1975 Societal Costs of Motor Vehicle Accidents

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Summary Discussion

Motor vehicle accidents result in significant costs to individuals and to society at large. This report, which is an update and revision of a societal cost study published in 1972,[1] presents estimates of societal costs through quantification of societal loss components.

The purpose of this study is to assess some basic losses to society from motor vehicle accidents. Measurable cost components are identified to provide some indication of the scope of the human problem. However, the total of individual cost estimates of accidents should not be interpreted as the value placed on a life or as the total cost of a fatality or injury to society. Neither is it the total amount that society is willing to spend to save a life or to prevent an injury. Rather, the cost components and the total of these components are indicators of the significance of the motor vehicle accident problem.

The basic concept of societal loss is a decrease in individual and group welfare. Societal welfare is, in general terms, the sum total of individual well-being; and, in specific terms, it includes levels of health, production of goods and services (both qualitative and quantitative), personal satisfaction and happiness, and physical comfort. The concept goes beyond economic welfare. Precise specification of societal welfare would require determination of a consistent ordering of individual values and probably will never be specified in totality. In addition, quantification is not possible on all factors. The broad concept of societal welfare just described is embraced in this study with the recognition that all factors cannot be identified or measured.

Summary of Costs

Application of the societal cost components and totals should be considered with this conceptual basis in mind. The primary usefulness of the cost estimates is to serve as an indication of the magnitude of the problem. Though the societal cost estimates can be useful in a benefit-cost context, it should be recognized that a benefit-cost ratio or net benefit figure is only one component of a relatively substantial array of social and technological factors that must be considered in evaluating the worth of a program.

The general approach of this study is to derive cost estimates that adequately reflect certain losses to society. Some losses are to individuals as a part of society and others are to society external to the individual. The two basic criteria for identifying loss components are (1) resources consumed in the repair of damage to people and vehicles that could be shifted in the long run to welfare-producing activities and (2) the consumption losses of individuals and society at large caused by losses in production and the ability to produce.

Costs of medical care, repair costs of vehicle damage, legal and court costs, accident investigation costs, and insurance administration costs relate to the first concept of loss. The resources consumed in these activities could be shifted to raise the existing level of economic and social welfare of society were they not devoted to "cleaning up" the damage from accidents. On the other hand, losses in production relate to the accident victim's inability to produce in the market context, in home and family activities, and in community service. Losses in production are also related to the time spent by others in response to accident ramifications and in the delay caused by the accident to others on the road.

The current measurement does not identify the redistributions that occur between individuals as a result of an accident; nor does the quantification determine how much of a loss is compensated and by whom the compensation is provided, whether by the individual, by private insurance, or by government. Redistributions in the Gross National Product (GNP) occur as the result of accidents; in fact, the overall level of GNP may be increased by the occurrence of accidents. Therefore, in the context of losses in societal welfare, a GNP approach to measurement is neither valid nor relevant. Losses may be largely to the individual for some cost components, but these are losses to society as a whole because the individual is an integral part of society.

[1] *Societal Costs of Motor Vehicle Accidents: Preliminary Report*, Washington, DC, National Highway Traffic Safety Administration, Apr. 1972.

Costs are presented in section II by fatality, by injury (by severity levels), and by property-damage-only involvement (i.e., per vehicle). Injury costs are estimated for the Abbreviated Injury Scale severity classification system, which is discussed in section III. The societal cost components are presented and discussed individually in section IV of this report. The conceptual basis, the data, and the method of calculation for each component are described. The study represents a slightly improved cost data base than existed in 1971,[2] but much improvement is still needed. As improved data become available, specific component cost estimates can be adjusted. Appendix D discusses future directions in accident cost research.

Most costs were estimated for 1973, since these were the latest data for most sources at the time of analysis. These costs were updated to 1975 using a range of pertinent cost adjustment factors. These factors are presented in Appendix C.

Tables 1 and 2 present the average costs per fatality and injury by Abbreviated Injury Scale (AIS) level (see sec. III), and per vehicle for property-damage only (PDO) accidents.

[2] *Ibid.*

Table 1. Societal Costs, Summary, 1975 (Dollars)

Cost Component	Injury Severity (AIS)						
	6	5	4	3	2	1	PDO
Production/consumption:							
Market	211,820*	126,650*	55,550*	1,645	865	65	—
Home, family and community	63,545*	37,995*	16,660*	425	310	20	—
Medical:							
Hospital	275	5,750	2,250	1,095	450	45	—
Physician and other	160	5,520	2,160	525	165	55	—
Coroner-medical examiner	130	—	—	—	—	—	—
Rehabilitation	—	6,075	3,040	—	—	—	—
Funeral	925*	—	—	—	—	—	—
Legal and court	2,190	1,645	1,090	770	150	140	7
Insurance administration	295	295	285	240	220	52	30
Accident investigation	80	80	70	45	35	28	6
Losses to others	3,685	4,180	1,830	260	130	32	—
Vehicle damage	3,990	3,990	3,960	2,920	1,865	1,595	315
Traffic delay	80	60	60	160	160	160	160
Total	287,175	192,240	86,955	8,085	4,350	2,190	520

*7 percent discount rate.

Table 2. Average and Total Costs, 1975

	Fatality	Non-Fatal Injury					Average Injury	PDO Involvement
		5	4	3	2	1		
Average cost excluding vehicle damage and traffic delay, in dollars	283,105	188,190	82,935	5,005	2,325	435	1,360	45
Total	287,175	192,240	86,955	8,085	4,350	2,190	3,185	520
Number of occurrences in thousands	46.8	4	20	80	492	3,400	4,000	21,900
Total cost in billions of dollars	13.44	.77	1.74	.65	2.14	7.45	12.75	11.40

The Abbreviated Injury Scale

The Abbreviated Injury Scale (AIS) was first published in 1971 by a joint Committee of the American Medical Association, the Society of Automotive Engineers (SAE), and the American Association of Automotive Medicine (AAAM). The scale was devised in response to a research need for a consistent scale for collecting and analyzing injury severity data and, specifically, for use by multidisciplinary accident investigation teams, which were being set up by the National Highway Traffic Safety Administration. Since that time, AIS has gained acceptance in accident investigation research, and it is likely that its use will increase in the future. For these reasons it was decided that costs should be estimated for injury severity levels in the scale.

The AIS has undergone several revisions since its inception. The most recent revision of AIS[3] was done by the Subcommittee on Injury Scaling of the SAE. The scale, as it now stands, is as follows:

AIS Code	*Category*
1	Minor
2	Moderate
3	Severe (not life threatening)
4	Severe (life threatening, survival probable)
5	Critical (survival uncertain)
6	Maximum severity (currently untreatable)

For the purposes of estimating costs in this study, the AIS constitutes the end, rather than the means. In other words, the AIS is based on life-threatening criteria rather than on cost-based criteria. Some limited cost data are currently available for the AIS; some have been specifically tabulated for this study. Data for some cost components had to be fitted into the AIS levels. The resulting cost estimates are subject to error because past and current application of the AIS has not produced a large volume of direct cost information. Studies dealing with the direct measurement of costs by AIS-level injury will improve the component estimates. An entirely new, cost-based scale, having specific correlation to the AIS, may have to be developed to improve estimates of component costs.

[3] *The Abbreviated Injury Scale* (1976 revision), American Medical Association, Society of Automotive Engineers and American Association for Automotive Medicine, Joint Committee on Injury Scaling, 1976.

Societal Cost Components

The conceptual basis and the measurement of societal cost components are presented in the following sections. The basic concepts are explained in the context of the two criteria for component identification: resources devoted to accidents and production losses. Sufficient detail is presented in the calculation of each component to identify the strengths or weaknesses of the estimates.

Production Losses

Losses in present and future production resulting from the casualties of highway accidents are significant societal costs. The basic concept of production loss relates to decreases in individual and group welfare. The following scenario describes the concept better than a general discussion. When a person dies accidentally, future potential production by that individual ceases; the deceased individual no longer produces the units of production that would have been consumed by the individual and his family and by others in society. Individual and societal welfare would have been derived from that person's production. Whether the loss is largely to the individual and his immediate family or to the rest of society is inconsequential, since the well-being of each individual in society is part of total societal welfare. This is the case for persons temporarily or permanently injured as well. Measurement of the value of lost production is, in effect, only a proxy measure of these losses in societal welfare. Assigned compensation to the individual is one means to determine societal valuation of production. In this context, the quantity to be measured is average compensation in the marketplace. That an individual might be replaced by an unemployed individual is not relevant, since the quantity to be measured is the value of life activity of that individual. When a person dies prematurely or is permanently disabled, the value of life activity of that individual is lost to society.

There are two components to lost production. The first is the market or market-proxy portion, which is the measurement of the 8-hour day or 40-hour week. The second component of total production loss is those production losses in the home and community context outside the 8-hour day. (These two components of total production loss will be presented and discussed separately.)

Market and Market-Proxy Production Losses

In determining production losses due to accident fatalities and injuries, the measurement should be

general enough to be applicable to the average accident casualty. To this end, the basic approach to measurement is to quantify production losses within and outside the 40-hour workweek context. The market and market-proxy production measurements relate to production within the 40-hour week.

Many efforts have been made to measure individual productivity. The major problem in any attempt to compare or to accumulate statistics on labor services has been to find a common denominator for different industries and for different sectors of the economy. For this reason, the basic standard for measuring market production has been market compensation. Despite its inadequacies, which represent institutional rigidities and discrimination, measurement of market compensation is the most practical for the present study. There are two indirect means for estimating the value of nonmarket production: opportunity costs and market costs. In a recent study for the Social Security Administration, Wendyce Brody[4] took a market cost approach to estimate the cost of housewife production by identifying equivalent market occupations and associated hourly market wages. On the other hand, opportunity costs are the average compensations forgone in the marketplace. This approach fits the motor vehicle casualty valuation better than the market cost approach, because distinctions of labor market status or occupation are rarely made in accident data files. In addition, the opportunity cost approach is generally preferable because it does not involve the problem of being comprehensive of tasks, which is a particular problem in determining compensation in the household sector.

Once the decision is made to apply the opportunity cost principle, the appropriate value of nonmarket production must be determined. In an article discussing opportunity cost valuation in the household sector, Reuben Gronau[5] addresses the difficulty of knowing precisely what is the compensation forgone by the individual not in the labor market. In his view two assumptions can be made: "The fraction of those people who do not work are those who are the most efficient in the home sector (i.e., those who have the highest value of time)," or "those who abstain from entering the labor force are those who are least efficient in the market sector (i.e., those who face the lowest wage offers)." The first assumption would lead to a value slightly higher than the mean wage. Application of the second assumption would result in valuation of lower-than-average wages. The valuation for the present societal cost is for all nonmarket production, not just for household production. Average (mean) compensation in the marketplace is used for the following reasons: (1) of the nonmarket employed at a given point in time, some are labor market nonparticipants and others are unemployed, and (2) there exists in this group a broad range of skill levels as well as reasons for market nonparticipation, some institutional and some personal. Therefore, for long-term analysis the population mean compensation appears to be reasonable. Mean income as opposed to mean earnings was chosen for this measurement.

Use of Mean Income Versus Mean Earnings

As previously stated, the concept of loss relates to production losses that translate into consumption losses of individuals and society as a whole. Nonmarket, as well as market, losses are included for a comprehensive evaluation. Mean income figures have been used to satisfy further the criterion of comprehensiveness. Income includes earnings, as well as income from all other sources. In essence, income reflects the payoff from previous earnings. In carrying out analysis of lost future production, the return on future production should be included. For comparison purposes, Table 3[6] presents the relationship between earnings and income for 1974.

Table 3. Mean Earnings and Income, 1974 (Dollars)

Year-round, Full-time workers	Male	Female
Mean earnings	12,762	7,108
Mean income	13,364	7,411

Sex and Age Distinctions in Calculating the Average Productivity Loss

Although arguments have been advanced against distinguishing sex and age in calculating average productivity loss for fatalities and injuries, there are

[4] Wendyce H. Brody, "Economic Value of a Housewife" in *Research and Statistics Note No. 9*, Washington, DC, U.S. Department of Health, Education, and Welfare, Social Security Administration, August, 1975.

[5] Reuben Gronau, "The Measurement of Output of the Non-Market Sector: The Evaluation of Housewife's Time," *The Measurement of Economic and Social Performance*, New York, National Bureau of Economic Research, 1975.

[6] *Money Income in 1974 of Families and Persons in the United States*, Washington, DC, U.S. Department of Commerce, Bureau of the Census, Series P-60, No. 101, Jan. 1976.

three basic reasons for distinguishing sex in the current analysis. The reasons are as follows:

- The distribution of motor vehicle fatalities by sex significantly differs from the overall sex distribution of the population. Of the total number of persons killed in motor vehicle accidents in 1975, 73 percent were males.[7]
- Once an average productivity loss is calculated, that value is applied to every victim of accidents; therefore, the criterion of equity is satisfied.
- Use of male-only income as a proxy for all productivity losses could probably not be justified for the following reason: When there is a thorough mix of men and women in what are now considered as sex-defined roles and occupations, the mean income will likely emerge somewhere between the present female and male income (including, of course, a factor for increase over time). In all likelihood, the new average productivity loss will be higher than the current average. Hence, the weighted value for motor vehicle casualties, currently weighted to males, is probably a reasonable proxy value for the population for the future. Once an average value is computed, this average is applied to all victims of accidents.

The distinction for age in analyzing productivity losses is crucial for two reasons: (1) the distribution of highway fatalities and injuries differs from the overall U.S. population age distribution and (2) productivity loss analysis for child casualties begins at an age subsequent to the age of the child when the accident occurs, i.e., when the child enters the labor force.

Fatalities

The value of lost production for fatalities is strongly dependent on the age distribution. Tables 4 and 5 present the age distribution of fatalities for 1973. It should be emphasized that although the production calculations are carried through age 64 only, the derived average value for productivity loss should be applied equally to any fatality.

Criteria for production loss analysis (table 4).

- Begin production analysis at age 20; end at age 65.

[7] Fatal Accident Reporting System, Washington, DC, U.S. Department of Transportation, National Highway Traffic Safety Administration, unpublished computer run, 1975.

Table 4. Direct Future Productivity Loss for 1973 Fatalities (Market)

Age Group	Number of Fatalities	Average Direct Productivity Loss, in Dollars, Per Fatality in Age Group*
0–4	2,000	103,935
5–9	2,005	127,100
10–14	2,120	175,320
15–19	9,310	201,965
20–24	8,725	237,960
25–29	5,115	244,155
30–34	3,505	229,805
35–39	2,740	213,245
40–44	2,655	172,020
45–49	2,740	156,720
50–54	2,705	120,720
55–59	2,435	79,365
60–64	2,340	31,700
Overall average direct productivity loss per fatality		184,110

* 7% discount rates applied. For discussion of appropriate discount rates see appendix A.

- Make distinction based on sex for each age group.
- Increase 3 percent per year for productivity; discount at 7%.[8]
- Calculate mean full-time income (opportunity cost).
- Calculate for median age in age group.

Method of calculation. Mean full-time income figures were increased three percent per year for productivity increase. No adjustment was made for inflation. Fatalities in each age group were carried through each income age group to age 65[9]. The following is an example of calculations:

- Age 5–9 –Median age = 7[10]
  –Begin analysis age 20
  –Discount rate, year 13 to year 58

[8] Paul DeGarmo, *Engineering Economy* (4th ed), New York, MacMillan Company, 1967, Tables XX and XXII.

[9] Average life expectancy excluding motor vehicle deaths were investigated for discrete age and in each case fell beyond age 65.

[10] The median age for each age group was determined by a special computer run which indicated fatalities by specific age. Special unpublished computer run, Baltimore, Md., Social Security Administration Office of the Actuary, 1975.

–Beginning at 20 calculate income loss for each year based on mean income figures for each age group discount each year at 7 percent
–Separate calculations for male and female in 5–9 age group
–Total each sex and calculate weighted average

• 20–24 –Median age = 22
–Begin analysis year 1
–Discount rate, year 1 to year 42
–Calculate according to above

By these calculations, the stream of income for each age was developed. The totals for each age in the age group as shown in table 4 were then averaged into the overall average figure per fatality in 1973. The updated production loss figure for 1975 is $211,820.

Non-Fatal Injuries

The value of lost production for unfatal injuries is crucially dependent on assessments of disability and impairment for each level injury. Although estimates of activity restriction in the short term and the long term by the Abbreviated Injury Scale (AIS) system are deficient in many respects, an assessment was made for each level using the currently available sources. The following sections describe the data and the method of calculation for each AIS level.

AIS 1. Tables 6 and 7 indicate the income distribution by age and sex for AIS 1 and the calculated weighted average.

AIS 2. Tables 8 and 9 present income distribution by age and sex for AIS 2 and the calculated weighted average.

AIS 3. Tables 10 and 11 show income distribution for AIS 3 and the calculated weighted average.

Estimates of disability for market and market-proxy losses, AIS 4, 5. Information on prolonged disability from serious injuries is limited, because this kind of data can only be accumulated over an extended period of time. At best, only estimates can be made. A special study of spinal cord injuries has indicated the incidence of specific types of impairment.[11] Estimates are also available of the total number of those with motor vehicle injuries who are receiving Federal disability payment. In addition, a study for the U.S. Air Force has indicated percentages of impairment for permanent total disability and for permanent partial disability based on experience of the Air Force with ground accidents.[12] A medical assessment was also made in conjunction with the development of the Comprehensive

Table 5. Basic Data for Table 4.

	Year-Round Full-Time Mean Income, 1973* (Dollars)	
Age Group	*Male*	*Female*
20–24	7,581	5,552
25–34	11,691	7,287
35–44	14,179	7,293
45–54	14,416	7,207
55–64	13,288	7,248
	Sex Distribution of Fatalities, 1973** (Percent of Total in Age Group)	
Age Group	*Male*	*Female*
0–4	58.0	42.0
5–9	61.4	38.6
10–14	67.6	32.4
15–19	74.4	25.6
20–24	80.1	19.9
25–29	78.7	21.3
30–34	76.8	23.2
35–39	75.2	24.8
40–44	72.4	27.6
45–49	71.8	28.2
50–54	70.4	29.6
55–59	70.0	30.0
60–64	65.7	34.3

* *Money Income in 1973 of Families and Persons in the United States,* Washington, DC, U.S. Department of Commerce, Bureau of the Census, Series P-60, No. 97, Jan. 1976.

** "Motor Vehicle Deaths, 1973," *Vital Statistics of the U.S. 1973,* Rockville, Md., U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, 1975.

[11] J. F. Kraus, C. E. Franti, R. S. Riggins, D. Richards, and N. O. Burhani, Incidence of Traumatic Spinal Cord Lesions, Davis, Calif., University of California, School of Medicine, Departments of Community Health and Orthopedic Surgery, unpublished data, Oct. 1974.

[12] *Assessment of U.S. Air Force Injury and Fatality Cost Standards,* Norton AFB, Calif., Directorate of Aerospace Safety, July, 1975.

Table 6. Distribution and Average Income, AIS 1

Age	Percent of Total 20–64*	Percent of Age Group* in Dollars		Annual Average Income in Dollars**		Average, in Dollars, Male and Female
		Male	Female	Male	Female	
20–24	31.1	49.1	50.9	7,581	5,552	6,548
25–34	32.9	51.2	48.8	11,691	7,287	9,542
35–44	15.9	50.8	49.2	14,179	7,293	10,791
45–54	12.6	50.0	50.0	14,416	7,207	10,812
55–64	7.5	52.6	47.4	13,288	7,248	10,425
Weighted Average						9,036

* Restraint Systems Evaluation Program, Washington, DC, U.S. Department of Transportation, National Highway Traffic Safety Administration, special computer runs, unpublished, 1975.
** Census, *Money Income in 1973.*

Table 7. Average Work Loss Days and Value of Loss, AIS 1

AIS 1 with:	Percent of AIS 1	Average Work-Loss Days
Hospital stay	3.2*	17.1
No hospital stay with work loss	16.8**	6.5
No hospital stay without work loss	80.0***	—
Weighted average		1.6

Loss per day:

$$\frac{\text{Weighted average income}}{\text{Weighted average days in year}} = \frac{\$9{,}036}{260} = \$35 \text{ per day}$$

Value of loss (1973) = 1.6 ($35) = $56
Value of loss (1975) = 1.6 ($40) = $65

* Unpublished special computer study, Commission on Professional and Hospital Activities, Ann Arbor, Michigan, 1975.
** John Z. Delorean Corporation, "Automotive Occupant Protective Safety Expenditure/Benefit Study," For Allstate Insurance Co., Aug. 1975.
*** J. D. Flora, J. Bailey, and J. O'Day, "Financial Costs of Automobile Accidents," *HIT Lab Reports,* Vol. 5, No. 10, June 1975.

Table 8. Distribution and Average Income, AIS 2

Age	Percent of Total 20–64*	Percent of Age Group* in Dollars		Annual Average Income in Dollars**		Average, in Dollars, Male Female
		Male	Female	Male	Female	
20–24	30.6	58.4	41.6	7,581	5,552	6,737
25–34	28.8	60.3	39.7	11,691	7,287	9,943
35–44	17.9	52.0	48.0	14,179	7,293	10,874
45–54	14.0	51.3	48.7	14,416	7,207	10,905
55–64	8.7	46.6	53.4	13,288	7,248	10,062
Weighted average						9,274

* NHTSA, Restraint Systems. ** Census, *Money Income in 1973.*

Table 9. Average Work-Loss Days and Value of Loss, AIS 2

AIS 2 with	% of AIS 2*	Average Work-Loss Days
Hospital stay	27.9	37**
No hospital stay with work loss	72.1	16***
	100.0	21

Loss per day: $\frac{\$9,274}{260} = \$35.70$

Total loss (1973) = 21 (35.70) = $750

Total loss (1975) = 21 ($41) = $865

* NHTSA, Restraint Systems. ** Delorean. *** Flora, *et al.*, "Financial Costs."

Table 10. Distribution and Average Income, AIS 3

Age	Percent of Total 20–64*	Percent of Age Group* in Dollars Male	Female	Annual Average Income in Dollars** Male	Female	Average, in Dollars, Male and Female
20–24	34.9	51.0	49.0	7,581	5,552	6,587
25–34	27.4	72.5	27.5	11,691	7,287	10,502
35–44	12.3	66.7	33.3	14,179	7,293	11,886
45–54	14.4	57.1	42.9	14,416	7,207	11,323
55–64	11.0	68.8	31.2	13,288	7,248	11,404
Weighted Average						9,523

* NHTSA, Restraint Systems.

** Census, *Money Income in 1973.*

Table 11. Average Work-Loss Days and Value of Loss, AIS 3

AIS 3 with:	Percent of AIS 3*	Average work-loss days**
Hospital stay:	72.1	
Short term only	68.8	7 + 29 = 36
Long term	3.3	7 + 64 + 281 = 352
No hospital stay with work loss	27.9	10 = 10
	100.0	39

Loss per day:

$\frac{\$9,523}{260} = \$36.60$

Value of loss (1973) = 39 ($36.60) = $1427

Value of loss (1975) = 39 ($42.20) = $1645

* NHTSA, Restraint Systems. ** Flora, *et al.*, "Financial Costs."

Injury Scale (CIS) of the potential percent of physical impairment for different severity levels of injury.[13] These and other sources were synthesized to develop estimates of disability.

[13] American Medical Association, unpublished correlation between AIS and CIS.

Table 12. Permanent Impairment Index (Percent of Impairment)

AIS	20 or Less	21–40	41–60	Weighted Average*
1	X			20 or less
2	X	X		20 or less
3	X	X		20 or less
4	X	X		21–40
5		X	X	21–40

* Based on Incidence Index in the American Medical Association Comprehensive Injury Scale.

Table 13. Total Motor Vehicle Spinal Cord Injuries

Injury level	Percent	Number
Quadriplegia-paresis	28.7	1,795
Paraplegia-paresis	44.7	2,795
Other paralysis	22.4	1,400
No paralysis/ other impairment	4.2	260
Total	100.0	6,250

Development of Impairment Estimates for AIS 4 and 5. The data collected in the special study *Incidence of Traumatic Spinal Cord Lesion*[15] reveal the distribution of injuries and impairment shown in table 13.

These impairments were distributed over injuries at the AIS 3, 4 and 5 level as shown in table 14.

Table 15 presents the percent of total injuries in AIS accounted for by spinal cord injuries.

Table 14. Impairment Distribution by AIS

AIS	Quadriplegia and Paresis	Paraplegia and Paresis	Other Paralysis	No Paralysis	Total*
3	—	—	1,087	260	1,347
4	593	2,237	313	—	3,143
5	1,202	558	—	—	1,760
Total	1,795	2,795	1,400	260	6,250

* Distributed according to occurrence and incidence identified in the AMA CIS.

Table 15. Spinal Cord Injuries as Percent of Total Injuries in AIS

AIS	Total Spinal Cord	Quadriplegia	Paraplegia	Other Paralysis	No Paralysis
3	1.5	—	—	1.2	0.3
4	13.3	2.5	9.5	1.3	—
5	44.8	30.5	14.3	—	—

Comprehensive injury scale assessment. In conjunction with development of the CIS, an assessment was made by a medical team of the extent of permanent impairment for specific injuries. A comparison of the Permanent Impairment Index[14] and the AIS yields the figures in table 12:

Applying this generalized scheme, the average impairment for AIS 4 and 5 would be 20 percent and 40 percent, respectively.

The following assumptions were made on extent of impairment:

Quadriplegia = 90%
Paraplegia = 50%
Other paralysis = 25%
No paralysis = No permanent impairment

[14] The Permanent Impairment Index is a part of CIS.

[15] Kraus, *et al., Incidence.*

Applying these percentages and the Overall Permanent Index from the CIS yields the impairment figures shown in table 16.

Table 16. Estimates of Impairment Combining Paralysis and CIS Assessments

Percent of AIS Injuries		Percent of Impairment
AIS 4	AIS 5	
2.5	30.5	90
9.5	14.3	50
1.3	—	25
13.3	44.8	

For the remaining portions of AIS 4 and 5, the CIS average impairment estimates were applied (see table 17).

Table 17. CIS Average Impairment Estimates (AIS 4 and 5 Residual)

Percent of AIS Injuries		Percent of Impairment
AIS 4	AIS 5	
—	55.2	40
86.7	—	20
86.7	55.2	—

The weighted averages are 24.7% impairment for AIS 4 and 56.7% impairment for AIS 5.

Alternative assessment of impairment. A study for the Air Force by the University of California at Los Angeles, entitled *Assessment of U.S. Air Force Injury and Fatality Cost Standards,*[16] estimated disability figures of 75% (maximum allowable) for permanent total disability and 66.8% (actual) for permanent partial disability. The calculations in table 18[17] were based on this study and on the U.S. Department of Transportation *Automobile Insurance and Compensation Study.*

Table 18. Distribution of Disability for Serious Injuries (Applied to AIS 3–5)

Disability	Percent of Serious Injuries
Permanent total	0.3
Permanent partial	6.5
No permanent	93.2

Based on the distribution and the assessment of disability, the following weighted average disability figures were developed:

- AIS 4: 18.5% = 66.8% remaining years; 81.5% = 60 days average[18]
- AIS 5: 9.3% = 75.0% and 90.7% = 66.8% remaining years; average = 60.0% disability remaining years.

Calculation of market and market-proxy production losses, AIS 4 and 5. Based on the previous discussion and on calculated disability, the estimated production losses for AIS 4 and 5 appear in tables 19[19] and 20.

Table 19. Stream of Future Income, AIS 4 and 5

Age	Average Future Income for Each Age in Age Group*
0–5	$150,135
6–14	152,855
15–19	195,850
20–24	226,115
25–44	200,620
45–64	140,050
Weighted average**	$193,120

*Figures are for 100% of future income; see adjustments for impairment.

**Weighted average, weighted from distribution by age in a sample from the Commission on Professional and Hospital Activities.

Home, Family, and Community Services Production Losses

The production losses outside the 40-hour workweek related to home, family, and community services are significant and are amenable to measurement on application of the opportunity cost principle. The opportunity cost concept is applied to these losses for the following reasons:

- To maintain consistency with the market and market-proxy production analysis

[16] Directorate of Airspace Safety, *Assessment.*

[17] "Economic Consequences of Automobile Accident Injuries," *Automobile Insurance and Compensation Study,* vol. 1, Washington, DC, U.S. Department of Transportation, 1970.

[18] Derived from excluding 18.5% permanent partial from Delorean estimate of total disability days including those with the probability of permanent disability.

[19] Census, *Money Income in 1973;* Restraint Systems.

Table 20. Estimated Value of Future Production Loss, AIS 4 and 5

AIS 4*	
Percent of AIS 4 Injuries	Percent of Impairment
2.5	90
9.5	50
1.3	25
86.7	20
100.0	25**
AIS4, Average value of production loss from disability:	
1973	$48,280
1975	$55,550
AIS 5	
Percent of AIS 5 Injuries	Percent of Impairment
30.5	90
14.3	50
55.2	40
100.0	57**
AIS 5, Average value of production loss from disability:	
1973	$110,080
1975	$126,650

* See disability discussion.
**Weighted average.

- To determine a proxy value that best reflects the value of production

Specifically, on the second point, there is no other reasonable alternative. To determine a value on the basis of replacement cost leaves one to determine whether or not the person would be replaced in a given function. Because many home or volunteer services might not be replaced, opportunity cost is a more direct measurement of the individual's production than replacement cost.

The average home, family, and community production losses for fatalities and injuries were determined on the basis of time devoted to the identified functions. The production time devoted to home and community was estimated, and the resulting percent of the 40-hour week was applied to the average dollar loss for market losses for each severity level. The lost production time was calculated and applied to the average dollar loss for proxy-market losses for each severity level. The average production was determined to be 10 hours per week for home and family sector production and 2 hours per week for volunteer activity. The combined total is 30% of the 40-hour week. This percent was applied to fatalities and injuries; the results appear in table 21.

Table 21. Home, Family, and Community Production Losses, 1975

AIS Level	No Discount Rate	7% Discount Rate in Dollars
6*	—	63,355
5	—	37,995
4	—	16,660
3	425	—
2	310	—
1	20	—

*Fatality.

The following two sections describe the derivation of these production losses.

Home and Family Sector Losses

These loss components include the following service production functions: home maintenance, household tasks, training, teaching, and counseling children, and many other functions. These productive services are lost if a fatality occurs and are diminished in proportion to disability and activity restrictions for injuries. The method of calculation is to estimate a percent of market production for these tasks and to apply the percentage to the previously determined opportunity-cost measurement of the workweek loss for fatalities and injuries.

As indicated in the introductory discussion of market and nonmarket production losses, the research on the value of home production has centered on the value of housewife production. The desired quantity for the present purposes is the value of production done outside the 8-hour workday by both men and women.

The following calculations were made in the derivation of an average value:

Estimates of the value of household production:[20]

	Percent of GNP
Morgan—Sirageldin	38
Nordhaus—Tobin	48
Gauger	26
Average Value	36

Calculation of Household Production:

(a) 1973 Gross National Product (GNP) = $1,289.1 billion

(b) Average value household production 1973 = (0.36) ($1,289.1 billion) = $464.1 billion

(c) Total male income recipients 1973 20 years or older = 63.8 million[21]

(d) Average income, male income recipients 20 years or older = $10,215[22]

(e) Total income (c) × (d) = $651.78 billion

(f) Percent of household work contributed by male = 33%[23]

(g) Value of male household contribution (f) × (b) = 0.33 ($464.10 billion) = $153.15 billion

(h) Percent household production of total income (g)/(e) = $153.15/651.78 = 23.5%

The derived value of 23.5% is for males, but would apply to both men and women for non-8-hour-day home production losses. This figure does not include certain tasks relating to child raising such as teaching and counseling. Including these in the concept of total loss, the figure of 25% appears to be a reasonable approximation of value.

Volunteer Production

Volunteerism is an increasing phenomenon in U.S. production. The Center for a Volunteer Society has estimated that in 1974 the volunteer contribution to GNP was $50 billion. The National Center for Voluntary Action estimates that from 50 million to 60 million persons belong to volunteer groups. [24] (Five percent of the members are active at any one time.) Many kinds of community services are provided by these groups: rehabilitation work (exconvicts, drug-users), help for the elderly and sick, advising children's groups (Scouts, Big Brothers), counseling, and religious activities. Corporations are encouraging volunteer action for their employees.

The component of volunteer production in this report is considered as that time spent outside the 40-hour workweek. Volunteer production for the 40-hour week has been measured in the opportunity cost measurement of market production.

The following calculations were made to derive the value of volunteer production:

(a) Contribution to GNP from volunteer production (1973) = $50 billion[25]

(b) Resident population, 20 years and older (1973) = 133.569 million[26]

(c) Average share per capita (a)/(b) = $374

(d) Average hourly earnings (1973) = $3.92[27]

(e) Average hours per year (c)/(d) = 95

(f) Average hours per week = 95/52 = 1.83

(g) Percent of weekly work hours = 1.83/40 = 4.6%

Medical Care Costs

Overview

Billions of dollars are spent and large amounts of manpower resources are devoted to the Nation's personal health care. Of the total $96.8 billion spent on personal health care in 1974, $43.5 billion (45%) was for hospital costs, $20.7 billion (21%) was for physician costs, and $32.6 billion (34%) was for all other drugs and services.[28] An estimated $59.6 billion (62%) of the total $96.8 billion was paid by private sources and $37.2 billion (38%) was paid out of public funds.[29] For measurement of medical costs of motor vehicle fatalities and injuries, no attempt has been made to identify the source of payment. These total personal health care expenditure statistics are presented to give a general overview and point of comparison for the medical costs calculated for this study.

Medical treatment resulting from injuries and fatalities in motor vehicle accidents consume medical resources that could be shifted in the long run to preventing and curing diseases. Medical costs are a

[20] Gronau, "Measurement of Output."

[21] Census, *Money Income in 1973.*

[22] Ibid.

[23] K. E. Walker and W. Gauger, "The Dollar Value of Household Work," Information Bulletin 60, *Consumer Economics and Public Policy,* No. 5, Ithaca, N.Y., 1973.

[24] "Helping People—An American Custom on the Rise," *U.S. News and World Report,* Sept. 2, 1974, pp. 29–32.

[25] Ibid.

[26] *Statistical Abstract of the U.S., 1975,* Washington, DC, Department of Commerce, Bureau of the Census, July 1975.

[27] Ibid.

[28] M. S. Mueller and R. M. Gibson, "National Health Expenditures, Calendar Year 1974," *Research and Statistics Note,* No. 5, Washington, DC, Social Security Administration, Apr. 1976 (Preliminary figures).

[29] Ibid.

measure of consumed medical resources. The following components of total medical costs can be identified: medical treatment at the scene, transportation and treatment enroute to medical facility, emergency room treatment, hospitalization, rehabilitation, long-term medical care at home or in extended-care facilities. Any or all of the above resources could be utilized, depending on the seriousness of the injury.

It should be pointed out that even though there is a strong correlation between the AIS and the medical resources devoted to the victim, a person may be seriously injured and may or may not have long-term medical side effects. Certain types of injuries will consume greater amounts of medical resources than others. Long-term medical ramifications are more difficult to determine than immediate effects from injuries, because many years may be required to determine the ultimate consequences of a particular type of injury. The same kind of information could be determined through a recall survey. To date, this kind of data collection effort has not been made.

Non-Fatal Injuries

Incidence of Treatment

Since there is at present no ongoing data system that tracks motor vehicle injuries and their consequences, it is necessary to estimate medical costs from available sources. The Restraint System Evaluation Program (RSEP) has grouped data on 16,000 vehicle occupants in 1973–75 model vehicles according to various factors. Table 22[30] shows the treatment distribution derived from these data.

The combined data yield the following percent distribution:

Total non-fatal injuries	100.0
Received no treatment or first aid only	28.0
Seen by physician (includes emergency room (ER) treatment)	58.3
Required hospital stay	9.0
Unknown	4.7

The data above and in table 22 are complete in terms of identifying the medical treatment of injuries. The major problem in the data is that their coverage is only of late model vehicles in tow-away accidents. By contrast, data from the Department of Health, Education, and Welfare (HEW)[31] on all moving vehicle injuries are given in table 23.

Table 24 shows the distribution by AIS and treatment from the RSEP file.[32]

Treatment distributions are valid within the given AIS level. This type of information is needed to isolate costs by incidence of treatment. From the data in table 22 the cost factors in table 25 were identified.

Table 22. Distribution of Occupants and Injuries by Type of Medical Treatment

Injury Level or Treatment Type	Percent of Total Occupants	Percent of Total Non-Fatal Injuries
Not injured	48.2	—
No treatment	10.3	20.2
First Aid at scene	1.2	2.4
Consultation with doctor advised	3.0	5.4
Consultation with doctor	7.1	15.2
Emergency room treatment	20.4	43.1
Admission to hospital and release	4.3	9.0
Fatal	.5	—
Unknown	4.9	4.7
Total	99.9	100.0

Emergency Care Costs

Table 24 indicates the percentage of each AIS level with emergency care costs. Injuries in each group with such costs include those who were transported, those who were treated in the emergency room and released, and those who were admitted to the hospital. A data survey done in conjunction with *The Statewide Highway Safety Program Assessment*[33] indicated an average emergency transportation cost of $30 in 1973. Data on emergency hospital care are not collected on an ongoing basis. A special study of Blue Cross records done in conjunction with the RSEP has tabulated outpatient and inpatient costs by specific hospital codes.[34] These sources were used to derive average emergency transportation and care costs, as shown in table 26.

[30] NHTSA Restraint Systems.

[31] National Health Survey, 1973, Rockville, Md., U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, unpublished data, 1975.

[32] NHTSA, Restraint Systems.

[33] *The Statewide Highway Safety Program Assessment, A National Estimate of Performance,* Washington, DC, U.S. Department of Transportation, National Highway Traffic Safety Administration, July 1975.

[34] Survey of Blue Cross Insurance Company, unpublished data, 1975.

Table 23. Moving Motor Vehicle Injuries Data

HEW	Number in Thousands	Percent
Total injuries, 1973	3,927	100.0
Injuries seen by physician	3,467	88.3
Injuries requiring hospital stay	561	14.3

patients.[35] The sample of 23,000 patients used for the present study were those patients identified by a motor vehicle code within the Professional Activity Study (PAS) 7th Patient Sample. The data are for calendar year 1973. The following basic distribution derived appears in tables 27 and 28.

The AIS categories were created from the basic data file using a cross-classification of hospital codes

Table 24. Percent Distribution by Type of Treatment for Non-Fatal Injuries

Treatment Categories (Mutually Exclusive)	AIS Level				
	1*	2*	3*	4**	5**
Received no treatment	26.8	1.7	0.6	—	—
Received first aid at scene	3.1	0.2	—	—	—
Directed to consult doctor	7.1	0.6	—	—	—
Consulted doctor only	19.0	7.1	3.6	—	—
Received emergency room treatment and released	40.7	62.5	23.7	—	—
Admitted to hospital	3.2	27.9	72.1	100.0	100.0
Total	100.0	100.0	100.0	100.0	100.0

*File data adjusted for unknown.
**File data adjusted for miscoding.

Table 25. Cost Factors, Percent of RSEP Non-Fatal Injuries

Treatment Type	Cost Type			
	Ambulance	Physician Care	ER Care	Hospital Care
Consulted doctor	—	15.2	—	—
Received emergency room treatment and released	43.1	43.1	43.1	—
Admitted to hospital	9.0	9.0	9.0	9.0
Percent of total injured with applicable cost	52.1	67.3	52.1	9.0

Short-Term Hospital Costs

The Commission on Professional and Hospital Activity (CPHA) in Ann Arbor, Michigan, maintains records on 16 million patients in 2,000 short-term general hospitals (defined as less than thirty days' stay). A special study was conducted using the CPHA 7th Patient Sample (United States only) to identify average stays and other characteristics of (International Classification of Diseases, Adapted) and the AIS formulated by a medical team at Johns Hopkins University for a special study in 1973.[36]

The cost data on average daily charges for 1973 were obtained from published HEW data. The average charge per day in 1973 was $109.[37] The first two days of a hospital stay are the costliest, since it is on these days that intensive treatment, tests, operations, and x-rays occur. In subsequent days, maintenance costs become a larger share of total cost. Average short-term hospital costs were estimated as shown in table 29.

[35] Commission on Professional and Hospital Activities.

[36] Additional data on total patients and average stay were obtained from the special study on AIS classification based on patient age and vehicle source of injury and on age, sex, and vehicle source of injury, via the PAS sample, but are not presented in this study.

[37] Health Insurance Institute.

Table 26. Emergency Care Cost by AIS Level

AIS	Cost in Dollars for Those Receiving: Transportation* 1973	Transportation* 1975	ER Care** 1973	ER Care** 1975	Percent Receiving Transportation and ER Care***	Average Cost in Dollars per AIS Injury 1975: Transportation	Average Cost in Dollars per AIS Injury 1975: ER Care
1	30	38	40	50	43.9	15	20
2	30	38	50	60	90.4	35	55
3	30	38	60	75	95.8	35	70
4	30	38	115	145	100.0	40	145
5	30	38	150	190	100.0	40	190

*NHTSA, Statewide Highway Safety.
** Blue Cross Insurance Company.
***NHTSA, Restraint Systems. Washington, DC, U.S. Department of Transportation.

Table 27. Distribution of Professional Activity Study (PAS) Sample Patients

Patient classification	Number	Percent of Total	Average Stay (Days)
Total patients	23,168	100.0	10.0
Discharged alive	21,704	93.7	9.6
Transferred	963	4.2	19.5
Died	501	2.2	9.1

Long-Term Hospital Costs

In addition to short-term hospital costs, to which the data from the CPHA sample relate, certain very serious injuries result in longer term hospitalization or care. The percentages for those patients transferred were examined to determine the applicable percentage of injuries experiencing these costs. Table 30 presents this distribution.

Table 28. Percent Distribution, Average Hospital Stay, and Discharge Status by AIS Level

Patient Classification	Percent of Total	Average Stay (Days)	Percent Discharged Alive	Percent Transferred
Total, discharged alive and transferred	100.0	10.0	95.8	4.2
AIS 1	14.4	5.7	98.2	1.8
AIS 2	41.5	10.4	96.2	3.8
AIS 3	38.6	10.4	95.5	4.5
AIS 4	3.1	14.0	92.8	7.2
AIS 5	2.4	21.6	81.7	18.3

Table 29. Average Short-Term Hospital Costs, Non-Fatal Injuries

AIS	Average Cost in Dollars for Injuries Hospitalized	Percent Hospitalized	Average Cost in Dollars per AIS Injury: 1973	Average Cost in Dollars per AIS Injury: 1975*
1	620	3.2	20	25
2	1,135	27.9	317	395
3	1,135	72.1	820	1,025
4	1,525	100.0	1,525	1,910
5	2,355	100.0	2,355	2,950

*See appendix C.

Table 30. Percent of Injuries Resulting in Long-Term Care or Transfer

AIS	Percent Hospitalized*	Percent Transferred**	Percent of Total Injuries Transferred
1	3.2	1.8	0.1
2	27.9	3.8	1.1
3	72.1	4.5	3.2
4	100.0	7.2	7.2
5	100.0	18.3	18.3

*See table 24.
**See table 28.

Table 31. Long-Term Care Costs, AIS 4 and 5

Item	AIS 4	AIS 5
Long-term hospital:		
Average stay* (days)	46	68
Average cost per day*	$ 47	$ 47
Percent transferred	7.2	18.3
Cost, 1973	$155	$585
Cost, 1975	$195	$730
Nursing home:		
Average monthly/yearly charge 1973**	—	$510/$6,120
1975	—	$640/$7,680
Average stay (years)	—	2.63
Percent injuries	—	9.3
Average cost per injury	—	$1,880

*American Hospital Association.
**National Nursing Home Survey, 1973-1974, Rockville, Md., U.S. Department of Health, Education, and Welfare, Division of Health Resource Utilization Statistics, National Center for Health Statistics, unpublished tables.

Table 32. Cost Incidence for Physician Costs, Percent of Total Injuries by Severity

AIS	Physician in Hospital	Physician Outside Hospital (Only)	Total
1	3.2	59.7	62.9
2	27.9	69.6	97.5
3	72.1	27.3	99.4
4	100.0	—	100.0
5	100.0	—	100.0

Data from the American Hospital Association and the 1973–74 National Nursing Home Survey were used to estimate long-term care costs. A determination was made not to estimate long-term care costs for AIS 2 and 3.

Table 31 identifies the estimate costs for AIS 4 and 5.

Physician Costs

As with hospital costs the average cost per injury in a given severity level depends on the incidence of treatment. The figures in table 32 relate to the incidence of physician costs.[38]

Unit costs for physicians are shown in table 33.

Average costs combining these two data sets appear in table 34.

Rehabilitation Costs

The resources associated with rehabilitating seri-

[38] See table 24.

Table 33. Physician Cost, In and Outside Hospital (Dollars)

AIS	Physician in Hospital		Physician Outside Hospital	
	1973	1975	1973	1975
1	100	125	50	60
2	200	245	75	90
3	500	610	150	185
Total physician, 1975:				
4		2,120		
5		5,480		

Table 34. Average Physician Costs, Non-Fatal Injuries, 1975* (Dollars)

AIS	Average Cost
1	40
2	130
3	490
4	2,160
5	5,520

*See tables 32 and 33.

Table 35. Estimated Rehabilitation Costs, AIS 4 and 5

AIS	1973	1975
4	$2,550	$3,040
5	$5,100	$6,075

ous motor vehicle injuries could be shifted in the long run to respond to physical problems from disease or to general health care. Rehabilitation costs were estimated only for AIS 4 and 5, as shown in table 35.[39]

[39] Based on estimates from the Rehabilitation Institute of Chicago.

[40] Fatal Accident Report System (FARS), Washington, DC, U.S. Department of Transportation, National Highway Traffic Safety Administration, unpublished computer runs, 1976.

[41] NHTSA, *Statewide Highway Safety.*

Summary of Medical Costs, Nonfatal Injuries

Table 36 displays medical costs for each AIS level nonfatal injury.

Fatalities

The medical resources devoted to accident casualties who die are related to the time and place of the fatality occurrence. Emergency transportation costs apply to all fatalities, whether they are taken to a hospital and or to a mortuary. Emergency room and hospital care costs apply only to a portion of fatalities. Table 37 presents the distribution of place of death for fatalities in 1973.[40]

Unit costs for care are as follows:

Emergency transportation	$30 per run[41]
Emergency room treatment	$150[42]
Hospital care	$990[43]
Physician care	$315[44]

Table 36. Cumulative Medical Costs, Non-Fatal Injuries, 1975 (Dollars)

AIS	Hospital	Physician	Rehabilitation	Other
1	45	40	—	15
2	450	130	—	35
3	1,095	490	—	35
4	2,250	2,120	3,040	40
5	5,750	5,480	6,075	40

Combining these percentages and costs yields the following average costs:

Emergency Transportation:

30% = 1 run
70% = 2 runs
(to hospital, to mortuary)

0.30 ($30) + 0.70 ($60) = $50

[42] NHTSA, Restraint Systems.

[43] Commission on Professional and Hospital Activities.

[44] Derived from information in Delorean, *Automotive Occupant.*

Table 37. Fatalities by Place of Death (Percent)

Place of Death	Vehicle Occupants	All Others	Total in File
At scene	56.2	43.8	53.1
En route	5.7	6.4	5.8
Before admission (ER)	33.2	41.2	35.2
After admission	5.0	8.6	5.9
Total	100.0	100.0	100.0

Emergency Room Treatment:
23.1 + 5.8 + 35.2 + 5.9 = 70%
0.70 ($150) = $105

Hospital and Physician Care:
Hospital 0.059 ($990) = $ 60
Physician 0.411 ($315) = $130
(Includes those dying in emergency room (35.2%) and after admission (5.9%))

The totals are:
Hospital $60 + $105 = $165 (hospital + emergency room)
Physician and other (emergency transportation) $130 + $50 = $180
Total = $345

Coroner-Medical Examiner

Coroner-Medical-Examiner costs from a study on the indirect costs of accidents[45] were $85 in 1969. Price adjustments of 1973 and 1975 yield an average cost of $110 and $130 per fatality, respectively. This cost applies to 100% of fatalities.

Funeral Costs

The measurement of funeral costs is the difference between the present value of average funeral costs that would occur in a future year and the average funeral cost in the current year. Even though funeral costs are experienced ultimately, future money is worth less than present money, and funeral costs experienced in the current year are relatively higher for that reason. The following identifies the calculated funeral costs:

Average funeral cost 1973 = $990 (range $500–$1800)[46]
Consumer Price Index (CPT) update 1973–75 = 13.5%[47]
Average funeral cost 1975 = $1,125

Median age of fatality:[48]	Male	26 years
	Female	32 years
Remaining years of life expectancy:[49]	Male	44.5
	Female	45.5
Percent distribution of fatalities:[50]	Male	73.5
	Female	26.5

Weighted average remaining years 44.5 (0.735) + 45.5 (0.265) = 45
Productivity price increase 3% per year = $1,125 (3.7816) = $4,255
Discounted (7% present worth factor) = $4,255 (0.0376) = $200
Net difference 1975, future cost = $1,125 − 200 = $925

Losses to Others

Costs associated with losses to others include employer losses (temporary or permanent replacement costs), time spent visiting patients, transportation for medical attention, home care, and time spent in vehicle repair and replacement. The basic concept for loss measurement is the opportunity cost of time spent by others in these activities.

[45] H. Wuerdemann and H. Joksch, *National Indirect Costs of Motor Vehicle Accidents,* Center for the Environment and Man, Report 4114-494-B, June 1973.

[46] *Federal Trade Commission Survey of Funeral Prices in the District of Columbia,* Washington, DC, Federal Trade Commission, Bureau of Consumer Protection, Division of Special Projects, 1974.

[47] "Consumer Price Index-U.S. Average," table 25, *Monthly Labor Review,* U.S. Department of Labor, Bureau of Labor Statistics.

[48] "Motor Vehicle Deaths, 1973," *Vital Statistics of the U.S., 1973,* Rockville, Md., U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, 1975.

[49] Social Security Administration, Office of the Actuary, unpublished computer runs on life expectancy.

[50] NHTSA, Fatal Accident, 1976.

Estimates of losses (table 38) to others in the 1972 Societal Cost study[51] were used to derive the present estimates according to the following method:

AIS 1, 50% of market production loss
AIS 2, 1971 cost updated to 1973 for nonpermanent disability injury
AIS 3, AIS 2 proportion—losses to others to market production loss
AIS 4 and 5, 1971 proportion of market production loss, for permanent partial impairment injuries
Fatality, 1971 fatality proportion of market production loss

Legal and Court Costs

The concept of loss applicable to legal and court costs is that of resource consumption in response to accident consequences; the resources consumed are legal and judicial. There are two elements of cost: tort actions and accident citation costs. Within each of these are private (legal) and public (legal and court) costs. Since the limited amount of data on these costs has never been collected on the basis of the AIS injury classification system, it was necessary to estimate AIS legal and court costs. As with certain other categories of loss, legal and court costs are not applicable to all fatalities and injuries. In per-applicable-case terms, these costs are higher than when averaged over all fatalities or injuries in a given injury level.

Table 38. Losses to Others, Cost per Injury (Dollars)

Injury Level	1973	1975
AIS 1	28	30
AIS 2	115	130
AIS 3	225	260
AIS 4	1,595	1,830
AIS 5	3,630	4,180
Fatality	3,200	3,685

Tort Action Costs

Legal and court costs associated with legal actions for damages are not experienced in all cases of fatality or nonfatal injury. Therefore, the incidence of these costs must be considered as well as the unit costs involved. The following text and tables 39 through 45[52] indicate the calculation of legal and court costs of tort actions.

Court Costs:

Cost per case tried 1968
(average of Federal, State and Local)
= $4,675[53]
Government wage index 1968–75
= 57.7%[54]
1975 Cost
= $7,370

Defendant Cost:

1968, $820 per case plus $250 expenses[55]
Consumer price increase in legal services 1968–75
71%
1975 Cost = $1,400 + $430 = $1,830[56]

Accident Citation Costs

The second component of legal and court costs are the costs associated with traffic citations issued

Table 39. Percent of Total Injuries in Severity Class by Legal Action*

Injury Level	Retained Counsel	Filed/Terminated Lawsuits	
		Total	Suits Tried in Court
Fatality	26.5	19.5	2.5
AIS 5	26.5	19.5	2.5
AIS 4	26.5	19.5	2.5
AIS 3	19.2	14.1	1.8
AIS 2	4.8	3.4	.4
AIS 1	4.8	3.4	.4

*Adjusted from percentages of one-vehicle accidents.

[51] NHTSA, *Societal Costs.*
[52] DOT, "Economic Consequences."
[53] "Automobile Accident Litigation," *Automobile Insurance and Compensation Study,* Washington, DC, U.S. Department of Transportation, 1968.
[54] Census, *Statistical Abstract.*
**Ibid.*
[55] DOT, "Accident Litigation."
[56] BLS, "Consumer Price Index."

Table 40. Average Tort Court Cost by Injury Severity

Category	Applicable Percentage	Court Costs in Dollars, 1975	Average Cost per Injury in Dollars
Fatality	2.5	7,370	185
AIS 5	2.5	—	185
AIS 4	2.5	—	185
AIS 3	1.8	—	135
AIS 2	.4	—	30
AIS 1	.4	—	30

Table 41. Percent Injured Retaining Counsel by Action Taken*

	No Suit Filed	Suit Filed and Terminated	Total
Fatality	7.0	19.5	26.5
AIS 5	7.0	19.5	26.5
AIS 4	7.0	19.5	26.5
AIS 3	5.1	14.1	19.2
AIS 2	1.4	3.4	4.8
AIS 1	1.4	3.4	4.8

*See table 39.

Table 42. Plaintiff Costs as Percent of Estimated Recovery

Injury Level	Estimate Recovery in Dollars*	Percent Legal of Recovery*	Plaintiff Cost Per Suit Filed in Dollars
Fatality	30,940	26	8,045
AIS 5	20,225	26	5,260
AIS 4	9,240	26	2,400
AIS 3	7,445	32	2,380
AIS 2	4,275	25	1,080
AIS 1	2,800	27	750

*Percentage of loss from DOT, "Economic Consequences," applies to estimate of tort-coverable loss from present study.

Table 43. Plaintiff Legal Costs

Injury Level	No Suit Filed	Suit Filed and Terminated	Total in Dollars
Fatality	.070 ($430) = $30	0.195 ($8,045) = $1,570	1,600
AIS 5	.070 ($430) = $30	0.195 ($5,260) = $1,025	1,055
AIS 4	.070 ($430) = $30	0.195 ($2,400) = $470	500
AIS 3	.051 ($430) = $20	0.141 ($2,380) = $335	355
AIS 2	.014 ($430) = $6	0.034 ($1,080) = $35	40
AIS 1	.014 ($430) = $6	0.034 ($750) = $25	30

in accidents. Administrative adjudication of traffic offenses will undoubtedly reduce these costs in the future. The recently completed phase of the *Statewide Highway Safety Program Assessment*[57] estimated the following data for 1973:

Total citations, 36.1 million
Serious citations, 9.0 million
Accident citations, 4.9 million

[57] NHTSA, "Statewide Highway."

Table 44. Defendant Legal Costs

Injury Level	Suit Filed and Terminated	Total in Dollars
Fatality	0.195 ($1,830)	355
AIS 5	0.195 ($1,830)	355
AIS 4	0.195 ($1,830)	355
AIS 3	0.141 ($1,830)	260
AIS 2	0.034 ($1,830)	60
AIS 1	0.034 ($1,830)	60

Table 45. Average Tort Action Legal and Court Costs, 1975, Summary (Dollars)

Category	Court	Legal	Total
Fatality	185	1,955	2,140
AIS 5	185	1,410	1,595
AIS 4	185	855	1,040
AIS 3	135	615	750
AIS 2	30	100	130
AIS 1	30	90	120

A comparison of this total with the total number of accidents in 1973[58] reveals that 29.5% of the total of accidents involved citations.

Accident citation costs are composed of court and prosecution costs.

The following are the calculated costs for these components by injury severity:

Prosecution costs, AIS 4, 5, and 6:

Average cost per case (high estimate), 1969[59] = $100
Average cost, 1973[60] = $125
Percent of accidents with citations[61] = 24.8%
Average cost per accident = $30 (1973)
Average cost per accident = $35 (1975)
Average cost per fatality = $35 (0.862) = $30 AIS 4 and 5[62]

Court costs, AIS 4, 5, and 6:

Average cost, 1973 = $85
Percent of accidents with citation = 24.8%
Average cost per accident = $20 (1973)
= $25 (1975)
Average cost per fatality, AIS 4 and 5 injury $25 (0.862) = $20

Prosecution costs, AIS 1, 2, and 3:

Percent of accidents with accident citations[63] = 26.8%
Average cost per case[64] = $45 (1969)
= $55 (1973)
Average cost per accident (0.268) ($55) = $15 (1973)
= $17 (1975)
Average cost per injury (0.65) ($17) = $10 (1975)

Court costs, AIS 1, 2, and 3:

Percent of accidents with accident citations = 26.8%
Average cost per case[65] = $30 (1969)
= $40 (1973)
Average cost per accident (0.268) ($40) = $10 (1973)
= $11 (1975)

[58] *Accident Facts, 1974,* National Safety Council.
[59] Wuerdemann and Joksch, *Indirect Costs.*
[60] Updated using State and Local Wage Index, Census, *Statistical Abstract.*
[61] Estimated for each level injury using NHTSA, "Statewide Highway," and *Accidents Facts, 1974.*
[62] Per injury adjustment from cost per accident.
[63] NHTSA, "Statewide Highway," NSC, *Accident Facts.*
[64] Wurdemann and Joksch, *Indirect Costs.*
[65] Ibid.

Average cost per injury (0.65) ($11) = $ 7 (1975)

Prosecution costs: property damage only (PDO) involvements

Percent of accidents with accident citations [66] = 29.8%

Average cost per case [67] = $15 (1969)
case [67] $20 (1973)

Average cost per accident (0.298) ($20)
= $ 6 (1973)
= $ 7 (1975)

Average cost per vehicle (0.593) ($7)
= $ 4 (1975)

Court costs: PDO involvements

Percent of accidents with accident citations = 29.8%

Average cost per case [68]
= $10 (1969)
= $12 (1973)

Average cost per accident (0.298) ($12)
= $ 4 (1973)
= $ 5 (1975)

Average cost per vehicle (0.593) ($5)
= $ 3 (1975)

Summary, Legal and Court Costs

Table 46 summarizes legal and court costs resulting from accidents.

Table 46. Average Legal and Court Costs per Injury in Severity Class, 1975

Category	Tort Action	Accident Citation	Total
Fatality	$2,140	$50	$2,190
AIS 5	1,595	50	1,645
AIS 4	1,040	50	1,090
AIS 3	750	20	770
AIS 2	130	20	150
AIS 1	120	20	140
PDO		7	7

[66] NHTSA, "Statewide Highway," NSC, *Accident Facts.*
[67] Wuerdemann and Joksch, *Indirect Costs.*
[68] Ibid.
[69] Ibid.

Insurance Administration Costs

The costs of insurance overhead represent resources devoted to accidents that could be saved with the reduction of accidents. A study of indirect costs of motor vehicle accidents conducted by the Center for the Environment and Man (CEM) [69] was the basis for the cost estimates of severity. Table 47 indicates the average loss adjustment costs from this source:

Table 47. Average Insurance Loss Adjustment Costs

Type of Adjustment	Cost per claim (1969)	Update 1973*
Bodily injury liability	$300–340	$370–420
Property damage liability	40–42	50–52
Collision	40–50	50–60

*Consumer Price Index (CPI) Auto Insurance Premiums, see appendix C.

Since these costs are not based on the severity basis being used in this report, the distribution was estimated in table 48.[70]

The distribution for fatal accidents was assumed to apply to fatalities and AIS 4 and 5 injuries. The costs for these two severities are therefore:

Fatalities and AIS 5 = 0.622 ($420) + 0.378 ($60) = $285

AIS 4 = 0.622 ($410) + 0.378 ($55) = $275

The distribution of costs for AIS 2 and 3 is as follows:

AIS 3 = $405 + $55 = $460/2 = $230

AIS 2 = $370 + $50 = $420/2 = $210

The AIS 1 cost is assumed to be equal to property damage involvement for the liability portion and to the low estimate of costs for collision.

(0.80) ($50) + 0.20 ($50) = $50

Insurance administration costs for PDO involvement will be less than cost per claim, since a portion of PDO accidents are not submitted to claim. (See table 49.)

0.813 ($50) + 0.187 ($50) = $50

0.60[71] ($50) = $30 = average cost per PDO involvement

[70] NSC, *Accident Facts.*
[71] Based on Ford estimate that 39.5% of PDO involvement accidents do not repair damage.

Table 48. Distribution of Accidents by Type of Collision, 1973

	Fatalities	Injuries	PDO Accidents
Pedestrian and two motor vehicles	62.2%	80.0%	81.3%
Other collision and noncollision	37.8	20.0	18.7

Table 49. Insurance Administration Costs, 1975 (Dollars)

Severity Level	Average Cost
PDO	30
AIS 1	50
AIS 2	220
AIS 3	240
AIS 4	285
AIS 5	295
AIS 6	295

Accident Investigation Costs

Accident investigation costs apply to all injuries, accidents, and a significant portion of all PDO accidents. The amount of resources devoted to the investigation is variable according to the severity of the accident. The basic source for estimating accident investigation costs was the study by CEM on indirect costs of accidents.[72] The basic data and calculations are shown in tables 50 and 51.

Table 50. Basic Data, Accident Investigation Costs (Dollars)

Item	Fatality	Injury	Property Damage
Average cost per crash, 1969	65	30	7
Average cost per fatality, injury, and PDO Involvement, 1969*	55	20	4
Average cost per fatality, injury, and PDO Involvement, 1973	70	30	5

**Factor adjustment: 1969–73 State and local wage index (Statistical Abstract of the U.S., 1975), 1973/1969 = 1.2835.

*Adjusted according to *Accident Facts, 1970,* National Safety Council.

[72] Wuerdemann and Joksch, *Indirect Costs.*

Table 51. Average Accident Investigation Costs by Severity in Dollars

Severity Level	1973	1975*
Fatality	70	80
AIS 5	70	80
AIS 4	60	70
AIS 3	40	45
AIS 2	30	35
AIS 1	25	28
PDO	5	6

*See appendix C.

Vehicle Damage Costs

Vehicle damage is a component of the societal costs of accidents that both is generally accepted as a direct cost and is subject to direct measurement. The cost of repairing vehicle damage amounts to a significant portion of total cost for low-severity accidents. The resources devoted to repairing vehicles can be shifted in the long run to increasing the existing levels of safety and maintenance in vehicles on the road, i.e., welfare-producing activities versus the present damage attenuation.

Efforts to collect vehicle crash damage data have increased in recent years in response to the rising cost of repair and, particularly, to the issuance of bumper standards for vehicle protection in low-speed impacts. Unfortunately, there is no data collection system that systematically collects data covering the entire spectrum of automobile collisions. There are many data collection systems in operation, most of which can provide information on a limited segment of accidents only.

At the present time, one of the most comprehensive accident-reporting systems for all levels of accidents for current model year vehicles is that operated by the Highway Loss Data Institute (HLDI) since 1972.[73] This system has collected data from seven of the largest auto insurance companies concerning policy coverage and accidents. The data are then com-

[73] *Automobile Insurance Losses—Collision Coverages,* Insurance Institute for Highway Safety, Highway Loss Data Institute, annual.

bined into a comprehensive set of statistics broken down by make, series, and model year and provide accident frequency, average accident repair cost, and expected loss payment per vehicle-year. The sample is thought to be representative, in terms of size, geographical distribution, representation of driver, and vehicle type. The data contain claim frequency and distribution of claim cost (i.e., the cost to repair the car, minus the deductible amount) for individual cars, for classes of cars, and for all cars aggregated. The major shortcomings of the data are that the HLDI file contains collision claims only, and no identification of injury and severity.

Another source of vehicle repair data is the State Farm Insurance Company's *Current Model Year Study.*[74] This ongoing study contains a sample of repair cost estimates for both collision and property damage claims distributed by impact point, geographic area, and market class of car. The estimates are for total cost, and include only cars which come to drive-in claim centers. Therefore, disabled cars are not included in the sample, biasing the distribution of costs somewhat toward the lower end. The main value of the data, then, is in establishing the baseline distribution of accidents by impact point and cost, and in supplying the only ongoing data on property damage claims; however, as with the HLDI files, there is no identification of injury severity. An additional and important source of specific accident cost data is the barrier crash tests performed on small cars and sedans by the Insurance Institute for Highway Safety.

All of these systems have some basic weaknesses in terms of specificity, primarily in not identifying cost by the injury severity scale being used in this study. A special computer run was done for the purposes of the current Societal Cost study by State Farm, based on their general claim file, not on the current model year file, which contains new cars only. The sample data covered all claim activity during November and December 1974 (current structure of the data files precluded a larger sampling period).[75] The sample indicated the following average claim costs: collision coverage, $474 (all claims) and $491 (all nonzero claims); property damage liability coverage, $350 (all claims) and $353 (all nonzero claims); and a weighted overall average of $415 (all claims) and $426 (all nonzero claims). An attempt was made to stratify these data by the AIS categories without success, but the average costs per claim were informative generally.

Ultimately, the file used for the estimates in this study was a one-time study done by the General Electric Company for NHTSA under Title II of the Motor Vehicle Information and Cost Savings Act.[76] Data were gathered from the claim files of 20 insurance companies. Vehicles included 1968 and newer models, and injuries were identified by the researcher according to the AIS scale. The distribution of cost to repair in Table 52 was extracted from the file by a special run for the Societal Cost Study.

Table 52. Vehicle Repair Costs by Injury Severity (Dollars)

Severity Level	1973	1975*
(PDO)	604	748**
AIS 1	1,289	1,597
AIS 1	1,507	1,867
AIS 3	2,358	2,922
AIS 4	3,196	3,960
AIS 5	3,222***	3,992
AIS 6	3,222	3,992
Unknown	1,462	1,811
File Average	758	939

*See appendix C.
**Adjusted to figure in table 1 for unrepaired damage.
***Number of AIS 5 cases is not sufficient for valid estimate; therefore, fatality cost was assigned to this level.

Traffic Delay Costs

For the present study of societal costs, a reevaluation of cost components was made to determine if any significant components had been omitted. The only potentially significant cost omitted was determined to be the costs to others in terms of the value of time if traffic delays were caused by accidents.

The problem of delays from traffic accidents has not been studied adequately, although there has been much work done on the value of time for various

[74] *Current Model Year Study,* Bloomington, Ill., State Farm Mutual Automobile Insurance Company, annually.
[75] Special computer runs, State Farm Mutual Automobile Insurance Company, Bloomington, Ill., 1975.
[76] Development of Vehicle Rating for the Automobile Consumer Information Study, General Electric Company, DOT Contract No. DOT-HS-4-00903, unpublished, special computer run.

Table 53. Accident Data—1973

Severity Level	(A) Total Accidents Adjusted	(B) Rush Hour, Mon.–Fri.		(C) Rush Hour, Mon.–Fri., Urban	
		%	No.	% of (B)	No.
Total	16,348,300	25.7	4,197,987	71.8	3,015,820
Fatal	48,300	18.4	8,887	34.9	3,100
Injury	1,950,000	25.7	501,150	66.9	335,270
PDO	14,350,000	25.7	3,687,950	72.6	2,677,450

purposes.[77] In addition, the *Nationwide Personal Transportation Study*[78] has yielded data on trip-making characteristics. Only one study was identified that actually measured time lost because of rush-hour accidents.[79] These related sources were used to estimate average traffic delay costs. Figures on vehicle hours of delay from the last-mentioned source are conservative ones for the following reasons: (1) The figures are for a minor accident in the a.m. rush hour; (2) response to the scene of the accident is shorter than normal because of in-place visual surveillance; and (3) the relationship of on-the-road to on-the-shoulder accident investigation is influenced by the fact that these were freeway accidents and, therefore, a greater effort was probably made to clear the road. However, the third reason is somewhat neutralized because traffic volumes (and, therefore, number of vehicles affected) are higher on freeways than on city streets.

Value of Time Data:

Table 54. Value of Time for Commuting

Income (in dollars)	% of Workers at Rush Hour*	Time Value per Hour** (in dollars)
4,000	10.6	0.277
4,000– 6,000	13.3	0.936
6,000– 7,500	14.0	1.154
7,500–10,000	21.3	2.120
10,000–15,000	27.1	2.943
15,000+	13.4	3.664
Weighted Average		2.055

Note.—Adjustment for increase in earnings 1969–73,***

1973 value = 1.28 ($2.055) = $2.63

[77] T. Thomas and G. Thompson, *Value of Time by Trip Purpose,* Stanford, Calif., Stanford Research Institute, 1970.

Calculation of Traffic Delay Costs

The average costs for traffic delay were calculated by the data and method in "Cost Data and Method" (following) and those shown in tables 53[80] and 54.

Time Loss Data:

Vehicle-hours lost per rush hour accident = 340[81]
Persons per vehicle, rush hour = 1.4[82]
Person hours lost per rush hour accident = 475

Cost data and method average costs (see above for base valued):

Fatality:	
Number of accidents	3,100
Person-hours lost per accident	475
Total hours lost	1,472,500
Cost per person-hour	$2.63
Total cost	$3,872,675
Number of total fatalities	56,040
Average cost per fatality, 1973	$70
1975 Update = $70 (1.1505)[83]	$80
AIS 4 and 5:	
Number of accidents	700
Total hours lost	332,500
Total cost	$874,475
Number total AIS 4 and 5 injuries	16,800 [84]
Average cost per AIS 4 & 5 injury	$52
1975 Update	$60

[78] "Home to Work Trips and Travel," *The Nationwide Personal Transportation Study,* Report No. 10, Washington, DC, U.S. Department of Transportation, Federal Highway Administration, 1973.

[79] M. A. Pittman and R. C. Loutzenheiser, *A Study of Accident Investigation Sites on the Gulf Freeway,* Texas Transportation Institute, 1972.

[80] NSC, *Accident Facts.*

[81] Pittman and Loutzenheiser, *Accident Investigation.*

[82] FHWA, "Work Trips."

*FHWA, "Work Trips.

**Thomas and Thompson, *Value of Time.*

***Census, *Statistical Abstract.*

[83] See appendix C.

[84] Estimated from NHTSA, Restraint Systems.

AIS 1, 2 and 3:	
Number of accidents	333,925
Total hours lost	158,614,375
Total cost	$417,155,805
Number total AIS 1–3 injuries	2,983,200 [85]
Average cost per AIS 1, 2, and 3 injury	$140
1975 Update	$160
PDO involvements:	
Number of accidents	2,677,450
Total hours lost	1,271,788,750
Total cost	$3,344,804,410
Number total PDO involvements	24,194,100
Average cost per PDO involvement	$140
1975 update	$160

Property-Damage-Only Involvement Costs

The overwhelming majority of accidents occurring each year involve vehicle damage only with no resulting injuries. There were 16,350,000 accidents in 1973; of these, 14,350,000 (88%) were property damage only (PDO) accidents.[86] These involvements result in a low societal loss per case relative to injuries and fatalities, but the total cost of PDO involvements is significant.

The following loss components have been identified for PDO involvements:

- Vehicle Damage
- Insurance Administration (variable)
- Legal and Court
- Police Accident Investigation
- Traffic Delay

Discussion and derivation of these components can be found in previous sections of this report identified by these loss headings. Table 55 is a summary tabulation of costs per PDO involvement.

Table 55. Average Costs Per Property-Damage Only Involvement (Dollars)

Component	1973	1975
Vehicle damage	255	315
Insurance administration	30	31
Legal and court	6	7
Police accident investigation	5	6
Traffic delay	140	160
Total	436	519

Non-Quantified Costs

Pain and Suffering

There have been considerable discussion and debate on the subject of the monetary valuation of pain and suffering as a societal loss of motor vehicle accidents. Conceptually, pain and suffering is a loss in individual well-being suffered by the individual who is injured and by the individual who is injured and who subsequently dies. Societal loss encompasses these individual losses. Therefore, it is logical to consider quantification of these losses. At this point, the concept of loss becomes difficult. The measurement of loss should be related to the magnitude of pain and suffering.

Part of the justification for measuring pain and suffering has come from the determination of the courts, acting in proxy for society, to allow pain and suffering to be a compensable loss. This determination can be used as a basis for measuring loss if the following conditions exist: (1) that a jury makes a determination as a proxy for society as a whole, (2) that an award for pain and suffering is based conceptually on the extent of the pain and suffering and is not a measure of guilt or culpability of the defendant, and (3) that a large enough sample of cases would be taken to eliminate any potential judicial bias.

Adoption of various kinds of no-fault insurance has brought the valuation of pain and suffering under increasing question. The various no-fault proposals deal with the problem of pain and suffering in different ways. Without undertaking a thorough review of no-fault, it must be recognized that some proposals exclude the possibilities of payment for pain and suffering but allow payment for permanent impairment, and at least one modified no-fault proposal (American Mutual Insurance Alliance) [87] suggests a provision for up to 50% of medical payment for pain and suffering for medical expenses up to $500 and 100% for medical expenses over $500.

A review of the literature in the field indicates that first-party coverage need not necessarily exclude losses for pain and suffering and that they can be determined either case by case or on a formula approach.

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[85] Ibid.

[86] This is an adjustment of the National Safety Council total based on excluding a portion for an additional number of nondisabling injury accidents not reported by NSC, *Accident Facts.*

[87] M. G. Woodruff, J. R. Fonseca, and A. M. Squillante, *Automobile Insurance and No-Fault Law,* Rochester, N.Y., Lawyers Cooperative Publishing Company, 1974.

For the present study, a determined effort was made to evaluate current pain and suffering losses according to the three criteria stated. Unfortunately, the law is not statistically oriented for the most part. The valuation of pain and suffering in the 1972 *Societal Costs of Motor Vehicle Accidents,*[88] was based on a review of cases by Belli in *Modern Trials.*[89] These cases are badly out of date and in hindsight were probably not related specifically enough to motor vehicle injuries. No comparable compilation has been done for motor vehicle injuries. In terms of what the current court trends are, the following statement is more recent and more to the point than any other found in the current research:

"Awarding damages for nonpecuniary injuries is not the most objective jury undertaking; there is considerable danger of jury speculation . . . The belief of modern juries that the burden of large judgments will be borne by insurance companies rather than individual defendants compounds the fear of inflated awards for nonpecuniary injuries . . . The possible confusion of injuries resulting in duplicative awards is feared if too many categories of compensable injuries are created . . . Despite these difficulties, courts in the United States continue to recognize nonpecuniary injuries as compensable, pain and suffering being the most frequent example." [90]

Due to a lack of compiled statistics on pain and suffering awards, it became necessary to read individual cases to attempt to derive a value. The outcome of this investigation was that the valuation of pain and suffering did not satisfy the second criteria of measurement, i.e., that the awards made appear to be strongly related to a judgment of guilt. As a result of this finding and because of the problem of collecting a statistically valid sample by reading individual cases, it was determined that no dollar value could be estimated.

Other Non-Quantified Costs

There are a number of qualitative losses to both individuals and society that defy measurement, for example, losses in conjugal affection, grief to others, loss of personal relationships. These losses are real and should be part of any analysis of the effects of accident reduction in qualitative terms. However, no attempt was made to place a monetary value on these losses.

[88] NHTSA, *Societal Costs.*

[89] Melvin Belli, *Modern Trials,* Indianapolis, Ind., Bobbs Merrill Company, 1973.

[90] Jacob Stein, *Damages and Recovery,* Rochester, N.Y., Lawyers Cooperative Publishing Company, 1972.

Appendix A: Alternative Discount Rates

The subject of appropriate discount rates for estimating future societal costs has been and continues to be controversial. For the present societal cost study, a 7% rate for discounting future production losses and for computing funeral costs was chosen. However, Appendix B of this report indicates the future production losses and funeral costs for a 10% discount rate application together with summary cost figures. Application of a discount rate expresses the concept that present money is worth more than future money.

In the past, a rather broad range of discount rates was used in analyses of public programs. In an effort to achieve comparability among analyses of Government agencies, the Office of Management and Budget (OMB) formulated a policy on discount rates. This policy, as outlined in the OMB circular A–94, March 1972, indicates use of a 10% discount rate for analyses of public programs, except where specifically exempted. However, the circular indicates that the discount rates prescribed are "suggested for use in the internal planning documents of the agencies in the Executive Branch," and "required for use in program analyses submitted to the Office of Management and Budget in support of legislative and budget programs." (underlining supplied). The approach taken by OMB was to derive a rate generally applicable to all programs. To this end, analyses were made of rates of investment return in various financial markets to determine, "the average rate of return on private investment before taxes and after inflation." (underlining supplied). For purposes of resource allocation decisions relating to public funds from the top down, this is as good a rate as any. It is useful from the OMB perspective to have some consistency by which to compare expenditure of public funds.

However, in the determination of societal costs and especially for lost future production, the appropriate discount rate should relate to the incidence of loss. In the case of lost future production, it is individual casualties—family and individuals in society—who are affected. Here the question is what time-preference value is applicable to the individual. Therefore, even though the precise time preference for lost future production is difficult (income as proxy) to conceptualize, the average rate of return faced by individuals fits the present context better than an average rate of return in all markets (i.e., inclusive of rates available to businesses).

Table 56 [91] indicates a derived weighted average rate of return for an individual.

Table 56. Derived Rate of Return for an Individual

Assets	Percent of Distribution of Assets Held by Households, 1973 (Weighting Factors)	Annual Rate of Return in Percent (Average 1970–74)
Time and savings bonds	23.3	5.0
U.S. Government bonds & other	3.9	6.0
State & municipal bonds	1.9	5.7
Corporate bonds	2.1	7.7
Corporate stock	27.8	5.5
Real estate	40.5*	10.0
Weighted Average		7.3

*Minus mortgages.

[91] Census, *Statistical Abstract.*

Appendix B: Summary of Costs, 10% Discount Rate

Table 57 presents the average costs per fatality, per Abbreviated Injury Scale (AIS) level injury, and per vehicle for property damage only (PDO) accidents for a 10% discount rate.

Table 57. Societal Costs, Summary, 1975, 10% Discount Rate (Dollars)

Cost Component	Injury (AIS)						
	6 (Fatality)	5	4	3	2	1	PDO Only
Production/consumption market	145,670*	82,250*	36,075*	1,645	865	66	—
Home, family, and community	43,700*	24,675*	10,820*	425	310	20	—
Medical							
Hospital	275	5,750	2,250	1,095	450	45	—
Physician and others	160	5,520	2,160	525	165	55	—
Coroner-medical examiner	130	—	—	—	—	—	—
Rehabilitation	—	6,075	3,040	—	—	—	—
Funeral	1,080*	—	—	—	—	—	—
Legal and court	2,190	1,645	1,090	770	150	140	7
Insurance administration	295	295	285	240	220	52	30
Accident investigation	80	80	70	45	35	28	6
Losses to others	3,685	4,180	1,830	260	130	32	—
Vehicle damage	3,990	3,990	3,960	2,920	1,865	1,595	315
Traffic delay	80	60	60	160	160	160	160
Total	201,335	134,520	61,640	8,085	4,350	2,190	520

*10% discount rate.

Appendix C: Cost Adjustment Factors, 1973-75

To compensate for the time constraints, on data reporting, all costs were computed for 1973 and updated to 1975. Section IV, Societal Cost Components, presented the 1975 figures for each component. Cost adjustment factors in table 58 were applied to the 1973 estimates.

Table 58. Cost Adjustment Factors, 1973–75

Societal Cost Component	Factor	% Increase 1973–75
Production losses Losses to others Traffic delay	Average hourly earnings—private sector*	15.05
Medical care	Consumer price index (CPI)**	
	Medical care	22.44
Hospital	Hospital care Charges	25.28
Physician	Physician fees	22.58
Legal and court	CPI legal services**	19.12
Insurance administration	CPI, auto Insurance premiums**	3.55
Accident investigation	State and local Wage index*	13.96
Property damage	CPI, auto Repair and maintenance**	23.90

*Census, *Statistical Abstract*, 1975.
**Bureau of Labor Statistics, *Monthly Labor Review*.

Appendix D: The Need for Further Research

Problems

The information sources available for an evaluation of societal costs of motor vehicle accidents are deficient in many respects. The basic problems in currently available data are lack of coverage and representation for all types of accidents and all levels of severity. In addition, an overriding problem in the area of cost evaluation is that there is no ongoing cost data system that reports basic fatality, injury, and property damage costs. Therefore, it is necessary to look to a number of scattered studies for evaluation of individual components. Furthermore, most of the studies that have produced cost data have not covered the entire spectrum of fatality, injury, and property-damage-only accidents.

Lastly, available cost data by the Abbreviated Injury Scale (AIS) classification of injuries are scarce. The Scale has been increasingly accepted as a standard classification system, but its application has not as yet produced a large volume of data from representative samples of accidents. Therefore, presentation of costs on this basis requires stratification of many of the available component costs by the AIS levels.

Planned and Recommended Future Research

There are some encouraging developments in accident and injury reporting. The National Crash Severity Study will be operated by the National Highway Traffic Safety Administration (NHTSA) between 1976 and 1978 and will collect data on ICDA[92] hospital codes, the AIS, surgical treatment, hospital days, and days of restricted activity. There is some hope that additional cost-related factors can be included in this system. In addition, the National Accident Sampling System (NASS) is being developed currently by NHTSA and will be operational in 1980. The NASS is an extension and broadening of the multidisciplinary accident investigation concept. The objective is to produce nationally valid data through a probability sample of the Nation's accidents, based on data collected by investigation teams. Among the data elements to be included will be injury severity identification (OIC)[93], injury treatment and convalescence, and vehicle damage. Plans for this system are not complete, and it is hoped that additional cost-related data can be incorporated. In conjunction with the development of these two systems, a study is being planned by NHTA to investigate the development of a number of injury-scaling systems that would indicate injury severity in terms of cost and other factors.

In addition to the work being done by the U. S. Department of Transportation, there are two ongoing injury data collection systems that should be expanded to produce injury cost data. One is the National Health Survey, a household interview survey conducted yearly by the National Center for Health Statistics. Because all types of health data are collected, it is unrealistic, both in terms of the operation of the system and of the cost of operating the system, to suggest expanding motor-vehicle-injury specific data collection as a permanent, annual part of the survey. However, a triannually expanded survey could produce useful data. Data on disability, restricted activity, injury severity, and hospital and physician resources could be part of an expanded motor injury section.

Another data collection system that has potential usefulness is the National Emergency Injury Surveillance System, operated by the Consumer Product Safety Commission. The system collects data from hospital emergency rooms daily on all types of injuries. Recently, a special arrangement was made by NHTSA to include motor vehicle injuries on a trial basis. The system would have to be expanded slightly to yield emergency treatment and hospital cost data. Its primary advantage is in producing current data on injuries.

It is hoped that a continuing interest in valid cost data will produce pressure for expanded data collection efforts. Current data availability is limited, and the estimates developed in this report should be interpreted with this in mind.

[92] International Classification of Diseases, Adapted.
[93] Occupant Injury Classification corresponds closely to AIS scale.

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