Presentations to management on the costs of worker injuries and illnesses can be attention-getting and convincing, provided the data are plausible and can be supported with suitable references. Unfortunately, little research and hard data exist to support the frequently used ratios of indirect to direct costs that appear in safety-related literature.

Furthermore, as in the sources cited by this article, the elements included in direct and indirect cost categories may differ (Heinrich, 1931; Grimaldi & Simonds, 1989; Leigh, Markowitz, Fahs, et al., 1997). And, the ratios in those sources are invalid because the direct costs of accidents have increased in recent years at a pace far greater than indirect costs.

This article discusses the author’s review of select data pertaining to indirect and direct accident costs. Computations are made in order to update a ratio reported in a plausible research study in order to approximate the current ratio of indirect to direct costs. In addition, the author discusses the inappropriateness of the “additional sales needed” argument to cover total indirect and direct accident costs.

Unsupported Statements About Ratios

Enter “indirect and direct costs of accidents” into an Internet search engine, and the search will return a wide variety of documents that include ratios of those costs. Some pertain to the costs that an employer would bear. Others are more broad and pertain to the societal burden of such costs. Select examples relating to employer costs are highlighted.

• The Business Results Through Health and Safety Guidebook, from Canadian Manufacturers and Exporters (Ontario Division) and Workplace Safety and Insurance Board (2001) “demonstrates the business case for workplace health and safety and reflects the experience of Ontario businesses.” The publication states, “The average workplace lost-time injury in Ontario costs over $59,000. The average lost-time workers’ compensation claim cost is over $11,771.” (Note: Round $11,771 to $11,800, and one finds that a 4-to-1 multiplier was used to get to $59,000. The guidebook recommends a 4:1 ratio within a cost computation system provided for employers to use.)

• The Spring 2006 issue of ASSE’s Journal of SH&E Research contains the article, “A Survey of the Safety Roles and Costs of Injuries in the Roofing Contracting Industry” Choi (2006). The author writes, “Traditionally indirect costs are measured as being four times the direct costs (Heinrich, 1941), but the indirect costs of injuries may range from two to 20 times the direct costs.”

• U.S. Fish and Wildlife Service, Division of Safety and Health, offers this: “For every dollar spent on direct costs, $4 to $10 are spent on indirect costs.”
Differences in Cost Categories

Many combinations of terms about the costs to employers of employee accidents appear in the literature, including direct and indirect, insured and uninsured, ledger and nonledger, and tangible and intangible. Ledger and tangible costs are those for which data are created in the normal business process that can be entered into a financial ledger, such as medical and indemnity costs paid. Nonledger and intangible costs are those that occur but for which no specific data are determined, such as the value of time spent by supervisors and others who give attention to the accident, time spent providing first aid and investigation time.

Also, the direct and indirect cost categories differ considerably among the various sources. What is an indirect or hidden or uninsured cost in one list may be excluded in another. For example, some lists include lost productivity or loss of profits as an indirect cost. Chapter 6, “Cost Analysis,” in Grimaldi and Simonds (1989) Safety Management, 5th ed., contains a 6-page discussion on the infamous and restricted items that should not be included when computing uninsured costs. For example:

Loss of profit of idle machines or workers is generally a valid cost. When workers or machines are made idle, one of two things occurs. Either the production is eventually made up, or it is not. If it is made up, in the sense that over a long period of time no less goods are produced and sold than would have been had the accident not occurred, there is no loss of profit apart from the increase in production costs.

For this article, the author focused on accident costs assumed by employers, the direct costs of which are the legally required indemnity payments and the medical costs paid, with all other related costs being the indirect costs. Other studies have addressed the costs of injuries and illnesses to society; however, because of the differences in cost allocation methods, those studies are of little value in determining employer costs.

Heinrich’s Indirect & Direct Cost Ratios

Heinrich’s presentation of the 4:1 indirect to direct cost ratio of injuries and illnesses was a historical first. It is often referenced in the literature. The following ratios are derived from the first edition of the book (published in 1931), giving the results of his 1926 study.

Heinrich wrote that, according to his research and analysis, an employer’s cost of the so-called “incidental” costs of worker injuries was four times as great as compensation and medical payments. This 4:1 ratio of indirect to direct costs also appeared in the three later editions of his book. Many statements in safety-related literature repeat Heinrich’s 4-to-1 ratio. Although his studies were made in 1926, his ratios have had staying power.

Heinrich’s direct costs of injuries and illnesses are “compensation and liability claims, medical and hospital costs, insurance premiums, and cost of lost time except when actually paid by the employer without reimbursement.” His list of hidden accident cost factors includes 11 subjects, some of which have subparts. Only the major categories are shown, some have been combined:

• time of the injured employee; the other employees who stop work or who are upset;
• time of foremen, supervisors, or other executives who give attention to the accident;
• time spent by first-aid attendants and hospital department staff when not paid for by the insurance carrier;
• damage to any machines, equipment and other property, and interference with the site’s production;
• costs to the employer of welfare and benefit systems, and continuing the full wages of the employee after returning to work that are not fully recovered;
• loss of profit on the injured person’s production, or idle machines;
• overhead (e.g., lights, heat) when the employee is away or not fully productive.

In the third and fourth editions of his book, Heinrich listed an example of hidden costs that contributed to insurance and other expenditures. Heinrich noted that some hidden costs are not in the医疗保险, on idle machines; losses to the employer of working time; and the legal costs of compensation and liability claims. Heinrich’s indirect costs also included such things as dental costs of worker injuries was four times as great as compensation and medical payments. This 4:1 ratio of indirect to direct costs also appeared in the three later editions of his book. Many statements in safety-related literature repeat Heinrich’s 4-to-1 ratio. Although his studies were made in 1926, his ratios have had staying power.

Heinrich’s direct costs of injuries and illnesses are “compensation and liability claims, medical and hospital costs, insurance premiums, and cost of lost time except when actually paid by the employer without reimbursement.” His list of hidden accident cost factors includes 11 subjects, some of which have subparts. Only the major categories are shown, some have been combined:

• time of the injured employee; the other employees who stop work or who are upset;
• time of foremen, supervisors, or other executives who give attention to the accident;
• time spent by first-aid attendants and hospital department staff when not paid for by the insurance carrier;
• damage to any machines, equipment and other property, and interference with the site’s production;
• costs to the employer of welfare and benefit systems, and continuing the full wages of the employee after returning to work that are not fully recovered;
• loss of profit on the injured person’s production, or idle machines;
• overhead (e.g., lights, heat) when the employee is away or not fully productive.

In the third and fourth editions of his book, Heinrich listed an example of hidden costs that contributed to insurance and other expenditures. Heinrich noted that some hidden costs are not in the insurance, on idle machines; losses to the employer of working time; and the legal costs of compensation and liability claims. Heinrich’s indirect costs also included such things as dental costs of worker injuries was four times as great as compensation and medical payments. This 4:1 ratio of indirect to direct costs also appeared in the three later editions of his book. Many statements in safety-related literature repeat Heinrich’s 4-to-1 ratio. Although his studies were made in 1926, his ratios have had staying power.

Heinrich’s direct costs of injuries and illnesses are “compensation and liability claims, medical and hospital costs, insurance premiums, and cost of lost time except when actually paid by the employer without reimbursement.” His list of hidden accident cost factors includes 11 subjects, some of which have subparts. Only the major categories are shown, some have been combined:

• time of the injured employee; the other employees who stop work or who are upset;
• time of foremen, supervisors, or other executives who give attention to the accident;
• time spent by first-aid attendants and hospital department staff when not paid for by the insurance carrier;
• damage to any machines, equipment and other property, and interference with the site’s production;
• costs to the employer of welfare and benefit systems, and continuing the full wages of the employee after returning to work that are not fully recovered;
• loss of profit on the injured person’s production, or idle machines;
• overhead (e.g., lights, heat) when the employee is away or not fully productive.

Heinrich’s indirect costs also included such things as dental costs of worker injuries was four times as great as compensation and medical payments. This 4:1 ratio of indirect to direct costs also appeared in the three later editions of his book. Many statements in safety-related literature repeat Heinrich’s 4-to-1 ratio. Although his studies were made in 1926, his ratios have had staying power.

Heinrich’s direct costs of injuries and illnesses are “compensation and liability claims, medical and hospital costs, insurance premiums, and cost of lost time except when actually paid by the employer without reimbursement.” His list of hidden accident cost factors includes 11 subjects, some of which have subparts. Only the major categories are shown, some have been combined:

• time of the injured employee; the other employees who stop work or who are upset;
• time of foremen, supervisors, or other executives who give attention to the accident;
• time spent by first-aid attendants and hospital department staff when not paid for by the insurance carrier;
• damage to any machines, equipment and other property, and interference with the site’s production;
• costs to the employer of welfare and benefit systems, and continuing the full wages of the employee after returning to work that are not fully recovered;
• loss of profit on the injured person’s production, or idle machines;
• overhead (e.g., lights, heat) when the employee is away or not fully productive.
A Construction Industry Study

In 1982, the Stanford Industrial Assessment Center conducted a study of the indirect cost of injuries on a construction site. This study aimed to determine the source of the costs that have been attributed to construction injuries, particularly the hidden costs. The study was conducted by a third-party administrator for the total cost of workers’ compensation claims, and the results were confidential, for this author by a third-party admin-
istrator for the total cost of workers’ compensation claims, and so on.

A Cost Distribution Study

The data in Table 2 were derived from the indirect cost distribution study conducted by the Stanford Industrial Assessment Center. The data were tabulated in Table 3, which presents the results of these computations. Table 4 presents data from the "2009 State of the Line" report (Mealy, 2009) from National Council on Compensation Insurance (NCCI). Indirect costs increased overall at about the same rate as did inflation. However, the percentage of self-insured firms that used indirect cost data increased significantly since 1980. The following exercise was devised to estimate what the 1.6-to-1 multiplier of the indirect cost to direct cost ratio would be in today’s dollars.

The relationship between indirect to direct costs has changed significantly since 1980. The following exercise was devised to estimate what the 1.6-to-1 multiplier of the indirect cost to direct cost ratio would be in today’s dollars.

Table 3: Inflation Computations

<table>
<thead>
<tr>
<th>Amount</th>
<th>Year</th>
<th>Had the same purchasing power as</th>
<th>In the year</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.00</td>
<td>1980</td>
<td>$2.01</td>
<td>2008</td>
<td>2.61</td>
</tr>
<tr>
<td>$1.00</td>
<td>1980</td>
<td>$1.80</td>
<td>2004</td>
<td>1.80</td>
</tr>
<tr>
<td>$1.00</td>
<td>1995</td>
<td>$1.41</td>
<td>2008</td>
<td>1.41</td>
</tr>
</tbody>
</table>

Note: Inflation computations relating purchasing power in 1 year to a subsequent year.

Table 4: Progression With Respect to Workers’ Compensation Claims Costs

<table>
<thead>
<tr>
<th>Average indemnity cost per lost-time claim</th>
<th>1995</th>
<th>$10,500</th>
<th>1999</th>
<th>$12,700</th>
<th>2005</th>
<th>$22,500</th>
<th>2008</th>
<th>$41,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average medical cost per lost-time claim</td>
<td>1995</td>
<td>$9,800</td>
<td>2005</td>
<td>$17,500</td>
<td>2008</td>
<td>$45,200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: Indemnity and medical cost per lost-time claim</td>
<td>1995</td>
<td>$15,300</td>
<td>2005</td>
<td>$40,500</td>
<td>2008</td>
<td>$67,700</td>
<td>157% increase</td>
<td></td>
</tr>
</tbody>
</table>


Updating the Stanford Indirect & Direct Cost Ratios

The relationship between indirect to direct costs has changed significantly since 1980. The following exercise was devised to estimate what the 1.6-to-1 multiplier of the indirect cost to direct cost ratio would be in today’s dollars. However, understand that these computations are ill-

A Cost Distribution Study

The data in Table 2 were derived from the indirect cost distribution study conducted by the Stanford Industrial Assessment Center. The data were tabulated in Table 3, which presents the results of these computations. Table 4 presents data from the "2009 State of the Line" report (Mealy, 2009) from National Council on Compensation Insurance (NCCI). Indirect costs increased overall at about the same rate as did inflation. However, the percentage of self-insured firms that used indirect cost data increased significantly since 1980. The following exercise was devised to estimate what the 1.6-to-1 multiplier of the indirect cost to direct cost ratio would be in today’s dollars.

The relationship between indirect to direct costs has changed significantly since 1980. The following exercise was devised to estimate what the 1.6-to-1 multiplier of the indirect cost to direct cost ratio would be in today’s dollars.

A Cost Distribution Study

The data in Table 2 were derived from the indirect cost distribution study conducted by the Stanford Industrial Assessment Center. The data were tabulated in Table 3, which presents the results of these computations. Table 4 presents data from the "2009 State of the Line" report (Mealy, 2009) from National Council on Compensation Insurance (NCCI). Indirect costs increased overall at about the same rate as did inflation. However, the percentage of self-insured firms that used indirect cost data increased significantly since 1980. The following exercise was devised to estimate what the 1.6-to-1 multiplier of the indirect cost to direct cost ratio would be in today’s dollars. However, understand that these computations are ill-

A Cost Distribution Study

The data in Table 2 were derived from the indirect cost distribution study conducted by the Stanford Industrial Assessment Center. The data were tabulated in Table 3, which presents the results of these computations. Table 4 presents data from the "2009 State of the Line" report (Mealy, 2009) from National Council on Compensation Insurance (NCCI). Indirect costs increased overall at about the same rate as did inflation. However, the percentage of self-insured firms that used indirect cost data increased significantly since 1980. The following exercise was devised to estimate what the 1.6-to-1 multiplier of the indirect cost to direct cost ratio would be in today’s dollars. However, understand that these computations are ill-

A Cost Distribution Study

The data in Table 2 were derived from the indirect cost distribution study conducted by the Stanford Industrial Assessment Center. The data were tabulated in Table 3, which presents the results of these computations. Table 4 presents data from the "2009 State of the Line" report (Mealy, 2009) from National Council on Compensation Insurance (NCCI). Indirect costs increased overall at about the same rate as did inflation. However, the percentage of self-insured firms that used indirect cost data increased significantly since 1980. The following exercise was devised to estimate what the 1.6-to-1 multiplier of the indirect cost to direct cost ratio would be in today’s dollars. However, understand that these computations are ill-

A Cost Distribution Study

The data in Table 2 were derived from the indirect cost distribution study conducted by the Stanford Industrial Assessment Center. The data were tabulated in Table 3, which presents the results of these computations. Table 4 presents data from the "2009 State of the Line" report (Mealy, 2009) from National Council on Compensation Insurance (NCCI). Indirect costs increased overall at about the same rate as did inflation. However, the percentage of self-insured firms that used indirect cost data increased significantly since 1980. The following exercise was devised to estimate what the 1.6-to-1 multiplier of the indirect cost to direct cost ratio would be in today’s dollars. However, understand that these computations are ill-
Professional Safety

January 2011

44

Professional Safety

JANUARY 2011

www.asse.org

Direct costs actual dollars spent or anticipated to be spent on providing medical care to an injured or ill person as well as property damage, police and fire services, administrative costs for delivering indemnity benefits and direct costs to innocent third parties. Medical costs include doctors’ and nurses’ services, hospital charges, drug costs, rehabilitation services, ambulance fees, payments for medical equipment and supplies.

Indirect benefits costs do not include the benefits themselves; these are implicitly accounted for in the indirect costs (lost wages). Indemnity benefit costs include the administration costs associated with providing workers’ compensation indemnity or Social Security disability payments to injured or sick workers and their families. Property damage includes costs of damage to vehicles, machines, buildings, and so on, directly associated with the injuries and illnesses.

The largest indirect costs include the injured or sick worker’s lost earnings, fringe benefits and home production. Other indirect costs include employer’s costs associated with retraining and restaffing, coworker costs of lost productivity, time delays and indirect costs to innocent bystanders (Leigh, et al., 1997).

Because of the allocation of costs into direct and indirect categories, the ratios developed are not comparable with any other system discussed in this article. Much of the NIOSH report is devoted to occupational injuries and illnesses and to speculations about their indirect and direct costs. Nevertheless, the report concludes:

Identifying the costs of occupational injury and disease in the U.S. has been an elusive goal. Our study repeats the first study to attempt to estimate the national cost of occupational injury and illness using national data. But, even with our study, this goal remains unattained (Leigh, et al., 1997).

The case is made that because the data required for a proper study do not exist, many speculative assumptions must be made to produce speculative conclusions.

OSHA Adopted the Stanford Report Ratios

OSHA gives credibility to the ratios that arose out of the Stanford research by publishing and promoting the use of the data in the Business Roundtable version of the Stanford report, with some revision.


The indirect cost ratio for the 0-2,999 “Range of Benefits Paid” in the Business Roundtable report is 4.1:1, rather than 4.5 as shown in Table 5. However, note that the OSHA exhibit shows no data for “no-lost-time” claims, for which the compound ratio would be higher than 4.1. This indicates that some combinations were made. The eTool says:

•Workers’ compensation claims which cover medical costs and indemnity payments for an injured or ill worker are the direct costs.
•All other related costs are the indirect costs.

To help users identify the impact of occupational injuries and illnesses on your profitability, try out OSHA’s “Safety Pays” program. It uses a company’s profit margin, the average cost of an injury or illness, and an indirect cost multiplier to project the number of dollars a company would need to cover these costs (OSHA, 2007).

An OSHA bulletin on its Safety Pays program, “Do You Know How Much Accidents Are Really Costing Your Business?” includes the ratios in Table 5 as well as a depiction of Bird’s icing. Another bulletin (OSHA, 2009a) says that the program will:

•offer choices from a set of lostworkday injuries and illnesses;
•prompt users for information to do the analysis;
•allow users to input the actual loss figures or workers’ compensation costs;
•generate a report of the costs and the sales needed to cover those costs.

The indirect and direct costs in each of the 53 injury or illness categories. The average cost for each of the categories is provided along with the appropriate indirect to direct cost ratio.


The calculations performed to relate costs in 1980-81 to current costs resulted in a 49% reduction in the 1.6-to-1 ratio, which appears in the Stanford report as the compound ratio for all injury levels. Receiving the 1.6-to-1 ratio used in OSHA’s Safety Pays program by 49% produces a revised ratio of 0.56 rounded to 0.6 to 1. Data on indirect costs produced using this program is misleading.

Computing the “Additional Sales” Necessary to Cover Injury Costs

Bird (1974) proposes that reports to management should include data to show the “additional sales” required to pay for accident costs. Needing additional sales to cover indirect and direct costs is the subject being questioned. The following discussion shows that the premise that additional sales are necessary to cover accident costs cannot be supported.

An executive with whom this subject was reviewed and whose background is in finance suggested that relating total accident costs to dollars of profit would be conceptually supported. Such a comparison might have significance. For example, a report prepared by a safety professional for management indicating that injury costs are equal to 100% of profits could get attention.

Bird (1974) offers a chart that shows the amount of additional sales necessary to pay for selected levels of annual costs at certain profit margins. Duplication of this chart containing identical numbers appear in many places, as does the following example. The source of the data in Table 6 is a Federal Motor Carrier Safety Administration (FMCSA) publication, “Accident Cost Table.” It was chosen because it is accessible online.

Table 5

<table>
<thead>
<tr>
<th>Direct cost of claim</th>
<th>Ratio of indirect to direct cost</th>
<th>Ratio of indirect to direct cost</th>
<th>Ratio of indirect to direct cost</th>
<th>Ratio of indirect to direct cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0-2,999</td>
<td>4.5</td>
<td>1.6</td>
<td>1.2</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Table 6

<table>
<thead>
<tr>
<th>Yearly accident costs</th>
<th>Profit margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5,000</td>
<td>1%</td>
</tr>
<tr>
<td>$10,000</td>
<td>2%</td>
</tr>
<tr>
<td>$15,000</td>
<td>3%</td>
</tr>
<tr>
<td>$20,000</td>
<td>4%</td>
</tr>
<tr>
<td>$25,000</td>
<td>5%</td>
</tr>
</tbody>
</table>

Note: Data from “Accident Cost Table,” by Federal Motor Carrier Safety Administration, Washington, DC. Author.
When revenues equal total operating costs, all indirect and direct costs incurred up to that time are recovered. Also, as sales increase and operations become profitable, revenues obtained continue to encompass all additional indirect and direct costs.

Cost levels shown in the FMCSA publication, but it still presents the idea appropriately. To determine the additional sales necessary, accident costs are divided by the profit margin percentage selected, then converted to a decimal. In the FMCSA publication, accident costs are a combination of the indirect and direct costs.

OSHA's Safety Pays program is another example of how Bird's concept has been applied. The program literature says the program will, among other things, encourage the user to "generate a report of the costs and the sales needed to cover those costs." As computations required by the program are made, a profit percentage is to be entered to produce the amount of sales necessary to cover direct and indirect costs.

As noted, statistics comparable to those in Table 6 were discussed with an operations executive whose degree is in finance. This conversation was highly instructive, particularly with respect to unit pricing methods and break-even charts, and why the computations to determine the additional sales necessary to cover indirect and direct costs are implausible. The discussion, briefly summarized, follows.

- As a company budgets for its operations, both the indirect and direct costs of injuries (unidentified for indirect costs and sometimes identified for direct costs) are included in estimates of operating costs, and the unit prices for products or services are set to recover those costs and the profit margin expected.

Although hidden costs are very real, they are very difficult to demonstrate. To say arbitrarily to management that they amount to four times the insurable costs is asking for trouble. If management asks for proof, you can only say, "Heinrich said so." Management wants facts, not fantasy. Without proof, hidden costs become fantasy.

SH&E professionals need proof to support the indirect to direct cost ratios they use. ASSE or its Foundation should consider funding research to develop valid and current data on indirect to direct costs ratio. For such a study to be successful, the methodology and scope should follow good research protocols, and a statistically based number of employers would need to be educated on and committed to the time and effort necessary. Such studies are not easily undertaken. That said, such a study will likely result in a determination that the indirect to direct cost ratio is significantly lower than the ratio that has appeared in safety literature.

PS

Acknowledgment

The literature on direct and indirect costs does not present a uniformly accepted computation method. Differences in the various systems are substantial. More importantly, no published ratios are currently valid because the increase in direct costs (indemnity and medical costs resulting from an injury or illness) has exceeded the increase in indirect costs substantially in the past 15 years. Computations in this article updating the Stanford study indicate that the ratio of indirect to direct accident costs is currently about 0.81. That ratio is given as an approximation. Safety professionals who use a 1-to-1 ratio can be reasonably comfortable. This author recommends avoiding the use of ratios for which there are no supporting data (4:1, 6:1, 10:1 or higher).

Petersen (1989) also expressed concern over the use of an indirect to direct cost ratio for which supporting data are questionable.

References


Petersen (1989) also expressed concern over the use of an indirect to direct cost ratio for which supporting data are questionable:

- Thus, from the first dollar of sales onward, a part of the indirect and direct costs are recovered.

- When revenues equal total operating costs (Figure 2), all indirect and direct costs incurred up to that time are recovered. Also, as sales increase and operations become profitable, revenues obtained continue to encompass all additional indirect and direct costs.

- No "additional sales" are needed to cover indirect and direct costs.

Consider the following example:

1) Sales budgeted for a year are $10 million.
2) A 3% profit margin and profits of $300,000 are expected.
3) Operating costs are $9.7 million.
4) Total direct and indirect costs are $800,000.
5) To determine the additional sales necessary to cover total injury costs, the $300,000 would be divided by 0.03, the result being $10 million. Such computations will not withstand a logic test, since all indirect and direct injury costs would be contained in the operating costs as the $10 million sales goal is attained. Thus, no additional sales, in addition to the organization’s total income, are necessary to cover accident costs.

Conclusion

The literature on direct and indirect costs does not present a uniformly accepted computation method. Differences in the various systems are substantial. More importantly, no published ratios are currently valid because the increase in direct costs (indemnity and medical costs resulting from an injury or illness) has exceeded the increase in indirect costs substantially in the past 15 years. Computations in this article updating the Stanford study indicate that the ratio of indirect to direct accident costs is currently about 0.81. That ratio is given as an approximation. Safety professionals who use a 1-to-1 ratio can be reasonably comfortable. This author recommends avoiding the use of ratios for which there are no supporting data (4:1, 6:1, 10:1 or higher).

Petersen (1989) also expressed concern over the use of an indirect to direct cost ratio for which supporting data are questionable: