NON-WAGE LOSSES ASSOCIATED WITH OCCUPATIONAL INJURY AMONG HEALTHCARE WORKERS

Final research report to WorkSafeBC

For the research project entitled “Documenting the Economic and Quality of Life Consequences of Work Injuries for Healthcare Workers in BC”

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Main Research Findings

- In this study, consenting BC healthcare workers filing a lost-time or medical-aid claim with WorkSafeBC reported weekly out-of-pocket expenses, time lost from non-work social roles, time used by others to assist them, and injury impact on their quality of life.
- Non-wage economic losses were estimated at $3,131 (95% CI: $3,035; $3,226) per each musculoskeletal injury during the first 12 weeks; or 59% of the lost-wages.
- The most significant non-wage losses were the time lost by the workers and those assisting them. Out of pocket expenses were a modest $338 per musculoskeletal injury.
- Most but no all workers had recovered by 12 weeks, and the quality of life impact of one musculoskeletal injury was the equivalent of losing 7.9 to 13.7 days of life.
- Musculoskeletal injuries to the neck and upper limb had the highest economic loss in absolute terms; however, the differences when compared to back and to lower limb musculoskeletal injuries were not statistically significant.
- The impact of non-musculoskeletal injuries was significantly less, but the impact could not be estimated with precision for specific types of non-musculoskeletal injury.
- The impact of injury varied according to the type of injury, region of residence and the occupation of the healthcare worker.
- These estimates of non-wage losses are based on worker self-report, which was considered the only currently feasible way of gathering the information.

Policy / Prevention Implications

- Governments and organizations determining compensation policies for injured workers should consider these non-wage losses in calculations of programme benefits.
- These estimates of non-wage losses can be used to integrate workers’ perspectives into comprehensive economic evaluations of occupational health and safety programmes to prevent musculoskeletal injuries.
- Proper consideration of non-wage losses may make the cost-benefit ratio of occupational injury prevention programmes more favourable, thus making investments in such programmes more justifiable at the societal level.
Executive Summary

Economic evaluations of occupational health and safety (OHS) programmes are increasingly reported and used to inform programme choices and funding decisions. However, published economic evaluations do not include the non-wage losses experienced by workers as a result of work injury. They focus primarily on losses accruing to employer or insurer.

Non-wage losses include the time lost from household and community involvement by the worker and by persons assisting the worker, out-of-pocket payments and the loss of quality of life (pain and suffering).

This study recruited consenting healthcare workers filing a claim for a loss-time or medical-aid occupational injury between October 2009 and March 2011. Worker self-reports and standard quality of life questionnaires were used to calculate: a) non-wage economic losses in 2010 Canadian dollars; and b) number of quality-adjusted life days lost.

Non-wage losses for each worker were calculated by the sum of out-of-pocket payments and hired help payments; plus the estimated dollar value of hours lost from leisure and volunteering and hours spent by others assisting the worker. The value of an hour of leisure or volunteering was estimated at the worker’s hourly rate of pay, and the value of time spent by others was calculated using the average hourly salary rate in British Columbia for 2010 ($20.32).

Quality-adjusted life days lost were estimated in two ways: assuming that the injured workers before the injury had the same quality of life as the general Canadian population of 35-44 years of age; and assuming that the best quality of life reported by the participants during recovery was their pre-injury baseline.

Musculoskeletal injuries among healthcare workers in BC resulted in a mean non-wage economic loss of $3,131 in 2010 Canadian dollars. Non-wage economic losses included a mean of $338 in out-of-pocket expenditures, 66 hours lost from leisure and volunteering, and 39.5 hours spent by others assisting the injured worker. Non-wage economic losses corresponded to 59% of the value of lost wages.

The corresponding loss in quality of life was 7.9 quality-adjusted life days per injury, when the health state of the general Canadian population of 35-44 years of age was used as the pre-injury baseline. This impact increased to 13.7 quality-adjusted days when the best health state achieved by the worker after injury was used as their baseline.

Type of injury, region of the province and occupation influenced the magnitude of these losses.

The impact of non-musculoskeletal injuries was significantly less. It was not possible to estimate detailed losses associated with specific types of non-musculoskeletal injuries due to the small number of workers with these injuries in the study.
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ABSTRACT

Objectives: To determine non-wage losses following occupational injury among healthcare workers in a Canadian province; and to explore demographic and work-related characteristics associated with the magnitude of losses.

Methods: This inception cohort recruited consenting healthcare workers filing a claim for a loss-time or medical-aid occupational injury between October 2009 and March 2011. Worker self-reports were used to calculate: a) non-wage economic losses in 2010 Canadian dollars; and b) number of quality-adjusted life days lost. Analysis was by two-way ANOVA and linear regression.

Results: 146 workers provided complete records; 84% had sustained musculoskeletal injury (MSI). Estimated mean non-wage economic losses were $3,131 (95% CI: $3,035; $3,226) per MSI including out-of-pocket expenses, time lost by the worker from non-work social roles, and time used by others to assist the injured worker. Non-wage economic losses varied with type of injury, region of the province and occupation. Estimated mean lost wages were $5,286. Assuming the cohort had the same quality of life as the general Canadian population of 35-44 years of age prior to injury, each MSI resulted on average in 7.9 quality-adjusted days of life lost. Non-MSIs had lesser non-wage losses, but the small number of workers with these injuries in the cohort did not allow precise estimations.

Conclusion: Non-wage economic losses after a MSI corresponded to about 59% of lost-wages and 7.9 quality-adjusted life days lost to a healthcare worker. Given this high magnitude, non-wage losses should be considered in workers’ injury compensation policies and in economic evaluation studies.

What is known:
Most available economic analyses of occupational injury prevention consider economic losses for the employer or the insurer, but ignore the non-wage losses that remain uncompensated consequences for workers experiencing the injury.

What this study adds:
Non-wage losses associated with an occupational musculoskeletal injury corresponded to about 59% of lost-wages and 7.9 quality-adjusted life days lost to a healthcare worker.

Given this high magnitude, non-wage losses should be considered in workers’ injury compensation policies and in economic evaluation studies.

Key words: occupational injuries, healthcare workers, economic impact, quality of life impact
Research Problem/Context

Economic evaluations of occupational health and safety (OHS) programmes are increasingly reported and used to inform programme choices and funding decisions [1]. However, published economic evaluations do not include the non-wage losses experienced by workers as a result of work injury. They focus primarily on losses accruing to employer or insurer [2]. At best they include a broad estimate of non-wage losses, such as 1 or 1.5 times the wage-replacement and healthcare payments [3]. Non-wage losses include the time lost from household and community involvement by the worker and by persons assisting the worker, out-of-pocket payments and the loss of quality of life. Ignoring non-wage losses makes it possible to conclude that an occupational health and safety intervention is cost-beneficial simply by shifting the costs to the worker and family.

The aim of the study was to record the economic and quality-of-life impacts of the most common types of injuries experienced by healthcare workers in British Columbia (BC), Canada, based on a direct report from the workers. The study objectives were:

1. To estimate the typical non-wage economic and quality-of-life (QOL) losses experienced by healthcare workers who suffer occupational injuries;

2. To define how type of injury and place of residence affect these losses; and

3. To identify other factors affecting these losses.

The following findings were expected: large non-wage losses for healthcare workers (between 50% and 100% percent of wage-losses); substantial initial decreases in quality of life that disappear for most but not all by the 12th week; and that losses would vary with type of injury,
region of residence and other factors, with larger losses for back injuries and the lower mainland region of BC.

Methodology

The study used an inception cohort design and included consenting healthcare workers who 1) filed a claim with the provincial workers’ compensation agency for a loss-time or medical-aid occupational injury within 2 weeks of the incident; 2) were full-time, part-time or casual workers of a regional health authority in BC; and 3) reported one of the following six injury types: musculoskeletal back injury (MSI-back); musculoskeletal neck and/or upper limb injury (MSI-neck/upper limb); other musculoskeletal injuries (MSI-other); exposures to blood and body fluids; bruises contusions and cuts without exposure to blood and body fluids; or irritations and allergies to skin, respiratory tract and mucous membranes. Workers not employed by the regional health authorities (physicians, students and sub-contracted facility workers), those unable to complete reports in English, and those who reported the injury 2 weeks or more after the incident were excluded from the study. A stratified sampling design was used to obtain representation from each of the six types of injury groups and each of four regions of the Province: Lower Mainland, Interior, Vancouver Island and Northern. This study was approved by the Behavioural Research Ethics Board of the Office of Research Services University of British Columbia (UBC).
Recruitment

The study was conducted in the province of British Columbia, with participants recruited between October 2009 and March 2011. Once a week during the study period, the provincial workers compensation agency produced a list of healthcare workers submitting a claim during the previous week (both time-loss and medical-aid claims). The individuals in the list were contacted by agency staff to ascertain consent to provide their contact information to the research team. Then, the research coordinator mailed a recruitment package to prospective participants and followed up with them by phone.

After obtaining the appropriate informed consent, study participants were asked to record economic information daily in a questionnaire developed for this study, and to report the information (online, by phone or by mail) to researchers once a week for the first 12 weeks after the injury (the data reported in this study). A few study participants, who did not fully recover after 12 weeks, provided additional data until 12 months after the injury. However, these data were not used in this study because of a small number of such participants.

Questionnaire

The study questionnaire was pilot-tested on a separate sample of 12 injured workers and refined based on their feedback, prior to the main study. The questionnaire collected economic information on seven sections: 1) out-of-pocket payments for injury-related health care and supplies, 2) out-of-pocket payments for injury-related non-healthcare expenses, such as transportation for medical visits, 3) regular and overtime hours of work lost due to injury, 4) hired help payments, 5) number of hours friends or relatives assisted the injured worker, 6) time taken off work by others (partner/family member), and 7) hours of leisure and volunteering lost.
due to injury. The impact of the injury on health-related quality of life of the workers was documented by completing the European Quality of Life 5D questionnaire (EQ-5D) once a week. This is a validated 5-item questionnaire that also provides a visual analog scale (EQ-VAS) to assess overall perceived health status using a 0-100 scale (0 is equivalent to worst and 100 to best possible health). The EQ-5D is a widely used instrument in economic evaluations of medical interventions [4].

**Measures**

Non-wage losses for each worker were calculated by the sum of out-of-pocket payments and hired help payments; plus the estimated dollar value of hours of non-hired help, time taken off work by partner/family member and hours lost from leisure and volunteering. The value of an hour of leisure or volunteering was estimated at the worker’s hourly rate of pay, and the value of time spent by others was calculated using the average hourly salary rate in British Columbia for 2010 ($20.32) [5].

Workers also reported hours lost from regular and overtime work. The value of an hour of regular work was calculated at the worker’s hourly rate of pay, the value of an overtime hour was calculated at 1.5 times the hourly rate.

The EQ-5D completed once a week was scored to derive the corresponding utility (EQ-5D Index) as per the EuroQol manual and applied to the preceding week, at each interval for 12 weeks [6]. Quality-adjusted life days lost were estimated in two ways: assuming that the injured workers before the injury had the same EQ-5D index score as the general Canadian population of 35-44 years of age [7] (a priori analysis); and assuming that the best EQ-5D index score reported by the participants after injury was their pre-injury baseline (secondary post-hoc analysis).
35-44 years old group was used for comparison because the mean age for the Canadian healthcare workforce is 41.9 years [8]. Results of perceived health status (EQ-VAS) were analyzed with descriptive statistics, but not included in the calculation of quality-adjusted life days lost.

Statistical Analysis

Mean with standard deviation and median with inter-quartile range of the losses were reported in 2010 Canadian dollars. To estimate the mean economic losses per episode of injury in the Province, weights were attributed to each type of injury in each region based on injury rates published previously by Alamgir et al [9] and 2010 workforce totals from the provincial workers’ compensation agency website. Only MSI losses were estimated, because the low number of participants in the non-musculoskeletal injury categories would make the estimates for such injuries unreliable. Thus, exposures to blood and body fluids; bruises contusions and cuts without exposure to blood and body fluids; and irritations and allergies to skin, respiratory tract and mucous membranes were collapsed in a single non-musculoskeletal injury (non-MSI) category.

Two-way Analysis of Variance was used to assess if there was a statistically significant difference in economic and QOL losses by type of injury and region of the province (pre-specified analysis, hypothesis testing). Other factors influencing economic and QOL losses were analyzed by multiple linear regression (exploratory analysis). Regression models included type of injury, geographical region, sex, occupation, and employment status (full time/part time/casual). Logarithmic transformation of dependent variables was done for all regression analyses because the data were skewed. Significance level was set at p<0.05 and 95% confidence
intervals were calculated. Statistical analyses were carried out using the Statistical Package for the Social Sciences (SPSS Version 19.0, 2010).

Research findings

Participants

During participant recruitment (October 2009 to March 2011), the provincial workers’ compensation agency provided the contact information of 651 potential participants. Of those 651 potential participants, 222 consented to participate in the study (34% recruitment rate). Ultimately, 146 workers provided complete records (65.8% retention rate).

The recruitment target of the study was 30 participants for each of the six injury types and 45 participants in each of four geographical regions, for a total of 180. These recruitment targets were not reached in the non-MSI categories and in the most remote region of the province. The study participants did not differ from those who declined to participate, based on region of residence and gender, but study participants were less likely to have non-MSIs (16% vs. 25%, p<0.05).

Overall, 84% (n=123) of participants had MSIs: MSI-neck/upper limb (40.4%), MSI-back (30.8%) and MSI-other (13.0%). The high proportion of MSIs in the study sample corresponds to the pattern of occupational injury among healthcare workers reported by other sources [9, 10]. As expected, the majority of participants were women – 91% (n=133), since most healthcare workers in Canada are female [8]. Almost half of the study participants were registered nurses (RNs) or licensed practical nurses (LPNs) (Table 1). The majority of the study participants
(59.6%) were employed in acute care, followed by long-term care (22.6%) and community care (17.8%). Among all study participants, 58.9% were full-time workers, 26% were part-time and 15.1% were casual.

Non-wage losses

Mean non-wage economic losses per MSI injury were $3,131 (95% CI: $3,035; $3,226). These included $338 in out-of-pocket expenditures, 66 hours lost from leisure and volunteering, and 39.5 hours spent by others assisting the injured worker (Table 2). Non-wage losses corresponded to about 59% of lost wages, resulting in total mean economic losses of $8,417 (95% CI: $7,213; $9,620). Median and inter-quartile range (IQR) are also reported in Table 2. Sensitivity analysis performed using 0.8 and 1.2 times of the estimated value of an hour resulted in estimates of total losses of $6,733 and $10,100, respectively.

Quality of life

Results from the EQ-5D showed that during the first week after injury: 41.5% of participants reported mobility problems; 59.8% problems with personal self-care; 85.7% problems with their usual activities; 87.2% pain or discomfort; and, 50.4% feeling anxious or depressed. As expected, EQ-5D index scores increased over time as workers recovered from their injury (better quality of life). Shortly after the injury, workers with MSIs reported worse EQ-5D index scores than workers with other types of injury. The highest EQ-5D index scores were observed in workers with exposure to bodily fluids.
The mean level of perceived health status (EQ-VAS) of study participants improved steadily from 55 in Week 1 to 78 in Week 12. For comparison, the mean EQ-VAS for the general Canadian population aged 40-49 was 81.2 in 2000 [11]. Perceived health status varied depending on type of injury. Workers with back injuries reported the lowest mean perceived health status, 43.2 in week 1 rising to 74.6 in week 12; whereas workers exposed to blood and bodily fluids reported the highest, 90.7 in week 1 rising to 93.6 in week 12.

Assuming that before the injury study participants had the same quality of life as the general Canadian population of 35-44 years of age (mean EQ-5D index of 87.4) [7], workers lost an equivalent of 1.0 quality-adjusted days of life in the first week, and 0.2 days in week 12. Overall, each MSI resulted on average in 7.9 quality-adjusted days of life lost. Assuming that the best EQ-5D index score achieved by the participant after injury was their pre-injury baseline, each MSI resulted on average in 13.7 quality-adjusted days of life lost.

**Impact of type of injury and BC region**

Type of injury and BC region had an impact on total economic losses (two-way ANOVA: F=3.774, p<0.001), and on non-wage economic losses (two-way ANOVA: F=2.132, p=0.013). MSI-neck/upper limb had the highest economic loss in absolute terms; however, the differences when compared to MSI-back and MSI-other were not statistically significant. Non-MSIs were associated with significantly smaller total and non-wage economic losses. For total economic losses, injuries occurring in the Lower Mainland were associated with the highest losses, whereas injuries occurring in the Interior region were associated with the lowest losses.
However, there were no statistically significant differences for non-wage economic losses among regions.

QOL losses were lower for non-MSIs and for healthcare workers residing in the Interior region.

**Other factors affecting economic and QOL losses**

Table 3 shows the results of the exploratory multiple regression analysis of characteristics associated with total economic losses in the cohort. The model was significant (p<0.001) with adjusted $R^2 = 0.26$, indicating that the model explains about 26% of the variation in total losses. In addition to the type of injury and region of the province, occupation was important with greater economic losses among RNs.

When the regression analysis was repeated using only non-wage economic losses as a dependent variable, the model was still significant (p=0.001) with adjusted $R^2 = 0.17$. As with the previous model, non-MSI injuries were associated with less non-wage losses (p<0.001) and RNs had higher non-wage losses. The higher non-wage losses for RNs were still statistically significant, when leisure and volunteering time were valued at the same rate for all occupations ($20.32) rather than at the rate of pay for the injured worker.

Table 4 shows results of the multiple regression analysis exploring factors that impact quality-of-life losses after occupational injury assuming pre-injury QOL was the same as the general Canadian of 35-44 years of age. This model was significant (p<0.001) with an adjusted $R^2 = 0.23$. In addition to type of injury and region of the province, it was found that Laboratory/Other...
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Health Service Workers reported higher quality of life losses after occupational injury. Using the highest (best achieved) post-injury EQ-5D index score as the workers baseline, the analysis revealed that none of the predictors had significant impact on quality-of-life losses ($R^2 = 0.02$).

**Implications for Future Research on Occupational Health**

This cohort study sought to determine the non-wage losses (both economic and quality of life) associated with occupational injuries among healthcare workers in a Canadian province; and to explore factors affecting the magnitude of these losses. MSIs among healthcare workers in this Canadian province resulted in a mean non-wage economic loss of $3,131 in 2010 Canadian dollars. The corresponding loss in quality of life was 7.9 quality-adjusted life days per MSI, when the health state of the general Canadian population of 35-44 years of age was used as the pre-injury baseline. This impact increased to 13.7 quality-adjusted days when the best health state achieved by the worker after injury was used as their baseline. Non-wage economic losses included a mean of $338 in out-of-pocket expenditures, 66 hours lost from leisure and volunteering, and 39.5 hours spent by others assisting the injured worker. Non-wage economic losses corresponded to 59% of the value of lost wages which is in line with the study hypothesis.

Type of injury, region of the province and occupation influenced the magnitude of these losses. It was not possible to estimate detailed losses associated with specific types of non-MSIs due to the small number of workers with these injuries in the cohort.

Countries, provinces and states differ in their policies and regulations governing compensation for occupational injuries [12]. In Canada, worker compensation agencies provide wage...
replacement benefits calculated as a defined portion of the lost wages. Non-wage losses do not enter in these calculations. Some non-wage losses might be eligible for reimbursement but for the most part non-wage losses are borne by the worker and her family and community.

Worker compensation systems also vary in how quality-of-life losses from occupational injury are compensated (often referred to as pain, suffering and loss of enjoyment of life). In some jurisdictions no compensation is provided, whereas in others a lump sum is given if workers do not fully recover from their injury (i.e., they experience a permanent impairment) [13]. For injuries that do not fall under the legal umbrella of workers compensation, it is not unusual for courts to award large amounts to compensate for pain, suffering and loss of enjoyment of life [14]. This is often the case in motor vehicle injuries and personal injuries.

The study findings confirmed that work-related injuries substantially affect the quality of life, although by week 12 the majority of the respondents recovered. Rather than assigning a dollar value to quality-of-life losses, quality-adjusted days of life lost as a result of injury were reported using a common and well-validated utility measure, the EQ-5D. Ideally, to calculate quality-adjusted life-days lost, the quality of life of the person before the injury needs to be determined. Participants’ retrospective reports about their quality of life in the weeks prior to the injury were considered unreliable due to a recall bias. Instead, quality-adjusted life days were calculated assuming that before the injury respondents were as healthy as the average Canadian of 35-44 years of age. A previous study in Alberta reported that the mean value of the EQ 5-D index for that age group was 87.4 in 2000 [7]. As the results were analyzed, it was realized that by week 12 after injury, the EQ 5-D index scores in the participants were significantly larger than 87.4. Therefore, a post-hoc analysis was performed assuming that the quality of life prior to the injury
was equal to the best EQ-5D Index score reported by the participant during the three months after the injury. Values under both assumptions were presented: 7.9 and 13.7 days. There is a cogent argument to rely primarily on the latter estimate, because it is logical to assume that the quality of life before the injury was better than the best health achieved during the 12-week post-injury recovery period (unless one proposes that having an injury improves the quality of life). However, the counterargument would be that the high EQ 5-D index scores observed during recovery were an artefact of multiple applications of the same instrument week after week, because participants wanted to reflect the gradual improvements experienced after injury.

Non-wage losses were highly skewed with median values that were substantially smaller than the mean values, because a few workers incurred very large losses. In fact a small number of participants continued to incur losses well beyond 12 weeks after the injury. This study cannot offer precise estimates for these high cost chronic disabling injuries, since it concentrated on the first 12 weeks after injury. The natural skewness of losses after an occupational injury needs to be considered in economic evaluations and in setting compensation policies.

Factors affecting economic and QOL losses

Non-wage losses were similar for all MSIs and perhaps larger for neck and upper limb injuries, rather than low back injuries as hypothesized. Non-MSIs, as a group, did show statistically significant lower non-wage losses compared to MSIs. It is well known that average payments for wage replacement and healthcare provided by worker compensation systems are higher for MSIs than non-MSIs [10]. Other studies indicate that exposures to blood and bodily fluids are
less likely to be reported than other injuries, and when reported healthcare workers do not seem to place a lot of importance on the injury [15]. This might partially explain the difficulty in recruiting workers with Non-MSIs. The findings emphasise the importance of prevention of MSIs among healthcare workers because they are associated with greater costs. Potential benefits from such prevention programmes would be much greater when the non-wage losses for the worker and their families are taken into account.

There were significant regional variations in total losses, but they were no longer significant when only non-wage losses were considered and models were adjusted for other variables. It was hypothesized that regional differences existed because of differences in days lost from work after injury, the local cost of goods and services, and salaries across the Province. Differences in days lost from work after injury across regions in this province have been noted (WorksafeBC unpublished data, 2009), although the reason for such differences is unclear. The observed regional differences, across a single Province in a single industrial sector with the same injury reporting and compensation systems, should alert researchers to the need to explore regional differences in their own setting when planning economic evaluations that include data for a large geographical area.

The observed differences on losses by type of injury and occupation are informative and could be used in future research to adjust the valuation of consequences, where these data cannot be collected directly. At first it was felt that the greater total losses reported by registered nurses were explained by their higher rate of pay compared to other occupations represented in the study. But the difference did not disappear when the analyses were repeated on non-wage losses
only, or using the same hourly rate for all occupations. The effect of occupation on losses after occupational injury should be studied in future research.

As hypothesized, QOL losses varied with type of injury, with non-MSIs having lower losses. Laboratory/Other Health Service workers had significantly more quality-adjusted life days lost as a result of occupational injury. The effects of type of injury and occupation on QOL losses were not statistically significant when the best achieved post-injury health status was used as a baseline. The reason for this was not clear.

The reviews by Weil [16] and Reville et al [17] provide a solid framework for understanding options for valuation of the consequences of work injury: documenting household income before and after injury, documenting how household members changed the time allotted to valued activities as a result of injury, and documenting the global loss in quality of life experienced by the worker [16]. This study provides information on the latter two ways of valuing consequences to the worker.

The study estimates of total losses for healthcare workers after occupational injury were in line with published studies. The overall consequences of injury across sectors and all occupational injuries (mild and severe) have been reported to be about $8,000 to $10,000 in the first year after injury and were larger for those who went on to develop long-term disabilities [18]. The literature also shows that workers’ compensation does not cover all costs incurred by injured workers because many injuries do not result in a compensation claim [19], and even for compensated claims, compensation amounts do not cover all economic and non-economic losses experienced by the worker [1].
Study strengths and limitations

This study has a number of strengths. It is the first study to systematically quantify non-wage losses after an occupational injury in an inception cohort of healthcare workers. It contributes unique new estimates of those non-wage economic losses, their relative composition (out-of-pocket payments, time lost from leisure and volunteering, time spent by others assisting the worker), and the relative value of non-wage losses in relation to wage-losses determined with the same methods in the same population. Data were recorded daily and reported weekly, so that the effect of recall bias is minimized. In addition, quality-of-life losses were estimated using a validated and standardized method based on the EQ 5-D index.

This study also has several limitations. The original study design called for recruitment of an equal number of participants in each injury category across all study regions, however this proved impossible to achieve during the study timeframe. MSIs were overrepresented in the study cohort, making up 84% of the total. MSI are known to be very frequent among healthcare workers and often require a longer recovery time than other injuries. The low number of non-MSIs included in the cohort did not allow detailed examination of each category of such injuries to be conducted.

It is possible that the workers participating in the study self-selected in someway by volunteering for the study and thus did not represent all injured workers. Comparison of the limited data available for non-participants showed that they were similar to participants in region of residence and sex, but different in injury type with higher frequency of non-MSIs.
Our estimates are based in worker self-worker and not confirmed by independent sources. Self-report was considered the only feasible way of assessing these non-wage losses.

The study estimates did not include the cost of most medical care provided for the injuries. In this province, and in most Canadian provinces, essential healthcare services are not paid by the injured worker: they are directly covered by the universal healthcare system in the province and then charged to the provincial worker compensation agency. A number of non-essential healthcare services (which during the time of the study in this province included chiropractic, physiotherapy and other rehabilitation services) are either paid by extended benefit plans or paid out-of-pocket by the worker. The cost of these services may then be reimbursed to the worker within prescribed limits. Studies in other jurisdictions may need to add healthcare costs, if paid directly by the worker.

The study did not include all people who work in healthcare, but only those considered employees of the regional health authorities. A large number of housekeeping workers and food service workers were contracted out, and thus not considered employees at the time of this study. Physicians, residents and students were also excluded.

No data on impact of the injury on specific roles, such as child-care, home maintenance or community involvement, were available. These were grouped together in global estimates of the time needed for other persons to undertake those roles while the injured worker recovered, and in a general category of leisure and volunteering.
A final limitation is that the study included only injuries resulting in the filing of a loss-time or medical-aid claim with the provincial worker compensation agency. Nothing could be said about the losses associated with injuries which did not result in such a claim [20].

CONCLUSIONS

Most published economic analyses of occupational health and safety interventions consider economic losses for the employer or the insurer, but ignore the non-wage losses that remain uncompensated consequences for workers experiencing occupational injuries. The information reported in this study can be used to integrate workers’ perspectives into comprehensive economic evaluations of occupational health and safety programmes to prevent MSIs. Future economic evaluations should take into account these substantial additional losses borne by the workers and their families, which corresponded to 59% of wage losses in this study. Furthermore, governments and organizations determining compensation policies for injured workers should consider these non-wage losses in calculations of programme benefits. Consideration of non-wage losses is likely to make the cost-benefit ratio of occupational injury prevention programmes more favourable, thus making investments in such programmes more justifiable at the societal level.
Implications for Policy and Prevention

a) Policy and prevention implications arising from the research

On average, each musculoskeletal time loss or medical-aid injury occurring to a BC healthcare worker, results on non-wage losses to the worker and their family and friends equivalent to 59% of the wage losses. Wage replacement benefits and medical care benefits do not compensate for these losses.

On average, the impact of a musculoskeletal injury on a BC healthcare worker’s quality of life (pain, suffering, loss of enjoyment of life) is equivalent to shortening the workers’ life by 7.9 to 13.7 days.

The above losses vary widely from worker to worker, depending among other things on the type of injury, the region of the province they reside in and their occupation. For the majority of workers the losses are modest, but for a few they are very large.

Consideration should be given as to whether this non-wage losses merit compensation and how this could be calculated for individual workers after an injury.

Economic evaluations of prevention programs conducted from the perspective of the worker or from a societal perspective must duly consider these non-wage losses.

A successful occupational health and safety program that prevents musculoskeletal injuries will prevent these non-wage losses, in addition to avoiding the need to pay wage-replacement and medical benefits.
b) Relevant user groups for the research results

- Policy-makers determining fair compensation for healthcare workers injured on the job
- Unions and other worker associations representing healthcare workers
- Policy analysts conducting economic evaluations of programs to prevent musculoskeletal injuries
- Analysts and researchers interested in determining the burden of occupational injuries to society

c) Policy-related interactions undertaken by the applicant

Preliminary results of this research have been shared in two meetings with representatives of BC healthcare employers and unions.

The researchers have used preliminary estimates from this study in conducting an economic evaluation of a program to prevent occupational injuries related to patient handling.

Dissemination/Knowledge Transfer

A user-friendly version of study findings will be distributed to BC healthcare stakeholders.

A manuscript reporting study findings will be submitted shortly for publication.

In addition, results of this work have been presented at the following research meetings:

- 2011 Canadian Injury Prevention and Safety Promotion Conference
- Canadian Association for Research on Work and Health Conference 2012 – Innovation in Worker Health and Safety Research
Quality Worklife Quality Health Care Collaborative – Mastering the Art and Science of Healthy Work Environments 2012
Acknowledgments

We would like to thank the following people for their support in this study: Jeremy Parr, Boris Kuzeljevic, Saleema Dhalla, Isabelle Lindon, Elizabeth Wilcox, Ron Kelly, Carol Shafer. This initiative was funded by WorkSafeBC and the Workers Compensation Board of Nova Scotia. The funding was provided as competitive peer-reviewed research funding. The sponsors had no access to study data, or involvement in the drafting of, and decision to submit, the manuscript.
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    [http://www.euroqol.org/fileadmin/user_upload/Documenten/PDF/Books/Measuring_Self-

    after chronic occupational back pain be explained? An exploratory analysis on disability

    to the Evaluation of Permanent Impairment. American Medical Association. *JAMA*
    2000;**283**:519-23.

    with monetary compensation versus psychological therapy. *Health Econ Policy Law*
    2010;**5**:509-16.


Table 1. Demographics and general characteristics of the study participants.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Nature of injury</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MSI - Neck/Upper Limb</td>
<td>MSI - Back</td>
</tr>
<tr>
<td><strong>Subsector</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute Care</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td>Community Care</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Long-term Care</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>22</td>
<td>12</td>
</tr>
<tr>
<td>Licensed Practical Nurse</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Care Aide</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Other occupations*</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>55</td>
<td>42</td>
</tr>
<tr>
<td>Male</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td><strong>Region of residence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>22</td>
<td>15</td>
</tr>
<tr>
<td>Vancouver Island</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Interior</td>
<td>16</td>
<td>13</td>
</tr>
<tr>
<td>Northern</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

* Other occupations includes: facility support services and maintenance workers (n= 18); community health workers (n=13); laboratory and imaging workers, health sciences professionals and therapists (n=12); and administrative staff (n= 3). Non-MSI include: exposures to blood and body fluids, bruises contusions and cuts without exposure to blood and body fluids, and irritations and allergies to skin, respiratory tract and mucous membranes.
### Table 2. Estimated economic and quality of life losses of participants with occupational MSI

<table>
<thead>
<tr>
<th></th>
<th>Neck and/or upper limb</th>
<th>Back</th>
<th>Other MSIs</th>
<th>All MSIs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Median (IQR)</td>
<td>Mean (SD)</td>
<td>Median (IQR)</td>
</tr>
<tr>
<td>Out of Pocket (OOP)</td>
<td>531 (744)</td>
<td>128 (824)</td>
<td>322 (415)</td>
<td>197 (615)</td>
</tr>
<tr>
<td>Value of time lost</td>
<td>2,076 (2,588)</td>
<td>1,085 (2,489)</td>
<td>1,775 (2,503)</td>
<td>866 (1,949)</td>
</tr>
<tr>
<td>from leisure, volunteering</td>
<td>1,675 (2,655)</td>
<td>467 (2,032)</td>
<td>651 (971)</td>
<td>203 (1,219)</td>
</tr>
<tr>
<td>and community involvement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value of time lost by</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>others ($)</td>
<td>4,461 (5,175)</td>
<td>1,833 (5,036)</td>
<td>2,789 (3,345)</td>
<td>1,845 (2,696)</td>
</tr>
<tr>
<td>Subtotal¹:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-wage economic losses ($)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value of time lost from</td>
<td>6,493 (5,352)</td>
<td>4,421 (10,009)</td>
<td>5,948 (4,847)</td>
<td>5,168 (7,111)</td>
</tr>
<tr>
<td>work ($)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total²:</td>
<td>10,953 (9,590)</td>
<td>6,550 (14,718)</td>
<td>8,737 (7,142)</td>
<td>6,825 (9,453)</td>
</tr>
<tr>
<td>Economic losses ($)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality-adjusted days of</td>
<td>8.5 (5.8)</td>
<td>7.0 (8.1)</td>
<td>8.4 (5.2)</td>
<td>7.7 (8.9)</td>
</tr>
<tr>
<td>life lost (days)³</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ Subtotal: Non-wage economic losses include out of pocket expenditure, value of time lost from leisure, volunteering and community involvement and value of time lost by others (partner/family members);
² Total: Economic losses include non-wage economic losses and value of time lost from work;
³ Based on assumption that the injured workers before the injury had the same quality of life as the general Canadian population of 35-44 years of age.
Table 3. Factors impacting total economic losses for participants with occupational MSI.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Beta coefficient</th>
<th>Standardized beta coefficient</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of injury</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>MSI back</em></td>
<td>Ref.</td>
<td>Ref.</td>
<td>-</td>
</tr>
<tr>
<td>MSI neck and/or upper limb</td>
<td>-0.282</td>
<td>-0.083</td>
<td>0.350</td>
</tr>
<tr>
<td>MSI other</td>
<td>-0.597</td>
<td>-0.120</td>
<td>0.165</td>
</tr>
<tr>
<td>Non-MSI Injury***</td>
<td>-2.509</td>
<td>-0.547</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Location in the province</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lower Mainland</em></td>
<td>Ref.</td>
<td>Ref.</td>
<td>-</td>
</tr>
<tr>
<td>Northern</td>
<td>0.331</td>
<td>0.058</td>
<td>0.498</td>
</tr>
<tr>
<td>Vancouver Island</td>
<td>-0.580</td>
<td>-0.150</td>
<td>0.080</td>
</tr>
<tr>
<td>Interior</td>
<td>-0.607</td>
<td>-0.164</td>
<td>0.058</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Care Aid</em></td>
<td>Ref.</td>
<td>Ref.</td>
<td>-</td>
</tr>
<tr>
<td>Administrative staff</td>
<td>1.519</td>
<td>0.129</td>
<td>0.101</td>
</tr>
<tr>
<td>Community Health staff</td>
<td>0.417</td>
<td>0.071</td>
<td>0.410</td>
</tr>
<tr>
<td>Facility Support Workers</td>
<td>-0.191</td>
<td>-0.038</td>
<td>0.680</td>
</tr>
<tr>
<td>Laboratory/Other Health Service Workers</td>
<td>0.565</td>
<td>0.093</td>
<td>0.280</td>
</tr>
<tr>
<td>Licensed practical nurse</td>
<td>0.875</td>
<td>0.168</td>
<td>0.062</td>
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<tr>
<td>Registered nurse</td>
<td>1.318</td>
<td>0.382</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><em>Female</em></td>
<td>Ref.</td>
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<tr>
<td>Male</td>
<td>-0.159</td>
<td>-0.027</td>
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<tr>
<td><strong>Type of Employment</strong></td>
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<tr>
<td><em>Full time</em></td>
<td>Ref.</td>
<td>Ref.</td>
<td>-</td>
</tr>
<tr>
<td>Part time</td>
<td>-0.426</td>
<td>-0.112</td>
<td>0.157</td>
</tr>
<tr>
<td>Casual</td>
<td>-0.387</td>
<td>-0.081</td>
<td>0.311</td>
</tr>
</tbody>
</table>

Note: $R^2=0.340$, Adjusted $R^2=0.261$; $F=4.302$; $p<0.001$
Table 4. Factors impacting the quality-of-life losses for participants with occupational MSI

<table>
<thead>
<tr>
<th>Factor</th>
<th>Beta coefficient</th>
<th>Standardized beta coefficient</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of injury</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSI back</td>
<td>Ref.</td>
<td>Ref.</td>
<td></td>
</tr>
<tr>
<td>MSI neck and/or upper limb</td>
<td>-0.489</td>
<td>-0.238</td>
<td>0.011</td>
</tr>
<tr>
<td>MSI other</td>
<td>-0.279</td>
<td>-0.093</td>
<td>0.305</td>
</tr>
<tr>
<td>Non-MSI Injury</td>
<td>-1.383</td>
<td>-0.499</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Location in the province</strong></td>
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<td></td>
</tr>
<tr>
<td>Lower Mainland</td>
<td>Ref.</td>
<td>Ref.</td>
<td>-</td>
</tr>
<tr>
<td>Northern</td>
<td>-0.069</td>
<td>-0.020</td>
<td>0.823</td>
</tr>
<tr>
<td>Vancouver Island</td>
<td>-0.357</td>
<td>-0.153</td>
<td>0.088</td>
</tr>
<tr>
<td>Interior</td>
<td>-0.534</td>
<td>-0.240</td>
<td>0.009</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Care Aid</td>
<td>Ref.</td>
<td>Ref.</td>
<td>-</td>
</tr>
<tr>
<td>Administrative staff</td>
<td>0.601</td>
<td>0.085</td>
<td>0.304</td>
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<tr>
<td>Community Health staff</td>
<td>0.287</td>
<td>0.081</td>
<td>0.370</td>
</tr>
<tr>
<td>Facility Support Workers</td>
<td>-0.146</td>
<td>-0.047</td>
<td>0.619</td>
</tr>
<tr>
<td>Laboratory/Other Health Service Workers</td>
<td>0.877</td>
<td>0.239</td>
<td>0.009</td>
</tr>
<tr>
<td>License Practical Nurses</td>
<td>0.344</td>
<td>0.109</td>
<td>0.244</td>
</tr>
<tr>
<td>Registered Nurses</td>
<td>0.317</td>
<td>0.152</td>
<td>0.161</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>Ref.</td>
<td>Ref.</td>
<td>-</td>
</tr>
<tr>
<td>Male</td>
<td>-0.134</td>
<td>-0.038</td>
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</tr>
<tr>
<td><strong>Type of Employment</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Full time</td>
<td>Ref.</td>
<td>Ref.</td>
<td>-</td>
</tr>
<tr>
<td>Part time</td>
<td>0.023</td>
<td>0.010</td>
<td>0.902</td>
</tr>
<tr>
<td>Casual</td>
<td>-0.366</td>
<td>-0.127</td>
<td>0.130</td>
</tr>
</tbody>
</table>

Note: $R^2=0.315$, Adjusted $R^2=0.228$; $F=3.623$; $p<0.001$

Figure 1: Mean EQ-5D Index values by week and type of injury
NON-WAGE LOSSES ASSOCIATED WITH OCCUPATIONAL INJURY AMONG HEALTHCARE WORKERS

Weeks after Injury

Guzman, Jaime