

# Economic Costs of Occupational Injury Fatalities in New Jersey in 1992

*Each fatality represents an array of hidden costs, from lost household production to legal and administrative costs*

Lisa M. Roche'

Each occupational injury fatality represents a tragedy for the victim, his or her family and co-workers, and society at large. While the suffering of the workers involved can not be quantified, the economic costs can. This article provides estimates of the economic costs of the 114 occupational injury fatalities in New Jersey in 1992, based on the methods of T. R. Miller<sup>1</sup> and T.A. Miller, et al.<sup>2</sup> The estimated costs of occupational injury fatalities can vary depending on assumed values for various unknowns as well as the methods used.

## New Jersey's experience

The 114 occupational injury fatalities that occurred in 1992 are estimated to have cost a total of \$122,420,908 or \$1,073,868 per fatality. Table 1 shows the distribution of the 114 fatalities in New Jersey in 1992 by age, sex, and race. Table 2 contains the estimated total and average costs which are also described below.

**Methods.** The framework for estimating the costs of occupational injury fatalities was constructed based on the work of T.R. Miller<sup>1</sup> and T.A. Miller, et al.<sup>2</sup> The estimated economic costs were computed on an incidence, rather than prevalence basis; that is, the total present and future costs of the 114 injury fatalities that occurred in 1992 were estimated. All costs are given in 1992 dollars and include lifetime lost wages and benefits, workplace costs, the value of lifetime lost household production, medical services, le-

gal and administrative costs, and property damage resulting from motor vehicle accidents.

**Lifetime lost wages.** The estimated total lifetime lost wages resulting from the 114 occupational injury fatalities were \$63,595,020. With the income cost adjuster for New Jersey of 1.333 the total estimated lifetime lost wages is \$84,772,161, or an average of \$743,615 per fatality. (The income cost adjuster is the ratio of the per capita income in New Jersey to the per capita income in the U.S. in 1992—\$26,457 and \$19,841, respectively.)

The lifetime lost wages for each death were estimated using a modification of a formula developed by T.A. Miller, et al.<sup>2</sup> The formula was adjusted to estimate the wage losses due only to occupational injury fatalities, rather than from all injuries:

$$P_{a,s} = \sum_{n=a}^b Y_{n,s} \{[(1+X)^{n-a+1/2}]/[(1+D)^{n-a+1}]\} \text{ where}$$

$P_{a,s}$  = present value of future earnings for a person of age  $a$  at death and sex  $s$

$a$  = age at death

$b$  = age would have stopped work if had lived, given age  $a$ , sex  $s$ , race  $r$

$Y_{n,s}$  = average earnings for age  $n$  and sex  $s$  in 1992

$X$  = annual productivity growth rate

$D$  = annual discount rate

The age at death, race, and sex were obtained from the New Jersey Census of Fatal Occupational Injuries (CFOI) for 1992.<sup>3</sup> The age at which a decedent would have stopped

<sup>1</sup> T.R. Miller, "Costs and Functional Consequences of U.S. Roadway Crashes," *Accident Analysis and Prevention*, 1993; 25:593-607.

<sup>2</sup> T.A. Miller, A.F. Hoskin, D.H. Yalung-Mathews, "A Procedure for Annually Estimating Wage Losses Due to Accidents in the U.S.," *Journal of Safety Research*, 1987; 18:101-119.

Lisa M. Roche' is an epidemiologist with the Occupational Health Service, New Jersey Department of Health. The views, findings, and conclusions expressed in this article are those of the author and do not represent an official position by the Bureau of Labor Statistics or by Bureau of Labor Statistics staff members who reviewed it.

<sup>3</sup> L.M. Roche', *Census of Fatal Occupational Injuries, 1992*, New Jersey Department of Health, Occupational Health Service, February 1994.

working was calculated by adding the average years of worklife remaining, for those currently active in the labor force<sup>4</sup> to the age at death (assuming no break in employment) and rounded off to the nearest year. The average earnings for year-round, full-time workers by age category and sex in 1992 were obtained from the 1992 Current Population Survey.<sup>5</sup> The average earnings are for 5-year age categories except the youngest age category which is 7 years.

The annual productivity growth rate, 0.014, is the average annual change in business productivity from 1984 to 1993.<sup>6</sup> Because future earnings are generally considered less valuable than current earnings, a discount rate was used to calculate the present value of future earnings. An annual discount rate of 0.04 was used, as in the most recent research.<sup>7</sup> The formula was applied to the occupational injury fatality cases to obtain the lifetime lost wages for each. Because national data were used to calculate the lifetime lost wages, the total cost for the fatalities was then multiplied by the income cost adjuster for New Jersey.<sup>8</sup>

*Lifetime lost benefits.* The estimated lifetime lost benefits were calculated as a percentage of the lifetime lost wages based on total wages and salaries and employer supplements in 1992.<sup>9</sup> Supplements to wages and salaries consist mainly of employer contributions to social insurance (Social Security, unemployment compensation, workers' compensation) and to private pension, health, and welfare funds.

In 1992, wages and salaries in the United States amounted to nearly \$3 trillion and supplements to wages and salaries, in the form of benefits, amounted to \$629 billion,<sup>9</sup> or 21.3 percent of wages and salaries. When applied to the estimated total lifetime lost wages, this is \$18,056,470 or an average of \$158,390 per fatality for lifetime lost benefits.

*Workplace costs.* Workplace costs include hiring and training temporary or permanent replacements for deceased workers and disruption to productivity caused by employee concern.<sup>1</sup> T.R. Miller estimates that severe-to-fatal injuries involve 4 months of lost production. Accordingly, the mean earnings of all persons 15 years and older for 1992<sup>10</sup> prorated to 4 months and the cost of benefits, based on a percentage of the 4-month mean earnings,<sup>9</sup> were added together and multiplied by the number of occupational injury fatalities in New Jersey in 1992. The estimated total for work-

place costs was then multiplied by the income cost adjuster.<sup>8</sup>

The mean earnings for all persons 15 years of age and older in 1992 was \$22,667;<sup>10</sup> the prorated 4-month mean earnings were \$7,556. Average benefits for 4 months were computed as \$1,609 (21.3 percent of \$7,556) for an average total compensation of \$9,165 for 4 months. The estimated total workplace costs were \$1,044,810 (114 x \$9,165). Multiplied by the New Jersey income cost adjuster, the total estimate is \$1,392,732 or \$12,217 per fatality.

*Lifetime lost household production.* Household production includes nonmarket activities in the home. The value of household production is often estimated as anywhere from 29 to 49 percent of the gross national product.<sup>11</sup> Thus, household production is an important factor to include in the costs of occupational injury fatalities. The value of lifetime lost household production for each death was estimated using a modification of the formula for lifetime lost wages:

$$HHP_{a,s} = \sum_{n=a}^b HHY_{n,s} \{[(1+X)^{n-a+1/2}]/[(1+D)^{n-a+1}]\} \text{ where}$$

$HHP_{a,s}$  = present value of future household production for a person of age  $a$  at death and sex  $s$

$a$  = age at death

$b$  = age expected to live to if had lived, given age  $a$ , sex  $s$ , and race  $r$

$HHY_{n,s}$  = average monetary value of household production of employed persons for age  $n$  and sex  $s$  in 1992 dollars

$X$  = annual productivity growth rate

$D$  = annual discount rate

The age at death, race, and sex were obtained from the 1992 New Jersey CFI.<sup>3</sup> The life expectancy (shown as the number of years of life remaining) at single years of age by race and sex was taken from the National Center for Health Statistics life tables<sup>12</sup> and added to the age at death to obtain the age to which each person would have been expected to live. The mean annual monetary values of household production by age group and sex were used,<sup>11, 13</sup> and converted to 1992 dollars using the change in annual average hourly earnings.<sup>14</sup> The annual productivity growth rate in household production was assumed to be 0,<sup>1,15</sup> and the same

<sup>4</sup> *Worklife Estimates: Effects of Race and Education, tables A2 and A5*, Bureau of Labor Statistics, February 1986.

<sup>5</sup> *Money Income of Households, Families, and Persons in the United States, 1992*, Current Population Reports, Series P60-184, Department of Commerce, Bureau of the Census, table 30.

<sup>6</sup> *Productivity and Costs, Fourth Quarter and Annual Averages, 1993*, Bureau of Labor Statistics, USDL 94-64.

<sup>7</sup> *Accident Facts, 1993*, National Safety Council.

<sup>8</sup> *Statistical Abstract of the United States, 1993*, Department of Commerce, Bureau of the Census.

<sup>9</sup> *Economic Report of the President, 1994*.

<sup>10</sup> *Money Income of Households, Families, and Persons in the United States, 1992*, Department of Commerce, Bureau of the Census, table 34.

<sup>11</sup> J.B. Douglass, G.M. Kenney, and T.R. Miller, "Which Estimates of Household Production Are the Best?" *Journal of Forensic Economics*, 1990, 4: 25-45.

<sup>12</sup> *Vital Statistics of the United States, 1989*, Department of Health and Human Services, National Center for Health Statistics, vol. 2, sec. 6, table 6.3.

<sup>13</sup> T.R. Miller, *Household Production of Employed People by Age and Sex in 1991*, National Public Services Research Institute, 1994.

<sup>14</sup> *Monthly Labor Review*, Bureau of Labor Statistics, November 1993, table 14, p. 112.

discount rate used for lifetime lost wages was used, 0.04.<sup>17</sup> This formula was applied to each occupational injury fatality case to obtain the estimated value of lifetime lost household production. The estimated total value of lifetime lost household production was then multiplied by the income cost adjuster.<sup>8</sup>

The estimated total value of lifetime lost household production was \$9,488,960. Multiplied by the New Jersey income cost adjuster,<sup>8</sup> the total estimated value of lifetime lost household production is \$12,648,783, or \$110,954 per fatality.

*Medical services.* Average medical costs per fatality under workers' compensation for New Jersey for the 1987 policy year (N=134) were \$10,671,<sup>16</sup> or \$15,782 in 1992 dollars.<sup>17</sup> Multiplied by New Jersey's 114 occupational injury fatalities results in total estimated medical costs of \$1,799,148.

The average cost per fatality for medical services was obtained from reports by employers covered by private insurance for workers' compensation (that is, not self-insured) submitted to the New Jersey Compensation Rating and Inspection Bureau for 1987 policies (the most recent year with the most valid data).<sup>16</sup> The cost of medical services was converted to 1992 dollars using the Consumer Price Index-All Urban Consumers (CPI-U) for medical care for the Northeast Region (annual average).<sup>17</sup>

*Legal and administrative.* These costs include incident investigation, record keeping, insurance claims processing, and litigation. Average legal and administrative costs in 1990, as computed by T.R. Miller,<sup>15</sup> were converted to 1992 dollars using the CPI-U<sup>17</sup> and then applied to the fatalities. The estimated total cost was then multiplied by a composite cost adjuster for New Jersey of 1.457.<sup>18</sup> (The composite cost adjuster is used here instead of the income cost adjuster because these costs involve more than income.)

T.R. Miller estimated legal and administrative costs at \$18,500 in 1990 dollars per occupational fatality<sup>15</sup> (\$19,855 in 1992 dollars).<sup>17</sup> Multiplied by the number of fatalities, this results in total estimated legal and administrative costs of \$2,263,470. With the New Jersey composite cost adjuster of 1.457,<sup>18</sup> average costs are \$28,929, or \$3,297,906 for all the fatalities.

*Motor vehicle traffic accidents and property damage.* Since a large proportion of the occupational injury fatalities in 1992 involved motor vehicle traffic accidents, property damage costs resulting from them also were calculated. The

cost per fatality in 1988 as compiled by T.R. Miller<sup>1</sup> was converted to 1992 dollars using the CPI-U<sup>17</sup> and then applied to the 36 occupational injury fatalities in New Jersey involving motor vehicle traffic accidents (International Classification of Disease, 9th edition, External Injury Codes 810 to 819). The total cost was then multiplied by the composite cost adjuster.<sup>18</sup>

The average property damage cost per person for motor vehicle accidents was \$7,294 in 1988 dollars,<sup>1</sup> or \$8,650 in 1992 dollars.<sup>17</sup> This amounts to \$311,400 for the 36 occupational injury fatalities due to motor vehicle traffic accidents in New Jersey in 1992. Using the New Jersey composite cost adjuster,<sup>18</sup> the estimated cost of property damage per motor vehicle accident is \$12,603, or \$453,708 for all 36 deaths due to traffic accidents.

### Limitations to the data

There are several limitations to the data presented in this article, mostly related to assumptions made due to the lack of information.

Regarding the lifetime lost wages estimates, the remaining years of worklife data are from a 1986 publication (the most recent data available), and do not take into account recent changes in worklife estimates. This probably results in an underestimate of the lifetime lost wages of women, since the trend has been for women to remain in the workforce longer.<sup>4</sup> Also, an assumption was made that employment in the future would be continuous. This is probably correct in most cases, but incorrect in others, which may have resulted in underestimates or overestimates depending on the timing and consequences for earnings of breaks in employment. Average wages in 1992 were given in 5-year age groups, not at single ages. The life expectancy figures used to estimate the value of lifetime lost household production are for 1989, the most recent year with reliable figures by single ages. Unpublished data from the National Center for Health Statistics for 1991 are very similar with differences of 1 year for a few of the single ages. The estimate for workplace costs does not include damage estimates for items such as machinery, equipment, supplies, or physical structures.

The estimated medical costs are based on data from 1987 that do not include all the fatalities in New Jersey (that is, fatalities among employees of self-insured employers, which include most public employers and some large companies, are not included).

The cost estimate for property damage caused by traffic accidents is based on data for all fatal motor vehicle traffic crashes. The costs for work-related fatal crashes may be higher because of the likelihood that expensive vehicles, such as tractor-trailers, trucks, and vans, are involved. Uncertainties in estimates used for other unknowns, such as the discount rate and loss of co-workers' productivity, also affect the cost estimates.

These estimates should not be used for cost-benefit analyses because they are monetary costs only. Elderly, women,

<sup>15</sup> T.R. Miller, *The Costs of Injuries to Employers: A Traffic Safety Compendium*, 1993, Report to the National Highway Traffic Safety Administration.

<sup>16</sup> *Annual Report, 1993*, New Jersey Compensation Rating and Inspection Bureau, 1994.

<sup>17</sup> Annual average data were used from the CPI Detailed Report, Data for January, Bureau of Labor Statistics, 1989-1993.

<sup>18</sup> *ACCRA Cost of Living Index, Fourth Quarter 1993*, American Chamber of Commerce Researchers Association.

and minority workers are undervalued because their wages are typically lower than those of white males. Another cost component, quality of life, defined as the value placed on avoiding pain, suffering, and lost enjoyment, is needed for any cost-benefit analysis.<sup>1</sup> T.R. Miller estimated a quality of life value for fatalities from a compilation of 47 studies.<sup>19</sup> After adjustments, including corrections for selected systematic biases and reanalyses using uniform values for travel time and the discount rate, the mean and median quality of life value from these studies is \$2.2 million in 1988 dollars,<sup>19</sup> or \$2.4 million in 1990 dollars<sup>15, 19</sup> per fatality. In 1992 dollars, using the Employment Cost Index,<sup>20</sup> this figure becomes \$2.6 million. After subtracting the average lifetime lost wages (\$743,615) minus taxes of 15 percent, or \$632,073, the average benefits lost (\$158,390), and the average value of lost household production (\$110,954), the quality of life value is \$1,698,583 per fatality. Applying this figure to the 114 occupational injury fatalities in New Jersey in 1992 results in a total quality of life cost of \$193,638,460. The economic costs and the quality of life costs together are considered comprehensive costs.<sup>1,7</sup> The estimated comprehensive costs for the 114 occupational fatalities in New Jersey in 1992 were \$316,059,368 or an average of \$2,772,451 per fatality. It is the comprehensive costs that should be used for cost-benefit analyses.

*Other cost estimates.* The National Safety Council (NSC) estimates the cost of fatal work accidents in 1992 as \$780,000 per fatality.<sup>7</sup> This estimate includes the present value of lost wages, benefits, and household production (using a 4-percent discount rate); medical expenses including ambulance and helicopter transport costs, cost of a funeral, and coroner costs; administrative expenses including in-

<sup>19</sup> T.R. Miller, "The Plausible Range for the Value of Life: Red Herrings Among the Mackerel," *Journal of Forensic Economics*, 1990, 3: 17-39.

<sup>20</sup> *Monthly Labor Review*, Bureau of Labor Statistics, November 1993, table 2, p. 104.

surance, police, and legal costs; travel delay costs and the costs associated with motor vehicle crashes; and employer costs. The estimate does not include lost quality of life. The NSC figure is lower than the estimated average cost of occupational injury fatalities in New Jersey (\$1,073,868) largely because of the New Jersey cost adjusters factors. Differences in the age, sex, and race of the occupational fatalities in New Jersey compared with the occupational fatalities nationwide may explain some of the difference in estimated cost per fatality, as may differences in methods of computing the costs.

## Conclusion

As can be seen from table 2, the economic costs of occupational fatalities are enormous. These costs, as well as ethical considerations, can be used to justify the expenditure of time and money on preventing them. The optimal level of expenditures needs to be determined by careful cost-benefit analyses that address nonfatal occupational injuries and illnesses, as well as fatal ones. Further, additional epidemiological information is needed to develop specific policies, programs, and standards to prevent these fatalities.

## Acknowledgments

Ted R. Miller of the National Public Services Research Institute is gratefully acknowledged for his assistance in providing information and explaining the methods used to obtain the costs of motor vehicle crashes and occupational injuries. Alan F. Hoskin of the National Safety Council provided invaluable comments on early drafts of the article. Joe Rizzo and Michele Kasick of the Occupational Health Service, New Jersey Department of Health assisted with the lifetime lost wages formula and computation. Rose Marie Martin and Kay Knaublauch of the New Jersey Department of Health also helped obtain needed information. The work of Emily Smith and Noreen Rooks of the New Jersey CFOI Program was also invaluable.

**Table 1. Number of occupational injury fatalities in New Jersey by age, race, and sex in 1992**

Age	Total	White		Black		Other	
		Male	Female	Male	Female	Male	Female
Total .....	114	87	5	16	1	5	0
Under 20 .....	1	1	0	0	0	0	0
20-24 .....	13	10	0	3	0	0	0
25-34 .....	24	19	1	3	0	1	0
35-44 .....	27	18	1	5	0	3	0
45-54 .....	27	20	1	4	1	1	0
55-64 .....	13	11	1	1	0	0	0
65 and over .....	9	8	1	0	0	0	0

**Table 2. Costs of New Jersey's occupational injury fatalities by cost category, in 1992 Dollars**

Category	Total Cost <sup>1</sup>	Average Cost <sup>1</sup>
Comprehensive costs .....	\$316,059,368	\$2,772,451
Quality of life .....	193,638,460	1,698,583
Total economic costs <sup>2</sup> .....	122,420,908	1,073,868
Lifetime lost wages .....	84,772,161	743,615
Lifetime lost benefits .....	18,056,470	158,390
Workplace costs .....	1,392,732	12,217
Lifetime lost household production .....	12,648,783	110,954
Medical services .....	1,799,148	15,782
Legal and administrative .....	3,297,906	28,929
Property damage <sup>3</sup> .....	453,708	12,603

<sup>1</sup> These figures apply only to New Jersey's 114 occupational fatalities in 1992.

<sup>2</sup> The total economic cost was divided by 114 to obtain the average cost.

<sup>3</sup> For the 36 deaths due to motor vehicle traffic accidents.