of Applied Arts and Technology, Toronto, Ontario, Canada

^d School of Public Health and Preventive Medicine, Monash University, Melbourne, Victoria, Australia

^e School of Public Health, University of Texas Health Science Center at Houston, Houston, Texas

^f Centre for Research on Inner City Health, St. Michael's Hospital, Toronto, Ontario, Canada

^g Department of Psychology, Wilfrid Laurier University, Waterloo, Ontario, Canada

^h Keenan Research Centre, Li Ka Shing Knowledge Institute, St. Michael's Hospital, Toronto, Ontario, Canada

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ABSTRACT

Purpose: This study sought to examine provincial variation in work injuries and to assess whether contextual factors are associated with geographic variation in work injuries.

Methods: Individual-level data from the 2003 and 2005 Canadian Community Health Survey was obtained for a representative sample of 89,541 Canadians aged 15 to 75 years old who reported working in the past 12 months. A multilevel regression model was conducted to identify geographic variation and contextual factors associated with the likelihood of reporting a medically attended work injury, while adjusting for demographic and work variables.

Results: Provincial differences in work injuries were observed, even after controlling for other risk factors. Workers in western provinces such as Saskatchewan (adjusted odds ratio [AOR], 1.30; 95% confidence interval [CI], 1.09–1.55), Alberta (AOR, 1.31; 95% CI, 1.13–1.51), and British Columbia (AOR, 1.46; 95% CI, 1.26–1.71) had a higher risk of work injuries compared with Ontario workers. Indicators of area-level material and social deprivation were not associated with work injury risk.

Conclusions: Provincial differences in work injuries suggest that broader factors acting as determinants of work injuries are operating across workplaces at a provincial level. Future research needs to identify the provincial determinants and whether similar large area-level factors are driving work injuries in other countries.

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Introduction

In Canada, workplace injury accounts for a substantial source of illness burden and disability in the working-age population [1]. Traditionally, risk of work injury is conceptualized to stem from a combination of individual (e.g., age, education, and gender) and work-related (e.g., hours worked, physical and psychological demands, and industry) factors [2,3].

The study of contextual effects on health outcomes, in which area-level factors influence health outcomes beyond the effects of individual-level factors, has become increasingly important in

public health research [4–6]. However, there has been relatively less interest in investigating contextual effects in the occupational injury field [7]. The potential benefits of understanding geographic differences that influence work injury rates are significant and can assist in planning prevention efforts that are more tailored to the needs of a region [8].

One way geographic variation in work injuries can occur is regions having a different sociodemographic composition (e.g., proportion of young workers or educational attainment) or be heavily made up of different types of jobs or industries [9]. For example, the industrial makeup in Canada's western provinces has historically led to a higher proportion of employment in the primary production sector in that region [3].

Geographic variation in work injury rates can also occur due to contextual factors [10]. At the provincial level, contextual factors that may influence work injury risk are the strength of occupational

* Corresponding author. Institute for Work & Health, 481 University Ave, Suite 800, Toronto, Ontario, Canada M5G 2E9. Tel.: +1 416 927 2027 ext. 2280; fax: +1 416 927 4167.

E-mail address: smorassaei@iwh.on.ca (S. Morassaei).

health and safety legislation [11]. Contextual factors also include the physical, social, and economic aspects of a geographic area [10], such as area-level material and social deprivation [12]. Material deprivation may, for instance, limit the capability of local businesses to invest in safer equipment, and social deprivation may, for instance, create a weak safety culture or lack of adherence to safety practices, which can influence work injury rates [12].

Previous research has found geographic variation in work injuries, even after differences expected to influence risk for work injury across regions, such as occupation or industry hazard, were controlled [7,13–15]. Furthermore, one study found that greater area residential stability was associated with regional variation in claim rates of young workers in Ontario [15].

The purpose of the present study was to examine geographic variation in work injuries among Canadian workers and to assess whether individual-level and area-level factors are associated with that variation. The study hypothesis is that some portion of any geographic variation in work injury is due to compositional differences, such as a different mix of workers or hazardous industries from area to area. While a second source of variation, after controlling for compositional differences, is the presence of contextual factors. Thus, this study had three objectives: (1) to examine provincial differences in work injuries; (2) to assess whether geographic variation remained after controlling for individual-level factors, such as sociodemographic and work-related characteristics; and (3) to determine whether contextual factors, such as a region's material and social deprivation, are associated with geographic variation in work injuries.

Methods

Data source and sample

This study used data from the Canadian Community Health Survey (CCHS), an ongoing series of cross-sectional surveys that provide demographic and health information at a subprovincial level [16]. The target population is household residents aged 12 years and older living in private dwellings in Canada. People living on Indian reserves or Crown lands, residents of institutions, full-time members of the Canadian Armed Forces, and residents of certain remote regions were excluded from the sampling frame [16]. The surveys used a multistaged, stratified sampling frame, and computer-assisted personal and telephone interviews were used to obtain informed consent and conduct interviews [16].

The CCHS cycle 2.1 was completed between January and December 2003, sampling a total of 135,573 respondents from 144,836 households with an overall person-level response rate of 92.6% [16]. This study also included a subsample from the CCHS cycle 3.1, which was completed between January 2005 and December 2005 [17]. Relevant labor market questions were only administered to one-third of this sample; therefore, only those 32,153 respondents from cycle 3.1 were included in the analyses. The CCHS cycle 3.1 had an overall person-level response rate of 92.9% [17]. This study was approved by the University of Toronto Research Ethics Board, Health Sciences Committee.

Samples obtained from the CCHS cycles 2.1 and 3.1 were combined to increase power to detect effects and the reliability of regional estimates. Guidelines provided by Statistics Canada on pooling across surveys to account for survey design were followed [18]. Accordingly, it is unlikely that a respondent would be represented in both surveys because these surveys were sampled independently. As well, labor market growth in Canada was relatively steady from 2003 to 2005; therefore, surveys are being combined over a stable period [19].

The study sample was restricted to respondents aged 15 to 75 years who had worked in the previous 12 months. This sample consisted of 99,556 respondents (59.4% of the total). Furthermore, 3923 from Canadian territories were excluded due to the small number of respondents. Another 6092 were missing information on one or more of the predictor variables, leaving a total of 89,541 respondents for analysis.

Measures

Outcome: work injury

Respondents were asked if they had been injured in the previous 12 months seriously enough to limit their normal activities. They were further asked if that injury occurred in the workplace and whether they had received medical attention. They were instructed not to report repetitive strain injuries. Examples of repetitive strain injuries provided to respondents were carpal tunnel syndrome, tennis elbow, or tendonitis.

Covariates

Sociodemographic variables

Covariates included a range of sociodemographic variables. Gender was classified as male or female. Age was derived from date of birth. Education was based on the highest level of educational attainment completed. Marital status was categorized as married or cohabitating versus single, divorced, or widowed. Immigrant status was categorized into less than 5 years in Canada, more than 5 years in Canada, or Canadian-born. Ability to converse fluently in English or French, Canada's two official languages, was also included. Visible minority status was derived from questions about cultural and racial backgrounds and then aggregated into two categories: white or visible minority (other). An indicator of whether the respondent lived in a rural or suburban versus urban environment was also included. Statistics Canada defines urban as a "population concentration of 1000 or more and population density of 400 or more per kilometer" [20].

Work characteristics

Each respondent was asked about the position they considered their main job. Respondents reported whether they worked full time (>30 h/wk) or part-time, the number of weeks worked in the previous 12 months, and whether they were self-employed. Industrial grouping was derived from respondents reporting what

Table 1

Principal components analysis with three factors as census division-level predictors of area-level material deprivation, social capital, and labor market factors of Canadian provinces

| Variables* | Factor 1 | Factor 2 | Factor 3 |
|--|--------------|--------------|--------------|
| % Movers in past 5 y (residential stability) | 0.92 | — | — |
| % Rent or mortgage >30% of salary | 0.80 | 0.36 | — |
| Average household income | 0.69 | — | — |
| % Residents with less than high-school education | -0.73 | — | — |
| Unemployment rate | — | 0.84 | — |
| Unemployed for more than 26 wk | — | 0.75 | — |
| % Residents who are lone parents | 0.38 | 0.74 | — |
| % Residents with permanent jobs | — | -0.66 | — |
| Employed in workplaces with <100 employees | — | — | 0.82 |
| Employed in firms with <100 employees | — | — | 0.76 |
| % Residents with weak sense of community belonging | — | — | -0.48 |
| % Residents part of union or collective agreement | -0.43 | — | -0.85 |

Variance explained by all three factors = 67%. Bold values indicate loading of >0.4 in absolute value.

* Variables are at the census division level gathered from the 2001 Canadian Census, the 2003–2005 Canadian Survey of Labour and Income Dynamics, and the 2003 and 2005 CCHS.

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