ORIGINAL ARTICLE

Young people and work injuries: an examination of jurisdictional variation within Canada

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Objective: The purpose of this study was to identify risk factors of work injuries among Canadian adolescents and young adults and to examine provincial differences in work injury rates.

Methods: Information on work and injuries were obtained from a representative sample of 14 541 Canadians aged 15–24 years. Respondents reported medically attended, work related injuries in the past 12 months, work hours, and type of occupation. A multivariate logistic regression on likelihood of work injury included demographic and work variables, as well as province of residence.

Results: Even when factors expected to vary by province such as occupation were statistically controlled, Saskatchewan youth were about twice as likely to be injured at work compared to Ontario youth. Type of job was a major correlate of injury risk, with all jobs showing higher risk than administrative clerical jobs. Even with type of job controlled, visible minorities, students, and 15–17 year olds had a reduced likelihood of work injury than their counterparts.

Conclusions: Many young Canadians sustain work injuries that have clear medical costs and potential long term health consequences. Individual level explanations for youth's increased risk for workplace injuries (for example, inexperience or developmental factors) need to be supplemented with a better understanding of the broader social, economic, and political factors across jurisdictions.

Work is a common part of the lives of most North American adolescents and young adults.¹ As a result of these work experiences, however, many will sustain a work injury.² For example, the lifetime prevalence of being injured while working a paid job for US teenagers aged 14–17 was 54%.³

Little is known about how much youth injury rates vary across regions with different occupational health and safety legislation and different industries. The purpose of this study was to examine variation in work injury rates across Canadian provinces and determine the extent to which any variation was due to individual and job factors.

The term young worker has been defined both narrowly and broadly. Policy makers and researchers, especially in the US, define young workers as those under 18 years old because child labor laws only apply to this age group.⁴ An alternative definition includes young adults up to 24 years old. This broad definition recognizes that many young adults are also just entering the labor market and are more likely than older adults to have a work injury.^{5–8} In this study, we used the latter definition.

Demographic characteristics are associated with work injury risk among young people. Young males sustain work injuries at about twice the rate of young females.⁹ Visible minorities in the service industry have higher rates of emergency department visits for work injuries than whites.¹⁰ Youth from low income families also hold hazardous jobs more often than youth from high income families.¹¹

Certain job characteristics place youth at higher risk for work injuries. Young workers in manual jobs (for example, stockhandlers, janitors/cleaners), jobs in the goods producing sectors (for example, agriculture, manufacturing, and construction), and food service jobs have higher work injury rates than youth in sales jobs or administrative/clerical jobs.^{9 12–14} Working longer hours is sometimes associated with injury risk,¹⁵ possibly due to fatigue or stress.¹⁶ These demographic and job related factors often cluster among

young workers, obscuring the relative contribution each makes to work injury risk.

Geographic variation in work injury rates can occur because regions may have demographically different subgroups of young workers and/or have different types of jobs/industries. For example, the industrial mix in the Atlantic and Western provinces leads Canadian teenagers and young adults to have slightly more jobs in the goods producing sector than in Ontario,¹⁷ though these age groups still tend to be concentrated in the sales and service sector across Canada. In addition, Canadians under 18 years old may exhibit regional differences in the jobs they hold because minimum age restrictions against hazardous jobs are a provincial responsibility, and these restrictions vary across province.¹⁸

Geographic variation can also occur due to contextual factors. Contextual factors refer to the physical, social, or economic aspects of a workplace, community, or region.¹⁹ In the present case, workplace and organizational factors may influence what hazards youth encounter, the quality of safety training, and how work is carried out. These contextual factors may include variation in the availability of work arrangements other than temporary employment, workplace size, and the extent of unionization.²⁰ Further, provincial variation in general occupational health and safety regulations and their enforcement would be a broader contextual factor that would be expected to exert its influence by shaping the incentives for firms to improve safety.^{21 22} Substantial geographic variation even after controlling for compositional differences raises the possibility of the presence of contextual factors.

One study of young worker injuries generally supports the notion that geographic variation in youth work injuries may be linked to contextual and/or compositional factors. In their regional analysis of working teenagers in Massachusetts, Brooks and Davis¹³ found that the lost time claim rate for this

Abbreviations: FTE, full time equivalent; SES, socioeconomic status.

age group was highest in the southeast region of the state. This region of the state also had a greater proportion of teenagers working in hazardous industries such as apparel manufacturing, lower per capita income, and higher unemployment than the state as a whole. These findings were descriptive, so it was unclear the extent to which the industrial mix of the region contributed to the elevated injury rates.

To examine provincial variation in work injuries among adolescents (that is, 15–17 years old) and young adults (that is, 18–24 years old), we used the Canadian Community Health Survey (CCHS). The survey's large, population based sample, uniform work injury questions, and occupational information offers the necessary provincial and individual level information for these analyses.

METHODS

Using a multistaged, stratified sampling frame, the CCHS targets individuals aged 12 years or older who are living in private dwellings within Canada.²³ The CCHS was completed between September 2000 and November, 2001, sampling a total of 130 827 respondents, from 125 159 households. The household response rate was 91.4%, and the selected person response rate was 91.9%.

For the purpose of the current analyses only respondents aged 15–24 years who had worked in the previous 12 months were selected ($n = 14\,894$), which was 80% of the total respondents 15–24 years of age. As only a small number of youth in the Northwest Territories were surveyed ($n = 321$), these respondents were removed. A further 32 respondents were missing information on one or more of the main predictor variables (occupation, hours of work in the last year, race, student status) and were deleted from the sample, leaving a study sample of 14 541 respondents.

Measures

Work injury

Respondents were asked if in the previous 12 months they had been injured seriously enough to limit their normal activities. Respondents who reported such an injury were then asked if they were working at a job or business (including travel to and from work) when this injury occurred, and if they received medical attention for this injury, from a health professional, within 48 hours of the injury. In cases where the respondent experienced two or more injuries that limited activities, respondents only reported on their most serious injury. Repetitive strain injuries were not included because the separate set of questions used to assess this type of injury did not ask whether the injury had been medically attended—our indicator of injury severity.

Only a portion of the injuries that working youth reported during the year were work injuries. Of the 14 541 adolescents and young adults who reported working, 2028 (14%) were injured badly enough in the past 12 months to visit a doctor, nurse, or hospital. Of these 2028 injuries, 25% occurred at work ($n = 511$).

With regard to mechanism of injury, respondents were asked if their injury was the result of a fall. Those respondents who reported their injury was not the result of a fall were then asked what caused their injury. Options included: (a) “transport accidents”; (b) “being accidentally bumped, pushed or bitten”; (c) “being accidentally struck or crushed by an object”; (d) “coming into contact with a sharp object, tool or machine”; (e) “accidental contact with a hot object, liquid or gas”; (f) “smoke, fire or flames”; (g) “extreme weather or natural disasters”; (h) “overexertion or strenuous movements”; (i) “physical assaults”; or (j) “causes not listed above”. Due to small sample sizes injury cause was

collapsed into four categories: fell/bumped/pushed/struck/crushed, “coming into contact with a sharp object, tool or machine”, “overexertion or strenuous movements”, and other causes which included “transport accidents”, “smoke, fire and flames”, “accidental contact with hot liquid or gas”, “extreme weather or natural disaster”, “physical assault”, and “causes not listed above”.

Age

Age was coded into two categories, adolescents (15–17 years old) and young adults (18–24 years old), with adolescents serving as the referent group. This age grouping was chosen because provincial age restrictions refer to people under 18 years old.

Gender

Gender was classified as male or female, with females serving as the referent group.

Province

Province was categorized based on the province of residence. Due to the low number of work injury events in some of the Atlantic provinces (that is, Labrador, Newfoundland, Nova Scotia), these provinces were combined.

Occupation

Each respondent was asked to select their current occupation from the following nine categories (management; professionals; technologist, technician, or technical occupation; administrative, financial, or clerical; sales or service; trades, transport, or equipment operator; farming, forestry, fishing, or mining; processing, manufacturing, or utilities; and other). Due to small sample sizes in some categories, we collapsed these responses into six categories.

Population density

Respondents were classified as living in urban or rural areas. Urban areas are defined as continuously built up areas having a population concentration of 1000 or more and a population density of 400 or more per square kilometer based on the 1996 Canadian Census.

Household socioeconomic status

Household income is a common indicator of social position for youth.²⁴ Based on information collected from all household members, the total household income was derived. Household income adequacy was defined on the basis of household income and household size.²⁵ This variable was dichotomized into either low income or middle/high income at both time points. For example, a household of 3–4 people where the total income was \$20,000 or less was defined as inadequate income or low family socioeconomic status (SES).

Race

Due to small sample sizes in certain subgroups, race was classified as white or visible minorities, which largely consisted of Black, Asian, and Aboriginal respondents.

School activity status

Respondents were classified into two categories for current school activity: (a) those attending school full time or part time; and (b) those not currently attending school.

Hours of work

Each respondent was asked to report the hours usually worked per week, and the number of weeks they had worked in the previous 12 months. We used respondents' reports of average hours worked per week and weeks worked in the past 12 months to calculate the proportion of a full time

Table 1 Background characteristics of working 15–24 year olds*

	Injuries (n)	Workers (n)	Rate/100 workers	Rate/100 FTEs
Province				
Ontario	107	4266	2.52	4.20
Atlantic Provinces	61	1875	3.25	6.20
Québec	93	2512	3.70	6.77
Manitoba	45	1077	4.14	6.83
Saskatchewan	58	995	5.83	9.41
Alberta	80	1901	4.21	6.09
British Columbia	67	1915	3.50	6.12
Gender				
Female	138	7039	1.96	3.68
Male	373	7502	4.98	7.70
Age (years)				
15–17	38	3471	1.11	4.43
18–24	473	11070	4.27	6.12
Occupation				
Admin and Clerical	67	3224	2.06	2.79
Sales and Service	180	6666	2.70	5.43
Trade and Transport	119	1762	6.75	8.66
Farming, Forestry, Fishing	32	653	4.93	8.49
Process and Manufacture	73	751	9.78	13.82
Other	40	1486	2.70	6.58
Population Density				
Urban	411	11806	3.48	5.87
Rural	100	2735	3.66	6.31
Household SES				
Highest	153	3724	4.10	6.45
Above average	158	4392	3.61	5.69
Below average	86	2883	2.99	5.41
Lowest	44	1524	2.89	6.08
Missing	70	2017	3.45	6.20
FTEs				
<0.7	168	8930	1.88	6.65
0.7–1.0	114	2147	5.31	6.13
>1.0	229	3463	6.62	5.45
Race				
Visible minorities	45	3054	2.18	3.97
White	466	12487	3.73	6.25
Student status				
Non-student	389	6701	5.81	6.92
FT/PT student	122	7840	1.55	4.10
Total	511	14541	3.51	5.95

*Data from the Canadian Community Health Survey 2000–01.

equivalent (FTE) that they worked. An FTE was defined as 2000 hours in one year.

Analytic strategy

To examine geographic, work, and individual factors in the chance of a work injury, we used a multilevel regression model with fixed effects predictors.²⁶ Respondents from the same geographic area may share similar characteristics or environment. The non-independence of observations inherent in a nested structure is explicitly accounted for in multilevel regression models. The CCHS survey included 136 health regions across the provinces.²³ Health regions consist of counties or municipalities and are administrative areas of

responsibility for hospital boards or public health departments. Thus, respondents (level 1) clustered within health regions (level 2), allowing us to code province as a level 2 categorical predictor.

We initially conducted a series of multilevel logistic regressions with only one of the nine predictors in each regression (that is, unadjusted models). We also conducted a fully adjusted regression to determine whether provincial differences in demographic and job factors might account for any provincial differences observed in work injury rates.

To account for the complex survey design of the CCHS, we used the survey weights in the descriptive and regression analyses (Lohr, 1999). We used the software package MLwiN

Table 2 Occupations of 15–24 year olds by province*

	Atlantic Provinces (n = 1875)	Québec (n = 2512)	Ontario (n = 2512)	Manitoba (n = 1077)	Saskatchewan (n = 995)	Alberta (n = 1901)	British Columbia (n = 1915)	Total (n = 14541)
Occupation (%)								
Admin and Clerical†	19.80	23.36	24.79	20.57	17.97	22.47	19.90	22.17
Sales and Service	47.67	40.33	45.23	45.30	48.55	47.49	49.90	45.84
Trade and Transport	10.09	14.49	9.36	13.51	15.50	15.82	10.89	12.11
Farming, Forestry, Fishing	8.59	3.77	2.82	4.79	6.05	4.32	4.34	4.49
Process and Manufacture	3.42	7.93	6.69	5.44	2.70	3.29	2.83	5.16
Other	10.44	10.12	11.11	10.39	9.22	6.62	12.14	10.22
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

*Data from the Canadian Community Health Survey 2000–01.

†Includes technical, administrative, financial, clerical, management, and professional occupations.

Table 3 Multilevel logistic regressions on work injuries among teens and young adults*

	Unadjusted			Adjusted†		
	Coefficient (SD)	OR†	95% CI	Coefficient (SD)	OR	95% CI
Province						
Ontario		1.00			1.00	
Atlantic Provinces	−0.07 (0.24)	0.94	0.58–1.50	0.05 (0.25)	1.05	0.65–1.69
Québec	0.32 (0.23)	1.38	0.88–2.14	0.29 (0.21)	1.34	0.89–2.01
Manitoba	0.22 (0.28)	1.25	0.72–2.17	0.20 (0.29)	1.22	0.70–2.14
Saskatchewan	0.79 (0.25)	2.20	1.35–3.59	0.78 (0.25)	2.19	1.35–3.54
Alberta	0.39 (0.23)	1.47	0.94–2.29	0.34 (0.21)	1.40	0.92–2.13
British Columbia	0.25 (0.24)	1.28	0.80–2.05	0.34 (0.23)	1.41	0.90–2.19
Gender						
Female		1.00			1.00	
Male	0.97 (0.13)	2.62	2.05–3.37	0.67 (0.15)	1.95	1.46–2.62
Age (years)						
15–17		1.00			1.00	
18–24	1.44 (0.22)	4.20	2.75–6.42	0.79 (0.24)	2.19	1.37–3.51
Occupation						
Admin and Clerical		1.00			1.00	
Sales and Service	0.24 (0.18)	1.27	0.89–1.82	0.68 (0.18)	1.98	1.39–2.81
Trade and Transport	1.18 (0.24)	3.26	2.03–5.25	0.84 (0.25)	2.32	1.42–3.78
Farming, Forestry, Fishing	0.87 (0.31)	2.38	1.29–4.41	1.03 (0.33)	2.79	1.45–5.37
Process and Manufacture	1.63 (0.26)	5.11	3.07–8.50	1.52 (0.26)	4.57	2.74–7.62
Other	0.29 (0.29)	1.34	0.76–2.37	0.75 (0.29)	2.11	1.19–3.73
Population density						
Urban		1.00			1.00	
Rural	−0.05 (0.17)	0.95	0.68–1.33	−0.11(0.18)	0.90	0.64–1.27
Household SES						
Highest		1.00			1.00	
Above Average	−0.15 (0.15)	0.86	0.64–1.14	−0.25(0.15)	0.78	0.58–1.05
Below Average	−0.36 (0.20)	0.70	0.47–1.02	−0.35(0.20)	0.70	0.48–1.04
Lowest	−0.37 (0.26)	0.69	0.42–1.14	−0.26(0.26)	0.77	0.47–1.28
Missing	−0.19 (0.25)	0.83	0.51–1.36	−0.16(0.23)	0.85	0.54–1.34
FTEs						
<0.7		1.00			1.00	
0.7–1.0	1.09 (0.16)	2.97	2.17–4.09	0.61 (0.18)	1.84	1.30–2.61
>1.0	1.32 (0.14)	3.72	2.84–4.89	0.60 (0.18)	1.82	1.28–2.58
Race						
Others		1.00			1.00	
White	0.46 (0.24)	1.59	0.99–2.54	0.46 (0.23)	1.59	1.00–2.51
Student Status						
Non-student		1.00			1.00	
FT/PT student	−1.34 (0.15)	0.26	0.19–0.35	−0.76 (0.20)	0.47	0.32–0.69

*Data from the Canadian Community Health Survey 2000–01.

†Odds ratios and confidence intervals. If 95% CI includes 1, then not significant.

‡Adjusted for all other variables in table.

version 2.0 to conduct the multilevel analyses (Goldstein *et al*, 1998). Because MLwiN uses a quasi likelihood method for estimating non-linear models, likelihood ratio tests could not be calculated.

RESULTS

Table 1 shows the background characteristics and work injury rates for this sample of young workers. Young males had higher crude injury per 100 FTEs than young females. Workers 18–24 years old had higher crude injury rates than 15–17 year olds. Jobs in trade/transport, farming/fishing/forestry, and process/manufacturing had the highest crude injury rates, while administrative/clerical and sales/service jobs had the lowest rates. Those young workers not in school had higher rates than those in school. White respondents had higher injury rates than visible minorities. With regard to provincial variability, Ontario had the lowest work injury rate, while Saskatchewan had more than twice this rate.

Some variation in occupational mix across provinces was observed. Most youth in Canada held jobs in the service sector, with Québec having the lowest percentage (40.33%; see table 2). Youth in Ontario were the most likely to work in administrative/clerical jobs (24.79%). Youth in Saskatchewan and Alberta were more likely to hold trade and transportation jobs (15.50% and 15.82%, respectively). These provincial differences in occupation underscore the need to use

multivariate analyses to determine its contribution to provincial differences in work injury risk.

The unadjusted multilevel logistic models in table 3 paralleled the crude incidence rates shown in table 1. In the fully adjusted multilevel regression, young workers in Saskatchewan remained at significantly higher risk for a work injury (adjusted odds ratio (AOR) = 2.19, 95% CI 1.35 to 3.54).

Certain demographic variables were also independently associated with work injury risk. Young men were more likely to sustain a work injury than young women (AOR = 1.95, 95% CI 1.46 to 2.62). Young adults were twice as likely to be injured at work compared to teenagers (AOR = 2.19, 95% CI 1.37 to 3.51). White respondents were 59% more likely to sustain a work injury than visible minorities (AOR = 1.59, 95% CI 1.00 to 2.51). Part time and full time students were less likely to sustain a work injury than those out of school (AOR = 0.47, 95% CI 0.32 to 0.69).

Work related covariates related to the likelihood of work injury in predictable ways. Compared to youth employed in administrative/clerical jobs, youth in sales/service jobs were almost twice as likely to sustain a work injury (AOR sales/service = 1.98, 95% CI 1.39 to 2.81). Youth in trade/transport and farming/forestry/fishing, and process/manufacturing occupations were two to four times more to be injured at work (AOR trade/transport = 2.32, 95% CI 1.42 to 3.78; AOR

Table 4 Mechanism of work injury for 15–24 year olds across provinces*

	Atlantic Provinces (n = 61)	Quebec (n = 93)	Ontario (n = 107)	Manitoba (n = 45)	Saskatchewan (n = 58)	Alberta (n = 80)	British Columbia (n = 67)	Total (n = 511)
Mechanism of work injury (%)								
Fell/bumped/pushed/struck/crushed	35.54	21.02	35.49	22.95	12.75	37.53	31.84	29.03
Contact with sharp object	20.01	49.32	29.26	21.04	25.29	35.88	36.91	32.68
Overexertion/strenuous movement	23.19	6.49	20.64	20.22	34.56	8.84	17.20	17.62
Other†	21.26	23.17	14.61	35.79	27.39	17.75	14.05	20.68

*Data from the Canadian Community Health Survey 2000–01.

†Includes “transport accidents”, “smoke”, “fire and flames”, “accidental contact with hot liquid or gas”, “extreme weather or natural disaster”, “physical assault”, and “other”.

farming, forestry, and fishing = 2.79, 95% CI 1.45 to 5.37; AOR process/manufacturing = 4.57, 95% CI 2.74 to 7.62). In addition, longer hours were positively associated with a greater likelihood of a work injury.

Table 4 shows the injury event by province. Two notable patterns were evident. Quebec, Alberta, and British Columbia had high percentages of injuries caused by contact with sharp objects. Also, Saskatchewan had proportionally more overexertion injuries, and injuries classified as “other” compared with Ontario.

DISCUSSION

Consistent with previous research, we found that young males and goods producing jobs increased the risk of work injury among teenagers and young adults.^{2, 5, 27} Previous studies, however, considered only work injuries in a particular state or province. We found that the work injury rate for 15–24 year olds was not uniform across Canadian provinces. Notably, Saskatchewan had double the work injury rate of Ontario.

The types of jobs youth held varied by province. Western provinces such as Saskatchewan had proportionally more youth employed in trade/transportation jobs and farming/forestry/fishing industries than in Ontario. Even with the type of job and other demographic factors controlled, however, the provincial differences in work injury risk remained.

Provincial differences in work injury independent of job type could have occurred as a result of broad differences in engineering (hazard exposure), education, and enforcement. Our between-province comparison of the mechanisms of work injury showed suggestive evidence of differential hazard exposures at work. Within the broad occupational groupings, there may still be differences in hazard exposure between workers.²⁸ Such differential hazard exposure might be due to provincial differences in firm size. Youth in Ontario are most likely to work in large firms,²⁹ and these firms tend to have more resources devoted to developing safety procedures and acquiring safer equipment.

Differences in OHS legislation and enforcement across provinces may also help explain why Ontario had the lowest work injury rate of any province. According to Tucker,²² the methods for protecting Canadian workers such as rights of participation in the management of workplace hazards and the right to refuse unsafe work differ by province and are weaker in Western provinces than in Ontario. His review also suggests Ontario has stronger worker entitlements to training and higher penalties for infractions than Atlantic or Western provinces. Although most OHS regulations are not specific to youth, they define for all ages what constitutes a safe workplace.

Many efforts have also been implemented at the provincial level, and may influence work safety. School based and mass media based work safety education programs targeting young workers can be found in all Canadian provinces.³⁰ However,

research is needed to determine whether any differences in coverage of the target population or effectiveness of the programs could influence a province’s youth work injury rate.

In terms of the relationship between demographic factors and work injury, we found 15–17 year olds, visible minorities, and youth in school to be at significantly lower risk for a work injury than their counterparts, even with type of job and work hours controlled. This reduced injury risk may be due residual confounding in that the broad job categories we used do not reflect some systematic differences in job tasks or hazard exposure across young worker subgroups. For example, a young worker who is also in school may perform more non-manual tasks in a sales or service job than a young worker who is not in school because of differences in temporary/permanent status or overall career trajectory.

The results of this study, however, should be interpreted given the following limitations. Our findings are based on self-report measures. Consequently, biases related to recall of events and attribution of an injury to work may be operating. However, there is no reason to suspect that these biases should vary from province to province. These cross sectional data also prohibit any firm conclusions about the extent to which these provincial differences constitute compositional (that is, different people in different provinces) or true contextual differences. We tried to optimize the ability to make causal inferences by controlling for common socio-demographic risk factors for work injury. Although we were able to examine the main effects of age on work injury risk, we were unable to examine whether risk factors had a differential influence on teenage versus young adult workers (that is, effect modification) due to insufficient power.

In conclusion, even though frameworks such as the public health approach to injury prevention acknowledge the relevance of these broad contextual factors,³¹ most of the research on young workers to date focuses on individual and

Key points

- The types of jobs youth held varied by province, though sales and service jobs still predominated. Type of job was a major correlate of injury risk, with all jobs showing higher risk than administrative clerical jobs.
- Even with type of job and demographic factors controlled for, the particularly higher work injury rate of a western Canadian province remained.
- Even with type of job controlled for, visible minorities, students, and 15–17 year olds had a reduced likelihood of work injury than their counterparts.
- Further research is needed to examine the compositional and contextual factors underlying the provincial differences.

job characteristics that account for injury risk. Our study raises the possibility that important determinants of youth work injury are operating at a provincial level, a meaningful geographic unit given the key role provincial governments have in improving occupational health and safety.²¹ A better understanding of how these broader social, economic, and political circumstances influence youth work injuries can help public health and OHS practitioners supplement the current health education approaches with more policy based and structural initiatives to reduce young worker injury risk.

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REFERENCES

- 1 Greenberger E, Steinberg L. *When teenagers work: The psychological and social costs of adolescent employment*. New York: Basic Books Inc, 1986.
- 2 National Research Council. *Protecting youth at work: Health, safety, and development of working children and adolescents in the United States*. Washington, DC: National Academy Press, 1998.
- 3 Dunn KA, Runyan CW, Cohen LR, et al. Teens at work: a statewide study of jobs, hazards, and injuries. *J Adolesc Health* 1998;**22**:19–25.
- 4 Runyan C, Zakacs RC. Epidemiology and prevention of injuries among adolescents workers in the United States. *Annu Rev Public Health* 2000;**21**:247–69.
- 5 Jackson L. Non-fatal occupational injuries and illnesses treated in hospital emergency departments in the United States. *Inj Prev* 2001;**7**(Suppl 1):i21–i26.
- 6 Breslin F, Koehoorn M, Smith P, et al. Age-related differences in work injuries and permanent impairment: A comparison of workers' compensation claims among adolescents, young adults, and adults. *Occup Environ Med* 2003;**60**:10e–16e.
- 7 Oi WY. On the economics of industrial safety. *Law Contemp Probl* 1974;**38**:669–99.
- 8 Dupre D. Accidents at work in the EU in 1996. *Eurostat* 2000:1–8.
- 9 Belville R, Pollack SH, Godbold J, et al. Occupational injuries among working adolescents in New York State. *JAMA* 1993;**269**:2754–9.
- 10 Mardis A, Pratt S. Nonfatal injuries to young workers in the retail trades and services industries in 1998. *JOEM* 2003;**45**:316–23.
- 11 Human Resources Division U. *Child labor: characteristics of working children*. United States General Accounting Office, eds. GAO/HRD-91-83BR, 1–52. Washington, DC, 1991.
- 12 Hendricks KJ, Layne LA. Adolescent occupational injuries in fast food restaurants: an examination of the problem from a national perspective. *J Occup Environ Med* 1999;**41**:1146–53.
- 13 Brooks DR, Davis LK. Work-related injuries to Massachusetts teens, 1987–1990. *Am J Ind Med* 1996;**29**:153–60.
- 14 Schober SE, Handke JL, Halperin WE, et al. Work-related injuries in minors. *Am J Ind Med* 1988;**14**:585–95.
- 15 Weller N, Cooper S, Basen-Engquist K, et al. The prevalence and patterns of occupational injury among South Texas high school students. *Tex Med* 2003:52–7.
- 16 Frone MR. Predictors of work injuries among employed adolescents. *J Appl Psychol* 1998;**83**:565–76.
- 17 Statistics Canada. *Youths and the labour market*. Ottawa: Statistics Canada, 1999.
- 18 Dehaas D. Keeping young workers safe. OHS Canada May/June, 1996.
- 19 Boyle MH, Wilms JD. Place effects for areas defined by administrative boundaries. *Am J Epidemiol* 1999;**149**:577–85.
- 20 Eakin JM, Lamm F, Limborg HJ. International perspective on the promotion of health and safety in small workplaces. In: Frick K, Jensen PL, Quinlan M, Wilthagen T, eds. *Systematic occupational health and safety management. Perspectives on an international development*. New York: Pergamon, 2000:227–47.
- 21 Tompa E, Trevithick S, McLeod C. A systematic review of the prevention incentives of insurance and regulatory mechanisms for occupational health and safety. Working paper #213. Toronto, ON: Institute for Work and Health, 2004.
- 22 Tucker E. Diverging trends in worker health and safety protection and participation in Canada, 1985–2000. *Ind Relat* 2003;**58**:395–423.
- 23 Statistics Canada. Canadian Community Health Survey Cycle 1.1 (2000–2001). Public use documentation. Ottawa, Ontario: Statistics Canada, 2003.
- 24 Liberatos P, Link BG, Kelsey JL. The measurement of social class in epidemiology. *Epidemiol Rev* 1988;**10**:87–121.
- 25 Statistics Canada. *National Population Health Survey Overview 1996–97*. Ottawa: Statistics Canada, 1998.
- 26 Goldstein H. *Multilevel statistical models, Second edn.*, London: University of London, 1995.
- 27 Breslin C, Koehoorn M, Smith P, et al. Age related differences in work injuries and permanent impairment: a comparison of workers' compensation claims among adolescents, young adults, and adults. *Occup Environ Med* 2003;**60**:e10.
- 28 Punnett L, Wegman D. Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. *Journal Electromyogr Kinesiol* 2004;**14**:13–23.
- 29 Statistics Canada. Canadian Labour Force Survey, public use files. Catalogue No 71M0001XCB. Ottawa, Canada: Statistics Canada, 2001.
- 30 Association of Workers' Compensation Boards of Canada. *Canada-wide inventory of young worker products and programs*. Toronto, ON: Association of Workers' Compensation Boards of Canada, 2005.
- 31 Stout N, Borwegen W, Conway G. Traumatic occupational injury research needs and priorities: A report by the NORA Traumatic Injury Team, 1998:98–134. Cincinnati, OH, US Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health.