

Healthcare Use of Families of Injured Workers Before and After a Workplace Injury in British Columbia, Canada

Le recours aux soins de santé par les familles de travailleurs blessés avant et après un accident du travail, en Colombie-Britannique, Canada



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Abstract

Objectives: To examine the overall healthcare and mental healthcare services use of families of injured workers before and after a workplace injury.

Methods: We use an administrative database that links individual publicly funded healthcare data and Workers' Compensation Board (WCB) data for the entire population of British Columbia (BC), Canada. The spouses and children of all injured workers who filed a WCB claim in 1994 and missed one or more days of work due to the injury (lost time) were included. We compare their change in use of healthcare services relative to a year before the injury to families of workers who did not require time off for their injuries (no lost time) and families of individuals who were not injured (non-injured comparisons).

Results: Differences in healthcare services use among the three groups of spouses were marginal, and differences for increases in mental healthcare services use were non-significant. As well, all three groups of children decreased their use of physician and hospital services and increased their use of mental healthcare services, with very little difference among groups.

Conclusion: This was a descriptive study looking at a broad group of injured workers and their families. Even modest increases in healthcare use following a workplace injury have some basis for further study.

Résumé

Objectifs : Examiner le recours général aux soins de santé et de santé mentale par les familles de travailleurs blessés, avant et après un accident du travail.

Méthodes : Nous utilisons une base de données administrative reliant des données individuelles sur les soins de santé publics et celles du *Workers' Compensation Board* (WCB) pour toute la population de la Colombie-Britannique, Canada. Les conjoints et enfants de tous les travailleurs blessés qui ont présenté une demande d'indemnisation en 1994 et qui ont manqué une journée de travail ou plus (temps perdu) à cause de l'accident du travail ont été inclus. Nous avons comparé leur recours aux soins de santé à celui qu'il était un an avant l'accident de travail, à celui des familles de travailleurs qui n'ont manqué aucune journée de travail (aucun temps perdu) à la suite de l'accident, ainsi qu'à celui des familles de travailleurs qui n'avaient subi aucun accident de travail (comparaisons avec des non blessés).

Résultats : Les différences entre les groupes de conjoints étaient minimales et les différences dans les augmentations du recours aux soins de santé mentale n'étaient pas significatives. On a observé également, chez les trois groupes d'enfants, une diminution du recours à des services médicaux et hospitaliers et une augmentation du recours à des services de santé mentale; il y avait très peu de différence entre les groupes.

Conclusion : Il s'agissait d'une étude descriptive qui visait à examiner un vaste groupe

de travailleurs blessés et leurs familles. Même de faibles augmentations du recours aux soins de santé après un accident de travail justifient une étude plus poussée.

IN CANADA, IN 2003, THERE WERE APPROXIMATELY 800,000 WORKPLACE INJURIES and illnesses reported to Workers' Compensation Boards of Canada (WCB), representing approximately one in 16 working Canadians (AWCBC 2005). In the United States the data are similar, with approximately 4.5 million occupational injuries reported in 2003, representing approximately one in 20 full-time equivalent workers (BLS 2005). Recent research in the area of consequences of workplace injury has documented, among other things, the reduced earnings, long-term physical limitations and mental health problems experienced by workers as a result of their injury (e.g., see Strunin and Boden 2004a,b; Ballantyne 2001; Keogh et al. 2000; Boden 2003; Adams et al. 2002).

However, we know very little about the direct impact of injury on workers' families. Most studies in the area are qualitative and, of the reliable studies currently available, most impute consequences to spouses and children based on measuring the impact of the injury on the worker (e.g., see Morse et al. 1998; Feuerstein et al. 1985; Keogh et al. 2000; Strunin and Boden 2004b; Dembe et al. 2002; Texas Workers' Compensation Research Center 1995). Research on long-term illness suggests that families of persons with chronic conditions may be affected. For example, Weitzner et al. (1997) found that family caregivers of people with cancer and other serious illnesses experienced increased symptoms of depression, anxiety, psychosomatic disorders, restrictions of roles and activities, marriage breakup and diminished physical health. There is little comparable research in the area of occupational health.

We know of one report that has directly studied the long-term consequences of injury for both injured workers and their family members: the New Zealand Department of Labour interviewed 15 seriously injured workers, their family members, employers and co-workers (Adams et al. 2002). The authors concluded that "in all the cases, the family suffered emotionally, mentally and financially. Family relationships were affected, mostly negatively. This impact rippled outside the immediate circle of the participant touching the workplace and the community" (Adams et al. 2002).

Given the indirect evidence that occupational injuries influence the emotional and physical well-being of family members of injured workers, and that these consequences extend beyond the workers' compensation system (Adams et al. 2002), we decided to examine the effects of work injuries on use of healthcare by families of injured workers.

Our study assesses the overall healthcare and mental healthcare services use of families of injured workers who filed a claim to the British Columbia (BC) WCB in 1994. Higher rates of post-injury use of overall and mental healthcare services by fam-

ily members are likely to indicate ongoing problems related to the injury and, hence, serve as an indirect measure of consequences of injury for families of injured workers. We examine Medical Service Plan (MSP) and hospital discharge records contained in the British Columbia Linked Health data (BCLHD) set for families of injured workers, five years before and five years after the injury.

Methods

The British Columbia Linked Health data set

The BCLHD links individual MSP payment data, hospital separations and WCB data for the entire population of BC, Canada. In BC, the workers' compensation system is a publicly administered single-payer system, funded exclusively by payroll levies on industry. It covers over 90% of workers in the province and is the single source of wage loss compensation for a workplace injury. Approximately 95% of the transaction records in each file are linked to an individual recorded on the Registration and Premium Billing file (R&PB) maintained by the MSP (Hertzman et al. 1999). In BC, the MSP insures medically required services provided by physicians, other healthcare professionals, laboratory services and diagnostic procedures. Under the *Medicare Protection Act*, enrolment with MSP is mandatory for all residents and their dependants. Coverage is usually available through the employer or is self-administered. When leaving and entering the province, residents are required to notify MSP of the date as soon as possible or risk having no coverage or being billed for services they no longer need. The Centre for Health Services and Policy Research (CHSPR) in BC maintains the BCLHD. We did not request information that could potentially identify individuals.

Study subjects

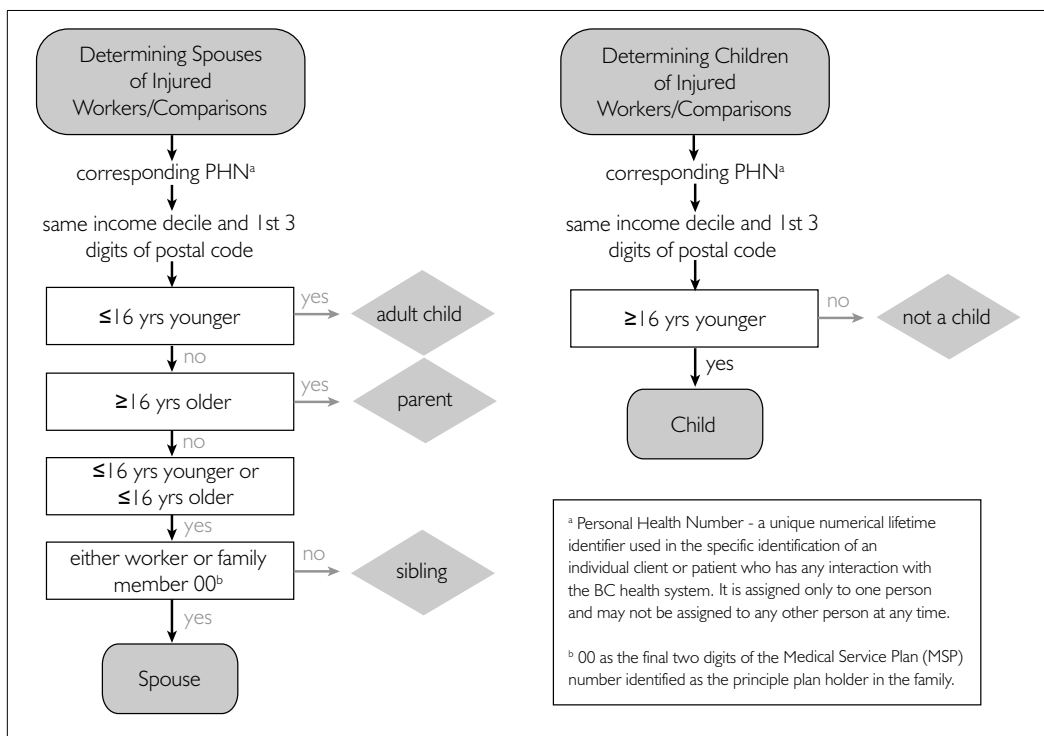
Individuals with the same Personal Health Number (PHN) as the injured workers were identified at the CHSPR. In BC, MSP numbers are part of the employment arrangement; employers pay for employees' medical premiums and benefits, and this payment results in the assignment of an MSP number. The employee is given 00 as the final two digits of his or her MSP number, the spouse a 01 designation and all dependents a 02-n designation (except for newborns, who are given a 66 designation). Subsequent spouses are given the next two-digit designation available.

Eligibility includes family members considered to be spouses and dependent children who were living with the worker at the time of injury. Children who were born after 1994 were not included; as well, children who were under 19 in 1994 were subsequently excluded in the year they turned 19.

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The first three digits of the postal code and the median income decile (1 lowest to 10 highest) of the residential neighbourhood (hereafter referred to as income decile) were used by the researchers to identify individuals residing with the workers during the time of injury. Of those fitting the above criteria, family members under 19 were considered children, and anyone 16 years younger or 16 years older than the worker, and not a sibling, was considered a spouse. Figure 1 shows the method used to select spouses and children of injured workers and comparisons.

FIGURE 1. Flowchart for determining family members



The spouses and children of all injured workers aged 25 and over who filed a WCB claim in 1994 and missed one or more days of work due to the injury were included (lost-time workers are hereafter referred to as LTs). Family members who were also workers injured in 1994 were not included.

The first comparison group consisted of spouses and children of workers who filed a WCB claim in 1994 but did not require time off for their injuries (workers with no lost time are hereafter referred to as NLTs).

The second family comparison group consisted of spouses and children of individuals in the general population who were registered for health benefits but who did

not submit a WCB claim between 1989 and 1999 (non-injured workers are hereafter referred to as NIs).

Measurement

MSP and hospital discharge records from 1989 to 1999 were reviewed (five years before and five years after the date of the 1994 injury). Using coding from the Canadian Work Injuries Standards (CWIS), injury types were separated into “acute” (e.g., fractures, cuts, lacerations) and “chronic” (e.g., low back pain, repetitive strain, hearing loss) to detect possible differences among family members in patterns of utilization by the disability of the injured worker (Menard 1996). The family member records were also examined according to the length of time the worker remained off work due to the injury (12 weeks or more and less than 12 weeks). To assess the possible effect of including families of workers with other claims before or after the 1994 injury, such as chronic conditions that required long-term physician care, we also examined the data looking at workers with a first injury in 1994 (first in the period 1989–1999) and workers with only one claim between 1989 and 1999.

General practitioners’ visits were determined using project case numbers, date of service and specialty code. The International Classification of Diseases, Ninth Revision (ICD-9) in the *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (DSM-IV), was used to assess service use for overall mental healthcare (290–319). All physician service use (GPs and specialists) was assessed for mental healthcare. Specific ICD-9 codes before 1992 were not available in the MSP data. WCB-funded physician services are included in the MSP data sets.

Days of hospitalization for overall and mental healthcare utilization were determined from the Hospital Admissions and Separations (HAS) data. The HAS data included ICD-9 codes dating back to 1989. WCB-funded services were not included in the hospital data.

Data analysis

Measures of healthcare utilization were calculated for each 12-month period, five years before and five years after the 1994 injury (yearly periods 5th to 1st pre-injury and yearly periods 1st to 5th post-injury). The first yearly period after the injury includes the date of injury.

To account for any differences among the families of injured worker groups and the NIs in registration for MSP benefits, a yearly weighting variable was created (from 0% to 100%) reflecting the percentage of time registered in each service period, which bases the analysis on person-time rather than on individuals.

To assess the possibility that individuals who remain in the system use healthcare

services differently from individuals who come and go, another analysis was restricted to individuals registered in the BC MSP for the entire study period.

We estimated yearly percentage change in mean visits before and after the injury, relative to the mean one year before the injury for each group.

Since we examine an entire population of injured workers and have an extremely large population, we do not provide estimates of sample variation for overall GP visits and days in hospital. For mental healthcare use (given the smaller numbers) we present results using Repeated Measures Analysis of Variance (ANOVA), with group and time as the factors of interest; their interaction shows an effect of the injury.

Results

Among the 52,319 workers who lost time because of an injury (LTs), 59% were married ($n=30,890$) and 43,029 children lived in their households. Sixty per cent of the 69,142 NLTs were married ($n=41,929$); and 57,196 children were present in these families. In contrast, those in the NI group ($n=52,319$) were less likely to be married ($n=24,722$; 47%), and their households had proportionally fewer children ($n=36,213$).

Roughly three-quarters of all spouses were female. Their average age and the average income level of their neighbourhood income decile were roughly comparable across the three groups. At the time of injury, spouses of LTs were on average 40.6 years old ($sd=10.4$) and had a mean income decile of 5.0 ($sd=2.7$); means for spouses of NLTs were 41.0 years ($sd=10.5$) and 5.5 ($sd=2.7$), respectively. Likewise, means for spouses of the NI comparisons were 41.6 years ($sd=10.9$) and 5.3 ($sd=2.7$), respectively.

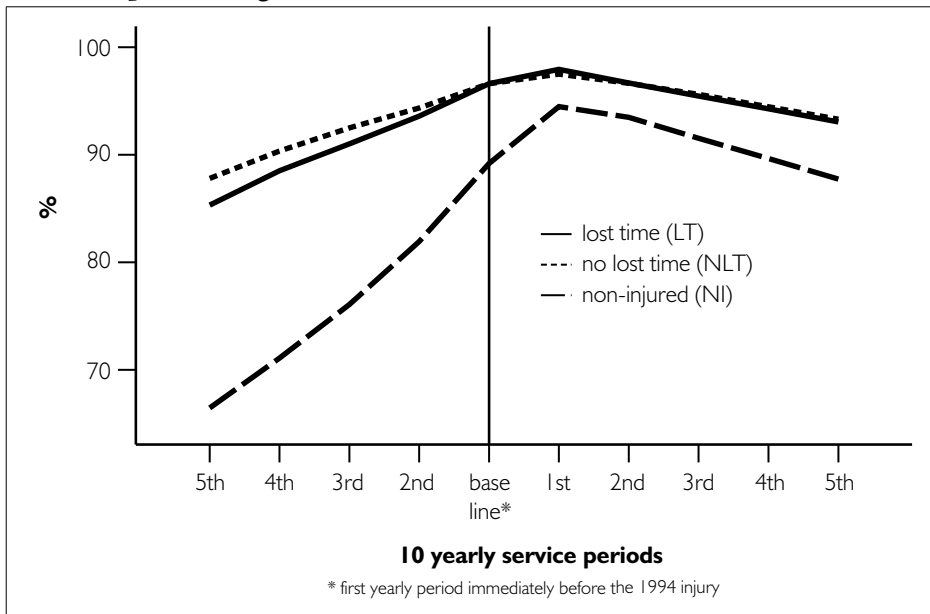
At the time of injury, children of LTs were on average 9.5 years old ($sd=5.3$), children of NLTs were 9.9 years old ($sd=5.3$) and children of the NI comparisons were 8.5 years old ($sd=5.1$).

Registration in the BC MSP

Figure 2 shows spouses' registration in the BC MSP. Throughout the study period, both groups of spouses of injured workers were more likely than the spouses of NIs to be registered in the BC MSP. Five years before the injury, 86% of LT spouses and 88% of NLT spouses were registered to receive services, compared to 65% of the spouses of NIs. One year pre-injury (baseline), 95% of the spouses of both injured worker groups were registered, compared to 85% of the NI spouses. By the end of the study period (five years after), 92% of spouses of both injured worker groups were registered, compared to 85% of the NI spouses (see Figure 2).

Figure 3 shows children's registration in the BC MSP. Throughout the study period, both groups of children of injured workers were more likely than the children

FIGURE 2. Spouses' registration in the BC Medical Service Plan



of the NI group to be registered in the BC MSP. Five years before the injury, 65% of LT children and 67% of NLT children were registered to receive services, compared to 49% of the children of NIs. These low registration percentages before the injury are likely due to some children not yet being born. One year pre-injury (baseline), 91% of the children of both injured worker groups were registered, compared to 80% of the NI children. By the end of the study period (five years after), all groups were equally likely to be registered (see Figure 3).

Healthcare use

Table 1 shows the baseline (one year before injury) means and standard deviations for GP, hospital and mental healthcare use for the spouse and children of injured workers and comparisons.

For the most part, spouses and children of injured workers were higher users of healthcare services than family members of the NIs, although, in some cases, the differences were slight.

GENERAL PRACTITIONER VISITS

Figure 4 shows the percentage change in mean visits for spouses of injured workers relative to each group's mean in the year before the injury. The three groups followed relatively the same pattern. The spouses of the LTs

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FIGURE 3. Children's registration in the BC Medical Service Plan

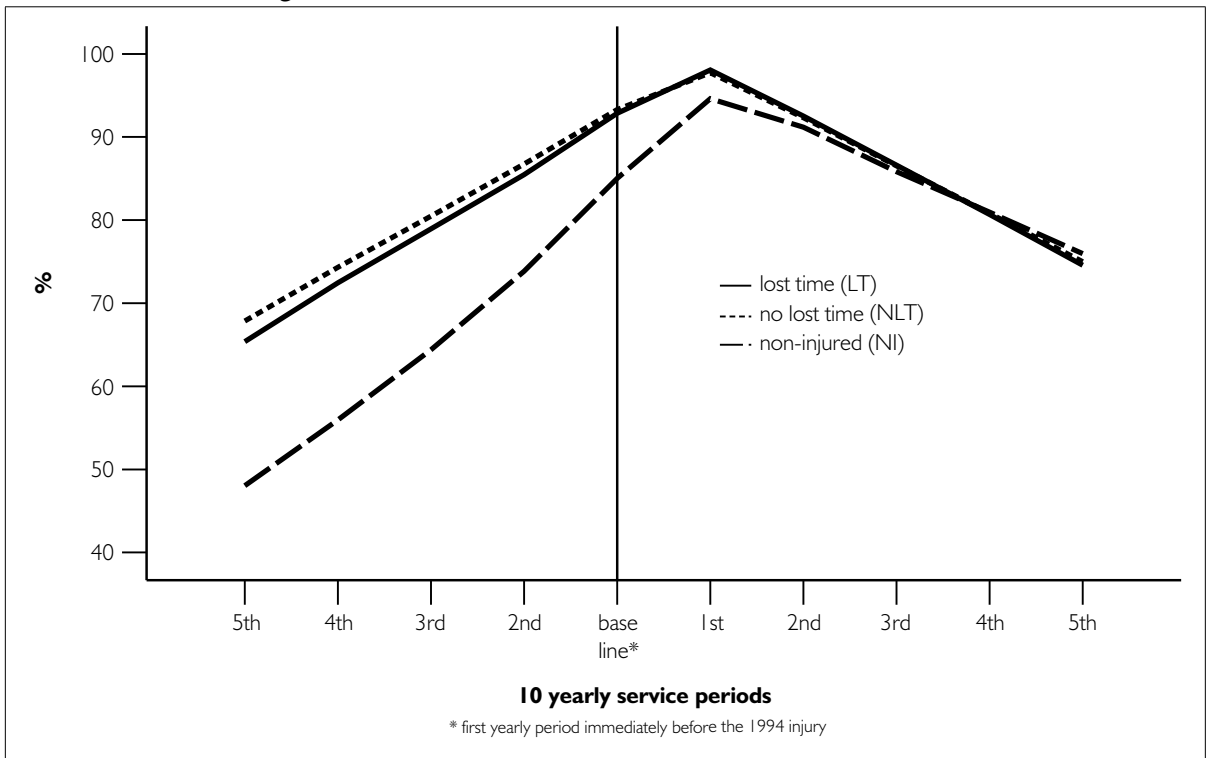
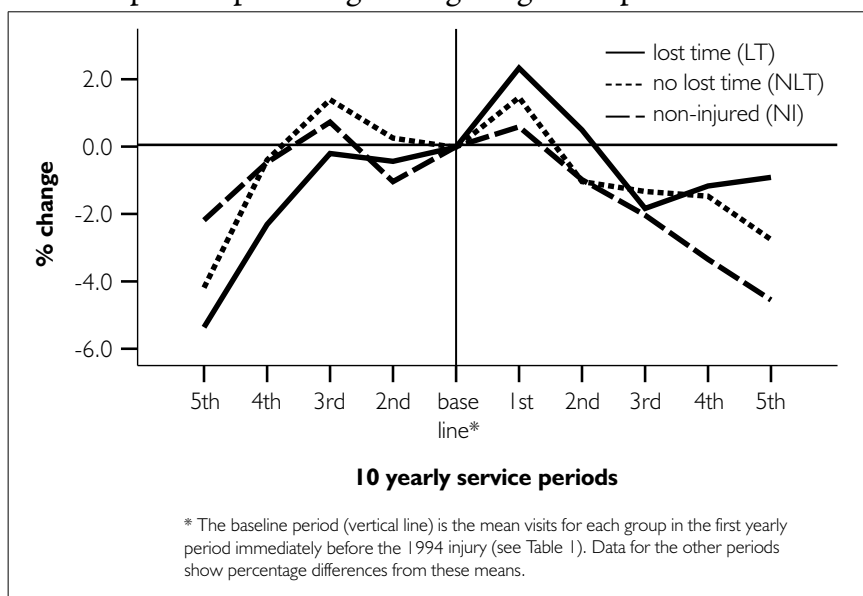


TABLE 1. Families of injured workers and comparisons, mean healthcare use at baseline (1 year prior to injury)

	GROUP	SPOUSES MEAN (SD)	CHILDREN MEAN (SD)
General practitioner visits	LT	6.2 (6.8)	4.3 (4.5)
	NLT	5.9 (6.7)	4.1 (4.4)
	NI	5.1 (6.1)	3.6 (4.1)
Hospital days	LT	1.2 (7.6)	0.34 (4.0)
	NLT	1.2 (6.8)	0.35 (4.7)
	NI	1.2 (7.4)	0.27 (3.8)
Physician visits for mental healthcare	LT	0.46 (2.6)	0.09 (0.69)
	NLT	0.43 (2.4)	0.10 (0.80)
	NI	0.34 (2.3)	0.07 (0.87)
Hospital days for mental healthcare	LT	0.08 (2.1)	0.03 (1.4)
	NLT	0.09 (3.8)	0.03 (1.0)
	NI	0.05 (1.3)	0.02 (1.0)

LT=lost time injured workers; NLT=no lost time injured workers; NI=non-injured comparisons

FIGURE 4. Spouses' percentage change in general practitioner visits



increased use by 2% one year after the injury, dropped somewhat and then remained stable at a decreased use of 1% five years after, relative to baseline. In contrast, spouses of the NI comparisons increased use slightly after the first year after the 1994 injury (0.5%) and fell to around 4% fewer visits by the end of the study period. Spouses of the NLT workers were somewhere in between, decreasing by 2%, relative to baseline, by the end of the study period.

Figure 5 shows the change in mean visits for children of injured workers and comparisons. All three groups showed relatively the same pattern of decreasing use, with the NI children decreasing by around 40%, the LT children by 22% and the NLT children by 25%, by the end of the study period.

Similar patterns in service use were seen when restricting the analysis to spouses and children of workers (1) with chronic injuries, (2) with a first injury in 1994, (3) with one injury during the study period and (4) requiring more than 12 weeks off work. Spouses registered in the MSP for the entire study period also showed similar patterns of use following the injury.

HOSPITAL DAYS

Figure 6 shows the percentage change in spousal hospital days relative to the year before the injury. For the most part, all three groups decreased hospital days, with the largest decrease seen for spouses of the NIs (around 40%) by the end of the study period. However, the groups showed different patterns, with the spouses of LTs

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FIGURE 5. Children's percentage change in general practitioner visits

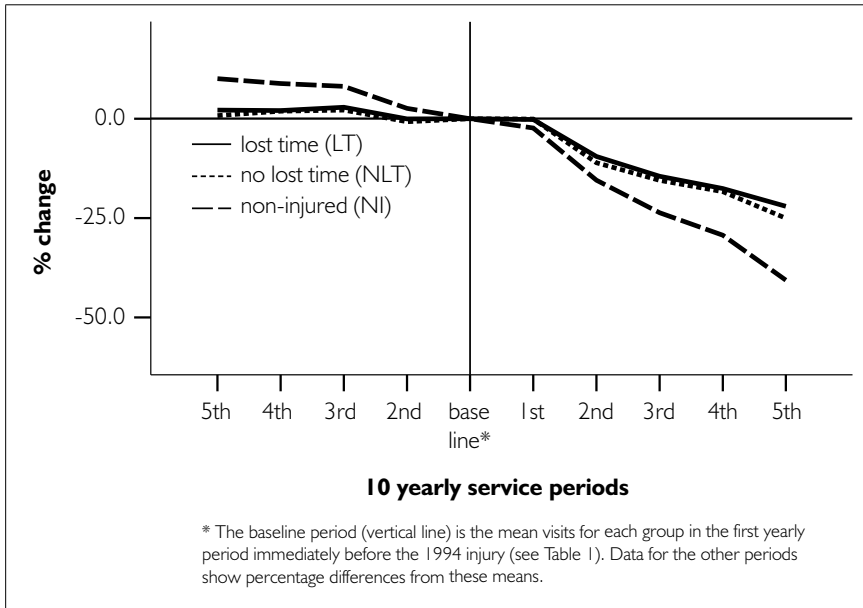
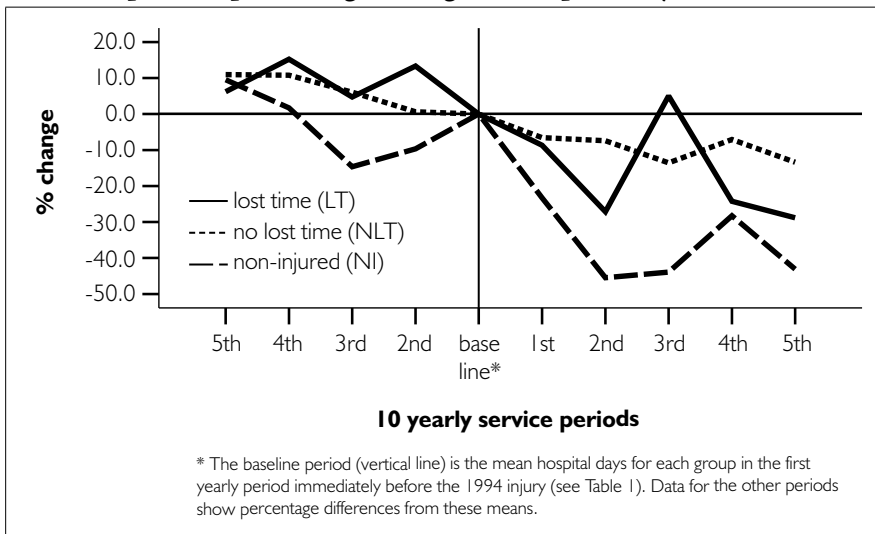


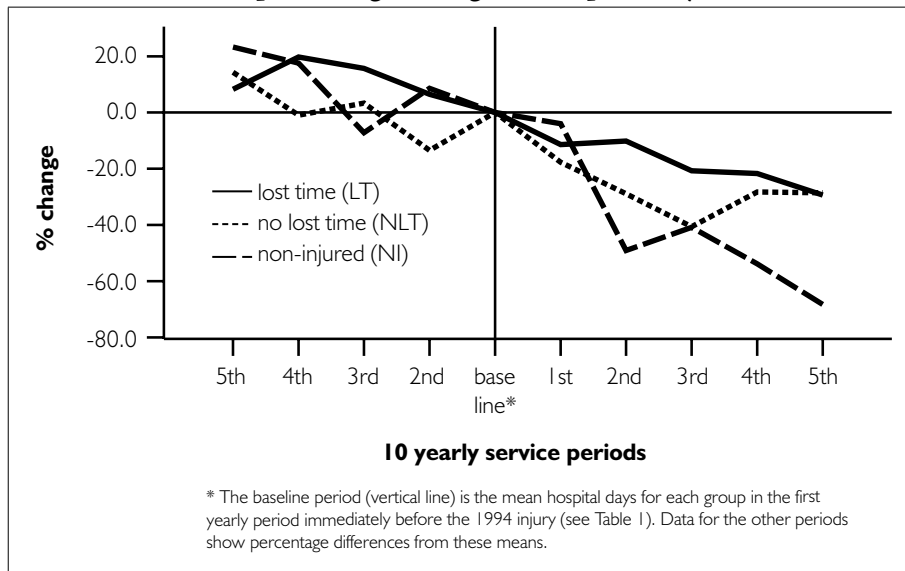
FIGURE 6. Spouses' percentage change in hospital days



decreasing use by 25% two years after the injury and then increasing use by 5% three years after the injury. In contrast, the NI spouses' decreasing use by 45% one year post-injury remained stable and then increased to a 40% decrease, relative to baseline. The NLT spouses decreased use slightly, relative to baseline, and then remained stable at a 13% decrease by the end of the study period (1989–1999). The children had

similar patterns of change, with the largest decrease seen for children of the NI comparisons (65%) (see Figure 7).

FIGURE 7. Children's percentage change in hospital days



MENTAL HEALTHCARE SERVICES USE

Figure 8 shows the mean change in mental healthcare visits of spouses to any physician's office. All three groups had similar percentage increases. The spouses of the LTs and NIs increased use by 25% relative to baseline by five years after the injury. The spouses of the NLTs increased use by around 20% ($p=0.09$). The pattern was somewhat similar for children, with all three groups increasing use by around 45% ($p=0.12$) (Figure 9).

Figure 10 shows very different patterns for the three groups for change in hospital days for mental healthcare. Spouses of the NIs increased days by 60%, fell by 7% the year after and then increased to around 60% five years after, relative to baseline. LT spouses decreased use by 7% two years after baseline and then increased to 60% three years after, relative to baseline. Spouses of the NLT workers increased mean days of use steadily to reach a 40% increase four years after injury ($p=0.08$). All three groups of children showed decreased hospital days for mental healthcare during the first service period following the injury and then increased percentage use thereafter ($p=0.93$) (see Figure 11).

Discussion

The objective of the study was to document patterns of healthcare use over time among family members of injured workers. In general, spouses of all three groups increased their percentage use of GP services one year after a workplace injury and decreased use thereafter (Figure 4). The observed differences among the groups was negligible, with a 1% difference between the LTs and the NIs in increased percent-

FIGURE 8. Spouses' percentage change in physician visits for mental healthcare

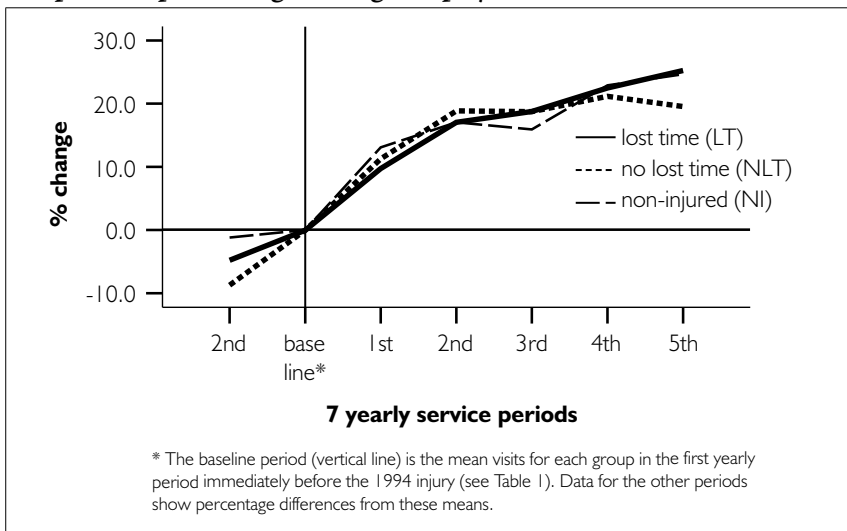
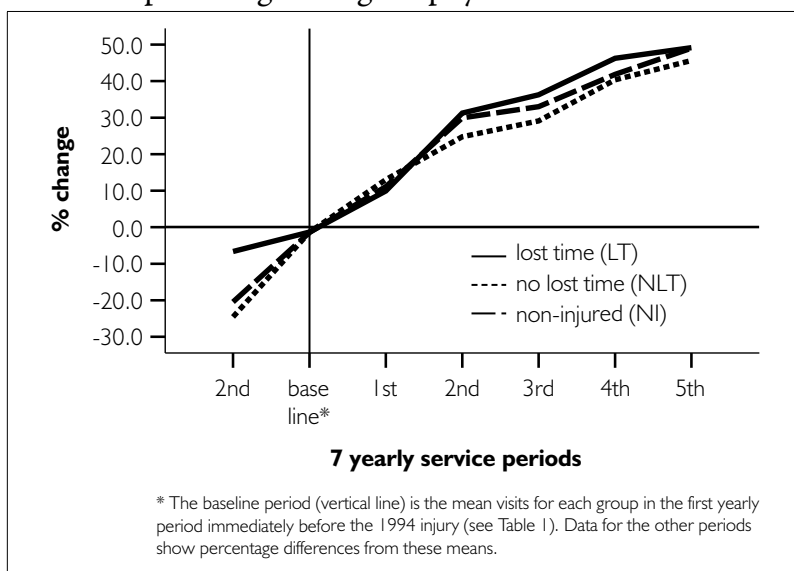


FIGURE 9. Children's percentage change in physician visits for mental healthcare



age change one year after the injury and a 3% difference in decreased utilization by the end of the study period (1989–1999). The children of all three groups decreased their service use, with the NI children having the highest decrease (around 40%) by

FIGURE 10. Spouses' percentage change in hospital days for mental healthcare

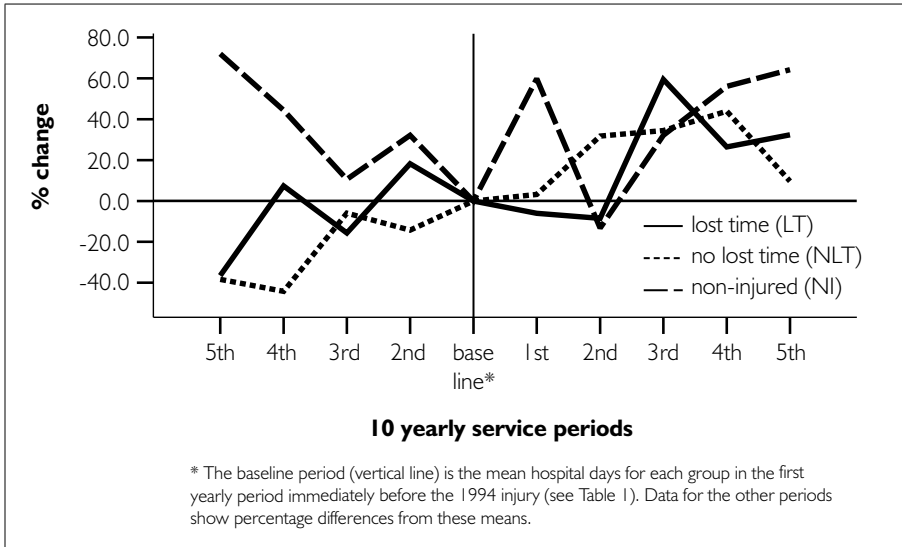
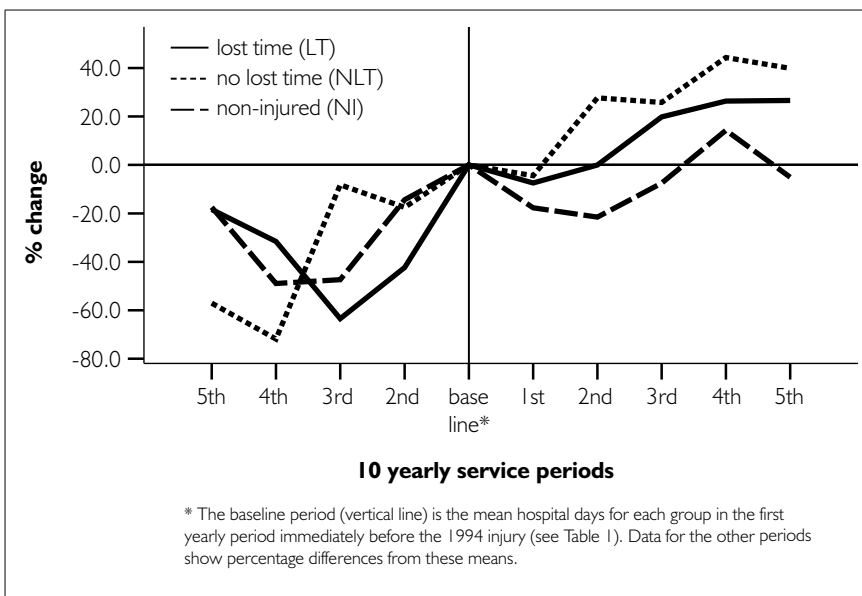


FIGURE 11. Children's percentage change in hospital days for mental healthcare



the end of the followup period (Figure 5), representing a 20% difference in decreased utilization between the LT and NI children. All groups decreased hospital days, with the spouses and children of injured workers having a smaller decrease in use (Figures 6 and 7). All groups increased their physician use for mental healthcare services, with very little difference between the three groups (Figures 8 and 9). All three groups increased hospital days by the end of the study period (Figures 10 and 11). These patterns persisted when controlling for registration in the BC MSP and several workplace characteristics. However, for physician and hospital mental healthcare use, the differences among groups were not statistically significant.

The finding of decreasing GP use among children is not surprising; data from the National Population Health Survey show that 95% of children in Canada under the age of three visited a physician at least once between 1998 and 1999. By the time children reach the age of 12 to 14, only 65% visited a physician during the same period (National Population Health Survey 1999). We sought an explanation for the sudden increase in service use for spouses between baseline and service period 1 in Figure 4, but were not successful. However, these increases were very small (between 1% and 2%) and perhaps are just fluctuations in the data. Increases in use were also noted for the group before the injury (under 1%). Decreases in hospital days for the spouses are likely due to changes in hospital admission criteria, hospital downsizing and the increasing tendency towards outpatient procedures in Canada during the 1990s (Mara 1993; Sheps et al. 2000; Tully and Saint-Pierre 1997). As well, increases in utilization of physician services for mental healthcare for all our groups are consistent with the overall trend towards increasing use of mental healthcare services by the population (Patten and Beck 2004).

Using administrative data to determine healthcare use is not without its limitations. The databases were originally constructed for billing purposes; healthcare providers submit claims in order to be reimbursed for their services. The data contained in these data sets were thus not originally intended for research purposes. Therefore, while the databases are rich in healthcare information, their usefulness for addressing other factors that may influence the health of populations is limited. For example, our analysis examined mental healthcare services provided by all physician types (the majority of whom are GPs). According to a recent report from the British Columbia Psychological Association (Lea and Crawford 2003), nearly 50% of cases of depression and anxiety go unreported by primary care physicians and approximately one-third are misdiagnosed. When we restricted our analysis to services provided by psychiatrists only, we found very little difference among the three groups. Regardless, we would not expect differential bias among physicians in reporting mental healthcare use for the three groups. If anything, one might expect a bias in favour of recognizing mental health symptoms among family members of injured workers (i.e., an expectation bias).

Our comparison group was selected using the criteria of Hertzman et al. (1999)

– workers in the general population who were registered for health benefits but who did not submit a WCB claim during the full study period (1989–1999). We also stipulated that the families of the NI comparisons should not have submitted a WCB claim during this period. These criteria no doubt resulted in a group at lower risk for a workplace injury than the injured worker groups. However, utilization was examined for the spouses of workers five years before the injury, and the injured workers clearly showed a change in use. When we looked at registration in the BC MSP, spouses of the LTs and NLTs were more likely to be registered in the province and thus showed increasing service use; this was an artefact of injured workers and their spouses entering the province (see Brown et al. 2006). Once we controlled for this factor, we found a flatter curve post-injury. Our group of NI comparisons was intended to identify trends rather than percentage levels of service use, and so is not considered a control group in the traditional sense; rather, we focus on measures of change in service use within each group.

Modest increases in mental healthcare services use among families of injured workers are inconsistent with recent evidence documenting more serious consequences of workplace injuries on the emotional well-being and quality of life of injured workers and their families. For example, Adams et al.'s (2002) study of 15 seriously injured workers and their families found that family members expressed feelings of guilt about the injured worker's condition, leading to changes in family relationships (arguments, irritability, isolation), and that smoking and substance abuse by children and other family members increased. Impacts on family relationships included several cases of separation, divorce, loss of physical intimacy, alienation and breakdown of the household unit. However, 14 of the subjects were the focus of an investigation by the Occupational Safety and Health Service (OSH) of New Zealand, and thus the authors point out that "they should not be seen as average but were selected to represent what happens when things go seriously wrong" (Adams et al. 2002). A population-based telephone survey in Connecticut examining work-related musculoskeletal disorders reported higher levels of stress at home and higher divorce rates, compared to the controls. However, the cross-sectional design of this study could not prove causality, and the self-reported retrospective assessments of risk may have been biased by differences in medical condition, between cases and controls (Morse et al. 1998).

The above-mentioned studies, and more, all contribute to the growing literature on the indirect consequences of workplace injury. However, they deal with a narrow range of occupations and injury types and, thus, cannot be generalized to the entire population of injured workers. Also, while they report on the economic and social consequences of workplace injury, most are based on relatively unstructured qualitative observations, rather than systematic population-based data.

Some other explanations are possible for the modest increases in healthcare use. Perhaps family members of injured workers make greater use of their social networks

for assistance and support in dealing with the effects of the worker's injury. Adams et al. (2002) reported that, in some cases, extended family and friends provided practical and emotional assistance to caregivers of injured workers. Perhaps increases in healthcare use by a small percentage of individuals are diluted at the population level. To try to identify individuals who may be more vulnerable to consequences of workplace injury we also looked at the groups by time off work (<12 weeks, ≥ 12 weeks), and according to two categories of injury type (acute and chronic); appreciable increases in healthcare use were not evident for those with longer time off work or chronic injuries.

This was a descriptive study looking at a broad group of injured workers and their families. Even modest increases in healthcare use following a workplace injury have some basis for further study. For example, a specific occupational group or a specific injury could yield different results for family members. Any increase in use among injured workers and their families that is directly or indirectly related to the injury should be paid for by the WCB system, which is funded by employer premiums. If it is paid by MSP, this represents a cost shift from the private to the public sector – an important issue, especially at a time when the healthcare systems in both the United States and Canada are under financial strain.

This is a population-based study, and about 90% of the paid workforce in BC is covered by the WCB system (Hertzman et al. 1999). As the high linkage rate for WCB records (97%) to healthcare services covered by BC's universal access to the medicare system is noteworthy, we have virtually complete information. In essence, this study has covered an entire population of injured workers in a Canadian province, a unique data set in the North American context. Since the broad principles of workers' compensation are comparable across the continent, we believe our results to be generalizable to injured workers in the United States and Canada. Our selection criteria were that at date of 1994 injury 100% of our injured workers and their matched comparisons were registered with the MSP. Before or after this time they may have entered or left the province, and thus differences in registration between 1989 and 1999 would be explained. We have adjusted for this factor by excluding individuals from the denominator for service periods during which they were not registered to receive health services.

In conclusion, the data provided an opportunity to examine the health services use of families of workers before and after a workplace injury. Although the differences were moderate, further studies of this nature, using specific occupational groups or more defined workplace injuries, are warranted.

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REFERENCES

- Adams, M., J. Burton, F. Butcher, S. Graham, A. McLeod, R. Rajan, R. Whatman, M. Bridge, R. Hill and R. Johri. 2002. *Aftermath: The Social and Economic Consequences of Workplace Injury and Illness*. Auckland: New Zealand Department of Labour.
- Association of Workers' Compensation Boards of Canada. 2005. "Work Injuries and Diseases. Number of Accepted Time-Loss Injuries, by Province, 1982–2003." Ottawa: National Work Injuries Statistics Program.
- Ballantyne, P. 2001. *Workplace Safety and Insurance Board Pre-1990 Claims Unit Study: Final Report to the Board*. Retrieved January 2, 2007. <<http://www.iwh.on.ca/archive/pdfs/WSIBpre1990claims.pdf>>.
- Boden, L. and M. Galizzi. 1999. "Economic Consequences of Workplace Injuries and Illnesses: Lost Earnings and Benefit Adequacy." *American Journal of Industrial Medicine* 36: 487–503.
- Boden, L. and M. Galizzi. 2003. "Income Losses of Women and Men Injured at Work." *Journal of Human Resources* 38(3): 722–57.
- Brown, J.A., P. McDonough, C. Mustard and H. Shannon. 2006. "Healthcare Use Before and After a Workplace Injury in British Columbia, Canada." *Occupational and Environmental Medicine* 63: 396–403.
- Bureau of Labor Statistics (BLS). 2003. "Workplace Injuries and Illnesses in 2003." Washington, DC: United States Department of Labor.
- Dembe, A. 1999. "Social Inequalities in Occupational Health and Health Care for Work-Related Injuries and Illnesses." *International Journal of Law and Psychiatry* 22(5–6): 567–79.
- Feuerstein, M., S. Sult and M. Houle. 1985. "Environmental Stressors and Chronic Low Back Pain: Life Events, Family and Work Environment." *Pain* 22: 195–307.
- Hertzman, C., K. McGrail and B. Hirtle. 1999. "Overall Pattern of Health Care and Social Welfare Use by Injured Workers in the British Columbia Cohort." *International Journal of Law and Psychiatry* 22(5–6): 581–601.
- Keogh, J., I. Nuwayhid, J. Gordon and P. Gucer. 2000. "The Impact of Occupational Injury on Injured Worker and Family: Outcomes of Upper Extremity Cumulative Trauma Disorders in Maryland Workers." *American Journal of Industrial Medicine* 38: 498–506.
- Lea, G. and T. Crawford. 2003. "An Expanded Role for Psychology in British Columbia's Mental and Behavioural Health Care." Vancouver: British Columbia Psychology Association.
- Mara, J. 1993. "Organizational Downsizing: A Health Care Trend of the '90s." *Nursing BC* 25(5): 28–30.
- Menard, M. 1996. "Comparison of Disability of Behavior After Different Sites and Types of Injury in a Workers' Compensation Population." *Journal of Occupational and Environmental Medicine* 38(11): 1161–70.

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After a Workplace Injury in British Columbia, Canada

- Morse, T., C. Dillon, N. Warren, C. Levenstein and A. Warren. 1998. "The Economic and Social Consequences of Work-Related Musculoskeletal Disorders: The Connecticut Upper-extremity Surveillance Project (CUSP)." *International Journal of Occupational and Environmental Health* 4(4): 209–16.
- National Population Health Survey Primary Cycle 3. 1999. "Some Demographic and Economic Influences on Health Services Utilization." Ottawa: Health Resources Canada.
- Patten, S.B and C. Beck. 2004. "Major Depression and Mental Health Care Utilization in Canada: 1994 to 2000." *Canadian Journal of Psychology* 49: 303–9.
- Sach, P. and D. Ellenberg. 1994. "The Family System and Adaptation to an Injured Worker." *American Journal of Family Therapy* 22(3): 263–72.
- Sheps, S., R.J. Reid and M. Barer. 2000. "Hospital Downsizing and Trends in Health Care Use Among Elderly People in British Columbia." *Canadian Medical Association Journal* 163(4): 1–5.
- Strunin, L. and L. Boden. 2004a. "Family Consequences of Chronic Back Pain." *Social Science and Medicine* 58(1): 385–93.
- Strunin, L. and L. Boden. 2004b. "The Workers Compensation System: Friend or Foe?" *American Journal of Industrial Medicine* 45: 338–45.
- Texas Workers' Compensation Research Center. 1995. "Economic Outcomes of Injured Workers with Permanent Disabilities." *Research Review* 27(3): 1–4.
- Tully, P. 1997. "Downsizing Canada's Hospitals, 1986/87 to 1994/95." *Health Reports* 8(4): 33–39.
- Weitzner, M., C. Meyers, S. Steinbruecker, A. Saleeba and S. Sandifer. 1997. "Developing a Caregiver Quality-of-Life Instrument." *Cancer Practice* 5(1): 25–31.