

The intangible economic costs of workplace injuries on workers and their caregivers¹

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Abstract

This study examines the intangible cost of workplace injuries for workers in Manitoba over the period 2010 – 2015. Intangible costs refer to things such as the pain and suffering arising from the injuries and recovery, loss of capacity to participate in a chosen vocation, loss of capacity to participate in avocations, and impacts on social and personal relationships. It uses information on fatalities, time lost from work, duration of the absence, merged with large sample survey (n=2,813) of injured Manitoba workers. The paper implements three innovations, First, a survey based (telephone) contingent valuation method places a monetary value on the changed quality of life triggered by the workplace injury. Second, increased reliability of the valuation rests on linking these primary survey data to administrative data from the Workers Compensation Board of Manitoba (WCB). Third, the presence of an informal caregiver (spouse, parent, child, sibling, friend) becomes a potentially important covariate in the valuation of intangible costs.

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

Introduction

The Workers Compensation Board in Manitoba recorded 15,052 time-loss injuries in 2014, which represents an import cost to the economy as well as individual workers and their families. This study offers a view into the nature and extent of the intangible costs of workplace incidents resulting in injury in Manitoba.

This paper attempts uses three approaches to the measurement of intangible costs of workplace injuries:

- Survey-based (telephone) contingent valuation methods estimate the intangible economic value of the change in the quality of life triggered by the workplace injury.
- Merging administrative and survey data supports a wider range of covariates to explain variation in the valuation of intangible costs.

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- Including the existence of an informal caregiver adds an important covariate to the valuation of intangible costs.

Conceptual foundation to the economic cost of injurys

A long literature exists on estimating the costs of healthcare in general and workplace injury and injurys. Representative studies either treat the costs associated with injurys 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 cost concepts are more complex, with elements that are not necessarily mutually exclusive.

Workplace injurys are commonly identified as having direct, indirect, and intangible (OSHA, n.d.) and (American Society of Safety Engineers, n.d.).

In brief:

- ▶ For the worker, the direct costs include net wage loss (wage at the time of the injury 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 injury, 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). In addition to pain and suffering due to the injury and recovery, intangible costs for the workers experiencing permanent disability potentially includes loss of career, loss of avocation, and disrupted family and social lives.
- ▶ For the employer, the direct costs include (but 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.³ Indirect costs may include increased regulatory oversight especially for serious injurys. Intangible costs can include loss of reputation.
- ▶ For the injury insurer (private or public), the direct costs of workplace injurys include the wage compensation paid, as well as medical/rehabilitation expenses. However, if employers and employees pay an actuarially fair insurance rate, the total revenue of the insurer should reflect these direct costs.
- ▶ Finally, for society, the cost of workplace injurys (direct, indirect, and intangible) the sum of costs experienced by workers and employers as well as any net loss for insurers

³ 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 injurys could effectively eliminate the need to compensate workers.

This paper focuses on a neglected aspect of workplace injury cost, namely the intangible costs such as the pain and suffering associated with the injury and recovery as well as losses associated with changes in careers, attenuated ability to enjoy avocations, and adverse impacts on family and social lives

Measuring the costs of workplace injuries

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 injuries. Key writings, such as Dembe (2001), Boden and Galizzi (2001) and Reville 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 injury, subsequent injury and recovery, using survey research.

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. 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.
- ▶ 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 a medically treated injury, resulting in \$80 billion in medical treatment costs and \$326 billion in lost productivity costs (\$406 billion overall lifetime cost).

Stated choice versus revealed methods for measuring intangible economic costs

The core idea in this paper is that intangible costs of a workplace injury is the value of avoiding the injury in the first place. The willingness-to-pay out of current income to avoid the injury resembles an “after the fact” the insurance decision, where a smaller expenditure offsets a risk adjusted much larger cost. In this case, contingent valuations becomes a method for expressing the value of injury avoidance.

Economists have two approaches to measuring value. Most traditionally, 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 and other covariates. Such revealed preference analysis remains the preferred method for estimating demand but has two important limitations. First, the covariates that condition preferences must derive from market, administrative, or less often, survey data. Market and administrative data too often have limited measures of consumer attributes. Survey data can expand the range of covariates, but unless merged with specific key elements of the derived demand function, such as prices and actual quantities consumed, estimates may become unreliable due to imperfect recall. Also, revealed preference cannot predict demand for hypothetical goods and services, which represents the core market research problem.

The second approach, stated choice uses hypothetical scenarios to estimate value usually 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 injuries 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.

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 injury and consequential injury, represents an extension of the core idea.

Contingent valuation in health

Contingent valuation models (CVM) rests on traditional welfare economics, where consumers state a price that they are willing to pay 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 CVM use a form of discrete choice model implemented in a survey setting, where respondents choose and rate one or more discrete alternatives. Examples from health include the following:

- ▶ 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)
- ▶ insurance covering treatment for four health problems (Gyldmark & Morrison, 2001)
- ▶ choice of treatment among caregivers of Alzheimer’s patients (Oremus & Tarride, 2008) and (Werner, Schnaider-Beeri, Aharon, & Davidson, 2002)
- ▶ valuation of patients’ time (van den Berg, Gafni, & Portrait, 2017)
- ▶ measuring the intangible costs of alcohol addiction ((Mosquera Nogueira & Rodríguez-Míguez, 2018).

Respondents must have very good (and accurate imaginations) about the alternatives offered. Health studies that query patients and caregivers about treatments that promise faster or more complete recover should, in principle, encounter fewer barriers in creating salience. This has prompted an explosion in the use of CVM techniques in valuing new medical treatments.

CVM in health studies appear in two general formats. The first is a single bound dichotomous choice. After describing the choice options, a trial price (P_k) selected from a range are assigned to randomly allocated subsets of the respondent group. Each group accepts or rejects the price offered for the k th option. The proportion of acceptances to total cell size creates A_k . For a normal good, A_k should fall as the trial prices rise. Clearly the larger the number trial offers, the more information will support the estimate of willingness to pay, but sufficient sample must exist in each group to support reliable estimates of demand. 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. The starting point and “steps” between each P_k are important design issues.

The double bounded dichotomous choice model is a more efficient method for collecting WTP information (Hanemann, Loomis, & Kanninen, 1991). A accepts or rejects a trial price P_k ; a “Yes” elicits a follow-up question: “Would you purchase for price $P_A + X$?. A “No” prompts the follow-up: “Would you purchase for price $P_A - Y$?” Usually $X=Y$. 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.

CVM has its critics. Diamond and Hausman(1994) and Hausman(2012) dismisses stated choice methods 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. The central criticisms revolve around the concept of salience. Non-users often have little knowledge of actual harms, especially when located far distances away from the location of potential negative impacts.

In a recent review Boyle (2017) and Bishop and Boyle (2017a) take a broader view on the accuracy of CVM, examining the reliability and validity of these methods. Using a wide-ranging review of the literature, they find that these methods are generally reliable, when measured using test/retest methods. A more challenging aspect of accuracy is validity, which they examine using the three “Cs” – content, construct, and criterion validity.

In brief, *content validity* refers to the entire method used to collect the CVM data. In the survey context this refers to everything from responding collection, questionnaire construction and data analysis. *Construct validity* focuses on reasonableness of the estimate. In a demand study, the willingness-to-pay for an item should align with expectations about the willingness to pay for substitutes. More concretely, an insurer who obtains WTP estimates for a planned product, should find that prices based on contingent valuation do support a profit. *Criterion validity* uses a generally accepted value as the standard against which to compare the CVM results.

It is challenging for any prospective study to meet all three tests of validity. A basic premise of stated choice methods is that few other studies exist to serve as criteria and often CVM attempts to measure abstract concepts. At a minimum any CVM study should detail the procedures to enhance content validity, by explaining respondent selection, questionnaire design and testing, data collection, data coding, and statistical modelling used to estimate the final values.

CVM faces other challenges when applied to the valuation of health states including:

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

Task complexity emerges in health economics when estimating abstract concepts such as quality life years (QALYs). When healthy individuals evaluate perceived loss in quality of life due to an injury that renders them a paraplegic, this is the same as the hypothetical bias. However, asking someone rendered a paraplegic *after* an injury 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 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. The vector of price

prices needs to start and end over some “reasonable” range. 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.

These issues fall the concept of “salience.” CV modelling can become very complex, depending on the nature of the good/services, the context of hypothetical states and the specific situation of the experiment.

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.

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. In this research, the task becomes easier since respondents are comparing their pre and post injury states. current situation. First, it is important to understand what respondents experienced. This can only occur through deep engagement with the respondents—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 respondent memories of the injury and its aftermath. The experiment in this study occurs in the context of a survey questionnaire designed to trigger recall of all the important dimensions of a workplace injury.

To create that deep understanding of the nature of the workplace injury, the research started with 20 dyadic interviews comprising injured worker and a named caregiver. Mason (2017) explains this in more detail, but the key finding reveals that serious workplace often have complex outcomes beyond physical limitations. Head traumas may produce long-term changes in function and any injury that requires retraining and job change can attenuate careers. In other cases, any physical limitation affects avocations. A universal finding is that serious workplace injuries can trigger depression which can affect social relationships.

A caution is important. Most workplace injuries are not serious. Using time-loss as a measure of seriousness of a workplace injury creates a convenient, but flawed metric as discussed later in the paper. The important point is that establishing salience if the entire injury experience must render valid recall by the respondent. The willingness to pay to avoid a accident that had a time-loss of a couple of days should be very low, if not 0.

Data collection

The nature of workplace injuries

WCB provided an extract (without any personal information) of all time-loss workplace injuries that occurred between April 10, 2010–June 30, 2014 which resulted in 54,445 cases. Figure 1 shows most workers with time-loss claims are off work for less than 15 days. The average time-loss is 31 days with a median of 7 days.

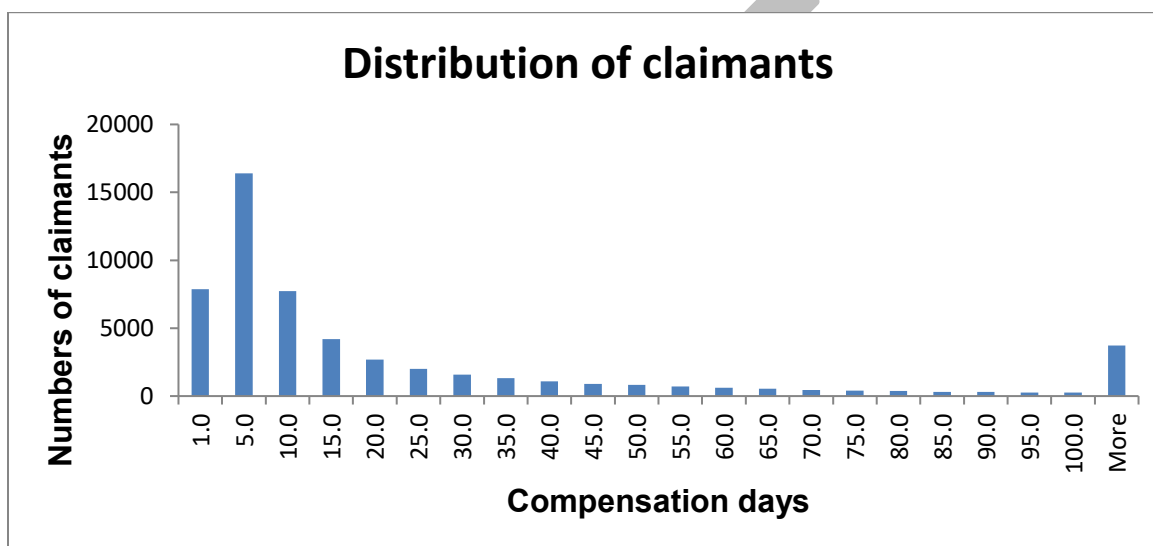


Figure 1: Distribution of time-loss (compensation days) (RWIP 2014)⁴

Table 1 reveals that about 57% of time-loss injuries result in fewer than 10 working days lost. Most of these workers return to work and their former position without much delay. Of more concern, are workers with longer time-loss and this is the group which forms for focus for the current proposal - RWIP 2018

⁴ Note: *Compensation days* are paid days of wage loss starting the day after injury when the worker cannot go back to work immediately due to their injury. Manitoba pays 90% of net earnings after deductions for EI, CPP, and income tax. A floor exists on this amount so that the 90% of net calculation does not fall below minimum wage if the injured worker is earning minimum wage.

Fewer than 2 days off	8,954	16.4%
2–5 days off	13,094	24.0%
6–10 days off	9,025	16.5%
11–40 days off	13,686	25.1%
41+ days off	9,801	18.0%
Total	54,560	100.0%
Mean		29.4 days
Median		7 days
Minimum		1 day
Maximum		1,532 days

Respondent recruitment

This study recruited primary and caregiver to participate in a telephone questionnaire. The sample frame drew from a de-identified administrative database (N=54,500) supplied by the Workers Compensation Board of Manitoba (WCB) of all time-loss accidents between April 10, 2010 and June 30, 2014 (N=54,500). PRA Inc, (www.PRA.ca) conducted the data collection under contract with WCB.

Rather than selecting a large sample frame and attempting to secure interviews, sampling and interviewing proceeded in several waves; with each smaller sample selected, the WCB supplied names, addresses, telephone numbers, and a unique identity number 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 the contact data 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 within WCB/PRA should the respondent desire more information. The research took pains to ensure that potential respondents had full information on the research and could refuse without prejudicing any compensation claims before the WCB.⁵

Caregivers were recruited at the end of the worker's interview. Table 2 shows the number of survey completions.

	Number
Injured worker	2,310
Caregiver	510
Total	2,820
Source: PRA Survey of workers and caregivers August 2014 – January 2015)	

⁵ WCB never received the identities of those workers who declined to participate

As an incentive respondents' were enrolled in a contest to receive a gift card of \$100

Questionnaire form and content to promote salience

The workers' questionnaire has 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 injury — 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, **Table 3** shows the questions used to identify a “spouse, partner, or another adult living with you who is familiar with your injury.” Note that, the survey included only cohabiting caregivers to ensure that they could report on the full range of support and costs associated with the cost of the injury. A caregiver not residing in the home can only report on part of the costs associated with injury

Table 3: Questionnaire format to enroll caregivers

In the letter I mentioned at the start of this survey, I 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]

2. 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]

Questionnaire validation

The workers' 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.

Assessment of the comprehension levels of the two questionnaires (workers and caregivers) ensured respondent understanding at no more than the grade 9 level using the Fleischer-Kincaid score. The worker questionnaire tests at grade 7.7, while the caregiver questionnaire tests at grade 8.9.

The pretesting of the PR questionnaire involved 100 respondents. Throughout each pre-test interview, requests for clarification and hesitation became the subject of further probing to ensure that each respondent understood the questions as intended. At the end of each interview, additional questions probed to identify any areas where respondents reported.

Using CV to estimate the perceived value of avoiding workplace injuries

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 and their caregiver. 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 injury. In effect, the questions ask the respondent to purchase insurance that would compensate him or her for the injury. This insurance would cover not only the financial losses, but the "pain and suffering" triggered by the injury.

The questionnaire frames the core question as follows: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 caregiver is a little more involved

⁶ Annex A presents the complete WTP question for primary and secondary respondents.

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 due to the injury.

This payment was normed to a percentage of the respondent's weekly income, which the respondent reviewed. The process used 10% of their weekly income as the first "price", then those that said "yes" received an "offer" of 15% more and those that said "no" received an offer of 5% less. 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.

It is important to underscore that the price was the percentage of their pre-injury income as retrieved from the administrative data. In some cases, the administrative record did not have the data, respondents supplied their own estimate. The administrative data were merged into the computer aided telephone interview database.

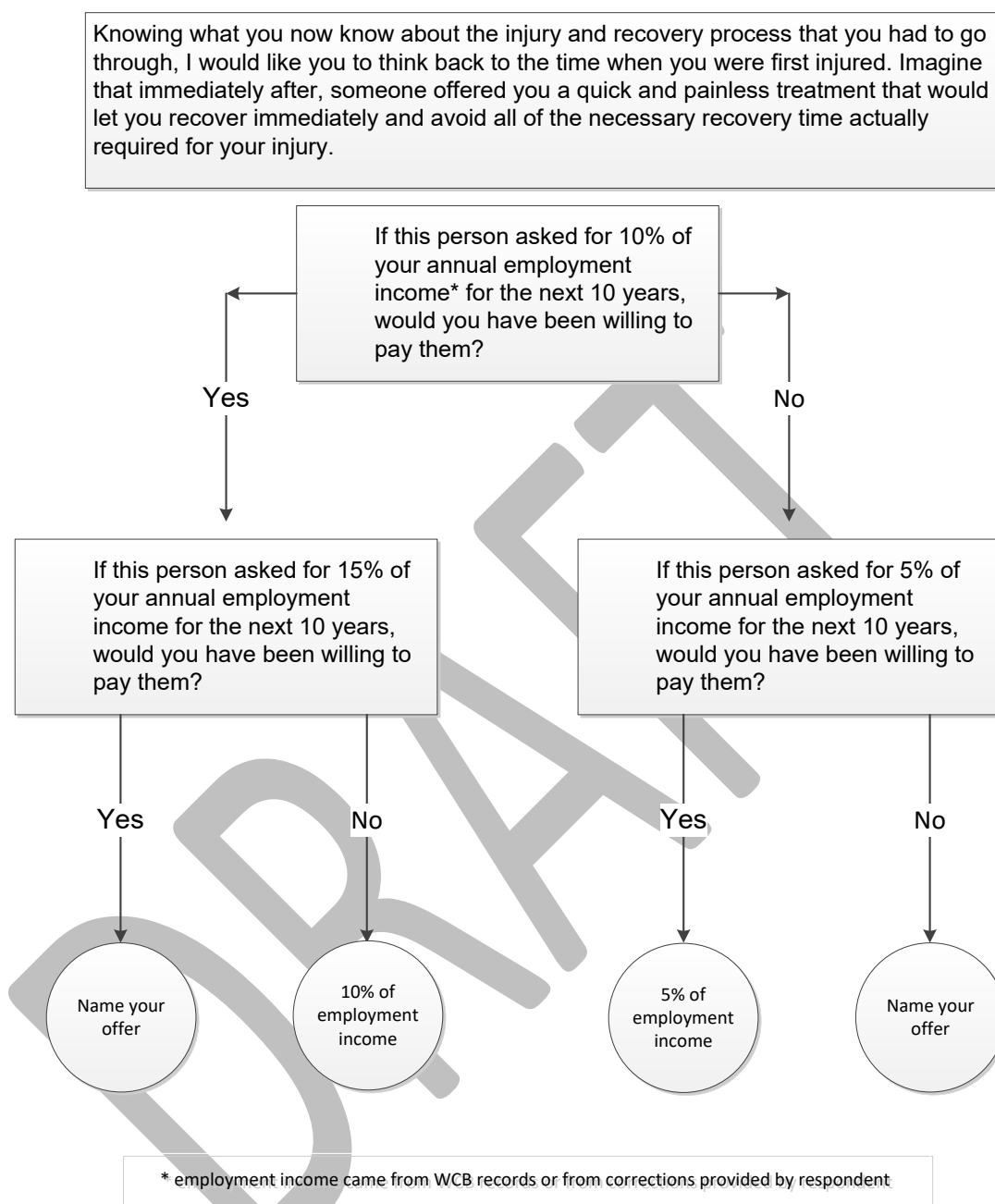


Figure 2: The conceptual structure of the double bounded dichotomous choice question for workers

Anchoring the starting point to actual pre-injury 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 anchor responses to the weekly income of the worker. Caregivers responded to a similar

sequence of questions. However, the WTP question for the caregivers was based on total household income, since many caregivers had no salary of their own with which to anchor their response.

Willingness to pay – workers

About half of workers would be willing to pay certain amounts out of their annual income for 10 years to avoid the injury. Although not strictly an insurance plan, it does represent a *retrospective valuation* of the pain and dislocation experienced with the injury. Table 4 shows the responses to the offer in the questionnaire.

Table 4: Willingness to pay – workers respondents		
<i>If the treatment cost x% of your annual income for the next 10 years, would you have been willing to pay for it?</i>		
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.

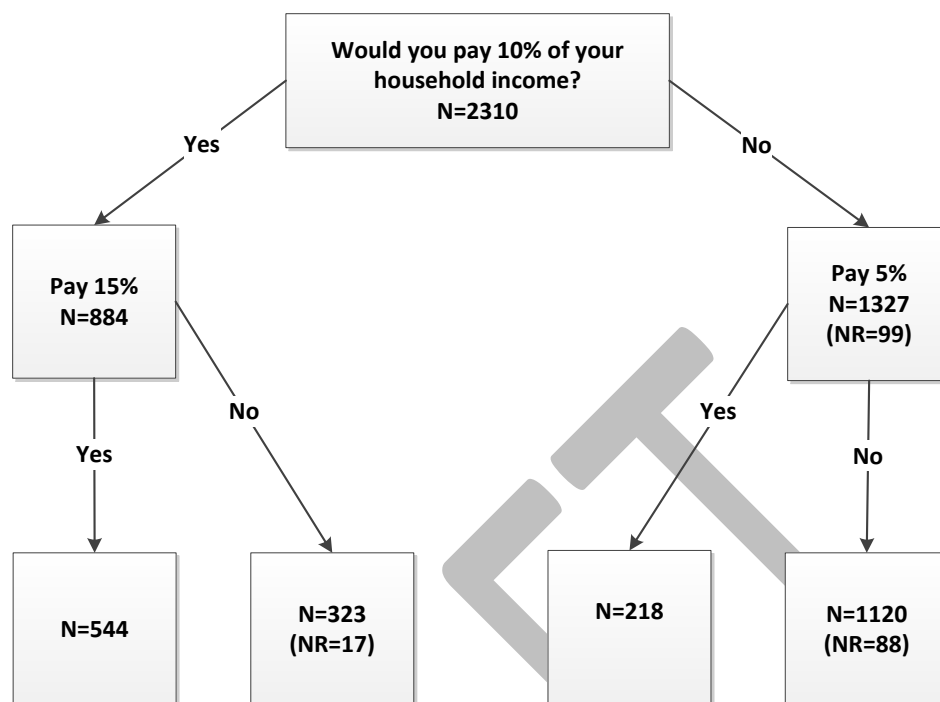


Figure 2: WTP Map for workers

Willingness to pay – caregivers

Caregivers would be willing to pay to avoid the effects of the injury. Table 5 and Figure 3 show the same information as shown for the primary respondents.

Table 5: Willingness to pay – caregivers		
<i>If the treatment cost x% of your annual household income for the next 10 years, would you have been willing to pay for it?</i>		
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	

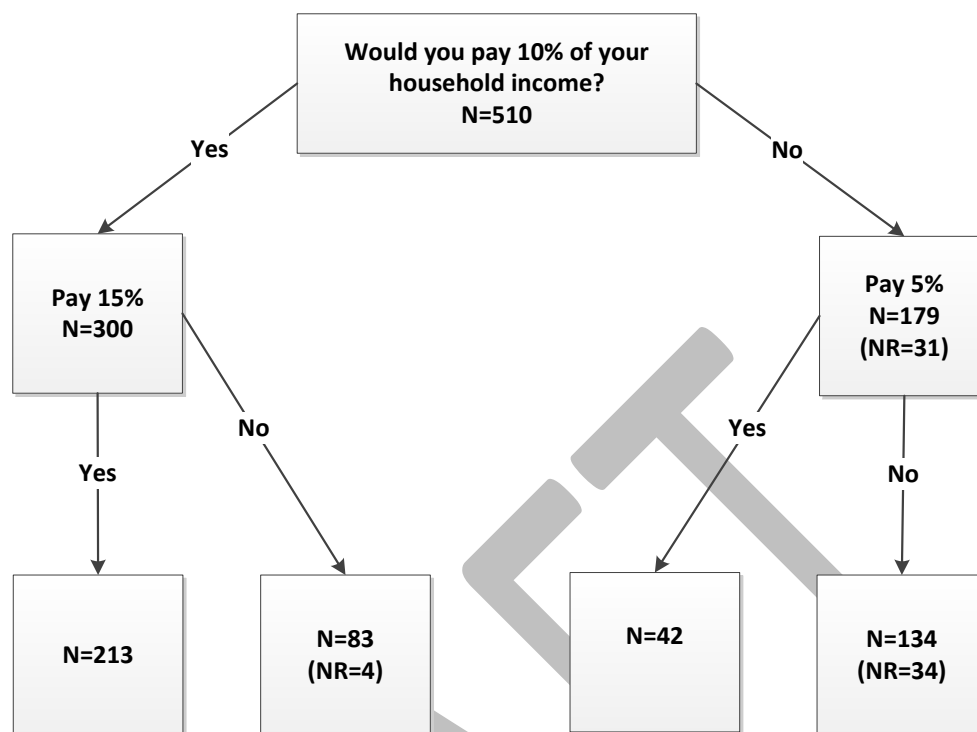


Figure 3: WTP map for caregivers

Coupled with the enumeration of the physical, social, and psychological outcomes in the interview, the survey process maximized the salience within the constraints of respondent burden and recall. Suffice to say that interviewers reminded respondents of both their total income and the sequelae of the injury. This emerges in the coherence of the responses apparent in Figures 2 and 3.

Preliminary estimates of the value of the injury

Fewer caregivers indicated that they placed a zero value of avoiding the injury (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 respondents did not consider their injuries as severe.

Table 6: Willingness to pay estimates to have been able to avoid the injury in the first place.		
Statistic	Workers	Caregivers
Mean (weekly payment for 10 years)	\$57.40	\$87.41
Standard Deviation	\$3.06	\$4.32
Minimum	0	0
Maximum	\$441.00	\$645.60

Applying these percentages to actual before injury incomes, caregivers have an average WTP of \$82 out of annual income, which is double that of the primary respondents who were willing to pay \$58 out of their annual income. Compared to car and home insurance, these seem like low amounts. However, this is typical of other valuations to avoid illnesses. No patient or injured worker can access insurance markets to mitigate the pain and suffering, and so no “market price” exists for such an intangible “product.”

It is also useful to recall that 75% of primary respondents did not identify a caregiver in the home. These workers experienced less serious injuries. Most primary respondents who had injuries recovered completely, with a loss of less than 15 working days; therefore, it is unsurprising that they were unwilling to pay anything to mitigate the tangible costs of that injury.

Workers with matched caregivers have an average WTP of \$57, out of annual income narrowing the gap in the valuation of injured workers and their in-home caregivers. This suggests a difference remains between workers and caregivers in the perceptions of the value of avoiding injury. It also indicates that carers perceive the impact of injury differently. Here gender and relationship status (whether the carer is a parent, child, or spouse) may be important.

Figure 3 shows the simple correlation ($\rho = .188$) between WTP and injury severity as measured by total compensation days. No clear relationship appears. A few outliers to the right represent those workers who have suffered a permanent and disabling injury

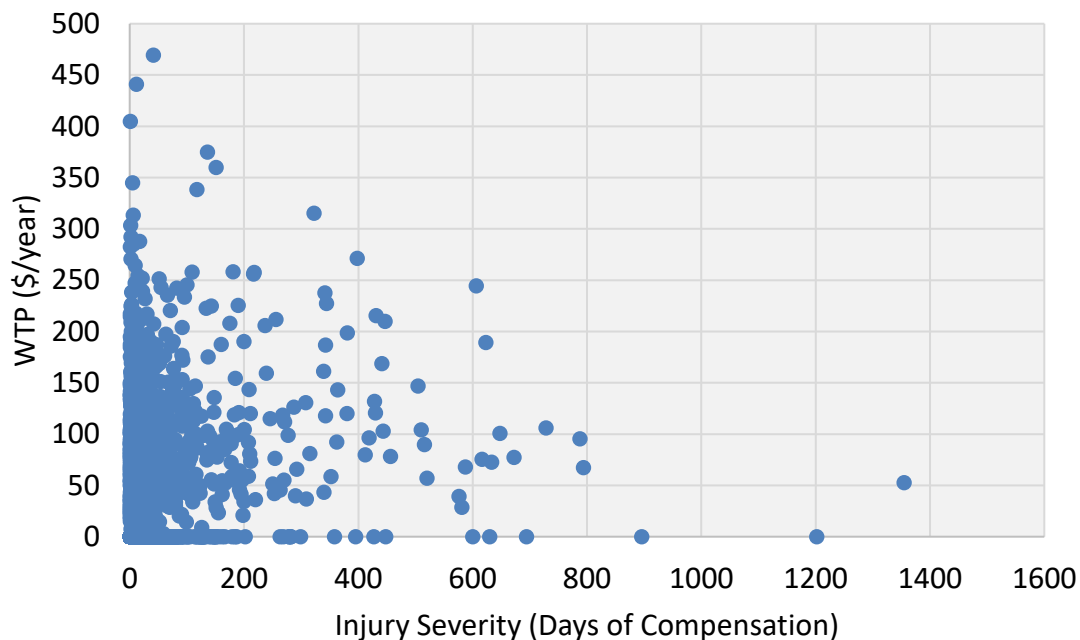


Figure 3: WTP and injury severity – Workers

Figure 4 shows little correlation between willingness to pay for workers and caregivers and that caregivers tend to have slightly higher offers.

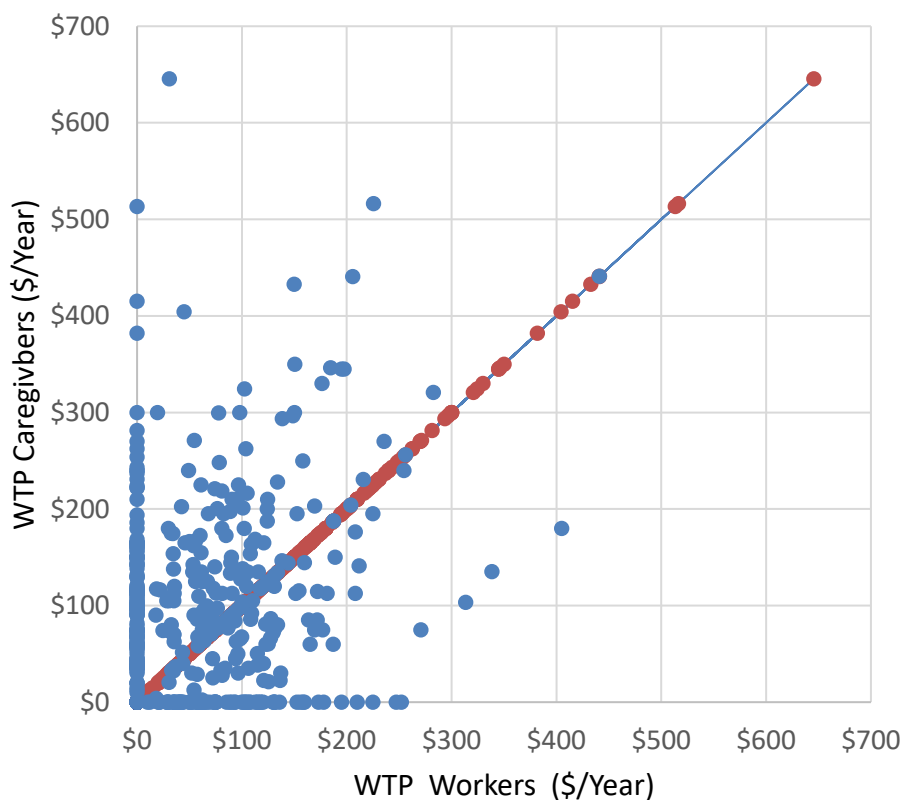


Figure 4: WTP: Workers vs caregivers

The sum of WTP for all 2,312 workers for making an annual payment is \$101,251 for this “insurance premium,” which — assuming this is a random selection of 2,312 from the administrative database ($n=54,481$) — totals approximately \$2,430,000 annually or \$24,300,000 (non-discounted) over 10 years.⁷ This forms the estimate of the non-financial, economic costs of workplace injuries over the study period and seems a credible total.

Determinants of WTP – Workers

Table 6 suggests some preliminary hypotheses to explore:

- The results suggest that caregivers have a higher WTP than workers, however, workers referenced their income, while caregivers referenced household income, which would tend to be higher

⁷ Recall that many respondents were unwilling to pay anything.

- Many workers and caregivers were unwilling to pay anything. For low impact injuries this would be obvious. More interesting is that the severity of the injury and injury recovery complexity/duration, age of respondents, and number of dependents should 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 injury may influence valuation as memory fades, despite using a series of questions to prompt recall and create salience.

Table 6 presents OLS estimates of the WTP by workers, with the following variables

- Dependent variable WTP (\$ per year for 10 years)
- Independent variables
 - Sex (61% of injured workers in the sample were men)
 - Injury severity (total days of compensation serves as a proxy for injury severity)
 - Caregiver present assisted with recovery, which could be spouse, other family member or friend excluded paid caregiver from WCB)
 - Current income (at time of survey) using a spline estimate to manage
 - Days since injury (date of survey less date of injury)

Table 6: WTP as a function of selected covariates (OLS estimates) (N=2310)				
	Coefficients	Standard Error	t Stat	P-value
Intercept	-9.00141	5.481525	-1.64214	0.100698
Sex (M=1, F=0)	-1.57561	2.487129	-0.63351	0.526466
Injury Severity (Days of total compensation)	0.099922	0.013356	7.481526	1.04E-13
Caregiver (1 = Yes, 0 = No)	10.84951	1.743624	6.222391	5.8E-10
Current household income (at time of survey)	0.050487	0.002979	16.9451	8.63E-61
Days Since Injury	0.005473	0.004031	1.357925	0.17462
R ² =.157				

Table 6 reveals that men experiencing workplace injuries have lower WTP to avoid the injury than women with injuries. Injury severity plays a positive (and statistically significant) role in WTP, but the effect is small. The presence of a caregiver also increases WTP, probably because those with severe injuries require more care. Current household income at the time of the survey raises WTP by a small (and statistically significant way). Finally, the elapsed time since the injury has a negligible impact on WTP.

Table 7 presents the results of eliminating those cases with 5 or fewer days of compensation. The represents a work-week lost. The results do not change much.

Table 7: WTP as a function of selected covariates (OLS estimates) (N=1390) (Compensation days > 5)				
	Coefficients	Standard Error	t Stat	P-value
Intercept	-7.23162	7.531638	-0.96017	0.337139

Sex (M=1, F=0)	-1.16892	3.366371	-0.34723	0.728469
Injury Severity (Days of total compensation)	0.081668	0.014863	5.494639	4.65E-08
Caregiver (1 = Yes, 0 = No)	8.134587	2.104023	3.866206	0.000116
Current household income (at time of survey)	0.05605	0.0039	14.37185	9.24E-44
Days Since Injury	0.004833	0.005514	0.876462	0.380931
R ² =.166				

The low explanatory power of the regressions in Tables 6 and 7 reveals an important element of WTP for intangibles such as pain/suffering, loss of income, loss of livelihood, and circumscribed quality of life. People can become accommodated to quite dramatic changes in their lives. The salience of the injury and its aftermath likely erodes with time but it remains elusive to measure. Since the days since the injury has no impact on the WTP, it may be that the minor injuries with few days of compensation have an undue effect on the valuations.

Conclusion

Using stated choice methods to assess the intangible costs of workplace injuries rests on establishing salience. The survey of injured workers used extensive questions about the injury and its aftermath to “take the respondent back” to that episode in their life. The contingent valuation question itself attempted to present a financial option that resembled an insurance plan and the coherency of the results, appears to support the validity of the approach.

However, the existing set of covariates do not explain the variation in WTP for primary respondents. It is possible that objective measures such as attributes of the injury and its aftermath as well as directly measurable attributes of the injured worker may never be sufficient to explain variation in the valuation of avoiding the intangible costs of the injury. It is possible that latent variables grouped under the concept of *weltanschauung* or the respondents’ world view may explain

this variability. This will require a broader set of covariates that offer a more detailed description of the nature of the injured worker.

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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, it is important that I 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.

3. [If don't know in Q]
 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]
 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]
- | | | |
|-----|---|-----------|
| Yes | 1 | [Go to 5] |
| No | 0 | [Go to 4] |
4. [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]
 ...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] per year.
- | | | |
|-----|---|-------------------|
| Yes | 1 | [Go to Section 7] |
| No | 0 | [Go to 6] |
5. [If don't know in Q]
 ...how about 15% of your annual income for the next 10 years?
 [If they answered 8 or said yes to Q]
 ...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] per year.
- | | | |
|-----|---|-------------------|
| Yes | 1 | [Go to 6] |
| No | 0 | [Go to Section 7] |
6. [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]
7. What is the most that you would have been willing to pay?
 _____ 6 [Go to Section 7]
8. 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 I 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]

2. [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 **Error! Reference source not found.**; must have been converted to annual] per year.

Yes	1	[Go to Section Q5]
No	0	[Go to 6]

3. [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]
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4. What is the most that you would have been willing to pay from your household income?
_____ 6 [Go to Section 5]

5. 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

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