2002

Analysis of accident cost and comparison with available research

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Analysis of Accident Cost and Comparison with Available Research

By Michael C. Osterhautd

Graduate Project/Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Environmental, Health & Safety Management

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Abstract

This project is designed to determine the cost of occupational injury in one case study and to relate it to the cost of occupational injury in the available literature. The main reason for this project is the general lack of knowledge that companies have regarding the actual cost of occupational injuries.

Information was gathered for this project through personal interviews with the case study individual, telephone calls to various agencies and hospitals regarding the scenario presented in the case study and compilation of the costs and hours spent with respect to this case study. Through the case study this project attempts to quantify and explain the source and magnitude of the many categories of costs related to occupational injury.

Literature was analyzed that dealt with occupational injury costs. The results of this analysis were compared with the case study to determine how the occupational injury analyzed in the case study compares with the costs reported in the literature.

One study estimated the average cost to employers for an occupational motor vehicle accident as $23,000 while the National Safety Council suggests that the cost of the average nonfatal disabling motor vehicle injury is $35,000. This case study calculates the cost of one nonfatal disabling motor vehicle injury at nearly $400,000. The difference is probably due to:

- the severity of the injury,
- the failure in the literature to provide for many of the direct and indirect costs observed that were caused by the injury and
- Researchers common practice of estimating costs conservatively.
The results of this and similar case studies should be made available to companies to motivate them to improve their policies and practices and thus increase profits.

Chapter 1: Introduction

This project is designed to analyze one case study of a work-related accident that resulted in injury. It compares the costs of that accident with the costs available in the available literature.

The costs of workplace accidents have a great impact upon the framework of safety in the United States. Many documents are written every year that make assumptions about the costs of accidents, and from these assumptions, many corporate policies are set. If these assumptions are false, many policies could have misguided goals with regards to accident reduction and cost avoidance.

Several researchers, with several different areas of focus have analyzed this topic, for example, costs of injury, costs of motor vehicle injury, costs of occupational injuries and illness and costs of occupational injury in the United States. This research varies in completeness. Some use national databases; some use compilations of national databases, and some researchers use surveys to gather data for their results. The need for more research into this field is one that all researchers agree upon.

"Surprisingly little is known about what occupational injuries cost." The costs of occupational injuries have been studied in less detail than most injury costs. Part
of the reason for this is the varied nature of occupational injuries; it is far easier to
study the cost of knee injuries or the cost of cervical spine injuries than the cost of
the broad topic of occupational injuries. The one main thread that relates
occupational injuries is that they happen while at work. Some people work
indoors, some outdoors; some people drive vehicles for a living, some cut down
trees, some people work at jobs that pose very little hazard to health; some work
at extremely hazardous jobs. There is much research as to which jobs are most
hazardous, are likely to develop certain types of injuries or have the highest and
lowest rates of injury. OSHA requires record keeping regarding injury and illness
type, rate, and severity, but nowhere does any agency require record keeping
regarding injury cost. Insurance companies, the Workers’ Compensation Board,
and the National Safety Council attempt to keep track of the direct costs of
accidents that occur at work. Direct costs are frequently referred to as
“accounting” or “out of pocket” costs.\(^2\) Indirect costs on the other hand are not
“accounting” or “out of pocket” costs, they represent forgone opportunities for the
injured or ill person, their family, employer, co-workers and society at large.\(^3\)

A thorough search of the literature revealed only a few studies that attempted to
determine the cost of occupational injuries. One reason for this is the low priority
that the American public has put on occupational injury rates as a category. For
example: the National Institute for Occupational Health and Safety (NIOSH)
receives the lowest levels of funding of the nearly 20 National Institutes of Health
and related agencies in the Centers for Disease Control. NIOSH research awards
sum to roughly 0.5% of the awards of the National Cancer Institute, 1% the funds of the National Institute on Aging and roughly 7% of the National Institute on Dental Research. In comparison, the costs related with occupational injuries and illnesses are five times the costs for AIDS, three times the costs for Alzheimer’s disease, more than the cost of arthritis, and nearly as great as the costs of cancer. (Cancer research receives financial awards of 200 times greater NIOSH.) Why is a subject with such huge costs such a low priority? The reason is lack of public knowledge of, and attention to, these costs. Many employers put little emphasis on safety cost reduction and cost avoidance, focusing on topics that bring money into the organization such as manufacturing, sales and service, because they are not aware of the huge potential for loss that occupational injuries pose.

How do occupational injuries effect employers? They effect the bottom line in several ways:

- Increased insurance premiums due to increased experience modifier
- Increased Workers’ Compensation payments
- Potential for OSHA penalties
- Damage to equipment, machinery, facility, company name recognition
- Production downtime (due to accident investigation, facility modification, emergency response, fire, explosion, chemical spill, etc.)
- Loss of product or services (spoilage, defects, damage, etc.)
- Demurrage (delays in shipment, filling orders)
- Additional overtime needed to compensate for injured worker(s)
- Hiring and training costs to replace severely injured workers
- Lost time by fellow employees
- Overhead costs while work was disrupted
- Supervisor lost time resulting from the accident (inspections, meetings, reports, etc.)
- Other managers lost time resulting from the accident (inspections, meetings, reports, etc.)
- Miscellaneous other costs
The first two costs can be included in the annual budget; the rest are unbudgeted losses. These costs can severely cripple a company’s bottom line. Reduction in profits or an increase in prices must offset the cost to employers. To understand this relationship please visualize this example: an employee is involved in an accident that results in a slight injury with total costs of $10,000. The company will have to make additional sales of $250,000 at a 4% profit to make up for the loss, just to be at the same place they were profit-wise before the accident. These would be the sales required to offset one accident. How much profit is lost on a national scale to offset the $155 billion\(^6\) in costs of accidents?

**Endnotes for Chapter 1**

Chapter 2: Background

The main way of evaluating the costs of an accident is called the Human Capital method.

The Human Capital method posits two broad categories of costs: Direct and Indirect. Direct costs represent the actual dollars spent or anticipated to be spent providing medical care to the injured or ill person and administrative costs for delivering medical care and delivering indemnity benefits. Direct costs are frequently referred to as “accounting” or “out of pocket” costs. Indirect costs, on the other hand, are not “accounting” or “out of pocket” costs, they represent forgone opportunities for the injured or ill person, their family, employer, co-workers, and society at large.

This document will be focussing primarily on the indirect costs of these incidents. All costs for accidents have been estimated for many years; it would seem that the estimates of indirect costs have been underestimated for many serious accidents.

Traditionally the indirect costs for accidents have been estimated as follows:

1. Wage losses
2. Fringe benefits
3. Workers compensation
4. Home production
5. Training costs
6. Disruption of business costs
7. Other indirect costs

Wage losses can be accounted for by using several different methods of calculation. In the case of fatality, it would vary greatly depending upon the age of the individual and his or her future plans. For example, if the individual was young and working as a laborer (an occupation with one of the highest injury rates) in order to earn money for college, it would be a much different value than a worker in the same job who has risen to his highest potential.
Home production has been defined as activities that take place in the home; this has included changing diapers, reading to children, home repairs, plumbing repairs and so on.\(^4\)

Training costs have included the time to locate, hire and train an individual to take the place of the injured or ill person while on extended leave. Training costs may be much higher than traditionally estimated depending upon the job markets, skills involved with the position required to replace or the hiring practices of the company. For higher skilled positions it may involve hiring someone for a less technical position and shifting many workers up so that a skilled individual may assume the position for the time of need. Several scenarios may be proposed to cover the costs of training for a position. Each one would have different costs to be quantified.

Disruption-of-business costs have been estimated; it would seem impossible to quantify the costs for all accidents. In the past, many costs have been ignored. This project has generated a list of the lost time and associated costs regarding a permanently partial disabled individual on different issues. These costs stretch out over the course of several years and certainly have not been traditionally accounted for in this category.

Other indirect costs are often described as costs to family, friends, and society at large. These costs can very greatly, from time spent bathing and feeding a severely injured person, to helping someone with an injured back move furniture. These costs are rarely
calculated, and nearly impossible to quantify. This document will point out some reasons that the costs to society have been underestimated.

Endnotes for Chapter 2

1 Leigh et al. (2000): 90-91.
2 There have been no studies where these costs are calculated. It seems that they are always estimated.
3 Leigh et al. (2000): 113-120.
Chapter 3: Literature Review

This literature review is separated into three sections: first, cost data analyses, next journal articles that discuss trend and softer data, and last narrow focus data analyses. The first group of documents is well written; analyses on costs of injuries, and the evolution of this type of information is easy to see. These documents are very well informed. The one major theme that persists throughout them is that more research is necessary in this field, more money needs to be spent on this research.

The earliest work published deals with only the cost of injury. Rice et al. identifies an injury cost of $157.6 billion for the year 1985. This cost includes:

- future earnings
- lost work time
- long term cost of treatment and rehabilitation of injuries
- years of life lost due to disabling effects of injury and premature death
- cost to society for injury

Rice and her colleagues generate the cost of all injuries, not just workplace injuries. They also address the topic of federal government investment into research on injuries and the reduction of their occurrence. This is the first document to perform this analysis on injuries alone.

Four years later Marquis extended the work of Rice et al. when she separated work related injuries from the total injuries in 1989. The cost that Marquis
associates with workplace injuries is $83.2 billion (for workplace injuries not fatalities). This work identifies two other questions, who pays, and the frequency of work related injuries. The answers to these questions are:

1. Frequency: about four percent of American adults suffer an injury at work that results in medical attention in the average year.

2. Who pays: the injured person and family pay about 45% and the remaining 55% comes from a variety of public and private sources that injured persons turn to for help with their medical bills when they are out of work. This would include private health insurance, employer provided benefits, workers' compensation and other public sources. This document is not clear about the source of the costs.

In 1995 Miller and Galbraith placed the yearly value of workplace injury much higher than did Marquis. Miller and Galbraith placed the value at $140 billion yearly, as compared with Marquis' value of $83.2 billion. Miller and Galbraith report that the average cost per injury is $13,000. They value the average motor vehicle injury at $75,000. This is a top down estimate, which uses several categories to estimate potential costs. These categories are:

- Medical and emergency service: hospital and nursing home care, physician services, physical therapy and such items as laboratory tests, prescriptions and wheel chairs. Emergency services include fire, police and paramedic response, emergency transport and coroner services.
- Wage and household work: lost wages, fringe benefits, housework and other household services.
- Administrative and legal costs: costs of incident investigation, record keeping, insurance claims, processing and litigation. Product liability litigation costs are excluded.
- Workplace disruption: overtime pay, loss of special skills, productivity losses by
supervisors and colleagues and recruitment and training costs associated with deaths and long term disabilities, among others.


Miller and Galbraith estimate workplace injury costs from the top down from national expenditure data. In instances where the data for cost estimation is limited, they develop workable assumptions to evaluate the potential magnitude of these cost factors.

For example:

- Emergency transport costs are computed by multiplying the transport costs per case from a study done in 1989 times the 1989 national health review survey of injuries at work. Then they arbitrarily multiplied the cost times 1.5 to account for the costs of police and fire departments response to emergencies. The authors feel that this would be an accurate measurement of highway crashes where the costs (of police and fire response) are double the transport costs.

- Lost wages for fatalities were computed at a 4% discount rate as described in the 1989 study by Rice et al. and the NHIS age and sex distribution of worker injuries.

- Workers compensation: The authors state that they found information that determined workers’ compensation compensated 60.3% of wage loss and none of the fringe benefit loss for covered cases in the mid 1980s. They estimated life insurance payments per worker death averaged $35,000 in December 1990 dollars. Sick leave was valued at the average nonsupervisory, private sector wage of $10.17/hour in December 1990. All lost wage injuries result in lost fringe benefits; they valued the fringes at 20% of wages.

Miller and Galbraith also developed assumptions for emergency transport, police and fire costs, quality of life costs, workplace disruption costs, administrative costs, lost value of household work and fringe benefit loss. Each of these costs are based upon assumptions and reasonable estimates throughout the document. This document and one other by Miller are used throughout this paper as references.
All the assumptions that Miller and Galbraith make are common throughout this field of study.

Blincoe and Faigan estimated that the economic cost of motor vehicle accidents in 1995 was $150.5 billion. Their work is relevant to this paper because the individual studied was injured in a motor vehicle crash on the highway in the course of his job duties.

Miller in 1997 published a study that estimated the cost of occupational injuries to U.S. employers was $155 billion. Highway crashes cost employers $56 billion per year ($23,000 average per crash). His study is another top down analysis of the costs, similar to his previous work. The uncertainties of these calculations are described in depth so there is no mistaking that these costs are only an estimate. Many times in describing the pattern of estimating, Miller describes how a conservative estimate was used, for example, the estimate of workplace disruption at 1/7th of the cost of an employer, the actual cost could vary from 1/20 to 1/4th the monetary cost of the injury, quite a broad range, and this is common throughout the available literature.

The National Safety Council publishes a yearly document called Injury Facts, which details costs for all types of accidents and illness in the United States. For 2000 the estimated cost of occupational injury was $131.2 billion, for a year with a low unemployment level. This information does not include calculations for
intentional injuries (e.g., homicides, and suicides) and it relies upon the Bureau of Labor Statistics’ Census of Fatal Occupational Injury (CFOI) system to generate its numbers.

In 1997 Leigh et al. published a preliminary report on the costs of occupational injury and illness in the United States. In 1992, injuries in the workplace generated a total of direct and indirect costs of $145.37 billion. Direct costs of fatal and nonfatal injuries were $49.17 billion. While the direct costs were clearly substantial, they represented only 34% of total costs, with indirect costs contributing 66%. Costs further described within the broad direct and indirect categories are shown in Table 1. Of the $49 billion in direct costs, $25.1 billion was spent on physicians, hospitals, drugs, nursing homes, and rehabilitation providers; $5.7 and $8.9 billion covered medical and indemnity insurance administration expenses; $8.7 billion covered property damage; and $0.8 billion paid for police and fire services. The $96.2 billion of indirect costs can also be disaggregated: $68 billion in wage losses, $14 billion in fringe benefits, $8 billion in home production losses, $5.2 billion for workplace training, and $0.3 for time delays.
Table 1 Direct and Indirect Categories

<table>
<thead>
<tr>
<th>Type of Costs</th>
<th>Costs, $ in Billions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>145.37</td>
</tr>
<tr>
<td>Direct</td>
<td>49.17</td>
</tr>
<tr>
<td>Medical</td>
<td>25.07</td>
</tr>
<tr>
<td>Administrative costs on workers' compensation (31%), private insurance.</td>
<td>5.7</td>
</tr>
<tr>
<td>Medicaid, welfare, Medicare (16%) Indemnity administration costs for workers' compensation (31%), Social Security and private insurance (10%)</td>
<td>8.86</td>
</tr>
<tr>
<td>Property damage</td>
<td>8.75</td>
</tr>
<tr>
<td>Police and fire services</td>
<td>0.78</td>
</tr>
<tr>
<td>Indirect</td>
<td>96.2</td>
</tr>
<tr>
<td>Lost earnings</td>
<td>68.16</td>
</tr>
<tr>
<td>Fatalities</td>
<td>2.55</td>
</tr>
<tr>
<td>Nonfatalities</td>
<td>65.61</td>
</tr>
<tr>
<td>Fringe benefits</td>
<td>14.33</td>
</tr>
<tr>
<td>Fatalities</td>
<td>0.56</td>
</tr>
<tr>
<td>Nonfatalities</td>
<td>13.73</td>
</tr>
<tr>
<td>Home production</td>
<td>8.21</td>
</tr>
<tr>
<td>Fatalities</td>
<td>0.31</td>
</tr>
<tr>
<td>Nonfatalities</td>
<td>7.9</td>
</tr>
<tr>
<td>Workplace training, restaffing and disruption</td>
<td>5.2</td>
</tr>
<tr>
<td>Fatalities</td>
<td>0.04</td>
</tr>
<tr>
<td>Nonfatalities</td>
<td>5.16</td>
</tr>
<tr>
<td>Time delays</td>
<td>0.31</td>
</tr>
<tr>
<td>Fatalities</td>
<td>0.01</td>
</tr>
<tr>
<td>Nonfatalities</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Leigh and his colleagues in their second publication extended Miller's work by studying the costs of illnesses as well as occupational injuries. The costs for both occupational injuries and illnesses are estimated at $155 billion. This is almost exactly the same as costs estimated by Miller for just injury cost to employers. But Leigh and his colleagues also included occupational illnesses in their analysis. Some difference in the calculation of injury cost between Miller and Leigh et al. may cause this result. The authors describe in great detail the calculations and the reason for the low bias in their costs.
Their work is the most complete to date on this topic. It breaks out the cost of occupational injury to $132.8 billion with direct costs of $38.4 billion and $94.3 billion in indirect costs. This study appears to be the first to use national data to produce estimates on costs for occupational injuries and illnesses. Prior studies underestimated costs for the following reasons:

- Ignoring nondisabling injuries, deaths and workplace violence.
- Taking inadequate account of diseases.
- Relying on only one or two sources of data.

The last is the most important reason for underestimation. One example of this being that

The Annual Survey of the Bureau of Labor Statistics (BLS) . . . provides the most reliable and comprehensive data on nonfatal injuries, yet it misses roughly 53 percent of job-related injuries. This is due to the exclusion of government employees and the self-employed, as well as illegal underreporting by private firms.10

Leigh et al. estimated that direct costs comprise 29% (estimated to be $51.8 billion) and indirect costs 71% (estimated to be $103.7 billion) of the total injury costs. The authors delve deeply into the definition of direct and indirect costs. For the US, within the direct cost category, medical costs are approximately $26 billion (68%), medical insurance administration costs are $5.5 billion (14%) and indemnity insurance administration costs are $6.8 billion (18%).11

Direct costs are composed of two components, medical and insurance administration. This text explains clearly the methodology of their calculations.
To calculate medical costs the authors simply multiply their estimates of number of occupational injuries by their estimates of average costs, which they have developed.

Table 2 Estimates of Injury Deaths and Nonfatal Injuries

<table>
<thead>
<tr>
<th>Category of Injury</th>
<th>Number of Injuries</th>
<th>Lower and Upper Bound for Deaths and Total Nonfatal Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaths</td>
<td>6,371</td>
<td>6,083 to 7,063</td>
</tr>
<tr>
<td>Total Nonfatal Injuries</td>
<td>13,337,000</td>
<td>9,468 to 16.690 million</td>
</tr>
<tr>
<td>Nondisabling</td>
<td>8,011,000</td>
<td></td>
</tr>
<tr>
<td>Disabling</td>
<td>5,326,000</td>
<td></td>
</tr>
<tr>
<td>Permanent Total</td>
<td>12,124</td>
<td></td>
</tr>
<tr>
<td>Permanent Partial</td>
<td>741,000</td>
<td></td>
</tr>
<tr>
<td>Temporary Total and Partial</td>
<td>1,947,000</td>
<td></td>
</tr>
<tr>
<td>One to seven days lost</td>
<td>2,626,000</td>
<td></td>
</tr>
<tr>
<td>Hospitalizations (5.4% of total)</td>
<td>720,000</td>
<td></td>
</tr>
</tbody>
</table>

This results in the following table:

Table 3 Number and Costs of Injuries and Illnesses in 1992

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
<th>Total Cost ($billion)</th>
<th>Direct Cost ($billion)</th>
<th>Indirect Cost ($billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injuries</td>
<td>13,343,000</td>
<td>132.8</td>
<td>38.4</td>
<td>94.3</td>
</tr>
<tr>
<td>Deaths</td>
<td>6,371</td>
<td>3.9</td>
<td>0.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Nonfatal</td>
<td>13,337,000</td>
<td>128.9</td>
<td>38.2</td>
<td>90.6</td>
</tr>
<tr>
<td>Illnesses</td>
<td>122.8</td>
<td>22.8</td>
<td>13.4</td>
<td>9.4</td>
</tr>
<tr>
<td>Deaths</td>
<td>60,290</td>
<td>15.1</td>
<td>8.8</td>
<td>6.3</td>
</tr>
<tr>
<td>Morbidity</td>
<td>1,184,000</td>
<td>7.7</td>
<td>4.6</td>
<td>3.1</td>
</tr>
</tbody>
</table>

It should be noted that Leigh et al.'s estimates are low because:

- 1992 was a high unemployment year with 7.4% unemployment. With fewer people working, fewer job related injuries and illnesses occur.
- They did not account for the health effects of occupational injuries or illnesses on the victims' relatives or costs of caregivers' time and energy. After a
serious injury or disease, someone in the family frequently provides care.

- They restricted job related circulatory disease deaths to people less than 65 years old.
- Their Human Capital method of estimating costs ignored the costs of pain and suffering. They feel that these costs would add at least an additional $350 billion to the overall $155 billion estimate.

These are large assumptions. This information is staggering at $155 billion, but when the total reaches $505 billion ($350 billion plus $155 billion) for the year 1992, the total effect on the US. economy is truly astonishing.

These documents discussed above comprise the lion's share of available research that generates hard numbers regarding occupational injury costs. These documents all have several common features: conservative estimates, limitations, and recommendations that more research be performed in this field.

**Journal Articles**

There are many journal articles available that do not have hard data but they do contain excellent points and substance regarding occupational injury cost reduction and cost avoidance. Insurance companies, loss control consultants and other people in the environmental health and safety community publish many of these articles. These documents rely heavily upon the previously discussed published information.

Neville reported that the indirect costs of industrial accidents, which take into account the sometimes immeasurable costs of lost production and efficiency on a
company-wide basis, can be several times the costs of calculable workers’ compensation and employee disability payments. They include the following costs:

- Wages for lost time of uninjured co-workers. Workers adjacent to the accident scene who stop their work to watch or offer assistance or talk about the accident need to be considered when assessing the financial impact of an accident.
- Repair or replacement of damaged material or equipment. This includes the time to order, deliver and test the new machine following the accident.
- Training replacement workers. Recruiting and training temporary or permanent workers and all the costs incurred by administrative personnel need to be considered.
- Overtime. Extra costs of employee overtime to make up lost production frequently occur after a workplace accident.
- Other indirect costs of an accident also result in loss of productivity including the following:
  - Foreman’s diverted activity. Supervisory wages for time attending to the accident must be assigned to the total costs of the accident.
  - Wages spent on reduced production. The cost of wages for an injured worker’s return to a job could also be a factor, if the worker’s performance decreases.
  - Clerical supervision and accident investigation. Filing accident and investigation reports to insurance company and regulatory agencies, and the expense of accident investigation and recommendations for preventive measures are to be considered.
  - Remedial and compliance costs for equipment safeguards.
  - Following the event, response to regulatory hearings and equipment modifications for compliance can be costly, including special safety training, procedures and monitoring of results as directly related to the accident.
  - Cost of criminal negligence: According to the National Safety Council, the indirect costs of industrial accidents are approximately four times the actual direct costs. In other words, the real costs of workplace injuries are several times the calculable workers’ compensation and employee disability payments. When this calculation is combined with the potential costs incurred by executives in defending against criminal negligence, the true cost of workplace injuries becomes staggering.

This document refers to the National Safety Council and does not give hard numbers. As mentioned before, it is one of many documents that reference
studies that give hard data.

"Making Better Safety Investments" by Minter describes a project, called Return on Health and Safety Investment (ROHSI). It provides a methodology and software that allows safety and health managers to look at spending on health and safety not as an expenditure, but as an investment. This should help employers and environmental health and safety professionals better understand the financial benefits of a good environmental health and safety program.

Another tool to determine total accident costs was presented by LaBelle. It addresses several questions that can be answered when the cost of incidents is known:

- How does a safety and health organization show value-added existence when direct workers’ compensation costs decline each year?
- Why spend money on safety and health when injury and illness rates are below industry average?
- When injury and illness rates are the only measure used to assess safety effectiveness, why should managers be concerned about low incident related rates?
- Why focus on safety when OSHA is no longer the driving force behind a company’s desire to reduce incidents?

To add in a popular quote "What gets measured gets managed" measurement is needed to manage safety costs and benefits. This tool is published along with the instructions for use in the article. While it is helpful in justifying environmental health and safety costs, it is not helpful when one attempts to ascertain the actual costs of an injury.
Covaleski extends LaBelle’s concern with safety to include the culture of an organization.\textsuperscript{18} He explains how safety cultures, according to insurers, academics and risk managers advocating the concept, are workplaces that encourage all employees, particularly line workers, to proactively search their work areas for hazards, admonish co-workers who are doing things unsafely and communicate to peers and superiors about matters that affect safety. The advocates say these cultures represent the latest gradation in corporate America's ever increasing awareness of safety as a major factor in bottom line costs.

The question of whether on-the-job injuries are rising was addressed in an article published in \textit{Occupational Hazards}.\textsuperscript{19} It offers this information: insurance rates and the number of on-the-job injuries will rise, and the way employers approach how to insure their workers will change. This is based on the prediction of Jeffrey Berkman, M.D., CEO of Industrial Health Care, a Connecticut-based occupational health care services provider. While the number of workplace injuries is at an all-time low, Berkman predicts the number will start creeping up this year. “In the 1980s, we saw 11 out of every 100 employees suffering injuries. That number is now seven out of 100.”\textsuperscript{20} He attributes the fall to better education and a job environment that has made workers unwilling to report minor injuries for fear of losing their jobs.
While well written and informative the information in journal articles is not in the class of the previous group, the cost data analysis articles. Much of the information in the journal articles is thoughts and suggestions, not hard data.

**Trend and Soft Data Articles**

The trend and soft data articles found in the literature offer insight into the area of occupational injury, but not in the depth or breadth of the cost data analysis articles. They are informative and relevant, but narrow in scope of coverage. They are a great source of specific information, but this information needs to be interpreted to be relevant to this project. Below is a brief summary of the data in each of these articles.

Jackson describes a study to determine the bias and merit of a new system of surveying occupational injuries and illnesses.\(^21\) Surveillance for occupational injuries was conducted in a national probability based sample of hospital emergency departments through the National Electronic Injury Surveillance System (NEISS). Approximately 3.6 million occupational injuries and illnesses were treated in emergency departments in 1998. Younger workers (males) tend to have the highest rates of work related injuries, something that is not unexpected. The leading three injury events were contact with objects, bodily reactions and exertions, and falls. Sprains and strains (mostly to the trunk) accounted for 25% of the injuries. Lacerations, amputations, punctures and avulsions account for another 25% of the injuries. Emergency department surveillance provides injury
estimates with few demographic or employer constraints which may be present in accident reports and investigations from employers.

Glied examines one way to determine indirect costs.\textsuperscript{22} Forgone earnings are one of the facets of indirect costs that have been traditionally calculated. Glied goes into great depth to describe the traditional method of calculating forgone earnings. She has identified three sources of significant error in the traditional method of calculation that can add 18\% or detract 20\% from the actual amount of the average earnings. The greatest source of variation are the business cycle, cohort (group of individuals measured) and earnings growth effects (predicted with the human capital method).

What does this mean? The large variability in earnings calculation means that it is nearly impossible to pin down an accurate value for potential earnings for an occupational injury or death. With known variability most studies try to be conservative, causing low estimates regarding costs and value of life. This should help make sense of the values regarding the different costs of injury.

Stout, Jenkins and Pizatella examined occupational injury mortality rates in the United States between 1980 and 1989.\textsuperscript{23} They report that the number of fatal occupational injuries in the United States declined from about 7,400 in 1980 to about 5,700 in 1989 — a 23\% decrease. The fatality rate decreased 37\%, from 8.9 in 1980 to 5.6 in 1989. This document also lists the six leading causes of
death: motor vehicle incidents, machine-related injuries, homicides, falls, electrocutions and being struck by falling objects. These six leading causes account for 72% of all occupational injury deaths. This group of causes would most likely also account for most of the injury costs.

Courtney and Webster examined the Bureau of Labor Statistics’ (BLS) annual Survey of Occupational Injuries and Illnesses (SOII). The SOII is perhaps the most frequently referenced source of information on occupational injuries and illnesses in the United States. Prior to 1992 the BLS SOII principally tracked injury and illness trends and reported industry specific case counts and rates including the subset of cases involving lost work days (cases with days away from work, with days of restricted work activity, or both). Frequently cited limitations of the SOII include little or no detail on the nature, extent, and causes of injury and illness and missing information on lost time accrued beyond the end of the calendar year in which the injury occurred, causing underestimates of case severity.

The BLS publishes information on what condition a worker suffered from but not in what part of the body. It publishes data on what body parts are injured but not what sort of outcomes are sustained. It publishes data on disabling morbidity due to particular classes of antecedent events or exposures but leaves its readers wondering what those injuries or illnesses actually were. By presenting information on disabling outcomes and connecting it to information on events and
exposures, the injuries and conditions that plague workers involved in particular incidents or exposed to particular activities or environments are revealed.

The medical costs of workers' compensation insurance were studied by Baker and Krueger. Their research shows how medical costs are more for workers' compensation injuries than for the same injury that is not covered by workers' compensation. The difference persists in individual services. Workers' Compensation recipients are charged more per X-ray and per examination than other patients. Quite inconsistent from the practice that should occur.

Brostoff reported that workplace fatalities declined three percent during 1998 to the lowest level since the Bureau of Labor Statistics began compiling statistics in 1992. In a recent report, the BLS said that an 18 percent drop in job related homicides accounts for a large portion of the decline. However, the BLS added in its National Census of Fatal Occupation Injuries, 1998 that worker deaths from highway crashes, from being struck by vehicles and from contacts with overhead power lines, were at their highest levels since 1992. This may be due to increased speeds on highways and/or more construction being performed.

An article in The Journal of the American Medical Association reports that the Center for Disease Control monitors deaths from occupational injuries through the National Traumatic Occupational Fatalities (NTOF) surveillance system. This report provides an overview of traumatic occupational deaths among civilian
workers from NTOF from 1980 through 1997, the most recent year for which data are available. The data presented in this report indicate a decrease in occupational deaths over this period with mining, agriculture/forestry/fishing, and construction having the highest death rates; motor-vehicle crashes were the leading cause of injury related deaths for U.S. workers. State health departments and others involved in prevention of occupational injuries can use the data to prioritize intervention programs.

Some statistics worth mentioning are: During 1980-1997, 103,945 civilian workers died in the United States from occupational injuries, an average of 16 work-related deaths per day. The annual number of traumatic occupational deaths declined 28% from 7,343 in 1980 to 5,285 in 1997. The rate for occupational injury deaths for all workers decreased 45% from 7.4 per 100,000 workers in 1980 to 4.1 in 1997.

Within this data males accounted for 93% of all deaths, with a death rate approximately eleven times that of females. Although 85% of civilian workers who died were white, blacks had a higher fatality rate (5.6 per 100,000 workers) than whites (5.0). Workers aged 25 to 34 years accounted for the largest number of occupational injury deaths, and workers greater than or equal to 65 years of age had the highest age specific death rate.
Since 1980 motor-vehicle crashes accounted for 24% of deaths and were the leading cause of injury related death for U.S. workers. In 1990 homicides became the second leading cause of occupational injury deaths (14%), surpassing machine-related deaths (13%). Deaths caused by falls and electrocutions accounted for 10% and 7% of work related deaths respectively.

This comprises the information that was obtained from traditional literature sources. Two other documents provided pertinent information for this project. The first was a safety training module on direct and indirect accident costs from Oregon’s OSHA. Available at the following link, this document has proven invaluable to the analysis of this topic.

http://www.cbs.state.or.us/external/osha/educate/training/pdf/iceberg.pdf The module depicts an “iceberg diagram.” It explains in an easy to understand format the difference between direct and indirect costs. It refers to the OSHA Safety Pays Program as well as to National Safety Council data for 1998. This document also gives a good work up of potential costs and the sales needed to offset the losses generated by workplace injuries.

The other pertinent document was obtained through a Freedom of Information Act request to the OSHA office in New York City. The request was for the average man-hours spent investigating a workplace fatality. The average man-hours spent per investigation nationally are 83.2 hours, and in the Syracuse NY region 93.7 hours. This information will be used to help show the costs to society
of workplace accidents.
Endnotes for Chapter 3

9 Leigh et al. (2000).
12 Leigh et al. (2000): 32, Table 2.4.
13 Leigh et al. (2000): 2. Table 1.1.
15 Neville.
20 “Are On-the-Job Injuries Rising?” 27.
Chapter 4: Methodology

The available literature suggests several areas where accident costs occur.

For example Miller and Galbraith\(^1\) set forth the following cost categories in a national cost accounting framework:

a) Medical and emergency services: hospital and nursing home care, physician services, physical therapy and such items as laboratory tests, prescriptions and wheel chairs. Emergency services include fire, police and paramedic response, emergency transport and coroner services.

b) Wage and household work: lost wages, fringe benefits, housework and other household services.

c) Administrative and legal costs: costs of incident investigation, record keeping, insurance claims, processing and litigation. Product liability litigation costs are excluded.

d) Workplace disruption: overtime pay, loss of special skills, productivity losses by supervisors and colleagues and recruitment and training costs associated with deaths and long term disabilities, among others.

e) Quality of life: reduced quality of life and pain and suffering of workers and their families. Individual workers and their families bear the non-monetary losses associated with work place injury. Severe impairments can endure for the remainder of the worker’s life.\(^2\)

Another example comes from Leigh et al.\(^3\)

- Direct costs comprise 29\% (estimated to be $51.8 billion) and indirect costs 71\% (estimated to be $103.7 billion) of the total injury costs for the United States of America, within the direct cost category, medical only costs are approximately $26 billion (68\%), medical insurance administration costs are $5.5 billion (14\%) and indemnity insurance administration costs are $6.8 billion (18\%).\(^4\)

- In 1992, injuries in the workplace generated a total of direct and indirect costs of $145.37 billion.

- Direct costs of fatal and nonfatal injuries were $49.17 billion. While these costs were clearly substantial, they represented only 34\% of total costs, with indirect costs contributing 66\%.

- Of the $49 billion in direct costs, $25.1 billion was spent on physicians, hospitals, drugs, nursing homes and rehabilitation providers; $5.7 and $8.9 billion covered medical and indemnity insurance administration expenses; $8.7 billion covered property damage, and $0.8 billion paid for police and fire services.

- The $96.2 billion of indirect costs can also be disaggregated: $68 billion in
wage losses, $14 billion in fringe benefits, $8 billion in home production losses, $5.2 billion for workplace training, and $0.3 for time delays.  

For this document, a case study was analyzed to determine the costs in all of the aforementioned categories. These categories can be reduced to these areas:

- Direct costs, costs acknowledged by the employer
  - Workers’ Compensation expenses
  - Cost of replacing damaged equipment and tooling
  - Salary continuation cost
  - Cost of replacing the damaged vehicle

- Indirect costs, costs not acknowledged by the employer
  - Lost time for employees other than the injured
  - Lost production
  - Time spent dealing with insurance company regarding accident
  - Overtime in injured person’s department to cover for their absence
  - Costs to the general public, such as police, fire, ambulance service, lost time by travelers on the highway and time spent by news media covering the accident.

To develop this case study, contact needed to be arranged between the researcher and the particular case; permission needed to be obtained from the individual’s employer, their insurance company and the individual’s lawyer.

Contact was initiated with the following individuals and organizations to gather information:

- The injured person
- The human resource person at his company
- Able Medical Transport Company
- Blue Cross-Blue Shield insurance company
- Rochester General Hospital
- St. Camillus Health and Rehabilitation Center
- Multi – Med Billing center.
- Syracuse Fire Department
- Baldwinsville Fire Department
- MedEvac helicopter transport.
- Several ambulance services
For each of these contacts, information was sought regarding the case study. If specific information was unavailable due to confidentiality, a generalized answer was sought that would apply to a similar situation. This way some cost information was obtained, and this information would be applicable to the case study situation.

A detailed list of questions was generated.

For the injured person:

- How much extra time does it take to walk and perform normal tasks while disabled?
- How much time do you spend talking about your accident?
- How much time was spent on home adjustments to compensate for your disability?
- How much time did you take to talk with other employees about home adjustments that were performed?
- How much time did it take to discuss property replacement, reorder, estimate and replace damaged property?
- How much time did it take to get someone to drive you to work? How much time for the ride home?
- How much time did it take to get someone to drive you between buildings to perform your job?
- How much time did it take to get a new truck, to replace the one damaged in the accident?
- How much time did you spend at work resenting this accident being nonproductive?
- How many visits by co-workers occurred while in the hospital?
- How long did you spend in the hospital?
- How much time did doctors spend with you?
- Was any time spent with home health care?
- How was production lowered due to decreased morale?
- What home improvements or repair did you have scheduled?
- How did your disability effect your ability to perform these tasks, if at all?
- Was there a financial impact regarding your home production?
- How has your disability changed your quality of life?
- What things have changed since this injury?
- Can you still have the same enjoyment from your hobbies?
- Are there any things that must be done different at your home since this accident?
For the company in general:

- How much time did it take for all employees to learn about the accident?
- How much time was spent discussing the accident around the water cooler?
- How much time did it take to officially inform the employees of this incident?
- How long did it take to deal with insurance company regarding this incident?
- How long did it take to get damaged property estimated, replaced and reordered?
- How much time was spent with another employee blaming the company for the situation that the injured person was in?
- How much overtime was spent for the injured person’s partner to get familiar with his job and to learn to fill in?

As the information available from the subject’s employer was limited for legal reasons, the facts of the accident were analyzed and the agencies involved were questioned with hypothetical scenarios. This resulted in reasonable cost estimates for the services provided at the accident scene and during the treatment and rehabilitation afterwards. All costs were compiled and compared with numbers available in the published literature.

This accident is much more severe than most, but it shows that the costs are astronomical when emergency services, hospital, and rehabilitation costs are combined especially when compared with information provided by the employer. More importantly, the indirect costs, which do not show on the corporate balance sheets, may be underestimating many societal costs.

Endnotes for Chapter 4

Chapter 5: Results

Background

Bob\(^1\) works for a heavy equipment dealer, he is an expert in the field of construction equipment repair. As such, a large part of his job is to help repair technicians determine the source of problems with the equipment they are repairing. He usually is called in only to solve the problems that the repair technicians cannot solve. His knowledge is invaluable to his company. He has worked for the same company since 1970 and has amassed an amazing amount of product knowledge. This knowledge is used throughout his company’s territory to help keep customers’ machinery in top condition. Bob was returning from one such trip when he was involved in an automobile accident on the interstate. In the course of the accident, Bob’s head was injured which caused motor control problems with his left leg. The following analysis looks closely at the costs resulting from this accident and relates them to national averages with respect to cost and number of accidents per year.

Initial accident, September 12, 2000

In an accident on the New York State Thruway, Bob was involved in an accident that involved two tractor-trailers and Bob’s vehicle. Unconscious at the scene, Bob was airlifted to Rochester General Hospital where he was admitted as an inpatient. From September 12\(^{th}\) to September 25\(^{th}\) Bob was an inpatient. On September 25\(^{th}\) Bob was transferred to St. Camillus Rehabilitation Center in Syracuse, New York where he remained an inpatient until November
30, 2000. From the date Bob was released as an inpatient, he was received outpatient care until July 2001. During the time Bob was receiving outpatient care, he was transported to and from the rehabilitation center by a medical motor service. Bob was released to work light duty (3 days each week, 4 hours per day) on January 24, 2001. The medical motor service transported Bob from home to work and rehabilitation until he no longer needed the services of the Rehabilitation Center. Bob was released to return to work full time on July 12, 2001. Bob retained the medical motor service until he was approved by the State of New York to drive on October 18, 2001.

**Issues that add cost or decrease value**

**Medical Motor Service:** Bob's experience with the medical transport service was that it was late arriving to pick him up, up to one hour late per trip. Bob had difficulty meeting appointments and or arriving at work in a timely manner. The timely arrival at work did not concern anyone other than Bob and people he had made appointments with. The waiting for transport caused Bob untold grief and frustration as sometimes he would be waiting for transport two to four hours per day. (home, work, rehabilitation center)

**Transport costs while an outpatient:**

Able Medical Transport was contacted, their rates are:

- $45.90 per pick up and $1.50 per mile, each flight of stairs is $1.00.

Estimated 36 miles each way. Total cost: $199.80 round trip.

- $7,849 from November 30, 2000 to January 24, 2001, 5 days per week.
- $38,589 from January 24, 2001 to July 12, 2001, 5 days per week for rehabilitation plus 3 days per week restricted duty return to work.
- $13,986 from July 12, 2001 to October 18, 2001 when released to
drive by the State of New York.

$60,425 is the calculated total cost for transport between home, rehabilitation, and work based upon the quoted rates.

**Transport between buildings:** The facility in which Bob works is separated from the heavy equipment repair shop by 200 yards. Before Bob’s accident, he would walk or drive between the buildings. After the accident, and before he was released to drive by the State, Bob needed to be transported between buildings by another employee. There was not always someone available to drive Bob at a moment’s notice, so he would have to wait until someone was available. This wait period would mean that he could not begin trouble shooting a problem until he arrived at the repair shop. This would have different effects depending upon the urgency with which Bob was needed. Either the shop foreman would stop what he was doing and go get Bob, or the Service Manager or some other person would take time away from the task they were performing, get in a vehicle and drive over to get Bob. At times while Bob was waiting, the phone would ring and someone else who needed his expertise would talk with him. Meanwhile, the person who drove to get Bob would be waiting. This does not sound like much trouble, but these people are usually union employees who are paid between $12 and $22 per hour. Sometimes it would take an hour to get Bob or return him to his office. Since these union employees are in the Service Department, they are billed out to customers at $66 per hour. If an employee is spending time transporting Bob, he cannot be charged to the customer. This would result in a cost to the employer of $86 per hour ($20 per hour in wages plus lost sales of $66 per hour). This translates to cost of $1.46 per minute not billed to
customers. The assumed result of this calculation is $49,536 for 3.5 trips per day, 3 days a week from the time released to return to work until when the State allowed Bob to drive himself.

Emergency response time: Without the actual log from the companies that responded to the accident, this is very difficult to quantify. We know that fire and rescue vehicles responded to the scene, removed Bob from the wrecked vehicle and determined that airlift was needed. A reasonable estimate of the time involved would be three hours total for the responders. This includes extrication and returning back to the firehouse. In a telephone interview with a member of the Syracuse Fire Department, it was learned that it is nearly impossible to generate an accurate cost for response. For example, there are several ways to calculate this value:

- Divide the annual budget of the fire department by the number of calls (unable to obtain that information.)
- Multiply the number of men on a call by the hourly rate and benefits to arrive at a cost. Factor in the cost of operating and repair of the vehicle. Ten men typically respond to an accident like this, in two vehicles. Their salary and benefits can amount to approximately $36 per hour.\(^2\) This would be $1,080 for a three-hour round trip not including the cost of the vehicle\(^3\) (unavailable at this time). These vehicles are about $300,000 each and should be factored in to the total cost of the response.
- Use the assessed charge that the fire department was authorized to charge $300 per highway accident.

For this category, the estimated cost of $1,080 for a three-hour round trip, not including the cost of the vehicle(s) is used.

Employee time to deal with insurance company: While involved with rehabilitation and return to work Bob and his employer had to interact with the insurance company. This is an estimated indirect cost:

- Injured person. Bob estimates that he has spent one hour per week dealing
with the insurance company. He spent 46 weeks as an outpatient. This case is still open. It has been 85 weeks since accident as of May 1, 2002. Forty-six (46) hours will be used as this estimated cost.

- Employer. The individual who does the interaction with the insurance company estimates approximately 40 hours for a large case such as this.
- The total estimated time for this category is 86 hours.

**Productive Time lost by employees:**

- Employee time to learn about the accident. Bob’s company has approximately 400 employees. A conservative estimate of time spent discussing this accident initially would be 15 minutes. The initial questions asked would be: Did you hear? Where was it? How is he? Where is he? How bad was he hurt? Where can I send a card? How long will he be out? This would include time for all employees to learn about the accident, discuss the accident around the water cooler and to officially inform all employees. This calculation results in 100 hours of time lost while people are discussing the accident.
- Many employees visited Bob while in the hospital. Some went while at work; others went on their own time. Each visit lasted not less than 20 minutes. The hospital was 25 minutes from the office. A conservative estimate of time spent per employee visit is one hour. Bob estimates that at least 20 people visited him in the hospital. The estimated time spent visiting in the hospital is 20 hours.
- The total estimated costs for this category is 120 hours

**Overtime for Bob’s technical group while he was out.**

While out of work for his injury and rehabilitation there was still a need to address the problem solving issues that Bob was responsible for. Another person in his department estimates that he spent at least 200 hours working on issues that Bob would have worked on had he been able.

**Time to walk while disabled:**

Bob estimates that it takes him an additional three to five minutes to walk per hundred feet he must travel. Initially after this accident he was in a wheel chair, then progressed to a walker, quad cane, two canes, two walking sticks, and now he is able to walk without the assistance of a cane at all. His balance is not very
good; he is unstable, but progress has been made. It would be irresponsible to
even guess at the amount of time that he has lost just walking between his office
and the lavatory, much less the photocopier, printer, or areas in the repair shop
that he must visit.

**Time to talk about the accident:**

During the early stages of recovery, there could be one or more hours each day
spent conversing about the accident and slow recovery. Obviously it needs more
than one person to have a discussion. Most likely a very conservative estimate
would be about 230 hours since accident lost due to this category.

**Time to get damaged property estimated, replaced and delivered:**

It is reasonable to assume that the tooling and testing equipment damaged in the
accident took at least four hours to estimate and reorder. This tooling was worth
approximately $4,000. What time was lost while the tooling was unavailable? It
is impossible to calculate the value of this time.

**Cost for time spent in hospital:**

To calculate this value, the facilities were contacted where Bob stayed.

- **Rochester General Hospital** costs $1,435 per day for a room in the Intensive
  Care Unit. The cost for 13 days in this room would be $18,665. This does not
  include the cost of physician visits or any emergency room facilities.\(^4\)
- **St. Camillus Rehabilitation Center** costs $788 per day. The cost for 66 days in
  this facility is $52,008, not including outpatient or Physical Therapy time.\(^5\)
- Due to patient confidentiality issues, it was impossible to gain access to
  billing records and physician logs to estimate time spent with doctors and
  physical therapists. These results do not quantify medical costs related to
  physician visits.

**Home health care:**

Not needed in this specific case.
**Time spent waiting for transport:**

Bob was disturbed by the constant waiting for a ride, to work, to rehabilitation or back home. He estimates that he spent one hour on average waiting for each ride that was provided him by the medical transport company. This would be at least 225 hours spent waiting.

**Time to replace truck:**

The company vehicle was not replaced, Bob needed to acquire a vehicle, and he estimates he spent one week searching for the vehicle he bought. About eight hours of time in total.

**Time spent at work resenting his accident:**

Bob was initially very despondent regarding his accident, usually after a weekend spent working on a home project or on his boat. He would spend a great deal of time being nonproductive and complaining about his accident and physical situation. This time is impossible to quantify. Initially this category was a significant amount of time, but as time passed, it gradually lessened.

**Home production:**

This individual has always been involved in home repair/remodeling. An interview with Bob gives some insight as to the lost quality of life that he now experiences. For example:

- Recently Bob replaced the faucet in his kitchen. This job would have ordinarily taken him three hours to perform. With his limited mobility and reduced endurance, it took nearly two days.
- Before the time of the accident, he was replacing the moldings in his kitchen and dining room, from painted pine to oak. This activity, while purely aesthetic, is not terribly expensive to perform yourself. Hiring someone to
do the work for you is very expensive and since the accident, Bob has limited time to perform this improvement. It may never be completed.

- Bob hired a contractor to perform some concrete work at his home. Before the accident Bob would have done the work himself, at an estimated cost of about $1,000. The contractor charged $5,000 to perform this same task. The difference is $4,000.

- With Bob’s difficulty walking, his driveway must now be kept clear from snow and ice to reduce slipping hazards. Each day it snows, Bob feels he must clean his driveway. This adds approximately twenty minutes to his morning routine, each time it snows. He also cannot operate his snowblower at any speed above first gear. This increases the time required to perform this task.

- Bob is an avid boater. His family has a 30-foot craft, which they use to explore the St. Lawrence River and eastern lake Ontario. Bob is disappointed with his mobility because it takes away his favorite things to do. For example, when traveling by boat they used to dock in interesting places and walk to visit museums, parks and restaurants. Walking is difficult for Bob; it is no longer feasible to walk places when docked. Swimming is nearly impossible from the boat because getting out of the water and into the boat because of limited use of his left leg. Combine the difficulty walking with the impossibility of swimming and Bob has much less enjoyment of his main hobby, boating, since the accident in 2000.

**Table 4 Direct Costs as Calculated by Bob’s Employer**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers’ Compensation total as of 2-22-2002 (includes reserve)</td>
<td>$139,532</td>
</tr>
<tr>
<td>Salary Continuation</td>
<td>$13,920</td>
</tr>
<tr>
<td>(calculated based on maximum weekly Workers’ Compensation disability, not actual salary)</td>
<td></td>
</tr>
<tr>
<td>Automobile loss (new Chevrolet C1500 truck totaled in accident)</td>
<td>$21,800</td>
</tr>
<tr>
<td>Tool loss (specialized tools lost in accident)</td>
<td>$4,000</td>
</tr>
<tr>
<td><strong>Total direct cost to employer</strong></td>
<td><strong>$157,882</strong></td>
</tr>
</tbody>
</table>

**Accommodations for Bob’s disability:**

- Home adjustments to compensate for disability

  Home modifications were necessary to allow access to the basement of Bob’s house. These modifications required three months to complete. The contractor was partly at fault for the delayed
completion of work. The stairs required modification and handrails and a handicapped accessible shower was installed in the basement since the main floor bath was a tub/shower unit and difficult for Bob to enter.

- Time to talk with other employees about home adjustments:
  A reasonable estimate would be 45 minutes of lost time each day while these adjustments were taking place. Approximately 45 hours of lost time for this category. (60 days times 45 minutes per day)

- Bob must wear shoes in the house; he cannot wear slippers or socks on smooth flooring surfaces, with his compromised balance. He must use footwear with support and traction or be barefooted.

- Bob calculates that each morning it requires forty-five minutes more to prepare for work than it required before the accident.

**Society at large results of accident:**

**Travel delay:**

It is impossible to determine how much cost the travel delay generated at the time of the accident. This accident involved five or six vehicles; at least two of them were tractor-trailers. The highway was backed up for the accident. We cannot determine an accurate number for the amount of vehicles it affected: many people would have no cost associated with this incident, others may have had significant costs. Fuel usage while waiting for the accident to clear would add to the cost of this accident. This cannot be quantified.

**News Media:**

There was information in the local news media regarding this accident, paper as well as Internet. Photos were taken, some travel time must have been involved, there must have been at least one to two hours spent covering this incident.

- Time spent by media on accident.
- Time to get to the story, report on the story, edit it and air or print the story.
- Time for public to react to story. The news media thinks of this as their product. It is actually a cost to society at large. The media could be spending its time on another issue if this accident had not happen.
OSHA:

Were OSHA to get involved in this incident, the average man-hours spent per investigation nationally are 83.2 hours, and in the Syracuse NY region 93.7 hours.7

Other Associated costs:

- Cost of ambulance: $300 to $450 plus $5 per mile loaded charge
- Cost of airlift: $3,000 plus $37.50 per loaded mile
- Cost of intensive care physician services: $200 per hour
- Cost of anesthesiologist services: $600 per hour

Due to patient confidentiality, it was impossible to gather complete information on particularly in areas such as physician cost, physical therapy, medical treatment, and insurance administration.

Police and fire expenses are unavailable as records are not kept on a per incident basis because in New York State it is unlawful to charge for the services of fire and police response to an incident.

For the following table, Accident Cost Tabulation, calculations were made using dollar values if available. For hour values, the following assumptions were made:

- Bob’s personal time was estimated at a value of $10 per hour.
- Bob and other employee’s work related time was estimated at a value of $30 per hour.
- Billable employee time was estimated at a value of $86 per hour ($20 per hour paid the employee, and $66 per hour billed to customers, if the company is unable to bill this employee’s time, there is a cost to the company of $86 per hour)

Direct costs are shaded gray and located at the top of the table.
Table 5 Accident Cost Tabulation
<table>
<thead>
<tr>
<th>Description</th>
<th>Direct Cost</th>
<th>Indirect Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able Medical Transport</td>
<td>$60,425</td>
<td></td>
</tr>
<tr>
<td>Airlift</td>
<td>$4,000</td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency intensive care unit</td>
<td>$18,665</td>
<td></td>
</tr>
<tr>
<td>Physician charges, medical procedures, physical therapy costs</td>
<td>unknown</td>
<td></td>
</tr>
<tr>
<td>Hospital rehabilitation</td>
<td>$52,008</td>
<td></td>
</tr>
<tr>
<td>Salary continuation</td>
<td>$18,920</td>
<td></td>
</tr>
<tr>
<td>Tooling loss</td>
<td>$4,000</td>
<td></td>
</tr>
<tr>
<td>Vehicle loss</td>
<td>$21,800</td>
<td></td>
</tr>
<tr>
<td>Workers compensation</td>
<td>$139,532</td>
<td></td>
</tr>
<tr>
<td>Discussing home improvements</td>
<td>45</td>
<td>$1,350</td>
</tr>
<tr>
<td>Emergency response</td>
<td></td>
<td>$1,080</td>
</tr>
<tr>
<td>Employee time to deal with insurance company</td>
<td>46</td>
<td>$460</td>
</tr>
<tr>
<td>Employer time to deal with insurance company</td>
<td>40</td>
<td>$1,200</td>
</tr>
<tr>
<td>Estimating and ordering tooling</td>
<td>4</td>
<td>$120</td>
</tr>
<tr>
<td>Looking for vehicle</td>
<td>8</td>
<td>$80</td>
</tr>
<tr>
<td>Lost home production concrete work</td>
<td></td>
<td>$4,000</td>
</tr>
<tr>
<td>Lost home production future home improvements</td>
<td></td>
<td>unknown</td>
</tr>
<tr>
<td>Lost time waiting for transport</td>
<td>225</td>
<td>$2,250</td>
</tr>
<tr>
<td>Lost time for discussion of accident</td>
<td>230</td>
<td>$6,900</td>
</tr>
<tr>
<td>Lost time for travelers on highway</td>
<td></td>
<td>unknown</td>
</tr>
<tr>
<td>Lost time for volunteer responders</td>
<td></td>
<td>unknown</td>
</tr>
<tr>
<td>Lost time preparing for work as of may 1, 2002</td>
<td>319</td>
<td>$3,190</td>
</tr>
<tr>
<td>Overtime for Bob's department</td>
<td>200</td>
<td>$6,000</td>
</tr>
<tr>
<td>Police</td>
<td></td>
<td>unknown</td>
</tr>
<tr>
<td>Productive time lost for employees to learn about accident</td>
<td>120</td>
<td>$3,600</td>
</tr>
<tr>
<td>Transport between buildings while at work.</td>
<td>576</td>
<td>$49,536</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$394,116</td>
</tr>
</tbody>
</table>
Endnotes for Chapter 5

1 The individual’s name was changed to ensure confidentiality.
2 This information obtained through a personal telephone interview with Lt. Lyman Grey with the Syracuse NY Fire Department.
3 Commercially vehicles are calculated with a cost per hour of operation or perhaps a cost per mile driven. Since fire and rescue vehicles typically do not drive long distances this type of vehicle would have a cost per hour of operation.
4 These cost values were obtained through a telephone call to the billing office.
5 These cost values were obtained through a telephone call to the billing office.
6 Due to confidentiality this cost value was used. This does not reflect the person’s actual salary.
Chapter 6: Analysis and Discussion

For this document a value of $10 per hour was used to calculate the value of Bob’s personal time. This is an estimate used for calculation purposes. In reality there is no actual value for his personal time. Bob is a salaried employee but there is no value to the employer for Bob’s personal time.

Quality of life is difficult to place a dollar value on. Bob would much rather have his mobility and ability to do the things that he enjoys than a monetary settlement. So how much money is the loss of quality of life worth? In Bob’s eyes, an immeasurable amount.

Home production is related to quality of life. Bob has always gotten pleasure from “do it yourself” projects. These projects add value to the home, as well as allow Bob to do things he enjoys (woodworking, plumbing, landscaping, etc.). Since the injury, Bob has had difficulty performing needed repairs, and, as quantified in the results section, had to hire some of the work performed that he ordinarily would have done himself. The cost difference between Bob’s cost and the hired cost was used in the results section calculation. No other dollar value was assigned to this category because of the uncertainty involved.

Workplace disruption and lost productivity are commonly called indirect costs because they are not costs of treating the injury. Nevertheless, these costs directly affect the employer’s profitability. Employers lose productivity whenever an employee misses work, works at less than the usual productivity or is diverted to
less demanding tasks.\textsuperscript{1} Productivity also is lost when employees other than the injured are involved in the activities of learning about and discussing the accident and injury that occurred to people they work with. For this study, lost time information is estimated. Detailed records were not kept regarding lost time for the injured person and his co-workers. Bob is a well-known person at his company. When the accident happened, there was much discussion about the circumstances. For example: how bad the accident was, what would be done about his responsibilities while he was out, how long he would be out, and even if he would be able to return to work at all. Not everyone in the company was involved in these discussions, but 100 hours is a very low estimate. Some people may have spent ten hours trying to determine the status of the part of their project for which Bob was responsible. This category is usually underestimated in the literature due to the difficulty of measuring effect. If this accident were to happen to a production line worker, and production were to slow down a measurable amount, the cost to the employer would be comparable to the overtime needed to make up for lost production.

The value of police and emergency services has been estimated at 1.5 times the cost of transport of an injured individual.\textsuperscript{2} This calculation, applied to the $4,000 approximate cost of the airlift of Bob from the accident scene to the hospital, would give $6,000. This value would be much lower if Bob were transported in an ambulance, $400 times 1.5 is only $600. This assumption of $6,000 cannot be correct on a case study basis. It may work on a national level, however, where all
the differences average out. An important thought regarding the value of these services is what cost/value would be assigned to them if they were needed to save another person’s life? For those involved with this particular accident, how could a dollar value be assigned? That is a cost to society that is immeasurable.

While Bob was out of work, people in his department needed to put in extra time to keep the projects he was working on moving forward. This time was not adequately tracked due to the nature of Bob’s position. He is not required to track the amount of time he spends working on specific problems or projects. This time value was calculated by asking the people he worked with questions about that period of time to get an estimate that they felt was reasonable. This value of 200 hours is conservative for the months that Bob was out of work or on restricted duty.

The literature available has an average value of an occupational automobile accident of $23,000 per crash, and $117,585 for each motor vehicle crash related injury. This number is comparable in size with the direct costs as calculated by the employer in the case study, $157,882 from Table 3. The calculated costs in Table 3 far exceed the costs in the literature, or acknowledged by the employer. This accident scenario is not unusual for a motor vehicle accident. The time spent at the hospital and in rehabilitation is not uncommon for the trauma experienced in a highway crash.
There is a large discrepancy between the costs reported by Bob’s employer and the costs calculated in this document. The costs reported by the employer in this case reflect the buffer of Workers’ Compensation Insurance. The other costs tabulated in this document would not be apparent to the employer because Workers’ Compensation Insurance will cover the large losses caused by hospital treatment. The Worker’s Compensation Insurance costs reported by the employer are not broken down to show how much of that cost is hospital, doctors’ fees and transportation costs. There may be some double counting of these costs. Thus there is a lack of conclusive information regarding costs from Bob’s employer.

The costs that are most surprising are the indirect costs to the company.

- The time the injured person spends at work discussing his accident with others reduces the time that all parties involved in the discussion are productive, essentially lost time.
- The time spent by individuals working for the employer dealing with the insurance company per case.
- The time spent by the employee waiting for transport between buildings, and transport to rehabilitation or home is an immense cost. When the injured person spends time waiting, it is not unusual for conversations to start regarding the accident or medical transportation. These conversations usually involve other employees that would otherwise be productive; effectively doubling or tripling the time lost depending on how many people are involved in the conversation.

Each of the direct costs in Chapter 5 is estimated except for the information available in Table 4. This information was gathered from the employer and reflects the actual costs that the employer is billed regarding the accident. The costs for transport, airlift, hospital stay, and rehabilitation center stay are estimated based upon the quoted rates found during telephone interviews. These
prices may be higher, or lower, due to the fact that insurance companies have negotiated rates with hospitals and physicians for services, and the quoted rates may be different from the negotiated rates.

These results are not complete due to the missing costs associated with physician visits, medical procedures performed, intravenous fluid, medications, or physical therapist costs. This information was unavailable for the case study due to patient confidentiality issues, and without knowledge of the actual procedures performed, it would be purely speculation to attempt to estimate these costs.

Insurance administration costs are not included. These costs are unavailable due to the size of the claim. The literature on occupational injuries is able to estimate the cost of insurance administration by analyzing the industry cost as a whole and dividing by the percentage of injuries that are occupational in nature. Records are not kept as to how much cost is generated administrating each particular claim.

The National Safety Council estimates the average nonfatal disabling injury cost was $35,300 in 2000.\(^4\) This accident cost is well over ten times that cost and as stated previously there are many costs related to this accident that are unavailable.

If anything, the costs for accidents are much higher than traditionally believed. Each of the source documents used as resources makes many assumptions regarding the data they report. In each of the assumptions, the authors preferred to
err on the conservative side, which reduces the calculated result when applied to
the entire nation. This document also makes assumptions; costs that are not
available are left out of the calculations for total cost of the accident. The reason
for this is simple; it is better not to compound any errors by estimating numbers
that are nearly impossible to estimate due to patient confidentiality restrictions.

As stated before in this document, all of the resources used in this document have
many assumptions in common. These assumptions tend to make the calculated
costs more conservative in every case.

Endnotes for Chapter 6

Chapter 7: Conclusions

This study was designed to evaluate the cost of one particular case where the company may have underestimated or neglected the costs of an accident. The actual cost of time spent at work discussing this particular accident served as the impetus for this case study. The individual in question spent a great deal of time discussing his injury, the rehabilitation and needed home adjustments. This time spent was an indirect cost of the accident that needed to be quantified.

There is little available literature on the topic of occupational injury cost. Much of the research available has been “top down” macro studies involving national data banks and costs. This project was designed to be a “bottom up” micro study where one particular case was evaluated and compared with the national data. This project also is important because no case study of an occupational injury could be found in the literature.

What was found as a result of the review of the literature and the case study?

- There are only six studies available that calculate the cost of occupational injury in the United States. Each of these studies is used as a reference by the other articles on the topic.

- The literature reports that one-third of the total cost of an occupational injury is composed of direct costs and the remaining two-thirds are indirect costs. This study found a ratio of four-fifths direct costs to one-fifth indirect costs. This finding does not agree with the available literature.
due to the severity of the accident used for the case study. But it does give an example of how the costs of an accident can exceed reasonable limits.

- The actual costs of an accident are much higher than one would think.
  - Hospital and transportation costs are much higher than commonly believed.
  - Indirect costs such as lost time and productivity as well as direct costs for an accident can reach staggering proportions.
  - Direct costs are somewhat controllable if they are measured.
  - Indirect costs are difficult, if not impossible, to measure. Without some attempt to measure and track these costs, they are impossible to control.

- Bob's company does not realize how much money and time his accident cost them. As shown in Table 4, Bob's employer is aware of only $150,000 in costs associated with this accident. As Table 5 suggests there are nearly $400,000 in total costs.

- The company does not realize the total costs; the company does not do all that it could do to prevent occupational illnesses and accidents. This consequently adversely affects the company's net profit. The literature, especially the major study by Leigh et al.¹ suggests that this is true for the nation as a whole.

This project demonstrates how indirect costs have a real effect on a company's bottom line. To draw a continuation of the visualization from the Introduction,
since this accident cost nearly $400,000 the company must sell $10,000,000 worth of goods and services at a 4% profit to recoup the loss. Had this accident not occurred, the company would have been able to bank the $400,000 as profit.

This study reflected the fact that companies do not track indirect costs of occupational injuries because:

- Indirect costs are difficult to measure due to their variability. They will not be the same for all employees. They may not even fall into the same categories.
- Companies are unaware of the magnitude of indirect costs and do not devote sufficient resources to reducing them.
- Because companies are unaware of the magnitude of these costs, there is no interest in measuring them. Since they are not measured companies do not have any interest in reducing them.

There needs to be better tracking of costs by each company with respect to occupational injuries. This information is vital to making companies aware of the costs associated with each injury. These costs are as important as saving money on raw materials or raising the price of the finished goods. Reducing the injury rate and associated costs will actually lower the cost of production of goods and services thereby increasing profit. In today’s competitive markets, accident prevention and the subsequent cost reduction are competitive advantages that every company should have.

Industry must be made aware of the costs associated with occupational injuries.

To address this issue OSHA and other national organizations need to:

- Require tracking of costs. OSHA currently requires accident information to be tracked via the OSHA 300 log. OSHA could add requirements to include cost
information that could be used to build a national database. This information would be composed of direct costs at first. As the program grows it could include some indirect costs and estimates of other indirect costs. The main goals would be to develop a national database to share these costs with companies and to show how profits decrease due to accident costs.

- Place more attention on costs of occupational injuries. By placing attention on these costs, companies will be more likely to focus on them. This would create more media attention, driving up the interest level of the general public.

The results of this information should then be communicated to business leaders so they are aware of the effects that poor workplace design, practices and policies have upon the costs faced by an organization. This may change the way in which companies structure their employee policies and facilities and hence improve their competitive position and profits.

A major problem is that the general public is not interested in reducing the costs of occupational injuries because:

- Americans have a “cowboy” attitude when it comes to occupational injuries. They tend to accept the fact that accidents happen, and that this part of the job.
- Occupational injuries are broad in spectrum. There is no one cause of injury, no one symptom.
- Many people associate occupational injuries with “accidents,” not preventable injuries.
- The media does not publicize occupational injury rates and costs because they are not exciting headlines. Media is designed to grab the public’s attention. When occupational injuries occur, they are not presented as preventable; they usually are presented as “freak accidents” to play upon the fears of the public and to sell as many copies, or gain as many viewers, as possible.

Occupational injuries may not be suitably addressed until the general public becomes interested in this issue. The media’s failure to publicize them, however, makes this unlikely.
Thus, the ultimate hope for reducing occupational injuries throughout the United States is for OSHA and other national organizations to implement the recommendations presented above.

Endnotes for Chapter 7

1 Leigh et al. (2000).
Bibliography


Clark, Patricia K. Letter to Michael C. Osterhaudt, 13 February, 2002:


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### Appendix

#### Table 6 Cost Calculation from Various Sources

<table>
<thead>
<tr>
<th>Document</th>
<th>Year Published</th>
<th>Injury Cost</th>
<th>Year Analyzed</th>
<th>Unique Fact About Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Injury in the United States: a report to Congress Rice D. P. et al.</td>
<td>1989</td>
<td>$157.6 billion</td>
<td>1985</td>
<td>This document uses all injuries that occurred in the United States in 1985. There is no distinction made for occupational or not. This calculates morbidity cost 57 million people injured in 1985 for this calculation.</td>
</tr>
<tr>
<td>The Economic Consequences of Work-Related Injuries. Marquis M. Susan</td>
<td>1992</td>
<td>$83.2 billion</td>
<td>1989</td>
<td>This document separates work-related injuries from all other accidents. Also separated are work loss costs from medical and other direct costs. Non fatal only.</td>
</tr>
<tr>
<td>National Safety Council, Injury Facts</td>
<td>2000</td>
<td>$122.6 billion</td>
<td>1999</td>
<td>This information does not include calculations for intentional injuries (homicides, suicides). It relies upon the Bureau of Labor Statistics' Census of Fatal Occupational Injury (CFOI) system.</td>
</tr>
<tr>
<td>National Safety Council, Injury Facts</td>
<td>2001</td>
<td>$131.2 billion</td>
<td>2000</td>
<td>This information does not include calculations for intentional injuries (homicides, suicides). It relies upon the Bureau of Labor Statistics' Census of Fatal Occupational Injury (CFOI) system.</td>
</tr>
<tr>
<td>The Lifetime Cost of Injury Max W. et al.</td>
<td>1990</td>
<td>$157.6 billion</td>
<td>1985</td>
<td>Using a 6% discount rate this document calculates the costs of injury for the United States. In 1985 143,000 Americans died of their injuries and 2.3 million people were hospitalized for their injuries.</td>
</tr>
<tr>
<td>The Economic Cost of Motor Vehicle Crashes, 1994 Blincoe L. J., Faigan B. M.</td>
<td>1996</td>
<td>$150.5 billion</td>
<td>1994</td>
<td>This document analyzes the cost of motor vehicle crashes. Relevant due to the nature of the case study. Other documents describe work related motor vehicle injuries as being the most expensive.</td>
</tr>
<tr>
<td>National Safety Council, Injury Facts</td>
<td>2001</td>
<td>$201.5 billion</td>
<td>2000</td>
<td>These costs are detailed on page 87 in the Injury Facts text. This cost segment details motor vehicle accident costs.</td>
</tr>
<tr>
<td>Estimating the Costs of Injury to U.S. Employers. Miller T. R.</td>
<td>1997</td>
<td>$155 billion highway crashes cost employers $56 billion per year ($23,000 per crash)</td>
<td>Costs calculated in 1990 dollars. 1989 and 1991 calculated</td>
<td>Text goes into great depth to describe uncertainties. This is a top down analysis using percentages developed by other researchers and applying current loss numbers to the data. This number is very close to the results of the Leigh et al. study.</td>
</tr>
<tr>
<td>Miller T. R., Galbraith M. Estimating the cost of occupational injury in the US. Accident Analysis and Prevention 1995;2:741-747</td>
<td>1995</td>
<td>$140 billion cost per injury $13,000, motor vehicle injury $75,000</td>
<td></td>
<td>Excellent breakdown of previous research. Describes other research deficiencies and costs. Breaks out costs for emergency services and automotive accidents.</td>
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</tbody>
</table>