**The intangible economic costs of workplace injuries[[1]](#footnote-1)**

Greg Mason[[2]](#footnote-2)

**Abstract**

Estimates of direct costs of workplace accidents often rest only on short-term direct expenditures, first by the employees who are required to manage recovery after the accident, second by the employers in modifying workplace settings and processes, and third by the payout compensation. However, personal impacts and the sequelae of the accident are often dominant for the worker and should be included in any estimate of the costs of workplace accidents. The current research does not usually present comprehensive measures of these costs. This study examines the full cost of workplace accidents, in Manitoba over the last 5 years, using information on fatalities, time lost from work, duration of the absence, and large sample survey (n=2,813) of injured Manitoba workers. It presents estimates of the non-economic and indirect costs associated with workplace accidents by implementing four innovations. Primary data (survey information) were linked to administrative data from the Workers Compensation Board of Manitoba (WCB) to increase the reliability of the estimates. We included a “significant other” (secondary respondent) in the analysis to increase the accuracy of recall and to complete the measure of economic cost from the perspective of the household. Increasingly, the costs of the burden of diseases must include significant others. Dyadic interviews (in-depth interviews) of 20 pairs of primary and secondary respondents offered a qualitative dimension of accident impacts to support questionnaire development. A survey based (telephone) contingent valuation method placed a monetary value on the quality of life changes triggered by the workplace accident.[[3]](#footnote-3)

*JEL:* ***J320****Nonwage Labor Costs and Benefits; Private Pensions, and* ***I380****Welfare and Poverty: Government Programs; Provision and Effects of Welfare Programs*

**Introduction**

Workplace injuries are on the decline in Manitoba, but at 15,052 time loss injuries and 15,150 non-time loss injuries in 2014, they still represent an important loss to the economy as well as individual workers and their families. This study offers a view into the nature and extent of the costs of workplace incidents resulting in injury in Manitoba. Comparatively few Canadian studies exist to estimate the full cost of workplace accidents, and in the course of this research, we did not find any Manitoban studies. The contribution this research attempts to make is to estimate the non-financial and indirect costs associated with workplace accidents.

This paper attempts to add the following important insights to the existing literature:

* By including a “significant other” (secondary respondent) who is the caregiver/carer in the analysis, we expect to identify a range of family and personal costs that may not be reported by the injured worker (primary respondent). We also expect differences in the valuations of the economic impact of the accident.
* We use survey-based (telephone) contingent valuation stated choice methods to estimate the non-financial economic value of the change in the quality of life triggered by the workplace accident.
* In addition to quantitative data (surveys of primary and secondary respondents linked to administrative data, qualitative research using dyadic interviews (interviews with the primary and secondary respondents) explored the etiology and sequalae of workplace accidents.

The theoretical framework rests on standard economic theory, with important augmentation from qualitative research (the use of dyads to increase insight into important elements of full cost) and the use of discrete choice modelling in the form of contingent valuation methodology.

Aside from providing estimates of the costs of workplace accidents for Manitoba, this research also endeavours to deepen the understanding of economic and social costs incurred by employers (loss of skilled trades), employees, and immediate families. Many of the current estimates of cost use macro-level statistics. In this research, we wish to collect micro data at the individual incident level, using survey information linked to the administrative data.

Specifically, we will use survey data (from the employees and immediate family members, such as a spouse, parents, or children) linked to Workers Compensation Board (WCB) administrative data, to develop micro information that will support an estimation of the full social and economic costs of the accident. In addition to quantitative measures of cost/impact, we will also complete qualitative research (, dyads,) to deepen the insights into the social and family impacts of the accident, in addition to the impact on businesses.

**Conceptual foundation to the economic cost of accidents**

A long literature exists on estimating the costs of workplace injury and accidents. Representative studies either treat the costs associated with accidents in a specific sector (Camm,T. & Girard-Dwyer, J, 2005) or attempt to present an economy wide measure of cost (Leigh, J-P., 2011). Conceptually, the idea of economic costs seems straightforward — it is the lost wages and compensation paid. In fact, the concepts are more complex, with elements that are not mutually exclusive. As a start, it is important to distinguish the financial and the economic costs. The financial costs, most commonly used as the estimate of the economic costs of workplace injuries, comprise the compensation paid by insurers, as well as the out-of pocket expenses incurred by the workers and their families.Workplace accidents are commonly identified as having direct and indirect costs (OSHA, n.d.) and (American Society of Safety Engineers, n.d.).

In brief:

* *Direct costs* accrue as the direct result of the injury and include loss of earnings and costs of medical care. In principle, these comprise the financial and non-financial (economic) costs.
* *Indirect costs* include the costs of training replacements, accident investigation, loss of reputation of the employer, etc.

To consider this in more detail, four dimensions emerge when considering these ideas in relation to the costs of workplace accidents:

* For the worker, the direct costs include net wage loss (wage at the time of the accident less the compensation while off work), as well as any out-of-pocket expenses not covered by WCB or health care plans (public or private). Indirect costs are longer-term costs due to the result of the accident, such as any reduction in wage in future employment because the worker has lost some capacity. For those permanently disabled, or who lose their lives, this amounts to the present value of future earnings plus the costs of care and end-of-life expenses (funerals and estates).
* For the employer, the direct costs include (but are not limited to) the loss of productivity when skilled/experienced workers are not available, the cost of training replacements, retraining returning workers to new positions, and costs of workplace modification. [[4]](#footnote-4)
* For the WCB, the direct costs of workplace accidents include the wage compensation paid, as well as medical/rehabilitation expenses.
* Finally, for society, the direct cost of workplace accidents is the loss of productivity, approximated by the net wage reduction experienced by employees, the loss of employees to the labour force, plus the net costs of using lower skilled workers.

This discussion is not exhaustive, but it does illustrate that some economic costs of a workplace accident are indirect, intangible, and non-financial.

**Measuring the costs of workplace accidents**

Research into the incidence of workplace injuries and fatalities, as well as the estimates of associated costs, varies greatly by scope and intent. Some studies attempt to estimate a limited number of costs, often focussing only on lost wages and medical costs. Other research expands the analysis to other types of costs for injured workers, their families, employers, and society as a whole. In addition, some researchers estimate costs for entire countries, whereas others focus on smaller regions (provinces/states). The following are five representative examples of the research:

* Work-related fatalities in Canada from 1993 to 2005 are high in the view of some (Sharpe & Hardt, 2006). Although they did not estimate costs, they found that there were 758 reported workplace fatalities in 1993, and 1,097 reported workplace fatalities in 2005, an increase of 45%. The results also showed that, in 2003, Canada had the fifth highest workplace fatality rate out of 29 OECD countries, surpassed by Portugal, Turkey, Korea, and Mexico.
* The national economic costs of work-related injuries, illnesses, and fatalities in the United States in 2007 may be estimated using publicly available data (Leigh, J-P., 2011). The major data sources for the study included the U.S. Bureau of Labor Statistics (BLS), the Centers for Disease Control and Prevention, the National Council on Compensation Insurance, and the Healthcare Cost and Utilization Project. To calculate total costs, the author multiplied the number of cases by the average cost per case.
* An example of a specific sector study may be found in (Anderson, Schulte, Sestito, Linn, & Nguyen, 2010) who studied the economic costs of work-related injuries, illnesses, and fatalities in the wholesale and retail trade (WRT) sector of the United States. They obtained statistics on injuries, illnesses, and fatalities from the U.S. Bureau of Labour Statistics, and were able to compare the statistics of the WRT sector to a baseline (the private sector as a whole). They obtained cost estimates from literature.
* Boden and Galizzi (1999) investigated the lost wages of work-related injuries and illnesses in Wisconsin. Their approach involved analyzing individual wage and injury/illness data and aggregating the overall lost earnings. Using a regression model, they compared post-injury wages across different groups of injured workers.
* Corso (2006) examined the national incidence and lifetime costs (in this case, medical costs and productivity losses) of injuries in the United States. The researchers combined various data sets to calculate medical and productivity costs. By multiplying these by the incidence rates of various injuries, and discounting to present value, they calculated the total lifetime costs of injuries in the United States in 2000. They found that, in 2000, more than 50 million Americans sustained an injury that was medically treated, resulting in $80 billion in medical treatment costs and $326 billion in lost productivity costs ($406 billion overall lifetime cost).

One final distinction is important, and that is the difference between financial and economic costs. This often appears as the distinction between economic and non-economic costs, but in the spirit of the quotations that started this section and the intent of this research study, the terms financial and economic are more accurate.

| **Table 1: Conceptual framework for the costs of workplace injury** | | |
| --- | --- | --- |
|  | **Direct (immediate) costs** | **Indirect (longer-term) costs** |
| **Financial costs** | Workers’ compensation  Medical costs: emergency services, treatment, rehabilitation, and ongoing care  Lawsuit costs for employers (could be lumped into a general legal fees category with the legal costs for workers)  Administrative fees (compensation qualification, administration, legal, etc.)  Reduced savings/assets | Replacement training  Replacement worker costs  Medical costs (rehabilitation, and ongoing care  Retraining of returning workers  Workplace safety enhancements  Capital loses (damage due to or a consequent of the accident)  Work interruption and productivity losses  Lost wages/productivity for carers  Costs of home modifications  Costs of disability support tools (crutches, wheelchairs, computers, etc.)  Social assistance (income replacement/welfare) programs |
| **Economic (full) costs** | Financial costs + intangibles such as:   * Reduced quality of life for injured workers * Stress, depression, trauma, other mental/emotional costs for workers * Pain and suffering * Reduced confidence/self-esteem * Job dissatisfaction * Reduced trust in management | Financial costs + intangibles such as:   * Social services (in kind services for people with disabilities) expenditures * Reduced quality of life for carers   Stress, depression, other mental/emotional costs for carers   * Employee morale * Customer relations and firm reputational losses * Forgone education for carers |

From this framework, financial costs are those easily expressed in monetary terms, and most commonly, these are forgone wages due to absence from work, and medical costs needed to treat and rehabilitate the worker. Other financial costs include legal, retraining, replacement of lost wages, and social services. Economic costs are financial costs plus a range of tangible and intangible outcomes, not readily expressed in monetary terms.

Researchers have long recognized that economic costs, especially the intangible costs experienced by the injured worker and his/her family, are potentially the most important consequences of workplace accidents. Key writings, such as Dembe (2001), Boden and Galizzi (2001) and Revile et al (2001), are examples of studies that raised this perspective. More recent work appears in Pouliakis and Theodossiou (2013). Seabury et. al. (2005) underscore the importance of measuring the economic value the accident, subsequent injury and recovery, using survey research.

This literature has evolved substantially in the last decade in its technical intricacy. This paper uses a real world administrative database as the foundation for a large sample survey of workers and their carers to measure the value of avoiding the accident and injury as their complete avoidance.

**Stated choice versus revealed methods for measuring economic costs**

The core idea in this paper is that the economic costs of an accident may be expressed as the value of avoiding the accident in the first place. This “inversion” of the usual way of expressing a cost is the first step in measuring intangible outcomes financially. The willingness to pay out of current income resembles the insurance decision, where a smaller expenditure offsets a risk adjusted much larger cost

Economists have two approaches to measuring value. Most commonly, value emerges from market outcomes, where demand and supply interact. Consumers signal value by their willingness-to-pay for a good or service, and the final price “reveals” the market consensus of value conditioned by the price of the product. Not surprisingly, this approach to measuring value is termed “revealed preference.” The second approach uses hypothetical scenarios to estimate value before transactions have occurred. For example, the hypothetical exercise of predicting demand for a proposed and currently non-existent product is the central market research question. Another example is the valuation of wilderness and other ecological goods and services. Examples of intangible but real consequences of accidents are interruptions in careers, attenuation of recreation and other opportunities, and indirect costs such as the time consumed by carers in supporting the injured worker.

Since valuation of intangibles occur in the absence of a concrete good or service, consumers and other economic agents must place a value a hypothetical. Early adopters of any new technology routinely make this assessment. Examples of such valuations include the following:

* smoking cessation treatment (Olsen, Røgeberg, & Stavem, 2012)
* hearing aids (Grutters, Anteunis, Chenault, & Joore, 2009)
* new attributes in foods (Zhang, Gallardo, McCluskey, & Kupferman, 2010).

Economists have applied stated choice methods to variety of contexts, including environment, new products in all domains, and increasingly, medical/health processes and procedures. The application of such to the valuation of complex health outcomes procedures, such as the avoidance of an accident and consequential injury, represents an extension of the core idea.

**Contingent valuation**

Contingent valuation (CV) methods are rooted in traditional welfare economics, where consumers state a price that they are willing to offer for a certain good (product or service) or a sum they are willing to accept to endure some negative outcome (also known as a “bad”). Many CV studies use a form of discrete choice experiment, implemented in a survey setting, where respondents choose among several alternatives. Examples include the following:

* insurance covering treatment for four health problems (Gyldmark & Morrison, 2001)
* choice of treatment among carers of Alzheimer’s patients (Oremus & Tarride, 2008) and (Werner, Schnaider-Beeri, Aharon, & Davidson, 2002)
* willingness to pay for treatments to avoid future angina episodes (Chestnut, Keller, Lambert, & Rowe, 1996)
* mothers’ willingness to pay for child health (Liu, Hammitt, Wang, Liu, & others, 2000)

The simplest willingness to pay uses a sample survey and assigns respondent to randomly assigned (at least three and ideally more) groups. The test prices for a good or service vary among the groups. The respondents in the first groups receive a description of the good Y and then respond “yes” or “no” to the question of whether they would purchase good Y at price “P1”. Each group presents a yes/no response to the question of purchaser where the only variable if the changing price Pi. Clearly the more discrete groups, the more information will be gathered on the demand for Y, but sufficient sample must exist in each group to support reliable estimates of demand. The pattern of yes/no (l/0) responses creates a qualitative variable, where the proportion of “No’s” will typically fall as the price increases (for a normal good). This form of CV is, naturally enough, termed “dichotomous choice.” The “trick” is to create a range of price options that avoid “corner” where at every price all respondents either accept or reject the option.

A variation of this approach uses a bidding game or a doubled bounded model. The respondent A accepts or rejects a trial price PA; a “Yes” elicits a follow-up question: “Would you purchase for price PA + X?”; a “No” prompts the follow-up: “Would you purchase for price PA - Y?” Respondents B, C,… start at higher values of Pi, typically greater than PA + X. Boyle et al (1985) and Flachiare & Hollard (2006) are two examples of this approach, which has become quite standard and is the technique used here.

CV modelling is simple in principle, but faces important challenges. Hausman (2012) has presented a critique of CV in estimating non-use value, which is the standard scenario for environmental goods and services. Typical examples of non-use value are preservation of wilderness areas remote from respondents or saving a species of frog in another part of the country. In a recent compendium several authors including notables such as Kenneth Arrow present a sceptical case that this technique can offer accurate measures of willingness-to-pay for non-use values (Hausman, J.A., 2012). The key challenges of hypothetical bias clearly present important barriers to respondents being able to place a value on these imaginary alternatives.

Using CV to estimate willingness-to-pay for use values, that is goods, services, and states of well-being experienced by the respondent, would appear to reduce the issue of hypothetical bias. In addition to hypothetical bias, CV faces other challenges including:

* task complexity (which is another form of hypothetical bias)
* strategic bias and anchoring
* recall decay

CV modelling can become very complex, depending on the nature of the good/services, the context of hypothetical imaginary “market,” and the specific situation of the experiment. Researchers need to take care that the complexity of the choice alternatives especially when using patients and other vulnerable persons. Often, the subjects, the setting for the survey, and the institutional context will condition the complexity of the questioning. This is especially true when asking patients experiencing a serious disease or victims of a workplace accident to value alternative states of better health.

Task complexity aemerges in health economics when estimating quality life years (QALYs). When healthy individuals are asked about their perceived loss in quality of life due to an accident that renders them a paraplegic, this is the same as the hypothetical bias. However, asking someone rendered a paraplegic *after* an accident to value their quality of life compared to their previous health state is less complex than as asking someone about the value of a park they will never use. For much of the CV literature, the complexity of the product/service is not that high, and most of the analysis tends to focus on technical aspects of estimating willingness to pay to obtain the good/service, or willingness to accept compensation for enduring the harm.

Strategic bias refers to respondents responding with inflated or depressed estimates of value, in the hope that their answers will influence the price actually paid. Creating multiple discrete categories of pricing and segmenting the trial prices is one way to control for bias. Milion (1989) is an early and careful review of the issue. It is vital that the researcher create an experimental setting where respondents understand that their WTP responses cannot affect real world prices.”

Anchoring may be manifest in the form of starting point bias and ordering bias. Starting point bias refers to the phenomena where the first price offered affects the second prices accepted/rejected. See Homes & Kramer (1995) and Whitehead (2002) for discussions of this. Ordering bias occurs when the order of the questions affects responses. Rotating question order and other randomization techniques are the customary ways to manage these distortions in survey questionnaire. It is important not to inflate the importance of ordering bias. As we explain the in the context of this research, the sequence of questions are instrumental in creating salience.

**Salience and stated choice methods**

Stated choice methods are by their nature unreal and require participants to engage in hypothetical selection of alternatives. This requires the researcher to create a high degree of salience to allow the research participants to understand alternatives and to make informed choices. Prospective stated choice engages respondents in a decision making process before the fact, such as valuing new products and services yet to be realized. Retrospective stated choice asks respondent to value the reversal of a state, such as recovery of a polluted site or restoration of a previous state of good health.

Providing detailed descriptions of the products/services in written form increases salience. Another approach is to use focus groups and then administer a CV test in the form of a printed survey. In such a case, price would become one of the product attributes. Finally, one can use a telephone (or web-based) interviews, where the questions prior to the CV tests qualify respondents and “educate” them on the nature of the “product.”

Two steps are essential to the development of salience, especially when valuing complex states, and when valuing health outcomes that respondents have yet to experience. First, it is very important that the researchers attain an understanding of what subjects have experienced. This can only occur through deep engagement with the repsondents—in this case, injured workers—to understand the nature of the trauma. Second, this understanding must support the creation of a structured recall process to trigger memory of the accident and its aftermath. The experiment in this study occurs in the context of of a survey questionnaire designed to trigger recall of all the important dimensions of a workplace accident.

**Qualitative impact of the accident on the worker and carer: embedding salience into the questionnaire.**

A central goal of this research is to understand the support systems outside the WCB and the health care system, available to injured workers. Invariably this includes family members and friends who provide support for the injured worker as he/she recovers. It is intuitive that the more severe and prolonged the injury, the more important such caregiving support becomes. It is also the case that a support system may comprise more than one person, something that is more likely if the families members and friends have other family and work responsibilities, and if the injury is severe and the aftermath prolonged.

The qualitative technique employed to study such effects is termed a “dyadic interview” (dyads for short) which differs from other qualitative research, such as paired individual interviews and focus groups, in some important ways. All three methods share a core process, comprising careful selection of interviewees/participants, a structured interview guide, and experienced interviewers/moderators that can come “off script” to pursue important ideas not foreseen by the researcher.[[5]](#footnote-5)

A dyad offers the opportunity to explore a shared event from the perspective of two individuals that have a long-standing relationship based on trust and familiarity. In the context of this research, the primary respondent (injured worker) named the secondary respondent (the carer) who would be involved in the interview, and so a degree of trust and familiarity may be assumed since in most cases the secondary respondent was a spouse, sibling or roommate.

For those workers who suffer an accident that results in an injury requiring a period of recovery and/or leaving their job with a permanent disability, recollection of the event and especially recollection of the aftermath may be selective. A trusted confidant can often temper the primary respondent’s recall of this event, and he/she will also often add detail that may be forgotten or add important nuance to the narrative. Dyads offer an excellent window into the nature of the accident and its aftermath; in this way, this technique will contextualize the full impact of the workplace injury.

We selected the dyads from a de-identified administrative sample provided by WCB on four different characteristics, with two groups within each characteristic, as follows:

* gender (M/F)
* age (18–34/35+)
* date the WCB Board was notified of the injury (earlier than July 1, 2011/July 1, 2011 or later)
* total compensation paid by WCB ($10,000 to < $50,000/$50,000 or greater)

This made for 2\*2\*2\*2=16 groups. We tried to get at least one dyad from each group, with four remaining as doubles. This ensured we had a distribution of workplace incidents in terms of gender, age, time since injury, and total costs. It also excluded minor accidents where the total cost (medical, wage replacement, rehabilitation, and retraining) was less than $10,000.

The dyadic interviews demonstrate that the effects of workplace injury are widespread and permeate all aspects of life, most significantly physical and mental health and financial stability. Interviewees came from many different industries and suffered a variety of different types of injuries, including severed fingers, torn tendons, and other muscular issues. Many have undergone surgery to repair the damage and almost all have been treated by a physiotherapist. Whether they have returned to their previous positions, changed fields, or have not returned to work, all interviewees had their lives affected in small and large ways. In addition, they relied and continue to rely on a support system — friends and family members — to provide physical, emotional, and financial support during their recovery.

Since the majority of interviewees suffered from a physical injury, clear effects on mobility and ability to complete physical tasks at home and at work have occurred. However, many report that the emotional toll of their accident is equally, if not more, damaging to their overall wellbeing, and in some cases, their ability to return to work. Interviewees report symptoms including anxiety, irritability, and depression, most often associated with feeling isolated by reduced mobility and stress caused by career and financial uncertainty. Almost all interviewees reported at least a moderate impact on their mental health for some period of time associated with their injury, but only some pursued mental health treatment options, such as counselling and medication, while many indicated that they have turned to their support system — spouse, family member, or friend — for emotional support.

Beyond the short-term concerns related to income, interviewees describe negative impacts to their career progression, which affect their financial stability. For interviewees who describe themselves as being at the beginning or middle of their careers, workplace injuries and the subsequent removal from the workforce (even if temporary) lead to incomplete or delayed training goals and missed opportunities for promotions. In some cases, they must leave the field of their choice and retrain in an alternate career. Several interviewees cite examples of retraining funded by WCB in fields that respondents see as less desirable and/or perceive to be less profitable, setting the interviewee on a path of career dissatisfaction and lower earning potential. For those towards the end of their career, a workplace injury can truncate their inability to work, affecting retirement plans.

In addition to the physical, emotional, and financial impacts described by individuals who were injured at work, the dyadic interviews reveal the impact of workplace accidents on the injured workers’ support system (friends and family) and the role of the support system in the recovery process. The majority of the secondary respondents in the interviews are spouses or romantic partners, while others who participated include parents and friends/roommates. Almost all secondary respondents are described as taking on a caretaking role for at least some period of time following the interviewee’s accident, and if they did not provide the care, someone else within the support system did.

The support system required for recovery of the injured interviewee, as well as demands on secondary respondent, affects finances. In some cases, secondary respondents reported they have taken time off work or reduced their own workload to provide care and maintain the household. Secondary respondents who are a spouse or romantic partner are the most impacted financially by workplace injuries, since they feel the effects of reduced household income. Secondary respondents who share the household often report changing jobs to earn more money/be more “stable,” reducing their spending on socializing and leisure activities, delaying vacations and other goals, and struggling to pay bills and for necessities. In turn, this is a cause for stress and can impact the mental health of secondary respondents. Romantic partners often reported that their relationship suffered due to the stress of dealing with the injury and recovery period.

The key themes emerging from the dyads informed the questionnaire content for workers involved in the accident (termed the primary respondent - PR), specifically regarding loss of earnings, career interruption, loss of physical abilities during recovery and permanent disabilities, etc. Those caring for the injured worker (termed the secondary respondents – SR) in effect held a mirror to the injured worker, and offered an “independent” perspective on the accident, the injury and its aftermath.

**Data collection**

This study recruited primary and secondary respondents (an individual living in the same household and identified by the primary respondent) to participate in a telephone questionnaire. The sample frame drew from a de-identified administrative database supplied by the WCB. Sampling and interviewing proceeded in waves; with each sample selected, the WCB supplied names, addresses, and telephone numbers of workers that had received compensation for an injury. Scrambled ID numbers ensured that the research team never received personal information about the respondents beyond what was required for the survey.

Sampled primary respondents received a letter explaining the research, and that no obligation existed to participate. The letter also provided follow-up contact information if the respondent desired more information. As explained in the next section, secondary respondents were recruited at the end of the primary respondent interview and were interviewed immediately or in a follow-up call. Table 2 shows the number of survey completions.

|  |  |
| --- | --- |
| **Table 2: Primary and secondary respondents surveyed** | |
|  | **Number** |
| Primary (injured worker) | 2,310 |
| Secondary (carer) | 510 |
| **Total** | 2,820 |
| Source: PRA Survey of primary and secondary respondents (August 2014 – January 2015) | |

**Questionnaire form and content to promote salience**

The primary respondent survey had eight phases:

1. The introduction established respondent qualification.
2. Questions about the injury and occupation at the time of the injury to provide context for the remaining questions.
3. Questions probing for employment and income before and after injury, using WCB information to frame the responses. Note that the WCB has little income or asset information for the period after the accident — respondents are the only source of this information.
4. Direct cost questions collected information on the expenses that were not supported by the WCB, but instead were funded by the respondent (and family). This included tracking any asset disposal needed to pay for medical, rehabilitation, and retraining expenses.
5. Questions on the perceived impact the injury has had on friends and family, including an enumeration of all those who the respondent recalled helping them, and the number of hours per week that help was (is) needed.
6. Standard questions collected information on the ability of the respondent to complete common activities of daily living (personal care, household care, mobility, etc.)
7. The most challenging part of the questionnaire asked respondents to indicate their willingness to pay for “a quick and painless treatment that would let you recover immediately and avoid all the necessary recovery time required for your injury.”
8. Finally, the questionnaire asked the respondent to identify a “spouse, partner, or another adult living with you who is familiar with your injury.” Note that, unlike the dyads where adults not living in the same household were accepted as secondary respondents, we elected to tighten the bond between primary and secondary respondent, since cohabitation contributed to a better understanding of the full impacts of the injury. The primary respondent provided the name of a household resident that had provided support during the recovery period.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| In the letter I mentioned at the start of this survey, we noted that it would be very helpful to also speak to your spouse, partner, or another adult living with you who is familiar with your injury.   |  |  |  |  | | --- | --- | --- | --- | | 1. Is there someone like this in your household? | | | | |  | Yes | 1 |  | |  | No | 0 | [Go to conclusion] |  |  |  |  |  | | --- | --- | --- | --- | | 1. Would they be willing to answer some questions as well? If they do, they will also be entered to win a gift card. | | | | |  | Yes | 1 | [Set callback time and take second person’s name] | |  | No | 0 | [Go to conclusion] | |

The PR questionnaire reflected current trends in the literature in terms of asking individuals to assess complex, hypothetical, and abstract concepts. These ideas are always difficult for respondents to manage. Accordingly, the design of survey questionnaire becomes a painstaking blend of art and science.

The pretesting of the PR questionnaire, involving 100 primary respondents, produced only minor changes in wording and the ordering of questions. We tested the two questionnaires (primary and secondary respondents) to ensure comprehension at the grade 10 level using the Fleischer-Kincaid score. The primary respondent questionnaire tests at grade 7.7, while the secondary respondent questionnaire tests at grade 8.9.

The SR questionnaire followed a similar format, with the questions modified to reflect their relationship to the PR.

**Using CV to estimate the perceived value of avoiding workplace accidents after the fact**

The challenge for this study is to place a monetary value on the intangible costs of a workplace injury from the perspective of the injured worker (primary respondent) and their carer (secondary respondent). This requires the respondent to collect “in memory” all aspects of the injury, tangible and intangible. Figure 1 presents the structure of dichotomous choice bid used for this study.

To move beyond the simple financial summation of WCB and workers’ out-of-pocket costs, requires that a valuation be placed on a complex idea — how much would the worker be willing to pay to reverse the accident. In effect, we are asking the worker to purchase insurance that would compensate him or her for the accident. This insurance would cover not only the financial losses, but the “pain and suffering” triggered by the injury.

The core question is framed on the survey questionnaire as follows:[[6]](#footnote-6)

|  |
| --- |
| **Primary respondent:**  Knowing what you now know about the injury and recovery process that you had to go through, I would like you to think back to the time when you were first injured. Imagine that immediately after, someone offered you a quick and painless treatment that would let you recover immediately and avoid all of the necessary recovery time actually required for your injury. With this treatment, you would be able to avoid all the changes that occurred in your own life as a result of the injury. |

The question for the secondary respondent is a little more involved

|  |
| --- |
| **Secondary respondent:**  Knowing what you now know about [name of ***primary respondent***]’s injury and what you had to go through afterward, I would like you to think back to the time when the injury happened. Imagine that immediately after, someone offered a quick and painless treatment that would let [name of ***primary respondent***] recover immediately and avoid all of the necessary recovery time actually required for the injury. With this treatment, you would be able to avoid all the changes that occurred in your own life as a result of the injury. |

We normed this payment to a percentage of the respondent’s weekly income, which we presented to the respondent again. The process used 10% of their weekly income as the first “price”, then those that said “yes” were tested with 15% and those that said “no” were tested with 5%. Those that said “no” throughout or “yes” throughout were asked to identify the highest amount they would be willing to pay. Those who agreed to 15% were prompted for an offer higher and those that refused at 10% and 5% of income, were also prompted for an offer.



**Figure 1: The structure of the CV – Primary respondent**

Anchoring the starting point to actual pre-accident salary is important, since this implicitly norms the questions to ability to pay. Respondents could offer their own valuation, but the conditioning of these open-ended responses by the two prior questions to which the respondent had replied served to anchored responses to the weekly income of the worker. Secondary respondents responded to a similar sequence of questions. However, the WTP question for the secondary respondents was based on total household income, since many secondary respondents had no salary of their own to anchor their response.

## Willingness to pay – primary respondents

Many primary respondents would be willing to pay certain amounts out of their annual income for 10 years to avoid the accident. Although not strictly an insurance plan, it does represent a *retrospective valuation* of the pain and dislocation experienced with the injury. Table 3 shows the responses to the offer in the questionnaire.

|  |  |  |
| --- | --- | --- |
| **Table 3:** **Willingness to pay – primary respondents**  *If the treatment cost x%% of your annual household income for the next 10 years, would you have been willing to pay for it?* | | |
| **Highest WTP as a percentage of income (x)** | **Number** | **Percentage** |
| 0 | 1120 | 48.5% |
| 5% | 218 | 9.4% |
| 10% | 323 | 14.0% |
| 15% | 544 | 23.5% |
| NR | 105 | 4.5% |
| Total | 2310 |  |

The essence of this table is hard to understand without following the logic of the questionnaire. This appears in Figure 2 below.



**Figure 2: Willingness to pay: Primary respondents**

**Willingness to pay – secondary respondents**

Secondary respondents would be willing to pay to avoid the effects of the accident. Table 4 and Figure 3 show the same information as shown for the primary respondents.

|  |  |  |
| --- | --- | --- |
| **Table 4: Willingness to pay - secondary respondents**  *If the treatment cost x% of your annual household income for the next 10 years, would you have been willing to pay for it?* | | |
| **Highest WTP as a percentage of household income (x)** | **Number** | **Percentage** |
| 0 | 134 | 26.3% |
| 5% | 42 | 8.2% |
| 10% | 83 | 16.2% |
| 15% | 213 | 41.8% |
| NR | 38 | 7.5% |
| Total | 510 |  |



**Figure 3: WTP map for secondary respondents**

The responses for the two types of respondents “appear” consistent. However, some anomalies remain, especially around the non-responses (NR). These could be interpreted a proxy measure of task complexity. It is important to underscore that for PRs, the questionnaire exhaustively enumerated income from the job at the time of the injury as well as other employment and other family income. The WCB value of the wage of the primary employment (the job at which PR was injured) was presented to the respondent to verify, and correct if necessary. Similarly, SRs went through a similar but briefer income enumeration that concluded with an estimate of household income.[[7]](#footnote-7)

Coupled with the enumeration of the physical, social, and psychological outcomes in the interview, the salience is as high as can be accomplished within the constraints of respondent burden and recall. Suffice to say that respondents were thoroughly reminded of both their total income and the sequelae of the accident. This emerges in the coherence of the responses apparent in Figures 2 and 3.

**Preliminary estimates of the value of the accident**

Table 3 and Table 4 show that over 50% of primary respondents are prepared to pay nothing to avoid the accident in the first place. More than anything, this reflects many accidents that results in time loss injuries are relatively benign in the sense that workers recovered fully, received wage compensation and other benefits, and experienced little or no long-term impacts.

Fewer secondary respondents indicated that they placed a zero value of avoiding the accident (26.3%). One possible explanation is that many of injured workers did not identify another member of the household who was familiar with the injury. Some injured workers lived alone while in other cases, the respondent declined to name some, possibly because since the injury was not considered severe.

|  |  |  |
| --- | --- | --- |
| Table 5: Willingness to pay estimates to have been able to avoid the accident in the first place. | | |
| **Statistic** | **Primary respondent** | **Secondary respondent** |
| Mean (weekly payment for 10 years) | $57.77 | $81.57 |
| Standard Deviation | $86.94 | 102.56 |
| Minimum | 0 | 0 |
| Maximum | $584.85 | $450.00 |

Table 5 suggests some preliminary hypotheses to explore:

* The difference between WTP for primary and secondary respondents is interesting. On the face, this suggests that secondary respondents (often a spouse, child, or parent) have a higher valuation of the injury impact than does the worker.
* Many workers and secondary respondents were unwilling to pay anything. The obvious conjecture is that the severity of the accident and injury recovery complexity/duration, age of respondents, and number of dependents would be factors.
* Current employment status and whether the respondent had returned to the same or equivalent employment are potentially important explanatory factors
* The time since the accident may influence valuation as memory fades, despite using a series of questions to prompt recall.

Next steps will involve continued data reconciliation (the data merge remains incomplete) and multivariate analysis.

**Annex A – Sequential bid questions**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sequential bid process (Primary Respondents)**  I am now going to ask you some questions about how much you would be willing to pay to avoid your injury symptoms. In reality, it is likely very hard to think of these things in terms of dollars. However, is important that we try to estimate the costs of changes in your life.  Knowing what you now know about the injury and recovery process that you had to go through, I would like you to think back to the time when you were first injured. Imagine that immediately after, someone offered you a quick and painless treatment that would let you recover immediately and avoid all of the necessary recovery time actually required for your injury.   |  |  |  |  | | --- | --- | --- | --- | | 1. [If don’t know in Q**Error! Reference source not found.**]   If this person asked for 10% of your annual employment income for the next 10 years, would you have been willing to pay them?  [If they answered Q8 or said yes to Q**Error! Reference source not found.**]  If this person asked for 10% of your annual employment income for the next 10 years, would you have been willing to pay them? Based on your earlier responses, 10% would have been about [10% of annual income from WCB records in question 7 or answer to question Q**Error! Reference source not found.**] per year. | | | | |  | Yes | 1 | [Go to 5] | |  | No | 0 | [Go to 4] |  |  |  |  |  | | --- | --- | --- | --- | | 1. [If don’t know in Q**Error! Reference source not found.**]   …how about 5% of your annual income for the next 10 years?  [If they answered 8 or said yes to Q**Error! Reference source not found.**]  …how about 5% of your annual income for the next 10 years? Based on your earlier responses, 5% would have been about [5% of annual income from WCB records in question 7 or answer to question Q**Error! Reference source not found.**] per year. | | | | |  | Yes | 1 | [Go to Section 7] | |  | No | 0 | [Go to 6] |  |  |  |  |  | | --- | --- | --- | --- | | 1. [If don’t know in Q**Error! Reference source not found.**]   …how about 15% of your annual income for the next 10 years?  [If they answered 8 or said yes to Q**Error! Reference source not found.**]  …how about 15% of your annual income for the next 10 years? Based on your earlier responses, 15% would have been about [15% of annual income from WCB records in question 7 or answer to question Q**Error! Reference source not found.**] per year. | | | | |  | Yes | 1 | [Go to 6] | |  | No | 0 | [Go to Section 7] |  |  |  |  |  | | --- | --- | --- | --- | | 1. [If don’t know in Q**Error! Reference source not found.**, otherwise skip to 7]   What is the highest percentage of your annual employment income that you would have been willing to pay? | | | | |  | \_\_\_\_\_\_\_\_\_\_\_\_\_ | 6 | [Go to Section 7] |  |  |  |  |  | | --- | --- | --- | --- | | 1. What is the most that you would have been willing to pay? | | | | |  | \_\_\_\_\_\_\_\_\_\_\_\_\_ | 6 | [Go to Section 7] |  |  |  |  |  | | --- | --- | --- | --- | | 1. Do you have any other comments about your injury or recovery process that you would like to share with us? | | | | |  | \_\_\_\_\_\_\_\_\_\_\_ | 66 |  | |  | No | 0 |  |   **Sequential bid process (Secondary Respondents)**  I am now going to ask you some questions about how much you would be willing to pay to avoid [name of ***primary respondent***]’s injury and all the changes that came afterward. In reality, it is likely very hard to think about these things in terms of dollars. However, it is important that we try to estimate the costs of changes in your life.  Knowing what you now know about [name of ***primary respondent***]’s injury and what you had to go through afterward, I would like you to think back to the time when the injury happened. Imagine that immediately after, someone offered a quick and painless treatment that would let [name of ***primary respondent***] recover immediately and avoid all of the necessary recovery time actually required for the injury. With this treatment, you would be able to avoid all the changes that occurred in your own life as a result of the injury. Please also imagine that you had to pay for this treatment from your total household income.   |  |  |  |  | | --- | --- | --- | --- | | 1. [If answer in Q**Error! Reference source not found.** = 0 or don’t know]   If the treatment cost 10% of your ***annual household income*** for the next 10 years, would you have been willing to pay for it?  [If answer in Q**Error! Reference source not found.** > 0]  If the treatment cost 10% of your ***annual household income*** for the next 10 years, would you have been willing to pay for it? Based on your earlier responses, 10% would have been about [10 % of amount from question **Error! Reference source not found.** plus amount from question **Error! Reference source not found.**; must have been converted to annual] per year. | | | | |  | Yes | 1 | [Go to Q5] | |  | No | 0 | [Go to Q4] |  |  |  |  |  | | --- | --- | --- | --- | | 1. [If answer in Q**Error! Reference source not found.** = 0 or don’t know]   …how about 5% of your annual household income for the next 10 years?  [If answer in Q**Error! Reference source not found.** > 0]  …how about 5% of your annual household income for the next 10 years? Based on your earlier responses, 5% would have been about [5% of amount from question **Error! Reference source not found.** plus amount from question Q**Error! Reference source not found.**; must have been converted to annual] per year. | | | | |  | Yes | 1 | [Go to Section Q5] | |  | No | 0 | [Go to 6] |  |  |  |  |  | | --- | --- | --- | --- | | 1. [If answer in Q**Error! Reference source not found.** = 0 or don’t know]   …how about 15% of your annual income for the next 10 years?  [If answer in Q**Error! Reference source not found.** > 0] Based on your earlier responses, 15% would have been about [15% of amount from question **Error! Reference source not found.** plus amount from question **Error! Reference source not found.**; must have been converted to annual] per year. | | | | |  | Yes | 1 | [Go to Q6] | |  | No | 0 | [Go to Section 5] |  |  |  |  |  | | --- | --- | --- | --- | | [If answer in Q**Error! Reference source not found.** = 0 or don’t know, otherwise skip to 4]  What is the highest percentage of your annual household income that you would have been willing to pay? | | | | |  | \_\_\_\_\_\_\_\_\_\_\_\_\_ | 6 | [Go to Section 5] |  |  |  |  |  | | --- | --- | --- | --- | | 1. What is the most that you would have been willing to pay from your household income? | | | | |  | \_\_\_\_\_\_\_\_\_\_\_\_\_ | 6 | [Go to Section 5] |  |  |  |  |  | | --- | --- | --- | --- | | 1. Do you have any other comments about the injury or changes in your life that you would like to share with us? | | | | |  | \_\_\_\_\_\_\_\_\_\_\_ | 66 |  | |  | No | 0 |  | |

**References**

American Society of Safety Engineers. (n.d.). Impact of Accident Costs on Businesses | American Society of Safety Engineers. Retrieved May 3, 2015, from http://www.asse.org/professionalaffairs/career-res/impact-of-accident-costs-on-businesses/

Anderson, V. P., Schulte, P. A., Sestito, J., Linn, H., & Nguyen, L. S. (2010). Occupational Fatalities, Injuries, Illnesses, and Related Economic Loss in the Wholesale and Retail Trade Sector. *American Journal of Industrial Medicine*, n/a–n/a. http://doi.org/10.1002/ajim.20813

Boden, Leslie, & Galizzi, Monica. (1999). Economic Consequences of Workplace Injuries and Illnesses: Lost Earnings and Benefit Adequacy. *Journal of Industrial Medicine*, *36*, 487–503.

Boden, L. I., Biddle, E. A., & Spieler, E. A. (2001). Social and Economic Impacts of Workplace Illness and Injury: Current and Future Directions for Research. *American Journal of Industrial Medicine*, *40*(4), 398–402.

Boyle, K. J., Bishop, R. C., & Welsh, M. P. (1985). Starting Point Bias in Contingent Valuation Bidding Games. *Land Economics*, *61*(2), 188. http://doi.org/10.2307/3145811

Camm,T., T., & Girard-Dwyer, J, undefined. (2005). Economic Consequences of Mining Injuries. *Mining Engineering*, *57*(9), 89–92.

Chestnut, L. G., Keller, L. R., Lambert, W. E., & Rowe, R. D. (1996). Measuring Heart Patients’ Willingness to Pay for Changes in Angina Symptoms. *Medical Decision Making*, *16*(1), 65–76. http://doi.org/10.1177/0272989X9601600115

Corso, P. (2006). Incidence and Lifetime Costs of Injuries in the United States. *Injury Prevention*, *12*(4), 212–218. http://doi.org/10.1136/ip.2005.010983

Dembe, A. E. (2001). The Social Consequences of Occupational Injuries and Illnesses. *American Journal of Industrial Medicine*, *40*(4), 403–417.

Flachaire, E., & Hollard, G. (2006). Controlling Starting-Point Bias in Double-Bounded Contingent Valuation Surveys. *Land Economics*, *82*(1), 103–111.

Grutters, J. P. C., Anteunis, L. J. C., Chenault, M. N., & Joore, M. A. (2009). Willingness to Pay for a Hearing Aid: Comparing the Payment Scale and Open-Ended Question. *Journal of Evaluation in Clinical Practice*, *15*(1), 91–96. http://doi.org/10.1111/j.1365-2753.2008.00959.x

Gyldmark, M., & Morrison, G. C. (2001). Demand for Health Care in Denmark: Results of a National Sample Survey Using Contingent Valuation. *Social Science & Medicine*, *53*(8), 1023–1036.

Hausman, J. (2012). Contingent Valuation: From Dubious to Hopeless. *Journal of Economic Perspectives*, *26*(4), 43–56. http://doi.org/10.1257/jep.26.4.43

Hausman, J.A. (Ed.). (2012). *Contingent Valuation: A Critical Assessment*. North Holland.

Holmes, Thomas, & Kramer, Randall. (1995). An Independent Sample Test for Yea-Saying and Starting Point Bias in Dichotomous Contingent Valuation. *Journal of Environmental Economics and Management*, *29*, 121–32.

Leigh, J-P. (2011). Economic Burden of Occupational Injury and Illness in the United States. *Milbank Quarterly*, *89*(4), 728–772.

Liu, J.-T., Hammitt, J. K., Wang, J.-D., Liu, J.-L., & others. (2000). Mother’s Willingness to Pay for Her Own and Her Child’s Health: A Contingent Valuation Study in Taiwan. *Health Economics*, *9*(4), 319–326.

Mason, G.C. (2016) The origins and consequences of workplace accidents: results of a dyadic study, Working paper

Milon, J.W., (1989). Contingent Valuation Experiments for Strategic Behavior. *Journal of Environmental Economics and Management*, *17*, 293–308.

Olsen, J. A., Røgeberg, O. J., & Stavem, K. (2012). What Explains Willingness to Pay for Smoking-Cessation Treatments—Addiction Level, Quit-Rate Effectiveness or the Opening Bid? *Applied Health Economics and Health Policy*, *10*(6), 407–415.

Oremus, M., & Tarride, J.-E. (2008). A Systematic Review of the Use of Contingent Valuation in Alzheimer’s Disease Research. *Dementia*, *7*(4), 461–480. http://doi.org/10.1177/1471301208096630

OSHA. (n.d.). Safety and Health Management Systems Etool | Module 1 - Safety and Health Payoffs - Costs of Accidents. Retrieved May 3, 2015, from https://www.osha.gov/SLTC/etools/safetyhealth/mod1\_costs.html

Pouliakas, K., & Theodossiou, I. (2013). The Economics of Health and Safety at Work: An Interdiciplinary Review of the Theory and Policy. *Journal of Economic Surveys*, *27*(1), 167–208.

Reville, R. T., Bhattacharya, J., & Sager Weinstein, L. R. (2001). New Methods and Data Sources for Measuring Economic Consequences of Workplace Injuries. *American Journal of Industrial Medicine*, *40*(4), 452–463.

Seabury, Seth, Reville, Robert, Rhodes, Hilary, & Boden, Leslie. (2005). How can behaviourfal economcis inform research on workplace injuries?

Sharpe, A., & Hardt, J. (2006). *Five Deaths a Day: Workplace Fatalities in Canada* (p. 155). Centre for the Study of Living Standards. Retrieved from http://www.csls.ca/reports/csls2006-04.pdf?avfm=174

Werner, P., Schnaider-Beeri, M., Aharon, J., & Davidson, M. (2002). Family Caregivers’ Willingness to Pay for Drugs Indicated for the Treatment of Altzheimer’s Tisease: An Economic or Psychological Model? *Dementia*, *1*(1), 59–74. http://doi.org/10.1177/147130120200100109

Whitehead, John. (2002). Incentive Incompatibility and Starting-Point Bias in Iterative Valuation Questions. *Land Economics*, *78*(2), 285–297.

1. Preliminary draft. Note for quotation. Comments welcome. [↑](#footnote-ref-1)
2. University of Manitoba (Economics)([gregory.mason@umanitoba.ca](mailto:gregory.mason@umanitoba.ca)) and PRA Inc. ([www.pra.ca](http://www.pra.ca)). [↑](#footnote-ref-2)
3. The research was supported by the Research Workplace Innovation Program of the Workers Compensation Board of Manitoba [↑](#footnote-ref-3)
4. As an aside, the interplay between the costs of compensating injured workers and the cost of modifying workplaces to be safer is an important issue. In theory, investing in workplace safety to eliminate accidents could effectively eliminate the need to compensate workers. [↑](#footnote-ref-4)
5. See Mason (2016) for a more complete discussion of the origins and consequences of workplace accidents. [↑](#footnote-ref-5)
6. Annex A presents the complete WTP question for primary and secondary respondents. [↑](#footnote-ref-6)
7. Please contact the corresponding author for questionnaires. [↑](#footnote-ref-7)