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Automobile Safety Problem

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HEALTH CONSEQUENCES OF ACCIDENTS*

In 1979, motor vehicle accidents killed 51,900 Americans, including 9,400 pedestrians and 42,500 nonpedestrians. The vast majority of the latter group, 28,900, were occupants of passenger cars; 6,700 were in trucks, and 3,700 were on motorcycles. An additional 2 million people received disabling injuries. All told, there were 18.1 million accidents involving 29.7 million vehicles, the large majority of which resulted primarily in property damage or nondisabling injuries. One in twelve vehicles registered in the United States was involved in an accident, and a similar ratio characterized the fraction of the population involved in an accident. Additional consequences included the following:

- 3.5 million hospital bed-days beyond initial emergency care;
- 35,700 person-years of work effort lost; and
- an estimated $35.8 billion in economic costs, ** almost half of the total costs of all types of accidents.

The motor vehicle accident toll is not distributed proportionately among the population. Over 40 percent of accident-involved drivers are under the age of 25, an age group constituting just under 23 percent of licensed drivers. Table 1 shows the most tragic consequence of this phenomenon: the motor vehicle death rate for 15- to 24-year-olds is twice the national average and five times that of younger children. Table 2 demonstrates further that there is a strongly unequal sex distribution of motor vehicle fatalities, with male drivers' age-specific death rates exceeding those of females by a factor of from 2.4 to 4.6. The worst rate for females (women under the ages of 20) is less than the best rate for males (men 55 to 64 years old). More than 1 in every 100 15-year-old boys will die in an accident before the age of 25, a death rate 20 times higher than that attributable to polio at its worst (13). *

Table 1.—Motor Vehicle Fatalities in the United States by Age, 1979

Age	Number of fatalities	Fatality rate[a]
<5 years	1,500	9.6
5 to 14 years	2,900	8.4
15 to 24 years	18,900	45.7
25 to 44 years	15,000	25.0
45 to 64 years	7,900	18.0
65 to 74 years	3,000	19.6
>75 years	2,700	28.8
Total	51,900	23.6

[a]Deaths per 100,000 population.

SOURCE: National Safety Council, *Accident Facts* (Chicago: NSC, 1980).

Table 2.—Motor Vehicle Fatality Rates of Licensed Drivers, by Sex and Age

Age	Fatality rate[a]	
	Males	Females
<20 years	131.8	35.1
20 to 24 years	107.9	23.6
25 to 34 years	69.1	15.2
35 to 44 years	52.1	13.7
45 to 54 years	44.6	12.0
55 to 64 years	36.4	12.5
365 years	37.0	15.6

[a]Deaths per 100,000 population.

SOURCE: National Highway Traffic Safety Administration, Highway Safety Facts 3 (Washington, D.C.: Department of Transportation, 1978).

Unfortunately for the purposes of this study, there are no good national data on the types and

*Data in this section are from the National Safety Council (31) and the National Highway Traffic Safety Administration (29). It should be noted that many accident-related data are estimates and that numerous data inconsistencies are found in the literature on *motor vehicle* accidents.

**This figure includes lost wages, medical expenses, insurance administration costs, and property damage. It does not include police, fire, and court expenses, the value of lost cargo on commercial vehicles, etc. (31). A recent independent study estimated the costs of motor vehicle deaths and injuries at $20 billion (11).

● Age-specific motor vehicle death rates are in part a function of exposure. For example, the number of passenger-miles per year varies from 16,000 for males in their early thirties to under 3,000 for elderly women. From their mid-twenties to early sixties, men ride from 50 to 100 percent more passenger-miles than women. As a result, fatality rates per 100 million passenger-miles by age differ from the simple age-specific fatality rates. The young males' rates remain the most socially alarming, but the highest rates per 100 million passenger-miles belong to the very elderly (over 75) (6).

numbers of handicaps that result from motor vehicle accidents. The National Highway Traffic Safety Administration (NHTSA) is trying to refine data collection to produce such information, but today's data on disabilities do not permit a useful assessment (34). Currently, data indicate severity of injury but do not follow through on the outcomes of injuries.

Table 3 presents the percentage distribution of injuries in a recent NHTSA sample by injury severity. The data indicate that over 70 percent of all injuries are scored as minor on the Abbreviated Injury Scale (AIS), a common index of injury severity. Under 12 percent of injuries are in categories (AIS 3 to 5) in which survival is probable or possible and in which serious handicaps could be a result. Given the total number of injuries, however, this relatively small percentage still represents many tens of thousands of people. Furthermore, moderate injuries (AIS 2) can also result in disabling handicaps. Thus, while reliable data on accident-produced handicaps are not available, injury severity data suggest the substantial probable burden.

Despite the "bad news" contained in the above motor vehicle accident data, there is also good news. During the 1970's, total motor vehicle deaths declined 7 percent—dropping from 55,791 deaths in 1969 to 51,900 in 1979. Given growth in the population and in the number of registered vehicles, the decline in death rates was quite dramatic. For example, the death rate per 10,000 registered vehicles dropped 37 percent, from 5.19 to 3.26. In 1979, the death rate per 100 million vehicle-miles stood at an all-time low of 3.4; in the 1940's and earlier, that rate was in the teens. The death rate per 100,000 population fell by 15 percent over the course of the decade; this included a lo-percent decrease in the 15- to 24-year-old age category, the smallest age-specific decline. A variety of factors contributed to these improvements, including the national 55-mph speed limit implemented in 1974, the increasing price of energy in the mid to late 1970's, and automobile safety features (47). We now turn to a look at the record of Federal governmental regulation of automobile safety.

Table 3.—Distribution of injuries by injury Severity

AIS		Percentage	Percentage
Code no.	Definition	of persons	in class surviving
1	Minor	71.1	99.989
2	Moderate	16.4	99.878
3	Serious, not life threatening	8.1	99.158
4	Severe, life threatening	2.2	91.978
5	Critical	1.5	41.799
6	Maximum injury, virtually unsurvivable	0.8	0.000

SOURCE: S. Partyka, "Effects of Traffic Accident Injuries on the Workforce Estimated From NCSS and NASS Data" (Washington, D. C.: National Highway Traffic Safety Administration, National Center for Statistics and Analysis, June 1981).

RECORD OF FEDERAL SAFETY STANDARDS

As substantial as the accident toll is today, there is evidence that it would have been considerably greater in the absence of existing Federal Government safety regulations. Analyzing data from the Fatal Accident Reporting System of NHTSA, Robertson (37) has estimated that for the years 1975 through 1978, some 37,000 fewer deaths occurred than would have been expected in the absence of the Federal safety standards.

Robertson observed a total death rate of 5.5 persons per 100 million vehicle-miles for cars not subject to safety regulations, but a rate of only 3.4 for cars meeting the Federal safety standards. A differential characterized all classes of victims (including pedestrians, motorcyclists, and pedalcyclists), but occupants of automobiles meeting the standards realized the greatest benefit, with a death rate of 1.5 per 100 million vehicle-miles compared with 2.9 for occupants of vehicles not subject to the standards.

Robertson did not examine the impact of safety standards on injuries and disabilities, but a qualitatively similar benefit would be expected. * Other studies also have documented decreased oc-

● It is possible that a safety standard which reduced deaths might thereby result in increases in nonfatal injuries. The evidence gathered to date, however, suggests that reductions in fatal and nonfatal injuries go hand-in-hand.

cupant deaths and nonfatal severe injuries associated with State and Federal safety regulations (7,16,21,35).

Most Federal safety standards are technological and fall into two categories: vehicle crashworthiness and crash avoidance. Table 4 lists prominent examples of existing Federal Motor Vehicle Safety Standards (FMVSSs) intended to protect automobile occupants solely in the event of an emergency; these standards are similar in intent to passenger restraint systems. It should be noted that nontechnological standards can have a comparable or greater effect in reducing the accident health toll; the national 55-mph speed limit stands as perhaps the most prominent example. In a 1979 study, the National Safety Council (NSC) estimated that there would have been an additional 5,500 motor vehicle, accident deaths per year were it not for reduced speeds and a narrower speed distribution, both of which are attributable primarily to the 55-mph law. NSC also estimated that if all States had raised their speed limits to 65 or 70 mph in 1978, an additional 5,200 to 7,800 deaths would have resulted that year (47).

The magnitude of the remaining accident health toll suggests the considerable potential for using additional technology to further decrease highway-produced deaths and disabilities. High usage rates of passenger restraint systems alone could reduce the toll by half (see ch. 4). Belted occupants of automobiles experience 50 percent fewer highway deaths than unbelted occupants (40)—yet it is estimated that only 10 to 15 percent of the population wears seatbelts, and the percentage has been falling in recent years (15). Automatic (i.e., passive) restraint systems are advocated precisely because of this failure of the vast majority of the population to use manual (i.e., active) belts. The reasons for, and implications of, the nonuse of manual belt systems are considered further below.

Table 4.—Existing Federal Standards Intended To Provide Protection in the Event of an Emergency

FMVSS	Title	Automatic performance required
105-75	Hydraulic brake systems	Requires split brake system for redundancy if primary system fails
110 .,.	Tire selection and rims	Rim must retain tire from 60 mph to stop after rapid deflation
111	Rearview mirrors	Breakaway inside mounting for mirror
201	Occupant protection in interior impacts	Contactable interior surfaces must be padded or meet performance requirements with headform impact at 15 mph
203	Impact protection for the driver from the steering control system	Steering assembly must absorb driver impacts under controlled crash criteria
205	Glazing materials	Windshield has a high penetration resistant inner layer
212	Windshield mounting	Requires windshield mounting retain specified periphery of windshield in crashes
215	Exterior protection	Provides vehicle protection in certain crash impacts
301	Fuel system integrity	Provides protection against fuel systems rupture and leakage in crashes

SOURCE: W. Haddon, Submission of Documents to W. Coleman, Jr., Secretary, Department of Transportation, Washington, D. C., Sept. 17, 1976.

MANUAL SEATBELTS

Front-lap seatbelts were first installed in all cars as standard equipment in 1964, when 14 States required them (41). By the late 1960's, lap and shoulder belts were required as standard equipment on all new cars sold in the United States. Thus, almost all cars on the road today are equipped with lap or lap / shoulder belts; the vast majority have the lap / shoulder combination. Studies indicate that, when worn, belts reduce the risks of death and serious injury by 50 percent or more (28,40). Although most people may not be familiar with the precise statistics, virtually everyone is aware that "seatbelts save lives, " as the publicity slogan put it years ago.

Yet, according to recent observations of manual belt use, only 11 percent of drivers wear their belts (15). Usage rates have fallen in recent years, following a brief period of increases in the mid-1970's. The increases in the mid-1970's may have been attributable in part to the ignition-interlock systems that were installed on 1974 and some 1975 model cars. The interlock systems provoked a loud and angry public response as drivers found themselves unable to start their cars when they placed cargo on the passenger seat (e.g., groceries or the family dog) that exceeded the weight minimum which activated the system. The congressional response was to prohibit the Department of Transportation from requiring the system on later cars (41).

Table 5 shows how belt usage varied in 1977-78 by automobile model year. The American Automobile Association claims higher usage rates in some of the (then) newer model cars with improved belt systems (13). Table 6 indicates how belt usage varied by sex, region of the country, and car size.

The result of such low usage rates is that manual belts in cars currently reduce the fatality and serious injury rates by less than 10 percent. Thus, a tremendous potential for saving lives and preventing injuries is going unrealized, despite the ready accessibility of the technology and the relative ease of its use.

Table 5.—Seatbelt Usage in 1977-78 by Car Modei Year

Car model year	Usage (percent) Lap only	Lap and shoulder	Total
1964 -67	8.9	—	8.9
1968 -71	8.5	2.4	10.9
1972-73	12.7	4.2	16.9
1974	2.7	14.4	17.1
1975	1.7	12.7	14.4
1976	1.4	12.2	13.6
1977	1.1	12.2	13.3
1978	1.2	12.5	13.7

SOURCE: National Highway Traffic Safety Adminlstration, Occupant *Protection Program Progress Report No. 2* (Washington, D. C.: Department of Transportation, April 1979).

Tabie 6.—Seatbeit Usage in 1977=78 by Sex, Region, and Car Size

Characteristic/Car model years	Total usage (percent)
Sex, 1964-78:	
Male drivers	12.6
Female drivers	16.4
Region of country, 1964-78:	
West coast	18.3
All other regions (average)	11.4
Car size, 1976-78:	
Subcompact	19.5
Compact	12.5
Intermediate	10.3
Full	9.6

SOURCE: National Highway Traffic Safety Administration, *Occupant Protection Program No. 2* (Washington, D. C.: Department of Transportation, April 1979).

What accounts for the extremely low usage rates? Two factors invariably cited in polls are discomfort and inconvenience (28), although a survey sponsored by General Motors (GM) has identified other factors as being of greater significance (e.g., fear of being trapped in a vehicle) (18). The issue of discomfort reflects belts' pressuring or abrading hips, chests, and necks and creating an unpleasant sense of confinement or restriction of movement. For some people, inconvenience refers simply to the minor effort involved in buckling a well-functioning belt system, while for others it relates to difficulties in retracting the belts or latching or releasing them.

In a study of its own, NHTSA concluded that many of the complaints about belts were well founded. A representative sample of Detroit-area drivers identified moderate or serious problems with comfort or convenience in all of the 30 cars tested, with the best-performing car cited as having a problem in 35 percent of the trials and the worst-performing car cited in 85 percent. In anticipation of automatic belt systems, NHTSA has been developing comfort and convenience specifications intended to address these problems (28). If the GM-sponsored study is correct, however, improvements in comfort and convenience may not lead to significant increases in belt usage (18).

The decision not to wear a belt presumably reflects a judgment that the disutility associated with discomfort, inconvenience, or other factors outweighs the perceived utility of reducing risk. Arnould and Grabowski (3) offer two related explanations for why this judgment is so common.

The first explanation, referred to as the "insensitivity-to-low-probabilities" hypothesis, suggests that for very low-probability events (such as a serious car crash on a single outing), individuals become insensitive to the high potential cost of not protecting themselves and indeed may not comprehend the meaning of the tiny probability; instead, they respond primarily to the unlikelihood of the event.

Arnould and Grabowski discuss a study (44) which illustrates the principle: two groups of experimental subjects were given data on the probability of experiencing a fatal or disabling accident. One group was given the figures for a lifetime (SO years) of driving (a l-in-100 chance of a fatal accident and a l-in-3 chance of at least one disabling injury), while the other group received the same information calculated on a per-trip basis (where the odds of the accident outcomes are minuscule). Compared with the latter group, the group given the lifetime figures responded by indicating a much greater increase in expected seatbelt usage and a greater disposition toward seatbelt laws.

Arnould and Grabowski also present evidence that people significantly underestimate their risk of involvement in an automobile accident. For example, a recent survey (45) queried: How likely do you think it is that you will be involved in an automobile accident of any kind in the next year? Fewer than a quarter of the survey respondents selected an answer equal to or greater than the actual societywide average, roughly 1 in ***10.*** A majority selected odds of 1 in 100 or smaller still.

The second explanation for the judgment that the disutility of buckling up outweighs the utility of protection is that the expected value of the protection for any given trip is extremely low, owing to the low probability of a serious accident, and thus, a driver (or passenger) simply may value avoidance of discomfort or inconvenience more than protection. This will be particularly true if, as above, the individual significantly underestimates the probability of an accident.

Arnould and Grabowski estimate the annual per-person benefits of buckling up at between $38 and $78 (in 1975 dollars) and state that, at prevailing wage rates (the assumed opportunity cost of time), this amount must exceed the time costs of buckling up. Hence, they conclude that a rational weighting of costs and benefits cannot explain the failure of so many people to wear their seatbelts. The authors acknowledge that "there may be significant discomfort costs to some individuals to wearing seatbelts. " Nevertheless, they suggest, "it would seem hard to argue that [this] would so change the . . . benefit-cost calculus to explain the 80- to 90-percent current nonutilization rate of seatbelts. "

While it is agreed that discomfort costs could not explain the entirety of nonutilization, it could be argued that they might explain much of it, particularly if "discomfort" is defined to include the psychological discomfort of those who fear being trapped in their cars by belts. Certainly, many riders who experience discomfort from seatbelts would accumulate hundreds of hours of discomfort if forced to wear them, and one would not need to value discomfort time highly to conclude that nonuse was rational behavior for these individuals.

Numerous characteristics differentiate belt wearers from nonusers (41). The latter tend to have less education than the former, rate belts as more uncomfortable and inconvenient, and are more likely to be smokers. The victims of serious crashes are less likely to wear belts than people not involved in serious accidents, especially in the case of youthful drivers and drivers under the influence of alcohol. Furthermore, unbelted drivers tend to follow the cars in front of them closer than do belted drivers. Collectively, all of these characteristics suggest that unbelted drivers are less risk-averse, or perhaps more risk-loving, than their belted counterparts.

Whatever the explanation, the fact remains that only a small minority of automobile occupants choose to wear seatbelts. The consequence in human destruction is tragic.