

ESTIMATES OF THE ECONOMIC AND HUMAN CONSEQUENCES
OF MOTOR VEHICLE ACCIDENTS IN VIRGINIA DURING 1980

by

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ABSTRACT

The purpose of this report is to describe the cost of motor vehicle accidents in two ways: first, by identifying the cost components and quantifying them, and second by showing the severity of such accidents in terms of human suffering. Although many statistics are kept concerning the causes of motor vehicle accidents, few are kept concerning the results. This report identifies techniques for estimating these statistics and points out the problems associated with each method. Alternative, and possibly more accurate, techniques are recommended for study.

The report concludes that motor vehicle accidents cost the Commonwealth of Virginia over \$800 million in 1980. Further, it shows that crashes are a leading cause of death for all Virginians, particularly for those younger than forty. Finally, it compares motor vehicle injuries with other accidental injuries, and it concludes that those caused by motor vehicles are, in general, significantly more severe.

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SUMMARY OF FINDINGS

1. Monetary Costs

In 1980, losses from traffic accidents in Virginia totalled at least \$800 million. Because this figure was derived with a conservative methodology, it probably understates the true extent of loss.

2. Human Costs: Fatalities

Over one thousand Virginians died in traffic accidents during 1980. Motor vehicle accidents were the sixth leading cause of death for all Virginians and the leading cause of death for those between the ages of ten and thirty-four.

3. Human Costs: Injuries

A significant number of emergency room admittees are traffic accident victims. Further, motor vehicle injuries are disproportionately severe as compared to other accidental injuries; they accounted for one-third of the cases of paraplegia and quadriplegia and half of the cases of brain damage suffered during 1980.

CONCLUSION

Traffic accidents in Virginia impose significant costs upon the Commonwealth and the health of her citizens.

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PURPOSE

This research sought to specify and estimate components of the economic costs imposed by traffic accidents in Virginia. Specific attention was directed toward assembling estimates that do not appear in Crash Facts, the annual report on traffic losses published by the Virginia State Police. The research also focused on the impact of motor vehicle accidents on the health of Virginians. Lastly, it sought to identify, for use in future research, sources of financial and health data that are updated annually.

SCOPE

The research was designed to measure traffic accident costs in Virginia for one year. Future research will be directed toward more accurate methodologies and year-by-year comparisons of traffic losses. The most recent year for which adequate data were available was 1980, and the report focuses on that year.

METHODOLOGY

For deriving monetary costs, the methodology used in this report paralleled that found in Accident Facts, a nationally recognized authority on accident costs published by the National Safety Council. This report also suggests potentially more accurate methodologies. Because it focuses on Virginia, it places a premium upon information specific to this state. Various state and federal agencies supplied the bulk of the information.

The health data were derived from fatality statistics solicited from the Virginia Bureau of Vital Statistics and from injury statistics obtained from a Virginia hospital and Virginia rehabilitation facility.

Throughout the report, it has been necessary to disaggregate reported figures by using percentage distributions from earlier epidemiological studies. Because these studies are not repeated each year, it must be assumed that the distributions do not significantly change over time.

ECONOMIC COSTS OF MOTOR VEHICLE ACCIDENTS

The 1980 Crash Facts shows that 1,045 people were killed and 58,036 injured in the 116,382 motor vehicle accidents that occurred in Virginia during 1980. That publication estimates that these accidents imposed an economic loss of \$690,000,000. Although the accident information is broken down in a number of ways, the economic loss is not divided into its component parts. Rigorous analysis requires that the separate components of economic loss be identified and estimated before being summed to a single estimate. In an attempt to measure these components of economic loss, cost figures were obtained from various state and federal agencies. However, because these agencies rarely break the figures down into those related to motor vehicle accidents and those which are not, estimations had to be based on figures and rates obtained elsewhere. Occasionally, these estimations are strained; in those places, an attempt has been made to explain why this estimation technique was chosen and the problems arising from that choice. It should be noted that every attempt has been made to err on the conservative side.

However, beyond the estimation problems, there are significant conceptual problems. In particular, there is the question of what actually is a "cost"? Many of the economic costs measured are not costs at all but transfers. The difference between a cost and a transfer is that a cost results from an expenditure (or loss) of resources, while a transfer is an exchange of resources from one segment of society to another. Thus, a transfer has only distributional effects. An attempt has been made to distinguish the transfers from the economic costs as well as to articulate the assumptions necessary for these transfers to reasonably estimate the actual cost. The description of the human costs given later helps put this problem in perspective; however, an appendix specifies exactly what costs these transfers attempt to estimate and suggests alternative, and perhaps more accurate, approaches to measuring these costs.

Indemnity Compensation by Private Insurers

Lines 1 through 4 of Table 1 show the insurable losses Virginia's private and commercial motorists claimed during 1980. It must be noted that these figures represent transfers from insurance companies to people who suffered injury either to their persons or property; they do not represent true costs. However, they can reasonably estimate the true costs once two assumptions are made. First, it must be assumed that the award an insurance company pays accurately reflects the medical costs, costs to repair or replace property, and lost wages of accident victims. This assumes away any institutional biases of overcompensation or undercompensation; however, it is likely that the insurance industry as a whole tends to undercompensate injured claimants because of deductibles and because of the expense of suing for more. Second, the lost wages must accurately reflect the productivity lost when an injured employee misses work. For this second assumption to hold, the production function must be linear; hence, the marginal productivity of labor is constant. In other words, a company of 500 employees will have the same increase in output as a company of 5,000 employees when each hires a single new worker. Because one purchases insurance in order to be compensated in case of injury, these assumptions are consistent with the purpose of insurance.

Table 1

Total Costs of Motor Vehicle Accidents in Virginia, 1980

Line Indemnity Compensation by Private Insurers, Losses Incurred:

1.	Private Passenger Auto Liability	\$273,720,000
2.	Commercial Auto Liability	63,911,000
3.	Private Passenger Auto Collision	101,481,000
4.	Commercial Auto Collision	16,109,000

Government Benefits Paid:

5.	Workmen's Compensation	2,491,000
6.	Social Security Disability	3,510,000
7.	Social Security Survivorship	21,036,000
8.	Uncompensated Wage Loss	1,769,000

Administrative Costs:

9.	Private Insurance	\$355,184,000
10.	Workmen's Compensation	5,975,000
11.	Social Security	<u>114,000</u>

Total Costs		\$845,300,000
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Lines 1 and 2 represent the losses incurred and reported to the Bureau of Insurance for private and commercial automobile liability policies in Virginia during 1980.⁽¹⁾ Lines 3 and 4, which show the losses incurred for collision policies, must be derived from physical damage losses reported to the Bureau of Insurance. These figures include not only collision losses but also payments for comprehensive policies. Because these payments are the result of such things as theft, fire, or vandalism, but not traffic accidents, the comprehensive losses must be subtracted out.

The most accurate estimate available of the collision share of physical damage insurance was provided by a representative of A. M. Best Company, Inc., the organization that publishes Best's Insurance Aggregates and Averages.⁽²⁾ The analyst totalled the collision and physical damage premiums received by ten New York insurers for their private passenger and commercial automobile policies, and he reported collision premiums as a percentage of the premiums for all physical damage. Although proprietary interests prevented the release of the companies' names, the analyst did report the highest and lowest percentages: 76% and 39% for private passenger vehicles, 74% and 27% for commercial vehicles. The weighted averages were 67.6% for private passenger vehicles and 64.1% for commercial ones. In order to estimate the collision share of the physical damage figure, it must be assumed that the percentages hold in Virginia. There are two problems with this assumption: (1) because they are New York figures, they may not apply to Virginia; and (2) they may not be particularly accurate even for New York, since only ten companies were sampled and the variance was high.

The Bureau of Insurance reports that losses incurred during 1980 for physical damage to private passenger automobiles totalled \$150,120,000; multiplying this by 67.6% gives \$101,481,000, the amount reported in line 3. Similarly, multiplying 64.1% by the reported physical damages for commercial vehicles, \$25,131,000, gives the amount shown in line 4, \$16,109,000. Adding these to losses incurred due to motor vehicle accidents during 1980 totalled \$461,221,000.

Workmen's Compensation

Workmen's Compensation is a system created by Virginia statute to compensate employees injured in the course of their work. The Workmen's Compensation Act, Title 65.1 of the Virginia Code, has very broad coverage and includes nearly every employee in the state of Virginia. The Industrial Commission, whose primary purpose is

to administer the system, roughly estimates that it covers 97% of Virginia's work force. The compensation paid is based on the employee's weekly wage; he receives two-thirds of his wage, with a minimum payment of 25% of the average weekly wage in Virginia and a maximum of 100%. Like the insurance company payments, Workmen's Compensation payments are not actual costs but transfers. However, these payments can accurately estimate true costs if it is assumed that the worker's wages represent the productivity lost due to his absence, one of the two assumptions made earlier. Another assumption must be made as well: that the total amount one receives from Workmen's Compensation and private parties fully compensates his losses. This assumption is consistent with the Workmen's Compensation Act, which calls for offsetting the benefits received by a third party tortfeasor's payments.

The Industrial Commission divided work-related motor vehicle accidents into three categories: "motor vehicle accidents," "worker struck against object", and "worker struck by object." In the first, all of the injuries are attributable to motor vehicle accidents. During 1980, 1,442 workmen were awarded compensation totalling \$2,490,773 for "motor vehicle accidents," and this amount, rounded to the nearest thousand, is the figure reported in line 5.⁽³⁾

This amount does not include the accident categories of "worker struck by object" or "worker struck against object" because the Industrial Commission keeps no data concerning whether the object was an automobile. An upper bound estimate of the Workmen's Compensation figure can be made by using the national ratio of work accidents caused by motor vehicles, 12.3%.⁽⁴⁾ Multiplying this by the total number of awards in 1980, 35,887, gives 4,414 as an estimate of those accidents caused by motor vehicles. Subtracting the 1,442 already classified as "motor vehicle accident" leaves a residual of 2,972, which would be divided into either of the other two categories. In 1980, 3,337 workers "struck by objects" were awarded compensation, and 3,850 received it for being "struck against object." Thus, of the 7,187 awards in both classifications, 46.4% were "struck by object" and 53.6% were "struck against object." Allocating the 2,972 residual accidents by these percentages estimates that 1,379 were "struck by" and 1,593 were "struck against" motor vehicles. Because the average awards in 1980 in these categories were \$1,058 and \$1,143, respectively, a total of \$1,459,000 under "worker struck by object" and \$1,821,000 under "worker struck against object" can be attributed to motor vehicle accidents. Adding these estimates to the lower bound estimate shown in line 5 of Table 1 gives the upper bound estimate of \$5,771,000.

Social Security Payments

Lines 6 and 7 represent the Social Security payments attributable to motor vehicle accidents. To be eligible for Social Security payments, one must be either a worker or a dependent of a worker who has become disabled for at least a year. Unlike Workmen's Compensation, the source of the disability need not be work. Once eligible, one's benefits are based on an annual average of one's lifetime earnings, not counting his five lowest income years and corrected for inflation. Survivorship benefits go to dependents of killed workers. Unlike Workmen's Compensation, Social Security is not offset by third parties' payments; however, it is offset by Workmen's Compensation payments. Social Security payments, like those from insurance and Workmen's Compensation, are transfers, not costs. The assumptions previously made must also hold if these estimates are to accurately reflect true economic costs.

The Social Security Administration reports both disability and survivorship statistics on a regular basis. Table 2 shows the disability payments made in Virginia from July 1, 1979, through June 30, 1980. Although the Social Security Administration does not record the specific cause of one's disability, it does record it by diagnostic classification. In 1976, the most recent year for which data are available, 5.3% of the Social Security awards in Virginia were the result of accidents in general.⁽⁵⁾ Assuming that the amount of benefits does not vary with the cause, then 5.3% of the total gives \$17,551,000 as the amount attributable to accidents. This assumption is consistent with the basis of the awards — lifetime earnings rather than cause. Also, because the 5.3% is based on people newly awarded compensation during 1976, it must be assumed that this figure does not vary over time. This assumption cannot be verified because the diagnostic classifications did not include "accidents" prior to 1976 and also because accurate data for later dates are not yet available. An underlying assumption must be made that those receiving benefits as a result of accidents receive them for the same length of time as other beneficiaries.

Table 2

Social Security Disability Beneficiaries in
Virginia by Type of Receipt and Amount of Benefits
— July 1979 through June 1980 —

	<u>Number of Recipients</u> ⁽⁶⁾	<u>Total Benefits</u> ⁽⁷⁾
Workers	66,074	\$272,798,000
Dependents (Spouses & Children)	43,194	\$ 58,357,000
Total	109,268	\$331,145,000

This amount must be reduced by the number of recipients whose accidents did not involve motor vehicles. Neither the Social Security Administration nor the National Safety Council keep the clear-cut statistics necessary for making a definitive estimate; however, upper and lower bounds of this estimate can be calculated. Table 3, derived from figures showing the average number of annual accidental injuries occurring nationally from 1977 to 1979, shows the percentage attributable to motor vehicle accidents by seriousness of injury.⁽⁸⁾ As can be seen from Table 3, the more serious the accident, the more likely it is that the accident involved a motor vehicle. The 50.1% shown for "deaths" is an appropriate upper bound because it includes only the most serious accidents.

The lower bound is derived from data presented in Accident Facts, which estimates that motor vehicles caused 20% of all "disabling injuries" in 1980.⁽⁹⁾ The 20% is an appropriate lower bound because Accident Facts defines a "disabling injury" as one which disables the victim beyond the day of the accident, a far less stringent definition than the one year used by the Social Security Administration.

Multiplying each of these percentages by the \$17,551,000 derived earlier gives a lower bound of \$3,510,000 and an upper bound of \$8,793,000. In the interest of a conservative estimate, line 6 of Table 1 presents the lower of the two.

Line 7 represents the survivorship benefits paid as a result of motor vehicle deaths. The Social Security Administration reports that survivorship benefits paid in Virginia during fiscal 1980 totaled \$536,872,000.⁽¹⁰⁾ Dividing this by 13,067, the number of Virginians between 24 and 64 who died during 1980, gives an average benefit per death of \$41,086. Because the survivorship benefits paid in 1980 may be the result of deaths not only in 1980 but also for ones prior to that, it must be assumed that motor vehicles have consistently caused a constant proportion of Virginia's deaths. Thus, multiplying \$41,086 by the number of people between 24 and 64 who died in traffic accidents during 1980, 512, gives line 7 of Table 1, the share of Social Security survivorship benefits attributable to motor vehicle accidents.⁽¹¹⁾

Table 3

Percentage of Injuries Attributable to Motor Vehicles,
by Seriousness of Injury
- 1977 to 1979 Annual National Average -

Deaths	Injuries		
	Bed Disabling	Not Bed Disabling	
		With Activity Restriction	Without Activity Restriction But Requiring Medical Treatment
50.1%	10.6%	6.75%	4.76%

Uncompensated Wage Loss

By statute, those who receive Workmen's Compensation may not be paid more than two-thirds of their wage, nor can they receive benefits for the first week after the injury. The benefits must also be at least 25%, but no more than 100%, of the average weekly wage in Virginia.⁽¹²⁾ The estimations assume that these two limitations do not bias the proportion of one's wages not paid by Workmen's Compensation. Although the loss from the benefit ceiling is likely to outweigh the gain from the benefit minimum, this bias is probably insignificant. Thus line 5 of Table 1 represents only a portion of the wages lost by people injured while working, and line 8 represents the portion for which they are not compensated. For this to equal an economic cost, the assumptions made with the Workmen's Compensation estimates must hold.

Because of the statutory limitation, the worker loses one-third of his wage, an amount equal to one-half of the benefits he receives. Dividing line 5 in half gives \$1,272,000 as the costs imposed by the code's first limitation.

To calculate the wage loss imposed by the one-week limitation, the number of people injured in motor vehicle accidents while working, 1,442, must be multiplied by the average weekly wage in Virginia during 1980, \$345.⁽¹³⁾ It should be noted that this amount, \$497,000, does not include the wage loss of those who return to work within seven days of their injury. Adding this to the loss already calculated gives a total uncompensated wage loss of \$1,769,000.

As noted earlier, this understates the true number of workmen injured in motor vehicle accidents by those categories as either "worker struck by object" or "worker struck against object." Using the method described earlier, the upper bound of this estimate is \$4,419,000, which is \$2,650,000 greater than the lower bound figure shown in line 8 of Table 1.

Private Insurance Administrative Costs

According to Accident Facts, the insurance administrative cost is the insurance companies' "cost of doing business and it is a part of the accident cost total."⁽¹⁴⁾ It includes the cost of offices, equipment, and personnel. It also includes the profits earned by insurance companies because it represents the "opportunity cost" of investing money in insurance companies instead of other enterprises. Because insurance companies do not break down their administrative costs between those associated with processing motor vehicle claims and those from other types of policies, these costs must be estimated from data provided by the Bureau of Insurance.

In doing this estimation, it must be assumed that the administrative costs are directly proportional to the premiums paid. This assumption is based on premiums paid rather than losses incurred, because it is unlikely that a claim for twice as much as a second claim costs twice as much to process. It is based on premiums because an insurance company will include in its charges to policyholders of different types of insurance the expected costs of administering the policy. For this assumption to hold, it must also be assumed that there are neither economies nor diseconomies of scale; in other words, it costs a small insurance company the same amount to administer a particular policy as it does a large company.

Table 4 shows the costs reported to the Bureau of Insurance by all domestic property and casualty insurance companies.⁽¹⁵⁾ Net income is the after-tax profit to the firms. Dividends are those dividends paid to policyholders of mutual insurance companies because they are considered part owners of the company. Thus, they are analogous to profits and are included because they represent opportunity costs as well. These companies earned \$16,190,000 for private passenger liability policies, \$1,941,000 for commercial liability policies, and \$7,593,000 and \$684,000 for physical damage, discounted with the A.M. Best ratios used earlier.⁽¹⁶⁾ These sum to \$26,408,000, which is 42.3% of the \$62,434,000 in total premiums they earned.

Table 4

Administrative Costs of All Domestic Property and Casualty Insurers, 1980

Loss Expenses Incurred	\$ 5,840,000
Other Underwriting Expenses	14,417,000
Federal Taxes	1,456,000
Net Income	7,651,000
Dividends	995,000
	<hr/>
Total Administrative Costs	\$30,359,000

A similar approach must be used for foreign (non-Virginian) insurance companies transacting business in Virginia. Table 5 presents their administrative costs. These companies reported premiums of \$399,123,000 for private passenger liability, \$106,419,000 for commercial liability, \$166,176,000 for private passenger collision (discounting out the comprehensive portion using the A.M. Best ratios) and \$28,100,000 for commercial collision

Table 5

Administrative Costs of All Foreign Property and
Casualty Insurers, 1980

Loss Expenses Incurred	\$ 7,213,181,000
Other Underwriting Expenses	20,824,198,000
Federal Taxes	488,565,000
Net Income	6,369,068,000
Dividends	1,232,251,000
Other Deductions	1,926,000
	\$36,129,189,000
Total Administrative Costs	\$36,129,189,000

(similarly discounted) policies in Virginia. Their sum, \$699,818,000, makes up 0.91% of their \$76,171,484,000 in total premiums earned. Multiplying that by the total administrative costs gives \$328,776,000 as the amount attributable to automobiles.⁽¹⁷⁾ Adding that to the already derived figure for domestic companies gives \$355,184,000, the amount shown in line 9 of Table 1.

Workmen's Compensation Administrative Costs

As with automobile insurance, the costs of administering Workmen's Compensation must be included. Similar estimation problems arise as well, since the costs of administering Workmen's Compensation are not reported by type of accident. There are two components to this cost: the first to private insurers who write the insurance policies, and the second to the state of Virginia. To do this estimate, it must be assumed that these Workmen's Compensation claims for automobile injuries cost the same to process as other types of claims.

To calculate the costs to the private insurers, the same technique is used as in the calculations for line 9 of Table 1. Domestic insurers earned \$5,783,000 in premiums for Workmen's Compensation policies in 1980, and this is 9.26% of the \$62,434,000 in total premiums earned.⁽¹⁸⁾ Multiplying this by \$30,359,000, the total domestic administrative costs derived earlier in Table 4, gives \$2,811,000 as the share attributable to Workmen's Compensation. Similarly, the \$283,138,000 earned by foreign insurers for Virginia Workmen's Compensation policies make up 0.37% of the \$76,171,484,000 total premiums they earned. Using this to apportion the total foreign administration costs derived in Table 5, \$36,129,189,000, gives \$133,678,000 as the share for Workmen's Compensation. Summing these figures gives \$136,489,000 as the total

costs to private insurers of administering Workmen's Compensation. However, this amount represents the administrative costs associated with all work-related accidents in Virginia, not merely accidents in motor vehicles. In 1980, the 1,469 motor-vehicle-related awards comprised 4.09% of the 35,887 total awards made in Virginia. Multiplying this by the private insurers' total administrative costs gives \$5,582,000 as the amount attributable to motor vehicle accidents. The upper bound is found using the national rate of work accidents involving motor vehicles, 12.3%.⁽¹⁹⁾ This gives \$16,788,000 as the upper bound estimate.

The state of Virginia also incurs costs because the Industrial Commission's purpose is to administer the Workmen's Compensation system. Its 1980 to 1982 budget of \$6,385,400 represents the costs of administering the system for two fiscal years.⁽²⁰⁾ Assuming that the costs in the second year are no greater than in the first, then the costs in 1980 are \$3,193,000. Multiplying this by the 4.09% gives \$131,000 as the amount attributable to motor vehicle accidents, with an upper bound of \$393,000. Adding this lower estimate to the lower bound estimate of private insurance costs gives the amount reported in line 10, \$5,975,000.

Social Security Administrative Costs

The final component of administrative costs is that arising from processing Social Security. In calculating this cost, it must be assumed that the assumptions made earlier when estimating the Social Security figures still hold and that claims arising from motor vehicle accidents cost the same to process as other claims.

In fiscal 1980, it cost 1.77% of the amount of benefits paid to administer the Old Age and Survivorship Insurance, and 2.19% to administer the Disability Insurance Program.⁽²¹⁾ Multiplying the survivorship estimate in line 7 of Table 1 by 1.77% gives \$37,000, and doing the same with the disability figure in line 6 and 2.19% gives \$77,000. Their sum, \$114,000, is the amount reported in line 11. It must be remembered, however, that this is a lower bound estimate. Using the upper bound of the disability payments estimated earlier shows that the Social Security administrative costs do not exceed \$230,000.

HUMAN COSTS OF VIRGINIA'S MOTOR VEHICLE ACCIDENTS

Thus far, the losses imposed by traffic accidents have been measured in strictly monetary terms. These losses can also be

measured in the pain and suffering borne by accident victims and their families. By emphasizing dollars and cents, one loses sight of the trauma and anguish associated with the amputations, paralyzes, or deaths wrought by traffic accidents. The human consequences of motor vehicle accidents will be shown in two ways. First, death statistics show that motor vehicle accidents are a major cause of death for all Virginians, disproportionately so for younger people. Second, hospital emergency room data show that injuries due to motor vehicle accidents are significantly more severe than those due to other causes. As a result, it costs more to treat these injuries.

Deaths From Motor Vehicle Accidents Compared to
Other Causes of Death

Each year, the Virginia Bureau of Vital Statistics tabulates residents' deaths by cause and age. Overall, 42,496 Virginia residents died in 1980, 1,081 of them in motor vehicle accidents.⁽²²⁾ As Table 6 shows, motor vehicle accidents were the sixth leading cause of death.

Table 6

Leading Causes of Virginia Residents' Deaths, 1980

<u>Rank</u>	<u>Cause</u>	<u>Number</u>
1	Cardiovascular disease other than stroke	16,862
2	Cancer	9,139
3	Stroke (cerebrovascular disease)	3,750
4	Pneumonia and influenza	1,149
5	Chronic obstructive pulmonary disease	1,130
6	MOTOR VEHICLE ACCIDENTS	1,081
7	Suicide	718
8	Diabetes mellitus	691
9	Chronic liver disease and cirrhosis	608
10	Conditions originating in perinatal blood	591
	Other causes	6,777
	All causes	<u>42,496</u>

The impact of motor vehicle deaths is brought into sharper focus when one disaggregates these causes of death into specific age groups, as has been done in Table 7.⁽²³⁾ Traffic accidents were the leading cause of death to Virginians between the ages of 10 and 34. Because of their relatively young age, those killed in traffic accidents represent a major loss to future productivity.

Table 7
 Leading Causes of Virginian's Deaths by Age, 1980

<u>Age</u>	<u>Rank</u>	<u>Causes</u>	<u>Number</u>
0-1	1	Conditions originating in perinatal blood	591
	2	Congenital anomalies	227
	3	Symptoms and ill-defined conditions	100
		MOTOR VEHICLE ACCIDENTS	4
		All causes	1,075
1-4	1	Home accidents	38
	2	Congenital anomalies	25
	3	MOTOR VEHICLE ACCIDENTS	16
		All causes	166
5-9	1	Cancer	21
	2	MOTOR VEHICLE ACCIDENTS	16
	3	Home accidents	15
		All causes	94
10-14	1	MOTOR VEHICLE ACCIDENTS	29
	2	Cancer	19
	3	Home accidents	12
		All causes	114
15-19	1	MOTOR VEHICLE ACCIDENTS	206
	2	Suicide	45
	3	Cancer	29
		All causes	467
20-24	1	MOTOR VEHICLE ACCIDENTS	189
	2	Suicide	90
	3	Homicide and legal intervention	74
		All causes	570
25-29	1	MOTOR VEHICLE ACCIDENTS	135
	2	Homicide and legal intervention	94
	3	Suicide	80
		All causes	553
30-34	1	MOTOR VEHICLE ACCIDENTS	86
	2	Suicide	74
	3	Cancer	72
		All causes	520

Table 7 (cont.)

<u>Age</u>	<u>Rank</u>	<u>Causes</u>	<u>Number</u>
35-39	1	Cancer	110
	2	Cardiovascular disease other than stroke	98
	3	MOTOR VEHICLE ACCIDENTS	56
		All causes	573
40 and Above*	1	Cardiovascular disease other than stroke	15,482
	2	Cancer	8,794
	3	Stroke	3,687
		MOTOR VEHICLE ACCIDENTS	344
		All causes	38,364

*Includes six cases where age was unknown.

A second useful way to illustrate the disproportionately young age of traffic accident victims is to present a percentage distribution of deaths by age, shown in Table 8, with the percentage distribution of all deaths by age.⁽²⁴⁾ The last two columns show what the first two columns would look like if motor vehicle deaths were not included.

Table 8

Numerical and Percentage Distribution of Virginians'
Deaths by Age and Cause of Death, 1980

Age	All Causes		Motor Vehicle Accidents		All Others	
	Number	Percent*	Number	Percent*	Number	Percent*
0-1	1,075	2.53	4	0.36	1,071	2.58
1-4	166	0.39	16	1.47	150	0.36
5-9	94	0.22	16	1.47	78	0.18
10-14	114	0.26	29	2.67	85	0.20
15-19	467	1.09	206	19.02	261	0.63
20-24	570	1.34	189	17.45	381	0.92
25-29	553	1.30	135	12.46	418	1.00
30-34	520	1.22	86	7.94	434	1.04
35-39	573	1.35	56	5.17	517	1.24
40-44	771	1.81	37	3.41	734	1.77
45-49	1,317	3.09	40	3.69	1,277	3.08
50-54	2,141	5.03	54	4.98	2,087	5.04
55-59	3,215	7.56	56	5.17	3,159	7.62
60-64	3,977	9.35	48	4.43	3,939	9.48
65-69	4,928	11.59	28	2.58	4,900	11.83
70-74	5,423	12.76	30	2.77	5,297	13.03
75-79	5,401	12.71	24	2.21	5,377	12.98
80-84	4,792	11.27	14	1.29	4,778	11.53
85+	6,393	15.04	13	1.20	6,380	15.40
Total	42,490	99.9	1,083	99.7	41,407	99.9

NOTE: Figures are exclusive of deaths where age was unknown.

*Cumulative percentage may not equal 100.00 due to rounding.

Injuries Resulting From Motor Vehicle Accidents Compared
to Injuries From Other Causes

Crash Facts reports that 58,037 people were injured in motor vehicle accidents in Virginia during 1980. The sheer size of the number injured requires that comparisons be made on the basis of sampling estimates.

The University of Virginia Medical Center provided information about its emergency room traffic during the twelve months between July 1, 1979, and June 30, 1980. Its data are summarized in Table 9.

According to this sample, motor vehicle accidents account for 38.5% of all injuries that require emergency room treatment and 5.3% of all emergency room admittances. The cost of these admittees' medical care is significant, particularly so in light of the fact that motor vehicle injuries are disproportionately severe, as will be seen below. Comparisons among different causes of injury are severely hampered by the large number of unreported injuries treated at home or by private physicians.

Table 9

Admittees to U. Va. Med. Center Emergency Room by Type
of Injury or Illness and Age
July 1, 1979, to June 30, 1980

Age	<u>Motor Vehicle</u>			Other	Total	Illnesses	Total
	<u>Auto- mobile</u>	<u>Pedes- trian</u>	<u>Motor- cycle</u>				
0-4	55	6	0	219	280	1,217	1,497
5-17	260	17	26	670	973	3,271	4,244
18-30	893	41	61	1,193	2,188	13,117	15,305
31-44	334	7	22	490	853	5,772	6,625
45-65	173	12	7	412	604	5,643	6,247
66+	74	3	1	250	328	3,047	3,375
Unknown	1	0	0	7	8	139	147
Total	1,790	86	117	3,181	5,174	37,440	37,440

The Severity of Motor Vehicle Injuries

Crash Facts classifies motor vehicle injuries (MVIs) into three categories: complaint of injury, slight visible injuries, and serious injuries. Table 10 shows the distribution of Virginia's MVIs for 1980, including the number of fatalities.

The classification system used in Crash Facts is rather subjective and is too vague to accurately describe the severity of Virginia's MVIs. In 1975, Hartunian, Smart, and Thompson⁽²⁶⁾ performed an extensive analysis of national crash data to distribute MVIs by the more rigorous standards of the six-point abbreviated injury scale (AIS) used by the American Association for Automotive Medicine and the Society of Automotive Engineers and shown in Table 11.⁽²⁷⁾ Hartunian, Smart, and Thompson's results are summarized in Table 12.⁽²⁸⁾

The study went on to estimate treatment costs, process costs, and the value of lost future earnings for MVIs by AIS code. These results are presented in Table 13.⁽²⁹⁾ Assuming that Hartunian, Smart, and Thompson's distribution of accident severity applies to Virginia's MVIs during 1980, an estimate of the number falling in each AIS code statewide could be made using the number of MVIs and the percentages in Table 12 under nonfatal injuries. These estimates are shown in Table 14.

Table 10

Crash Victims in Virginia by Type of Accident and Severity of Injury Including Fatalities, 1980

	<u>Auto or Truck</u>	<u>Pedes- trian</u>	<u>Motor- cycle</u>	<u>Total*</u>
Crashes Involving Injury or Death	24,569	3,441	2,490	40,439
Nonfatal Injuries				
Complaint of Pain	18,639	754	306	693
Slight Visible Injury	11,008	1,091	800	19,693
Serious Injury	20,818	1,626	1,804	12,883
Unknown and Discrepancy	<u>387</u>	<u>59</u>	<u>11</u>	<u>24,184</u>
Total Nonfatal Injuries	50,852	3,530	2,932	57,213
Fatalities	<u>769</u>	<u>196</u>	<u>82</u>	<u>1,045</u>
Total Injuries and Deaths	51,621	3,726	3,014	58,258

*Row totals exceed entries in this column because some accidents are coded into more than one type.

Table 11

Brief Descriptions and Examples of Injuries by AIS Code

AIS 1	Minor	Fractured Nose
AIS 2	Moderate	Ruptured Ear Drum
AIS 3	Serious	Ruptured Disc
AIS 4	Severe	Ruptured Spleen
AIS 5	Critical	Lacerated Aorta
AIS 6	Virtually Unsurvivable	Crushed Skull

Table 12

Number and Percentage of MVIs and
Nonfatal MVIs by AIS Code — 1975

AIS Code	Injuries		Nonfatal Injuries	
	Number	Percent	Number	Percent
1	3,053,035	71.49	3,053,035	72.25
2	702,923	16.46	706,923	16.64
3	353,569	8.27	353,569	8.37
4	87,262	2.04	87,262	2.06
5	28,611	0.66	28,611	0.68
6	44,995	1.05	--	--
	<u>4,270,395</u>	<u>100.00</u>	<u>4,225,400</u>	<u>100.00</u>

Table 13

Estimated Direct and Indirect Costs of MVIs by
AIS Code, Millions of Dollars — 1975

AIS Code	Direct Costs			Indirect Costs	Total
	Treatment During First Year	Future Treatment	Other	Lost Wages	
1	561	0	71	111	743
2	674	0	123	180	977
3	727	15	228	314	1,284
4	434	122	109	206	871
5	412	733	388	1,798	3,331
6	50	0	126	7,052	7,228
Total	<u>2,858</u>	<u>870</u>	<u>1,045*</u>	<u>9,662</u>	<u>14,435</u>

NOTE: Cost of lost wages and future treatment were discounted to present value at the rate of 6%.

*Of this figure, \$878,000,000 represented legal costs

Table 14

Expected Distribution of MVIs in Virginia
by AIS Code — 1980

AIS Code	Expected Number of Virginians Injured 1980
1	41,932
2	9,655
3	4,856
4	1,198
5	393
Total	58,037

As Table 13 reveals, a substantial share (46.2%) of the costs of nonfatal MVIs is attributable to the relatively few who suffer AIS 5 injuries. It is in this category where the human trauma of injury takes its starkest form.

During the seven quarters between October 1, 1977, and June 30, 1979, R. W. Rimel collected data on patients admitted to the University of Virginia Medical Center with injuries to the central nervous system (brain and spinal chord).⁽³⁰⁾ The patients' injuries were distributed as follows: Head injury — 1,077, head and spinal injury — 120, spinal injury — 133.⁽³¹⁾ These figures translate into annual rates of 615, 69, and 76, respectively, for a total of 760 cases. Rimel reports that 58% of these patients' injuries resulted from highway accidents. Applying this percentage to the annual rates just derived implies that 358 head traumas, 40 head and spinal injuries, and 44 spinal injuries resulted from motor vehicle accidents in 1980.

Because Rimel's study is limited to the fourteen counties served by the medical center's neurosurgical department, accident data for these counties must be compared with statewide data in order to project Rimel's figures to the entire state. Table 15 duplicates Table 10 for the proportion of Virginia's crash victims that Rimel would have observed.

According to Table 15, the area served by the medical center accounted for 8.27% of all the "serious injuries" in the state. Statewide injury tolls can be estimated by multiplying the injuries found in the sample by the ratio between serious injuries statewide and serious injuries in the sample. Table 16 shows the results of this projection, and it indicates that over 5,000 Virginians suffer injuries to the central nervous system each year.⁽³³⁾

Table 15

Crash Victims Served by U. Va. Medical Center by Type of
Accident and Severity of Injury, Including Fatalities, 1980

	<u>Auto or Truck</u>	<u>Pedes- trian</u>	<u>Motor- cycle</u>	<u>Total</u>
Crashes Involving Injury or Death	2,445 (7.07%)	185 (5.37%)	140 (5.62%)	2,770 (6.84%)
Nonfatal Injuries: Complaint of Pain	971 (5.20%)	20 (2.65%)	14 (4.57%)	1,005 (5.10%)
Slight Visible Injuries	837 (7.60%)	68 (6.23%)	45 (5.62%)	950 (7.37%)
Serious Injuries	1,820 (8.74%)	92 (5.65%)	90 (4.98%)	2,002 (8.27%)
Unknown	21 (5.42%)	0 (.0.00%)	0 (.0.00%)	21 (4.63%)
Total Nonfatal Injuries	3,649 (7.17%)	180 (5.09%)	149 (5.10%)	3,988 (6.97%)
Fatalities	91 (11.83%)	15 (7.65%)	7 (8.53%)	113 (10.81%)
Total Injuries and Deaths	3,740 (7.24%)	195 (5.23%)	156 (5.19%)	4,101 (7.03%)

NOTE: Numbers in parentheses show the number of victims as a percentage of comparable statewide figures.

Rimel's study includes a description of the posttreatment disposition of patients suffering central nervous system injuries. Five percent of the injured required further treatment in another hospital, and 8% were transferred to rehabilitation facilities.⁽³⁴⁾ These findings were applied to the projected statewide MVI estimates to obtain Table 17.

Many of those who require rehabilitative services are treated at state expense in the Woodrow Wilson Rehabilitation Center. Center personnel provided information on the number of MVI victims they treated during 1980 by type of injury, and the results are presented in Table 18. Besides the human toll described in these figures, each of these cases represents huge costs. As a point of reference, the Rehabilitation Institute of Chicago estimates that a 26-year old paraplegic will require \$600,000 of care during his lifetime. Both Rimel and Hartunian et al. note that MVIs often befall low income individuals and the burden of their care often rests with the state.

Clearly motor vehicle accidents are not only a leading cause of death to Virginians, but they also cause a significant proportion of the most serious injuries. Institutional care for these victims imposes a significant burden, both economic and emotional, on the people of Virginia. Although the economic cost can at least be estimated, no value can be placed on the emotional burden that motor vehicle accidents cause to Virginians.

Table 16

MVIs in Rimel's Sample and in Virginia by Type of Injury, Projected 1980

	<u>Rimel's Sample</u>	<u>Virginia</u>
Head Injury	358*	4,329
Head and Spinal Injury	40*	483
Spinal Injury	44*	532
Total	442	5,344

*Actual observations converted to annual rates.

Table 17

Virginia MVIs Requiring Further Treatment, Projected 1980

	<u>Another Hospital</u>	<u>Rehabilitation</u>
Head Injury	216	346
Head and Spinal Injury	24	39
Spinal Injury	27	43
Total	267	428

Table 18

Patients Treated at Woodrow Wilson Rehabilitation Center
by Cause of Injury and Type of Injury, 1980

Type of Injury	MVIs Only			All Injuries	MVIs Percent All Injuries
	Auto	Motor-cycle	Total		
Paraplegia	18	8	27	81	33.3
Quadriplegia	42	7	49	135	36.3
Brain Damage	84	9	93	156	59.6
Amputation	7	1	8	33	15.1
Muscle-Joint-Injury	27	4	31	151	20.5
Total Major Effects	179	29	208	575	36.1
Epilepsy	1	0	1	77	0.1
Emotional Disorder	3	0	3	300	1.0
Retardation	2	0	2	250	0.4
Visual Defect	1	0	1	67	4.5
Chronic Medical	1	0	1	67	1.5
Total Effects	187	29	216	1,292	16.8

FOOTNOTES

1. The source of the insurance figures is Report on Property and Casualty Insurers Transacting Business in Virginia During 1980, Bureau of Insurance, State Corporation Commission, p. 83R. (hereinafter cited as Insurance Report).
2. A. M. Best Co., provides an information service for a fee, a fee not paid by the University of Virginia. The numbers reported here are rough estimates an analyst gave by phone.
3. The source of these figures is Ron Umbel, a statistician with the Industrial Commission. It should be noted, however, that these are awards and not beneficiaries. An award is when an applicant is awarded compensation. This measure must be used because the Industrial Commission does not keep figures concerning the number of beneficiaries. It overstates the estimate to the extent that a worker might be awarded compensation, return to work for a short while, and later be awarded compensation for the same accident.
4. The 12.3% figure is from Accident Facts, National Safety Council, 1981 ed., p. 2.
5. The 5.5% figure is from a table available from the Social Security Administration entitled "Total Number and Percent of Workers Allowed Disability Benefits by Place of Residence & Diagnostic Group, 1976."
6. These figures are from the Social Security Bulletin, Vol. 45, No. 3 (March 1982), p. 75, from a table entitled "OASDI Benefits" Number of monthly benefits in current payment status, by type of beneficiary and by state, June 1980."
7. Similarly, the amount of benefits is derived from the Social Security Bulletin, p. 77, "OASDI benefits: Estimated amount of payments, by type of program and beneficiary and by state, fiscal year 1980."
8. These data are derived from Accident Facts, p. 2, from a table entitled "Estimated Annual Average Number of Injuries in the U. S., 1977-1979."
9. Ibid., p. 3, from a table entitled "Disabling Injuries by Severity of Injury, 1980."
10. Social Security Bulletin, p. 77.
11. The death statistics are from a table in Virginia 1980 Statistical Annual Report, Center for Health Statistics, Bureau of Vital Records and Health Statistics (Richmond, Va., 1981.)

The table is entitled "Resident Deaths by Age, by Cause, Sex, and Race, Virginia, 1980."

12. Va. Code Ann. §65.1-54 (1981).
13. The 1,442 has been derived earlier in the Workmen's Compensation calculations. The average weekly wage is reported by the Virginia Employment Commission in January of each year.
14. Accident Facts, p. 5.
15. The source of the figures in Table 4 is the Insurance Report, p. 14R.
16. The earnings figure are from the Insurance Report, pp. 14R and 83R.
17. Ibid.
18. The figures for Workmen's Compensation are from the Insurance Report, p. 83R. The other figures have been derived and cited earlier.
19. The 12.3% is from Accident Facts, p. 2.
20. The budgetary figures are from the Commonwealth of Virginia, 1980-82 Executive Budget, p. G-483.
21. These percentages have been obtained from The Budget of the United States Government, Fiscal Year 1982, U. S. Office of Management and Budget, U. S. Government Printing Office, (Washington, D. C. 1981), pp. I-K60 to -K63. The 1982 budget reports that in 1980, \$101,925,538,000 in benefits were paid for Old Age and Survivorship Insurance, with administrative costs totalling \$1,809,651,000 for O.A.S.I. and S.S.I. Similarly, Disability Insurance benefits totalled \$15,065,864,000, and it cost \$330,516,000 to administer these payments. Dividing the costs by the benefits gives the 1.77% and 2.19%, respectively.
22. The discrepancy between the 1,081 traffic deaths reported by the Bureau and the 1,045 reported in Crash Facts can be attributed to differences in methodology. The Bureau is concerned with residents' deaths regardless of where they occur. Consequently, they include Virginians killed in other states and exclude nonresidents' deaths within the state. Conversely, the Department of State Police is concerned with deaths within the state regardless of the residence of the deceased, and they

adopt the opposite methodology. Their death toll, reported in Crash Facts, excludes Virginians killed in other states and includes nonresidents killed within the state. Since Tables 6, 7, and 8 are based on information from the Bureau, its estimate of 1,081 deaths is used.

- 23. The data for Table 7 are from the 1980 Statistical Annual Report, from a table entitled "Resident Deaths by Age, By Cause, Sex, and Race, Virginia, 1980."
- 24. Ibid.
- 25. These figures were obtained from the Mini-Crash Facts for the State of Virginia, 1980, Virginia Highway and Transportation Research Council, (Charlottesville, Va. 1981). It is a compilation from tables on pages 1, 11, 17, and 23 of the Mini-Crash Facts which provide information about all accidents, those involving autos or trucks, those with motorcycles, and those with pedestrians respectively.
- 26. Hartunian, N. S., Smart, C. N., and Thompson, M. S., "The Incidence and Economic Costs of Cancer, Motor Vehicle Injuries, Coronary Heart Disease, and Stroke: A Comparative Analysis," American Journal of Public Health, Vol. 70, No. 12 (December 1980).
- 27. The AIS Code is described more completely in the Abbreviated Injury Scale, American Association for Automotive Medicine (Morton Grove, Ill., 1980).
- 28. Hartunian, et al., p. 1254.
- 29. Ibid., p. 1257.
- 30. Rimel, R. W., "A Prospective Study of Patients With Central Nervous System Trauma," Journal of Neurosurgical Nursing, Vol. 13, No. 3 (June 1981), p. 132.
- 31. Ibid., p. 135.
- 32. The fourteen counties served by the medical center's neurosurgery department are: Albemarle, Augusta, Bath, Buckingham, Culpeper, Fluvanna, Goochland, Greene, Highland, Louisa, Madison, Nelson, Orange, and Rockingham. The department also serves the cities of Charlottesville, Harrisonburg, Staunton, and Waynesboro. The data for Table 15 were gathered from each county's and city's Mini-Crash Facts, 1980, from tables covering all accidents, those involving autos or trucks, motorcycles, and pedestrians on pages 1, 12, 18, and 24, respectively, of each Mini-Crash Facts Volume.

33. Table 16 can be taken as only a very rough estimate of the number of central nervous system injuries statewide. Rimel explains that only Albemarle County and the immediately adjacent counties send all of their central nervous system injuries to the U. Va. Medical Center; the outlying counties treat the more minor injuries locally. Thus, Rimel's sample includes all of the injuries in some counties, but only a portion of those which occur in other counties. Further, people injured in Goochland County may be sent to either Richmond or the U. Va. Medical Center depending on the person's location, which skews this estimate even more. The estimation made in Table 16 assumes these problems away, and it requires two further assumptions: (1) the ratio of head to spinal injuries is the same for the entire state; and (2) injuries to the central nervous system are all classified by the state police as "serious injury" rather than "complaint of injury" or "slight visible injury."
34. Rimel, op. cit., p. 140.

APPENDIX

As has been noted throughout the text, many of the so-called costs measured are actually transfers. A number of assumptions have been made in order to use these transfers as cost estimates, and most of these assumptions are reasonable. However, because this methodology measures the costs of motor vehicle accidents only indirectly, further research on this subject should look into whether these costs can be more accurately measured directly. If such an inquiry is done, it should focus on at least these five areas: medical costs, lost productivity, administrative costs, damage to physical property, and costs to the state.

The first, the medical costs, would include the rescue, emergency, and hospital costs of motor vehicle accident victims. However, the inquiry should not stop there. It should, if possible, include the costs to those not hospitalized, such as medical examinations by accident victims' personal physicians. The medical costs of the more seriously injured, including rehabilitative treatment and institutional care, should also be measured.

The second area, lost productivity, would probably be more difficult to measure. If the constant marginal productivity assumptions made in the text continue to apply, then this cost would be the wages lost by those missing work because of motor vehicle accidents. This would require estimating the worker hours lost, a possibly difficult measurement. A more rigorous analysis would include studies estimating the value of the marginal product of labor, thus including both the lost wages and the efficiency loss from distributing the tasks among fewer people or from locating replacements.

The administrative costs, the third area, would be very similar to those costs estimated in the text. The justification for including these costs is the same — the administrative process required to deal with motor vehicle accidents uses employees who would be productive in other areas of the economy. Although the payments themselves are not costs, the expenses associated with processing those transfers are costs. Thus, the private insurance, Social Security, and Workmen's Compensation administrative costs should remain. However, legal expenses associated with motor vehicle accidents, including court costs, should also be included.

The fourth area of inquiry should be into the cost from damage to property. Included in this would be not only damage to motor vehicles, but also any damage to real property, homes, and highways themselves, which arise from accidents.

Finally, the fifth area, the cost to the state, would include costs very difficult to measure. It should include not only the costs arising directly from accidents which have already occurred, but also the costs of preventing accidents. For example, this includes the cost of police time spent investigating accidents as well as writing traffic citations, the purpose of which is to avert accidents. This also includes the costs of safety programs such as driver's education, of safety studies, and of making highways safer for pedestrians and drivers. Clearly, this area is very broad in scope and could become one of the largest components of motor vehicle accident costs.

Another area has not been included in the list but deserves mention: the human costs. One section of this report makes clear the human consequences of motor vehicle accidents by demonstrating their severity. This is an economic cost, the suffering imposed on accident victims. The law generally recognizes emotional trauma as being compensable, despite the fact that it is difficult to quantify the value of such suffering; however, this difficulty makes it virtually impossible to accurately measure the human costs of suffering.

By focusing on these areas, a subsequent study of motor vehicle accident costs would measure these costs directly. In contrast, the present study makes indirect measurements of transfers and must assume that they adequately compensate an accident victim. A further study using these guidelines would examine the competency of this assumption and could possibly reach more accurate conclusions.