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Investigating the Longer-term Health Consequences of Work-related Injuries among Youth

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Investigating the Longer-term Health Consequences of Work-related Injuries among Youth

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ONE PAGE OF BULLETED POINTS

1. Work is a common part of the lives of many young people (15-24 year olds) in British Columbia. Workers' compensation claim rates for 15 to 24 year olds have been consistently higher than the rate of claims for all workers.
2. The study of the impacts of occupational illness and injury, beyond disability outcomes, is still in its infancy but emerging evidence suggests wide-ranging consequences, including medical care and recovery consequences.
3. The purpose of this study is to further our understanding of the experience of young workers in BC and the longer-term health consequences of being injured on the job. *The primary research questions: Is a workers' compensation claim a significant predictor of increased health care utilization among young workers in British Columbia (aged 15-24 years) both before and after an injury claim is filed? For what type of work-related injuries does health care utilization increase significantly?*
4. Four long-term trajectories of health care utilization were identified in the study sample. One group estimated to comprise 5.4% of the sample, followed a consistently high trajectory of health care utilization (approximately 13-14 GP visits per year compared to the average of 4 GP visits per year). The strongest predictors of the high health care utilization trajectory group compared to the low utilization trajectory group were being female and having a claim compared to no work related injury.
5. Youth with a work-related injury were more likely over the long term to access medical services via the universal health care system, separate from workers' compensation benefits. This was particularly so for youth with a work-related musculoskeletal injury. A better understanding of the impact of work-related injuries is necessary to the process of establishing resource allocation, prevention initiatives and regulatory priorities aimed specifically at young workers.

ABSTRACT/EXECUTIVE SUMMARY

Introduction: Work is a common part of the lives of many young people (15-24 year olds) in British Columbia. In general, most people feel that work experiences are beneficial for adolescents or young adults. However, young workers also face exposure to a variety of health and safety hazards that can lead to work-related injury and illness. In BC, lost-time compensation claim rates for 15 to 24 year olds have been consistently higher than the rate of claims for all workers, although claim rates are approaching those of other age groups in recent years. The period between 15 to 24 years of age is when most Canadians make the transition from school to work and an injury early in one's work life can have devastating and permanent effects. While reports have begun to document the extent and causes of injuries, little research has focused on the longer-term health consequences. A better understanding of the impact of work-related injuries is necessary to the process of establishing resource allocation, prevention initiatives and regulatory priorities aimed specifically at young workers.

Purpose and Research Questions: The purpose of this study is to further our understanding of the experience of young workers in BC (age 15-24 years) and the longer-term health consequences of being injured on the job. It is hypothesized that lingering or persistent symptoms as a result of work-related injury early in life may present as increased health care utilization over the longer term. *Research Questions: Is a workers' compensation claim a significant predictor of increased health care utilization among young workers in British Columbia (aged 15-24 years) both before and after an injury claim is filed? For what type of work-related injuries does health care utilization increase significantly?* We were also interested in investigating patterns of health care utilization prior to the start of a workers' compensation claim

Research Methodology: This project used a population-based, longitudinal database to investigate the research questions of interest. Access to workers' compensation and health care records for research purposes was made possible via the British Columbia (BC) Linked Health Database (BCLHD) by application to the BC Ministry of Health and WorkSafeBC, the provincial workers' compensation agency. A confidential data file of injured workers aged 15-24 years at the time of injury between 1991 and 2001 merged with their out-patient data records was provided to the researchers. A similar data set was provided for a comparison population matched on age, gender and geographic residence drawn from the BC medical services client registry. We used a group-based method described by Nagin (1999) to a) identify group trajectories of health care utilization among the combined study sample and b) determine the risk factors that predict a youth's membership in the high health care utilization group.

Results: Four long-term trajectories of health care utilization were identified in the study sample for a 10-year window following the injury-matched comparison date. One group (5.4% of the study sample) followed a consistently high trajectory of health care utilization (approximately 13-14 GP visits per year compared to the average of 4 GP visits per year). Sixty-eight percent of individuals in the high utilization group had a workers' compensation claim compared to 30.6% among the lower than average health

care trajectory group. In the multivariable analyses the strongest predictors of the high health care utilization trajectory group following the injury-comparison date were being female (Odds Ratio (OR)=34.0) and having a claim for a work injury, particularly for musculoskeletal injuries (OR= for a musculoskeletal related strain (OR= 8.90 for Back Strain, 10.94 for Upper Body Strains and 11.54 for Unspecified Strains).

Conclusions: Youth with a work-related injury were more likely over the long term to access medical services via the universal health care system, separate from workers' compensation benefits. This was particularly so for youth with a work-related musculoskeletal injury. Young workers may seek medical attention beyond the compensation system for a number of reasons. These include ongoing health issues even after a claim is closed, a lack of awareness of the procedures for re-opening a claim or not wanting to take more time off work for fear of repercussions as a young worker.

INTRODUCTION

Millions of teenagers are on the job every day and young workers are an important part of the labour force, especially in the retail trade and services industries (BC Statistics, 2000). The most common occupational injuries to youth include lacerations, contusions or abrasions, sprains and strains, burns, fractures and dislocations. Inadequate on-the-job supervision of young workers, inadequate health and safety training and work hazards present in common jobs held by youth are all factors identified as contributing to their rate of injury (Workers' Compensation Board of British Columbia, 2000).

WorkSafeBC (Workers' Compensation Board of British Columbia) has implemented prevention initiatives aimed specifically at reducing injuries among young workers. Injury rates among young workers in British Columbia have decreased over the past decade but remain significantly higher in 2000 than that of all other workers, particularly for young males. Surveys and focus groups in BC with young workers, employers, parent, educators and other stakeholders (Angus Reid Group, 2000) indicate that young workers have specific needs that may not always be addressed in the workplace. Young workers reported that they received minimal job skills training and little or no safety training in their current jobs or previous jobs. Only one employer in a series of nine focus groups said that they use a 'youth-specific' approach in their skills and safety training.

While the WCB of BC has played a major role in developing and implementing prevention efforts, their focus report on young workers (Workers' Compensation Board of BC, 2000) states that it will take an 'array' of players including educators, regulators,

employers, parents, peers, and health care professionals to protect young workers given their unique needs in the workforce and the workplace. This recommendation has yet been to be fully realized. A better understanding of the impact of work and occupational injuries on the health of youth may provide evidence of the need for the various parties to establish priorities and devote resources to prevention, intervention and regulatory efforts aimed specifically at young workers

The consequences of injuries among young workers could be broad, encompassing not only physical health, but also social, psychological and educational health. However, the scope of this proposal and the data sources available do not allow for an investigation of multiple outcomes. Investigation of longer-term patterns of health care utilization does provide a starting point and further studies may investigate the broader social, cognitive and psychological consequences of work related injuries early in life. The study of the impacts of occupational illness and injury, beyond disability outcomes, is still in its infancy but emerging evidence suggests wide-ranging consequences, including medical care and recovery consequences (Dembe, 2002). In previous reports, 15% of injured young workers surveyed reported permanent impairments such as chronic pain, scarring, sensory loss or loss of range of motion (Parker et al, 1994s), and 26% reported ongoing medical problems (Parker et al 1994b). . Experiencing work disability, especially permanent disability, as one enters the labour market could lead to adverse health and work trajectories compared to older workers.

In British Columbia (BC), workers injured during the course of their jobs receive financial compensation and health benefits, but through a process that is separate from

the universal, provincial public health care system. The workers' compensation system covers approximately 90% of the workforce in the province of British Columbia. Coverage is lower for smaller employers (<3 employees), self-employed individuals, and federal worksites. Using existing administrative data, we could isolate medical services billed to the publicly-funded health care system that represent additional services beyond those covered by workers' compensation benefits over a long-term follow-up period both before and after injury date, as one indicator of the longer-term, health consequences of a work-related injury.

In summary, this project focuses specifically on young workers, a group at high risk of injury and on providing evidence of the longer-term health consequences of injuries early in life to support prevention and intervention priorities among multiple stakeholders.

Research Questions

Is a workers' compensation claim a significant predictor of increased health care utilization among young workers in British Columbia (aged 15-24 years) both before and after an injury claim is filed? For what type of work-related injuries does health care utilization increase significantly?

While both young people with a workers' compensation claim and the comparison group without a claim are expected to access medical services via the universal health care system on an on-going basis during our follow-up periods as part of regular health care, we hypothesize that young workers with a compensation claim may have more contacts with the health care system, particularly with general

practitioners (GP) and at a critical access point associated with their claim, than individuals from the general population of the same age, gender and geographic location without the experience of a compensation claim. Young workers may seek medical attention beyond the compensation system for a number of reasons. These include ongoing health issues even after a claim is closed, a lack of awareness of the procedures for re-opening a claim or not wanting to take more time off work for fear of repercussions. Although it may not be possible to determine if some of the visits or services are specifically related to a workplace injury, significant and consistent differences between youth with a claim and those without a claim provide an indication that increased use may be attributable to their work-related injury experience.

For comparison purposes, the analysis also investigated health care utilization patterns and predictors among injured workers prior to their injury date compared to an age-, gender- and geographically matched group without a claim. Young workers employed in hazardous jobs that eventually result in a workers' compensation claim may initially see health care providers for work-related symptoms associated with work. It may also be the case that young workers' unfamiliar with the workers' compensation system or worried about approaching a supervisor about a work-related problem may first seek medical attention from a general practitioner or other health care provider prior to progressing to the workers' compensation system. Finally, claims for more chronic or episodic conditions such as back problems may be preceded by health care contacts and services through the public system for initial symptoms and treatment prior to the problem progressing to the point of having to take time off work. Evidence has been

accumulating that these disorders are more gradual in onset with fluctuations in severity (McGorry et al, 2000).

MATERIALS AND METHODS

Study Sample

Participants in this study included young workers in the Canadian province of British Columbia with a workers' compensation claim who were 15 to 24 years of age at the time of injury between 1991 and 2001. Workers' compensation claims were restricted to time-loss, **short-term disability claims**, those where a payment is made for lost income (versus health care claims) and the worker was expected to return to work (versus permanent disability awards) and for which there is detailed data on the worker and the injury characteristics (limited data on health care only claims). For workers' with multiple claims during the follow-up period, only the first short-term disability claim was included. Workers with incomplete data on age and gender and who were not living in the province during the entire follow-up period were excluded. A comparison sample (1:1 ratio) was randomly selected from the provincial medical services registration file, matched on year of birth, gender and region of residence in the province for the year of injury of their matched counterpart (herein referred to as the matched comparison date). To be eligible for inclusion in the comparison sample, the registration file was restricted to those individuals who never filed a workers' compensation claim during the study period and for a 6 year period prior to the 1991 start date (given the years of compensation data available to the researchers).

It is important to note that the work status of the comparison population was not available in the administrative registration records. Some of these youth will have been in the workforce and some not over the 10 year follow-up period, although they did not have any type of accepted workers' compensation claim in the province of British Columbia over a 16 year window including the study period investigating health care utilization. There is no reason to suspect that the comparison group is systematically different in terms of employment patterns other than they may work in jobs with fewer risk factors resulting in injuries with claims. Similarly, data on the work status of the injured workers was only available from the claim record at the time of injury and these workers could have moved in and out of the workforce, given transient work patterns among youth, during the follow-up period. If we assume that youth in the workplace, even those defined by disability at one point in their career, benefit from the healthy worker effect and that conservatively everyone in the comparison population does not work the results would be biased towards decreased utilization among the injured workers and any observed increased utilization would be over and above the healthy worker effect.

Data Collection

Retrospective data for the study sample was available through the British Columbia Linked Health Database (BCLHD). The BCLHD is an extensive data resource for applied health services and population health research. It is housed at and has been developed by the Centre for Health Services and Policy Research (CHSPR) at the University of British Columbia (UBC). It includes longitudinal, person-specific,

health data on the province's four million residents, covering the period from 1985 to 2001. The study follow-up period was restricted to the years 1991 to 2001 based on the availability of diagnoses codes for medical services visits in the data files. For the purposes of this study, the data available included a registration file of BC residents (date of birth, gender, socioeconomic quintile, residency in the province); workers' compensation claims (date of injury, occupation and industry of employment, and nature and cause of injury); and records of medical services for general practitioner (GP) visits¹ (date of service, diagnosis code (International Classification of Diseases version 9 (ICD9)). CHSPR confidentially merged our study sample with their GP records and compensation records for the years 1991 to 2001 and provided the merged data set to the research team with all unique identifiers removed from the records. The linkage success rate was 97% across the four data files. This project was approved by the UBC Behavioural Research Ethics Board.

Medical Services Utilization

The outcome of interest was individual-level use of general practitioner (GP) visits covered by the publicly-funded health care services (versus health services reimbursed by the workers' compensation system). Information was available on all fee-for-services payments to GP from 1991 to 2001. A health care contact was defined by a unique combination of the service billing date and the provider code. For example, an individual with multiple billing records on the same day seeing a single provider was

¹ *Visits to specialists are coded separately in the medical services database and were not the focus of this study. GPs are an entry point to the medical care system and any visit to a specialist would be preceded by a contact with a GP.*

counted as one contact. Our primary outcome of interest was number of GP contacts per person per year.

Claim Status

Our primary explanatory variable of interest was claim status (yes/no) and claim status by type of injury (back strain, upper body musculoskeletal injury (e.g. carpal tunnel syndrome, bursitis), strains not otherwise specified, cuts and abrasions, heat exposures/burns, and all other injuries (e.g. allergic reactions, concussion, electrocution, fracture, hearing loss, dislocation, dermatitis) .

Covariates

The injury literature shows that patterns of injury can be identified on the basis of age, gender, social characteristics and geographic location (Soubhi et al, 1999). Our multivariable analysis were able to control for gender, age at time of injury/comparison date, neighbourhood socioeconomic quintile based on Census data, and geographic location of residence (defined by the 5 health service delivery authorities in the province as a measure of both geographic diversity and access to health care services: Vancouver Coastal, Fraser Health, Interior Health, Vancouver Island and Northern Health Authority).

Statistical Analysis

Building upon the work of Hertzman and colleagues (1999), we constructed individual trajectories of health care contacts based on 12-month periods. To permit

valid comparisons, GP utilization was aggregated for the same time periods for injured workers and for matched non-injured youth. We chose the claim injury-comparison date as the aggregation start date for each worker and matched comparison. Individual trajectories were constructed for each 12-month period before and after injury-comparison date, exhausting the years of data available. All analyses were conducted in SAS (2001).

For the second phase of the analysis, we used a group-based method described by Nagin (1999) to a) identify group trajectories of health care utilization among the study sample and b) determine the risk factors that predict a youth's membership in the high health care utilization group. Trajectory analysis is designed to model individual-level heterogeneity in data over time. This approach requires the researcher to make some assumptions about the distribution of trajectories in the population. Rather than assume that the population distribution of trajectories varies continuously across individuals, it assumes that there may be clusters or groupings of distinctive health care utilization patterns that by themselves reflect distinctive etiologies.

The group trajectory estimation was completed using a SAS-based procedure called Proc Traj (Jones et al, 2001). The analysis proceeded in 2 stages. First, the distinctive clusters of health care utilization trajectories were identified using a semiparametric, mixture model. For each such trajectory group, the model defined the shape of the trajectory (rising, falling, stable or u-shaped) and the estimated proportion of the population belonging to the trajectory group. A key step in model estimation was the selection of the number of trajectory groups that best fit the data. Model selection

was based on the Bayesian Information Criterion (BIC). Specifically, models with 2 to 5 groups were estimated. The model with the best BIC was selected as the optimal model.

In the second phase of the analysis, an examination of predictors of trajectory group membership was conducted. The posterior probabilities of group membership was conducted. For each individual in the sample, the posterior probabilities estimates the probability of the youth's belonging to each trajectory group. Each young person was assigned to the group for which he or she has the largest posterior probability estimate. This is the group that best conforms to the youth's individual behaviour. To identify characteristics that distinguish trajectory group membership, multi-nominal Poisson regression (for count data) was used to examine risk factors associated with the high utilization group, as opposed to the other groups, controlling for the levels of other risk factors. Two models were estimated, one for health care utilization prior to injury-comparison date and one for health care utilization after injury-comparison date.

RESULTS

Description of Injured Worker Population

A total of 268,238 workers' compensation claims were accepted for 15-24 year olds in the province of British Columbia between 1991 and 2000 (allowing for a minimum of one-year of follow-up of health services utilization following injury) including medical only, short-term disability, long-term disability and fatal claims. Of these, a total were 47,818 first occurrences of a short-term disability claims (17.8% of claims), removing occurrences of multiple claims and medical claims with limited data on the injury and the worker. Of the first occurrences, 18,903 were for individuals living in the province during the entire follow-up period (7.1% of claims), enabling a complete comparison of health care utilization.

There were more males (59.9%) than females (40.1%) in the injured worker sample. The mean age at the time of injury (limited to the 15-24 year age range) was 20.5 years (sd 2.1). The most common types of injuries were lacerations (21.6%) and unspecified strains (21.6%) followed by back strains (18.7%), contusions (15.6%) and burns (6.3%). This is consistent with the overall distribution of claims reported by all young workers in British Columbia (Workers' Compensation Board of BC, 2000): strains (37%), cuts (24%), contusions (18%) and burns (7%).

At the time of injury, workers in the study sample were primarily employed in the accommodation/food sector (27.1%), retail sector (20.3%), general construction (7.4%), services not elsewhere specified (6.9%), and wood and paper products sector (6.6%). The study sample was consistent with the overall distribution of youth employment by industry in BC (Workers Compensation Board of BC, 2000). The injured worker sample

had a higher representation of males to females than seen in the overall workforce, but this is consistent with higher claim/injury rates among male workers (Workers' Compensation Board of British Columbia, 2000).

Description of Comparison Population

The comparison sample matched on year of birth, gender and geographic residence were not significantly different from the injured worker sample with a mean age of 20.1 years of age (sd 2.1 years) and 59.9% males. By definition, the comparison sample had no accepted workers' compensation claims during the follow-up period, and as such had no injury data or occupation and industry of employment data.

Description of GP Visits

The injured work population had a total of 836,538 GP visits (excluding pregnancy and related visits) during the follow-up period, or an average of 4.4 GP visits per person per year. The comparison sample had a total of 635,263 GP visits during the same follow-up period, or an average of 3.4 GP visits per person per year.

Overall among injured workers, health care utilization rose from 3.1 visits per person per year at the start of follow-up to 4.2 GP visits per person for the year immediately preceding the injury date. GP visits jumped to 5.6 per person per year in the year immediately following the injury date and then leveled off to 4.5 visits to the end of follow-up. Among the comparison sample, GP contacts rose from 2.8 GP visits per person per year at the start of follow-up to 3.3 visits in the year immediately before the

matched comparison date. GP visits remained at 3.3 visits in the year immediately following the comparison date and rose slightly to 3.5 by the end of follow-up.

In all cases the most common type of service provided during a GP visit in any year was an examination (For example, 71.1% of visits among injured workers and 68.6% of visits among the comparison sample in 2000). Overall, the majority of GP visits by injured workers during the follow-up period were for symptoms/signs/ill-defined conditions (27.0%), followed by respiratory diagnoses (16.2%), injury/poisoning diagnoses (14.7%), genitourinary diagnoses (8.7%), musculoskeletal system diagnoses (8.2%) and skin conditions (6.5%). For the comparison group, the majority of GP visits followed the same order as the injured worker sample but with a lower percentage of visits for injury/poisoning diagnoses (11.5%) and musculoskeletal condition diagnoses (5.9%), and a slightly higher percentage of visits for respiratory diagnoses (17.4%), genitourinary diagnoses (9.2%) and skin conditions (7.8%).

Trajectory Analyses – Period Prior to Injury-Comparison Date

For the trajectory analysis, a total of 206 injured worker:comparison pairs (1.1% of total study sample) were excluded from the analysis with outliers for number of GP visits per year (>40 visits in a year). The majority of these visits for both the injured worker and the comparison subjects were for GP examinations and non-invasive tests/procedures for a mental disorder diagnoses or for symptoms/signs/ill-defined conditions. The trajectory regression analysis was further limited to 16,783 injured worker and comparison pairs (88.8% of total study sample) for which there was complete data on the work-related injury (nature of injury, occupation, industry of

employment). The characteristics of the regression analysis sub-sample did not change from the overall sample with 59.8% males and a mean age of 20.0 years.

For the period prior to the injury-comparison date, four trajectories of health care utilization were identified (Figure 1). The first was composed of those with consistently low health care utilization (approximately 1-2 visits per year). These individuals were estimated to account for 25.7% of the sample. The largest group, estimated at 45.1% of the sample, followed a steady pattern of average health care utilization (approximately 3-4 GP visits per year). The next group, estimated at 23.4% of the sample, followed a slow rising trajectory from 4 GP visits per year to 6 GP visits per year. Finally, a group estimated to consist of 5.8% of the sample, had a high and fast rising trajectory of health care utilization from 8 GP visits per year to 12 GP visits per year. The percentage of trajectory group membership with a workers' compensation claim rose steadily from 36.8% of Group 1 (low users) to 64.0% of group 4 (high, rising users).

In the multi-variable analysis for the period prior to the injury-comparison date (Table 1), the strongest predictors of the high, rising health care utilization group compared to the low health care utilization group, controlling for the levels of other covariates, were being female (OR 16.6) and having a work related claim, especially for unspecified strain injuries (OR 5.69), upper-body musculoskeletal injuries (OR 5.02) and back strains (OR 3.98).

Trajectory Analyses – Period Post Injury-Comparison Date

For the post injury-comparison date, four trajectories of health care utilization were also identified in the study sample (Figure 2). The first group (~30.6% of sample)

composed of those with consistent low health care utilization (approximately 1-2 GP visits per year) and a second group (~42.7%) composed of those with consistent average health care utilization (approximately 3-4 visits per year) were similar to the pre-injury follow-up period. The next group, estimated at 21.3% of the sample, had a higher than usually pattern of GP visits (approximately 7-8 visits per year), but with a bit of a downward trend over time. Finally, a group, estimated to comprise 5.4% of the sample followed a trajectory of high health care utilization (approximately 13-14 GP visits per year). Of those in the low utilization trajectory group, only 30.6% of the group had a work-related injury compared to 67.9% of the high utilization group.

In the multivariable analyses (Table 1), the strongest predictors at the time of the injury-comparison date of the high health care utilization trajectory group compared to the low utilization trajectory group, controlling for the levels of other covariates, were being female (OR 34.0) and having a work-related claim, especially for an upper body-musculoskeletal injury (OR 9.4), unspecified strains (OR 8.2), and back strains (OR 7.5).

DISCUSSION

Our findings show separate trajectories of health care utilization with longer-term, high GP visits associated with a work related injury, and in particular for musculoskeletal injuries. Our findings also corroborate many of the health care utilization patterns that are found in the literature. Among these patterns are the gender and socioeconomic differences in the use of health care services. Females and lower socioeconomic status were associated with higher health care utilization trajectories. Interestingly, our results revealed differences in health care utilization by health region of residence before the

injury/comparison date, but not after. The higher observed health care trajectories in areas outside of the large metropolitan region of Vancouver may be attributable to injured workers working in 'riskier' jobs in resource sectors (e.g. forestry, mining) typically found outside of metropolitan areas, with more signs and symptoms requiring GP services prior to work disability. It is not clear why the effect of geographic location wasn't as important following the injury-comparison date

Observed increases in health care utilization among the injured worker group and in particular for musculoskeletal injuries is consistent with recent findings from the National Ambulatory Medical Care Survey (NAMCS) in the United States (Dembe et al, 2002). Results indicated that patients with a work-related condition had significantly increased odds of receiving certain types of health care including x-rays, physical therapy, and counseling during a physician visit, compared to patients for non-work related conditions. The NAMCS did not allow for long-term follow-up of health care utilization. The longitudinal study by Feldman and colleagues (2002) found that youth who worked were more likely to develop musculoskeletal pain than those who did not (OR=1.6)

Work completed by Hertzman and colleagues (1999) showed, in a longitudinal, population-based workforce study not limited to youth, an increase in GP visits to the injury year, a peak during the injury year and then a decrease, though not to former levels among injured workers in British Columbia. This compared to a low but steady age-related increase in GP visits among a matched comparison group for the same years. These trends persisted regardless of stratification by acute versus chronic types of injuries. Although not specific to work injury, data from the longitudinal Netherlands

Health Interview Survey (1990-1997) revealed that persons with more than one chronic condition, in particular musculoskeletal disease as the most common chronic condition in combination with other diseases, reported more health services, both in terms of volume and variety than those with one condition (Westert et al, 2001). This is similar to other studies linking higher use of medical care with follow-up of chronic conditions, including occupational asthma (Liss et al, 1999).

It was hypothesized that observed increases in health care utilization during and after a musculoskeletal injury might be work-related, even though they were not reimbursed by the workers' compensation system but rather the publicly funded health care system. Dembe and colleagues (2002), as part of the NAMCS study described above, estimated that 17.8% of visits for work-related conditions were paid for by sources other than workers' compensation insurance. This is consistent with Canadian (Shannon & Lowe, 2002) and US studies (Morse et al, 1998) that have shown an under-reporting of workplace injuries to workers' compensation systems.

The nature of strains and sprains to the musculoskeletal system results in episodes of pain and discomfort prompting employees to see a health care provider for relief of symptoms prior to crossing a threshold where the symptoms necessitate time off work. As well, returning to work following a claim with continued exposure to conditions associated with musculoskeletal morbidity compounded by existing tissue damage of the musculoskeletal system leads to continued episodes of pain and discomfort necessitating medical care (Hagberg et al, 1997). For recurrent conditions, individuals may find it easier to visit their general practitioner for relief than to pursue

compensation benefits. This may be particularly true for young workers unfamiliar with the workers' compensation system.

Young adults are commonly employed in a number of settings where work-related factors, such as awkward postures, high forces and repetitive motions can result in musculoskeletal injuries. These injuries may cause permanent or episodic impairment with serious ongoing physical effects. Strains and sprains represent a fairly high proportion of the work-related injuries that are reported by adolescents (WCB of BC, 1999). Non fatal injuries result in immediate medical care as well as care associated with recuperation and disability. These short-term costs are usually born by workers' compensation benefits. However, lingering or persistent symptoms as a result of work-related injury may present themselves in the publicly funded health care system over the longer-term.

Key Limitations of the Study

The pattern of sustained, increased health care utilization following a musculoskeletal injury may be attributable to subsequent claims among the injured worker population. However, increased utilization after the injury date persisted for a sub-analysis of injured workers with only one claim during the follow-up period (data not shown). Persistent use of health care services after an injury may represent a cumulative burden of morbidity over the life course as a result of the chronic and persistent nature of some injuries. As described by Hagberg and colleagues (1997), repeated exposures in combination with existing tissue damage for musculoskeletal injuries can produce additional damage and secondary responses that necessitate

medical attention. Many employees with back pain will have recurrences in the following year (20-44%) (VonKorff and Saunders, 1996). The significantly higher health care use beyond compensation benefits by workers with musculoskeletal compensation claims in our study indicates more gradual onset and greater persistence than usually captured with the designation “injury”.

Exclusive reliance on administrative data results in missing data on several factors that influence health care utilization. For instance, unobserved individual health practices, privately funded rehabilitation interventions, and injury severity measures could confound any observed associations between injury status and general health care utilization. In this study for example, smoking status was unavailable in any of the administrative data file. However, smoking status would have to be associated with a claim to systematically bias the results. Studies investigating the link between smoking status and musculoskeletal injuries, those with interesting patterns of health care utilization in our study, have been equivocal (Ekberg et al 1997; Skov et al 1996). As well, socio-economic status is an explanatory variable for health and health care utilization (Marmot et al, 2001). For study subjects, we had access to census data aggregated to neighbourhood level income, categorized into quintiles. This may introduce some misclassification but non-differentially for both injured worker and comparisons based on census data. Finally, we did not have a measure of severity in our data but future work investigating differences by duration of claim may prove insightful.

We investigated the effect of including outliers in the trajectory analyses. Individuals with more than 40 GP visits per year were equally distributed among the

injured workers and comparison group. The trajectory analysis produced the same 4-group resolution with the same significant risk factors for membership in the high utilization groups, but the inclusion of the outlier data resulted in exaggerated GP visits trajectories over time (data not shown).

Summary

Findings from this study describe significant long term health consequences, as measured by increased health care utilization, associated with a workers' compensation claim among young workers, especially for episodic or recurrent conditions such as musculoskeletal injury. It also provided an opportunity to describe the potential shifting of health care to the publicly-funded health care system among a vulnerable segment of the workforce unfamiliar with making a report for symptoms related to work or for re-opening a claim once symptoms recur or persist after returning to work or even after leaving work and entering university following a job in high school, for example.

To our knowledge, this was the first-ever population-based study of health care utilization among young workers following a work-related injury. The data provide a substantive 10-year longitudinal profile of general health care utilization. The longitudinal aspect is particularly important for understanding the potential longer-term consequences of an injury by a young worker. Taken together, the results of this study are an example of how linkable administrative data sets can help identify health care utilization patterns among high risk groups such as young injured workers. There is a need to broaden the scope of injury data collection, to provide a more complete account of the burden of injuries and their consequences in order to target resources that will in

turn assist in the development of better injury prevention, rehabilitation and compensation measures.

POLICY IMPLICATIONS

The overall objective of this study was to investigate the burden of high health care utilization trajectories attributable to work-related injuries. Evidence of the longer-term consequences is fundamental to establishing resource allocation, prevention initiatives and regulatory priorities aimed specifically at young workers, despite their marginal position in the workforce. It is important to note the broader societal implications of maintaining a healthy workforce now to sustain our economy as our population ages.

Prevention

Although claim rates are approaching those of other age groups, there are reasons to believe that young workers may underreport injuries to the workplace. Given observed longer-term health consequences associated with a workers' compensation claim, youth remain a high risk group for dedicated prevention resources by the workers' compensation system. Surveys of young workers and focus groups with employee and employer representatives suggest that more work is needed around specific interventions and regulations governing young workers including 'youth-specific' training and supervision. Regulations and guidelines concerning young workers participation in the labour force and the type of work, tasks and hours they complete

may require reexamination in light of evidence of the longer term consequences of musculoskeletal injuries.

Rehabilitation

Rehabilitation and return to work programs may need to take into consideration the longer-term health consequences of work-related injuries, in particular for musculoskeletal injuries among youth. Although, this may in fact be true for injured workers regardless of the age group and future work replicating these results for other age groups is warranted. However evidence of a musculoskeletal injury in the first 10 years of one's work career, and among individuals whose musculoskeletal system is still developing, may mean very long term health trajectories of episodic and recurrent health problems. Findings that health care utilization increases prior to the start of a workers' compensation claim may also mean that health care providers play a role in the prevention effort by providing guidance to young workers about work, workplace risks and protective measures. Also, aggressive early treatment of certain injuries may prevent ongoing medical problems.

Administration

It is recommended that workers' compensation systems and the public health care systems discuss the potential shifting of health care to the publicly-funded health care system from the workers' compensation system for episodic or recurrent conditions such as sprains and strains, both before a worker goes on disability benefits, and after when a worker returns to the job. As a first step, it is recommended that the public health care system in British Columbia consider adding occupation and industry of

employment fields to the medical services billing record for improved monitoring and surveillance of emerging health issues within the general population by work related characteristics.

DISSEMINATION ACTIVITIES

Traditional knowledge transfer activities have included presentations at conferences and academic journal publications (to date):

Koehoorn M, Breslin C, Xu F. Investigating the long-term consequences of injuries among young workers. EPICOH 2004: 17th International Symposium on Epidemiology in Occupational Health. October 13-16, 2004; Melbourne, Australia. Abstract appears in *Occupational and Environmental Medicine*, 61, e51.

Koehoorn M, Breslin C, Xu F. Using trajectory analysis for occupational health research Canadian Association of Research on Work and Health, June 2006. St. John's Newfoundland.

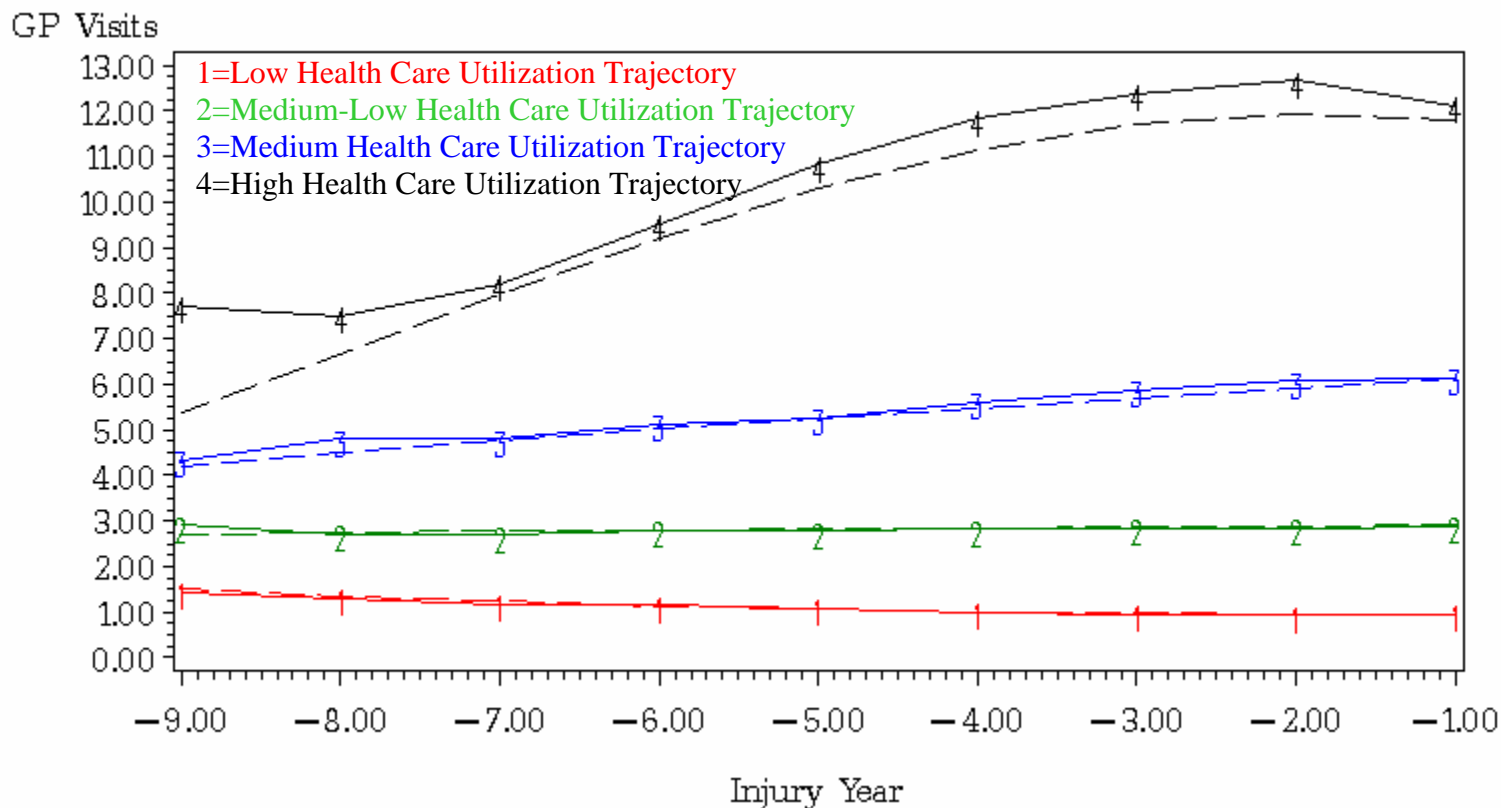
Koehoorn M, Breslin C, Xu F. The longer-term consequences of work-related injuries among youth. Journal article for submission to *Youth and Society*.

Knowledge translation research has identified the development of partnerships, based on regular exchange and contact, as the most effective approach in facilitating the use of research evidence and in creating a research-attuned culture among decision makers. Consistent with this approach, the principal investigator meets regularly with senior WCB decision makers as part of the WorkSafeBC-UBC Research Partnership to share research findings, including findings from this project. As part of this partnership, decision and policy makers are actively engaged in the research process.

Relationships with senior policy makers and leaders in the compensation field are well-established, and the 'receptor' capacity for the findings and mechanisms for interchange and policy/program development are underway. Findings from this study will be included in a presentation to the Board of Directors in January, 2006.

Findings from this project will also be posted on a public website (www.chspr.ubc.ca/research/wcbpartnership.htm) that has been created to profile the WorkSafeBC-UBC Partnership and to present the results of research projects to a broader audience. Knowledge translation will also be facilitated through our active collaboration with the UBC Centre for Health and Environment Research, which has dedicated research personnel and resources focusing specifically on knowledge translation in occupational health settings (www.cher.ubc.ca).

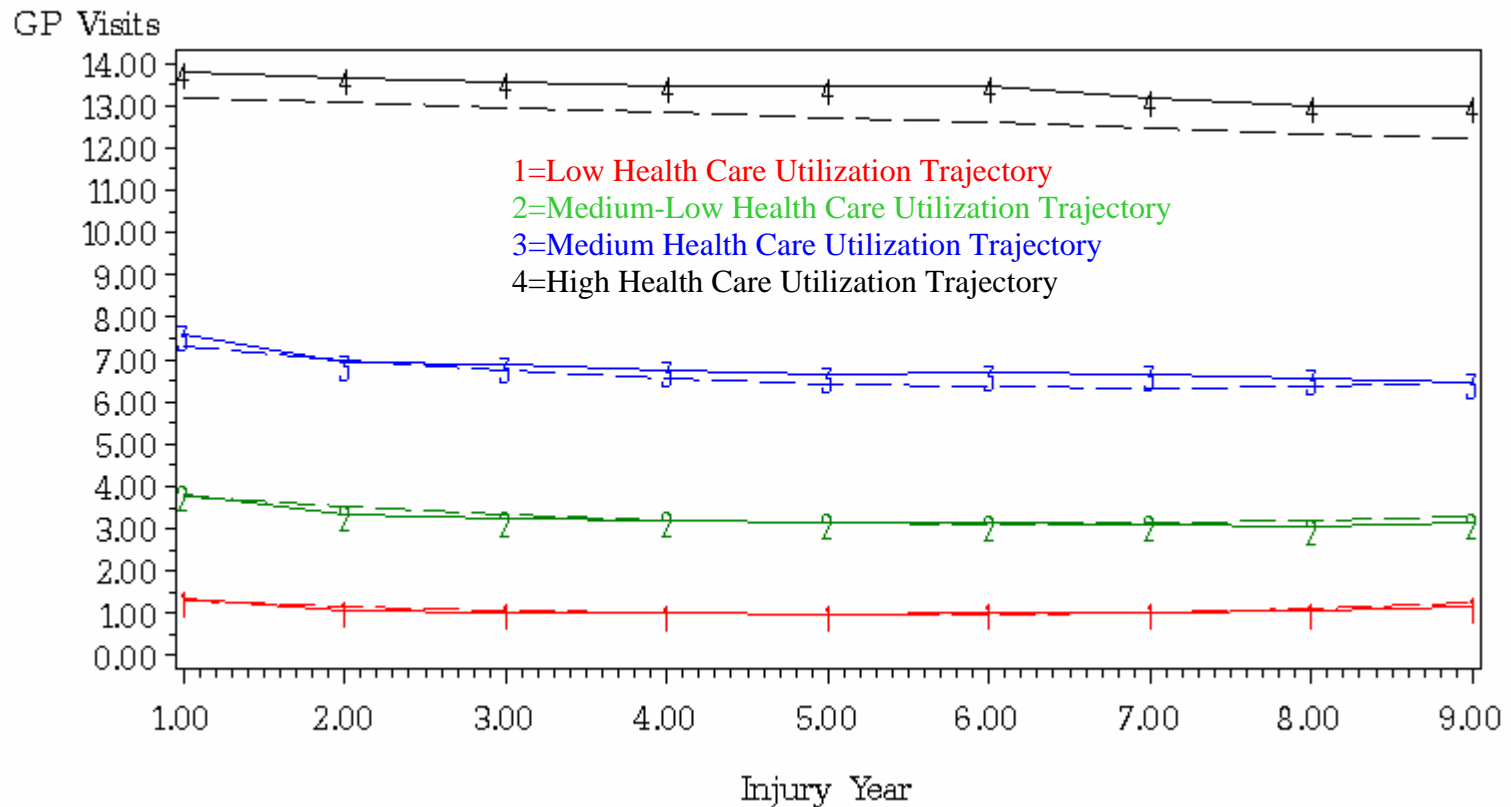
FIGURE 1: Trajectories of Annual GP Visits for 15-24 year olds (16,783 Injured Workers and 16,783 Comparison Youth) for 10 years PRE INJURY-COMPARISON DATE, 1991 and 2000.



-----Dotted Lines indicated Predicted Trajectories

_____ Solid Lines Indicate Actual Trajectories

FIGURE 2: Trajectories of Annual GP Visits for 15-24 year olds (16,783 Injured Workers and 16,783 Comparison Youth) for 10 years POST INJURY-COMPARISON DATE, 1991 and 2000.



-----Dotted Lines indicated Predicted Trajectories

_____Solid Lines Indicate Actual Trajectories

TABLE 1: Predictors of high health care utilization (annual GP visits) trajectory: Multinomial Poisson Regression among 15-24 years old.

Variable (characteristics at time of injury/matched comparison date)	OR (95% CI) High (Group 4) vs Low Trajectory Group	OR (95% CI) High (Group 4) vs Low Trajectory Group
	Pre-injury follow-up period	Post injury follow-up period
Female	16.6 (14.3, 19.3)	34.03 (29.26, 39.58)
Age (1 year increase)	1.05 (1.02, 1.09)	0.96 (0.94, 0.99)
Neighbourhood Socioeconomic Quintile		
Highest Quintile (reference)	1.00	1.00
Medium High	1.02 (0.83, 1.24)	1.18 (0.96, 1.44)
Medium	1.11 (0.90, 1.35)	1.43 (1.17, 1.74)
Medium Low	1.40 (1.15, 1.71)	1.71 (1.40, 2.08)
Lowest Quintile	1.52 (1.24, 1.85)	2.11 (1.74, 2.56)
Health Region of Residence*		
Vancouver Coastal (reference)	1.00	1.00
Interior British Columbia	1.56 (1.25, 1.95)	0.96 (0.78, 1.18)
Fraser Valley	1.84 (1.53, 2.22)	1.33 (1.12, 1.58)
Vancouver Island	1.61 (1.20, 1.99)	1.13 (0.93, 1.37)
Northern British Columbia	1.12 (0.86, 1.45)	0.81 (0.63, 1.04)
Work-related Injury (STD** claim)		
No injury claim (reference)	1.00	1.00
Back Strain	3.98 (3.22, 4.91)	8.90 (7.23, 10.96)
Upper-body Musculoskeletal	5.02 (3.41, 7.39)	10.94 (7.46, 16.04)
Strains other than Back	5.69 (4.68, 6.91)	11.54 (9.51, 14.01)
Abrasions and Contusions	4.76 (3.80, 5.95)	8.71 (7.09, 10.70)
Heat and Chemical Burns	2.31 (1.66, 3.22)	4.03 (2.87, 5.65)
All Other Injuries	1.93 (1.58, 2.34)	4.46 (3.70, 5.37)

*The province of British Columbia is divided into five geographically defined health authorities that govern, plan and coordinate health services regionally. Vancouver Coastal is the largest, metropolitan region.

** Accepted, short-term disability workers' compensation claim

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