THE EVENING SUN
July 25, 1990

HIGH-SPEED CRASHES

A SPECIAL REPORT

First of three articles

Irving H. Phillips Jr. — Evening Sun Staff

Investigator Donald Livingston measures how badly damaged a car was in a crash that caused severe injuries.

Shock-Trauma team studies the carnage

By Mark Bomster
Evening Sun Staff

HE WAS GETTING ready for a demolition derby, his 1973 Dodge Polara stripped of its lights, the words "Ghost 68" spray painted on the side in Day-Glo orange.

He got there sooner than he'd expected.

On a quiet, winding road in Anne Arundel County, the 35-year-old driver smashed into a tree after flying off the highway at about 60 mph one June evening.

The car's left front end crumpled into an accordion of razor-sharp metal, driving the bumper more than 5 feet back into the passenger compartment.

The driver was trapped in the wreckage. Rescue workers had to cut the roof to free him before he could be taken to the Shock-Trauma Unit in Baltimore.

A day later, the heap sat in a dusty towing yard, as a two-man reconstruction team tried to piece together what happened.

Their work is part of a groundbreaking Shock-Trauma study into high-speed crashes, funded by the National Highway Traffic Safety Administration and the U.S. Centers for Disease Control.

See CRASH, A4, Col. 1

Motor vehicle deaths in the U.S.

	Total deaths	Deaths per 100,000 people
1980	51,091	22
1981	49,301	21
1982	43,945	19
1983	42,589	18
1984	44,257	19
1985	43,825	18
1986	46,087	19
1987	46,390	19
1988	47,093	19
1989	45,555	18

Source: Insurance Institute for Highway Safety

Shock-Trauma team studies the carnage

CRASH, From A1

The three-year, $580,000 study, now two-thirds complete, is the largest and most complete federal study to date of actual high-speed crashes and their victims.

It reveals disturbing things about the people involved in such accidents, and about car design features that may contribute to severe crash injuries.

For example, many of the crash victims suffered severe injuries in cars that, when new, met the federal government's crash protection standard, which is based on hitting a fixed barrier head-on at 30 mph.

The degree of injury suggests that different and tougher standards may be needed, researchers say.

More surprising, however, is the emerging psychological profile of the crash victim — and the victim's role in the accident.

Preliminary data show that an unusually large number of the car crash victims are men in their 20s and 30s, with a history of drug and alcohol abuse, divorce or recent death in the family, and trouble with authority.

> **"You can only determine the effect of motor vehicle injuries on people. Dummy and cadaver studies are useful, but they do not produce injury and disability."**
>
> **— Dr. John H. Siegel, principal investigator**

"What you have here is a profile of a young risk-taker, with a background of family stress," says Dr. John H. Siegel, principal investigator and deputy director of the Shock-Trauma Unit.

When those high-risk drivers take to the road, often under the influence of alcohol, the results can be tragic.

The human cost is graphically apparent to Donald J. "Doc" Livingston, who heads the crash reconstruction team that goes over each vehicle after an accident.

Livingston works for Dynamic Science Inc., a consultant on the study. On a typical day, he and a co-worker arrive at a tow yard in Anne Arundel County to inspect a smashed car.

Less than 24 hours earlier, the severely injured driver was being pried from the vehicle.

On the car's right front fender sits a bloodstained work boot, a grisly reminder of the accident that nearly claimed a life.

The front seat shows a spattering of blood. Surgical gloves lie scattered on the floor — along with an empty Budweiser can.

The force of the crash ripped the floor apart, shoving the brake and gas pedals sideways past the center of the front seat.

The investigators find bits of clothing fabric under the dashboard and a "spider web" fracture in the windshield from the driver's head.

"A hell of a hit," says Livingston.

But, unfortunately, not an unusual one.

45,555 DIED ON HIGHWAYS

Last year, 45,555 people died on the nation's highways, according to the Insurance Institute for Highway Safety. The toll in Maryland was 726.

Millions more people are injured each year in car crashes that leave many victims permanently disabled and cost society billions of dollars.

The Shock-Trauma investigators will focus on about 150 such severely injured victims, all of them admitted to Shock-Trauma with multiple injuries from high-speed crashes.

The investigators reconstruct each accident, study the severity of crash injuries and the costs of treatment, and probe the psychological and social backgrounds of the victims themselves.

They track the subjects from the moment of their admission to Shock-Trauma through the long, painful process of rehabilitation that follows a severe crash.

By contrast, most federal studies use electronic dummies or cadavers to simulate car crash outcomes — and such tests have obvious shortcomings.

"You can only determine the effect of motor vehicle injuries on people," says Siegel. "Dummy and cadaver studies are useful, but they do not produce injury and disability."

Though still preliminary, the Shock-Trauma study paints a picture of the crash victim as a troubled young risk-taker beset by personal or family problems.

The pattern is most pronounced for those victims involved in lateral, or side, crashes.

That's the kind of accident that might come from running a red light, for example, or from cutting across a lane of oncoming traffic.

LATERAL CRASH VICTIMS

Among victims who had been involved in lateral crashes at this point in the study:

- 40 percent had suffered a recent death in their extended families.
- 47 percent had a history of trouble with alcohol, 27 percent trouble with drugs, and 58 percent had alcohol problems in their families.
- 26 percent had recently been divorced or separated, and 20 percent reported the breakup of a relationship.
- 20 percent had a history of family violence.
- 55 percent had been suspended from high school at some point, and 47 percent had prior problems with the authorities.

But a similar picture emerges for head-on crash victims, where some 24 percent of the initial study group

Breakdown of motor vehicle deaths in U.S.

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Occupants										
-Passenger cars	27,424	26,615	23,161	22,820	23,470	23,050	24,808	25,004	25,700	24,927
-Pickups, vans, utility vehicles	7,513	7,073	6,512	6,346	6,613	6,798	7,398	8,161	8,404	8,619
-Tractor-trailers	887	840	728	735	853	751	696	659	711	648
-Other trucks	347	292	215	244	220	220	223	190	198	201
Motorcyclists	4,961	4,746	4,270	4,104	4,431	4,417	4,309	3,834	3,486	3,036
Bicyclists	965	936	864	830	838	869	929	940	900	824
Pedestrians	8,070	7,837	7,331	6,826	7,025	6,808	6,779	6,745	6,869	6,552
Other	897	962	864	684	807	912	945	857	825	751

Source: Insurance Institute for Highway Safety

reported a death in the extended family, 27 percent had alcohol problems and 42 percent had been suspended from high school.

In general, the study found a higher than usual amount of "socially disruptive behavior" among a sample group of 48 patients.

Social worker Kathleen M. Read works closely with the patients in the study and with their families, taking detailed information on stressful events — known as "life stressors" — for the victims before the crash.

"It seems that across the board, we see people with a high level of stressors," says Read. In many cases, the stressful event took place three months to a year before the crash.

She cites as one example a 20-year-old man who lost control of his emotions and paid dearly on the highway one night. But there were danger signs long before the accident.

After a childhood full of behavior problems, the young man had dropped out of high school following numerous suspensions for drug abuse.

He had been through drug treatment for cocaine and marijuana use and had attended Alcoholics Anonymous. In the months before the crash, there were bouts of heavy drinking.

Upset about breaking up with his girlfriend, he went out drinking and wound up crashing a speeding car while being chased by the police.

The human cost was staggering: quadriplegia as a result of a severed spinal cord, along with a leg amputation.

But the financial cost was no less crippling: medical bills totaling $189,000 for hospitalization, physicians and in-patient rehabilitation, as of four months after the accident.

A similar pattern emerges in other cases pulled from the Shock-Trauma files:

■ A 39-year-old woman, recently relocated to Maryland, whose abusive third marriage broke up three weeks before the crash, and who was laid off two days before.

■ A 17-year-old boy with a history of drug abuse and high school suspension, who had been using alcohol at the time of the accident.

"It's the first time that we've really noticed these differences and some of these high-risk factors," says Read.

At this point, researchers are cautious about drawing any hard conclusions from the preliminary data.

But the results generally suggest that the typical fatal crash victim, in particular, may have been distracted behind the wheel at the time of the accident. Many also had been drinking at the time.

ABUSERS, RISK-TAKERS

"They're risk-takers to begin with," says Siegel. "Because of whatever substance abuse pattern they have, they misjudge."

As a more complete picture emerges of the typical high-risk individual, Siegel says, "one might be able to identify the potential category of risk-takers early."

That could lead to aggressive driver's training programs — or even restrictions on those drivers early in their driving careers, "rather than waiting till they get into the damn accident," says Siegel. "It's not only them they're messing up."

And Read cautions others not to be complacent just because they fall outside the high-risk pattern suggested by the study's early results.

Though many of the study subjects fit that pattern, many others were innocent victims in accidents that may have been caused by someone who met the high-risk profile.

"They may be the cause of many innocent people's lives being destroyed," Read says. "We're all such random victims, that's the scary part."

TOMORROW: Assault by metal and glass

HIGH-SPEED CRASHES

A SPECIAL REPORT

Crushing costs of automobile accidents

Tougher safety standards suggested

THE EVENING SUN
July 28, 1990
FRONT PAGE COVER

By Mark Bomster
Evening Sun Staff

THE HUMAN body in a car is like an egg in a lightly padded steel box. Imagine that box slamming into a wall at 50 miles an hour or more.

At the Shock-Trauma Unit in Baltimore, the federal government is sponsoring the largest and most complete study to date of what happens to actual victims in a high-speed car crash.

The study's preliminary findings suggest that current federal crash standards are insufficient to prevent devastating injuries costing billions of dollars each year.

Those standards, based on tests using special electronic dummies to simulate the injuries, are developed using head-on crashes at 30 mph into a fixed barrier.

Real crashes often take place at an angle or from the side, however, undermining the relevance of a head-on crash test.

And the standards assume that all drivers are wearing seat belts — a risky assumption at best, researchers say.

"The real crashes are quite a bit different from the arbitrary ones they're using for testing," says Dr. John H. Siegel, who is heading up the new study at Shock-Trauma.

As a result, he says, some of the government's standards are either too loose or simply irrelevant to the type of injuries that occur on the highway.

So far, the Shock-Trauma study has generated statistics from 55 victims of high-speed crashes who ended up in the emergency medical unit with injuries from head-on or side impacts.

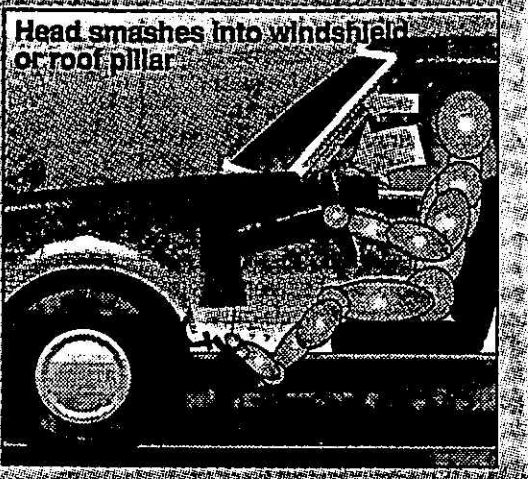
Those victims suffered a variety of traumatic injuries, caused mainly by parts of the car that crush their way into the passenger compartment and by parts of the passenger compartment itself.

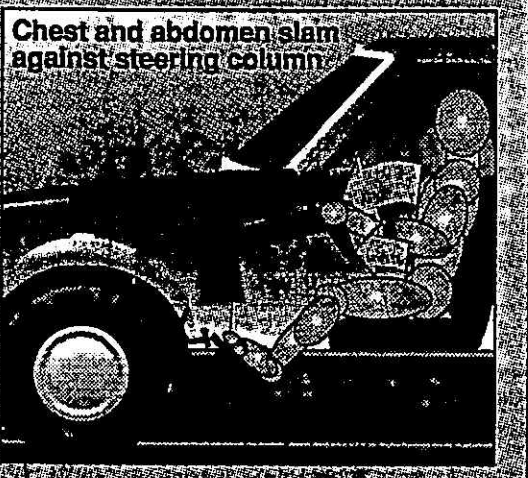
Many of those injured were hurt in vehicles that, when new, met the current federal crash test standards.

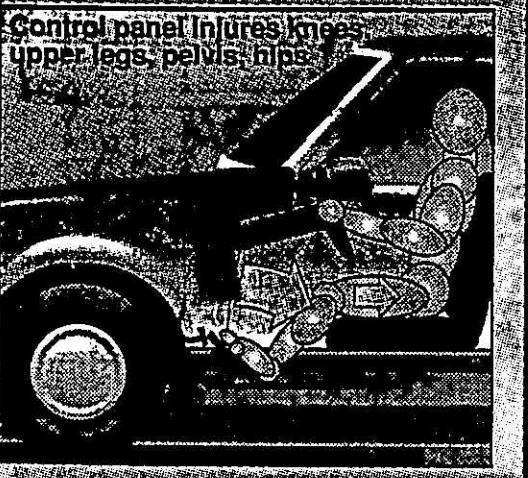
See CRASH, A4, Col. 1

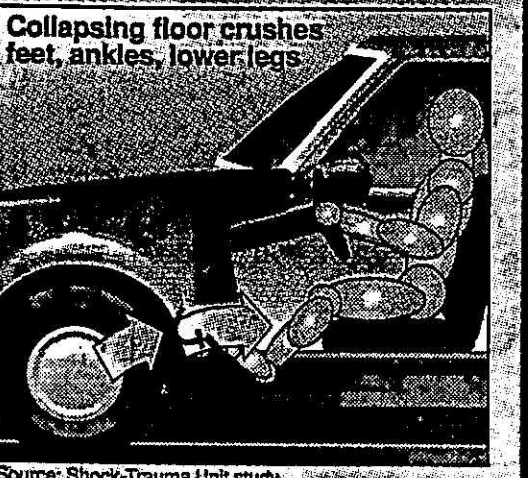
Assault by metal and glass

Unbelted driver in high-speed, head-on crash









Source: Shock-Trauma Unit study

By Jef Dauber — Evening Sun Staff

Crushing costs of accidents seen boosting standards

CRASH, From A1

"If people were fully aware of the devastation to family life and to people's personal dreams and hopes . . . none of us would drive around in the cars that are made today," says social worker Kathleen M. Read, who is assisting in the study.

Auto industry representatives respond that their vehicles meet the current federal crash standards.

But there is no arguing about the real human cost of high-speed crashes, which kill thousands of people and maim thousands more each year.

Based on preliminary results, Shock-Trauma researchers sketch this scenario of a high-speed crash involving an unbelted driver:

In a split second, your body is assaulted by metal and glass.

Your head slams against the windshield — or against the steel "A" pillar that supports the roof, cracking your skull and damaging your brain.

Your chest and abdomen smash into the steering wheel and steering column.

In a head on-crash, the front wheel crushes back into the passenger compartment. The "toe pan," or floorboard, smashes into your lower extremities, fracturing your feet, ankles and lower legs — maybe trapping you in the wreckage.

The control panel slams forward into your knees, driving the large bones of your upper legs back into your pelvis and hips.

It may take 20 minutes or more for the rescue team to cut you out of the mangled vehicle. In the meantime, the resulting blood loss compounds your brain injuries.

In a lateral or side crash, the car door crushes in on you, causing serious damage to your chest and internal organs, including the liver and spleen. Your head hits the "A" pillar supporting the roof or the side window frame.

The resulting brain damage is likely to be even more serious than if you hit the windshield, because the side of the head houses parts of the brain responsible for speech, hearing, and coordinative functions.

It may take 20 minutes or more for the rescue team to cut you out of the mangled vehicle. In the meantime, the resulting blood loss compounds your brain injuries.

If you live, you face months of painful recovery, staggering medical bills and the specter of long-term disability.

The exact injury depends to a great extent on whether the crash was a head-on or lateral impact, says Siegel.

In both kinds of crashes, most of those people studied were trapped in their cars.

But frontal crash victims were more likely to suffer from severe blood loss and shock, according to preliminary findings. That can lead to massive failure of the heart, lungs and other organs.

Frontal crash victims had crippling injuries from the crushed toe-pan and from the instrument panel. And they received more facial and skull injuries from slamming into the windshield, steering wheel and rear-view mirror.

But Siegel adds, "What we found in the lateral crashes was in some ways more disturbing."

People involved in side-impact crashes were more likely to have brain damage — and more serious brain damage — than those involved in head-on collisions.

The main instruments of injury appear to be the "A" pillar, the steel supporting structure that helps hold up the roof, as well as the side window frame.

A lateral head injury "is a terrible injury," says Siegel. "The ability to think, have some kind of memory, be able to go back to work, is significantly impaired."

Lateral crash victims also suffered serious internal injuries, along with fractures of the hip and pelvis, from the door, armrests and other side structures.

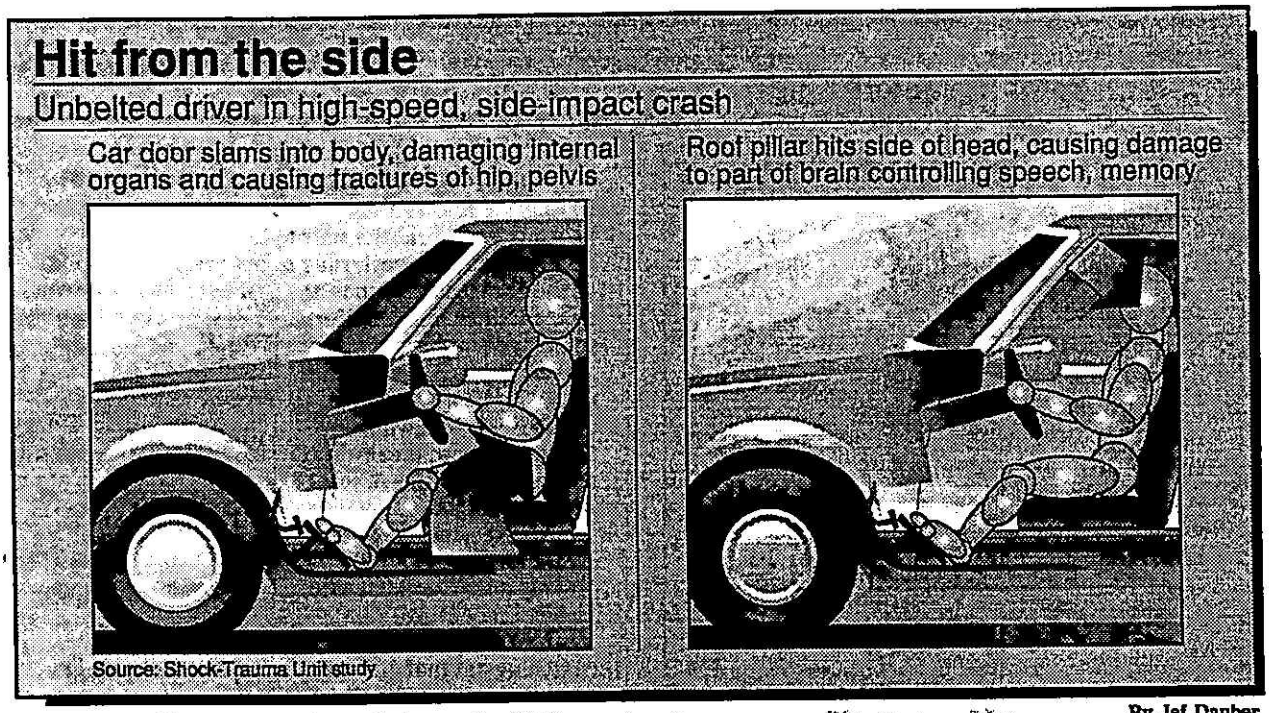
Seat belts certainly help protect motorists from some upper body injuries and head injuries in frontal crashes, Siegel says. But even they offer little protection to the driver in a side crash, or to victims of any crash in which the passenger compartment collapses inward.

In the study, fewer than one in three of those involved in head-on crashes — and only about one in five of the side crash victims — were wearing seat belts.

What could be done to reduce the injuries that take place in a high-speed crash?

Siegel suggests a number of vehicle design changes, based on the Shock-Trauma study's preliminary findings:

- A stronger toe-pan and reinforced instrument panel, to cut down on injuries to the lower extremities, hips and pelvis.
- Stronger doors, and different placement of armrests and other features.
- Moving the "A" pillar farther away from the occupant's head.
- Side air bags to protect against injury in lateral collisions.



By Jef Dauber

(As of the 1990 model year, all passenger vehicles must be equipped with "passive restraints" in the front seats, either front air bags or automatic seat belts. An estimated 4 million vehicles on the road had air bags as of this year, according to federal estimates.)

■ Shatterproof side windows with plastic inner linings, similar to those in the windshield, to prevent occupants from being thrown out the side.

Siegel also suggests that the current laboratory crash standard of 30 miles an hour fails to test for the kinds of accidents that actually take place — a view that has some auto industry support.

A lateral head injury "is a terrible injury," says Dr. John Siegel, head of the study. "The ability to think, have some kind of memory, be able to go back to work, is significantly impaired."

And Siegel urges tougher standards regarding head injuries, as well as standards that would for the first time specifically address injuries to the pelvis, lower leg bone, ankles and feet.

Some changes are in the works already, according to federal transportation officials. The government has proposed regulations to raise the level of protection required from side crashes.

A final decision on the regulations is due this year. The proposed rules would require improved door and door-latch structures and better padding on the interior of the door.

But Albert Slechter, a Chrysler Corp. regulatory expert, cautions that safer car design means more than just tinkering with individual parts of the vehicle.

In a crash, "the vehicle... is very much a system," whose different parts must work together to protect the passenger, he says.

To meet the 30 mph federal crash standard, for example, the car's front end is designed to crush inward by some 20 to 25 inches, dissipating the force of the crash. That force otherwise would be transmitted to the passengers.

Seatbelts or airbags further protect the passengers from the dangerous force of the crash, and their designs assume that crashes will take place within a certain likely range of speeds.

To meet a higher-speed crash standard, manufacturers would probably stiffen the front of the vehicle, meaning it would crush less in a frontal impact, says Slechter.

But a stiffer front end also means that passengers would have to be protected from more force in the event of a crash, complicating the job of the restraint system. There could even be some trade-off in the vehicle's performance in lower-speed crashes, says Slechter.

Tom Carr, a spokesman for the Motor Vehicle Manufacturers Association in Detroit, says he has not seen details of the Shock-Trauma study and therefore cannot comment on it directly.

But he says that car makers doing their own tests have modified designs to prevent injuries that might not have been predicted by the government-sponsored crash tests.

And he adds that "a lot of these injuries would be affected by better driver behavior," including consistent use of seat belts.

Siegel, however, insists that cars could be made safer, and that Congress should require it.

"We can't legislate out cancer," says Siegel. "We can do a lot to legislate out motor vehicle accidents."

TOMORROW: Safer cars vs. staggering medical bills

The Evening Sun

BALTIMORE, FRIDAY, JULY 27, 1990

Safer vehicles vs. staggering medical expenses

HIGH-SPEED CRASHES

A SPECIAL REPORT

Last of three

By Mark Bomster
Evening Sun Staff

THE 44-YEAR-OLD scientist was driving home from work in his pickup truck. A careful man, he was wearing his seat belt.

Then a car going in the opposite direction crossed the median strip out of control at about 50 mph — 73 feet per second — and hit the pickup head-on.

Both drivers survived, but the scientist got the worst of it. Severe brain damage and extensive lower-body injuries resulting in a year of rehabilitation, and $222,000 in medical bills within six months of the crash.

Recovering from the brain damage was especially difficult because the injury worked subtle changes on his personality and put a heavy strain on his family.

After six months at home, he was able to return to work just one day a week, under the careful supervision of his employers.

Such stories are typical among people injured in high-speed car crashes, say researchers at the Shock-Trauma Unit in Baltimore, site of a unique crash study funded by the federal government.

Though more than 40,000 people are killed on the roads each year, the thousands more who are severely injured put a far heavier financial strain on society.

According to a report prepared for Congress last year, automobile crashes resulted in direct costs of $12.3 billion in 1985. But the total projected lifetime costs from those injuries was far greater: $48.7 billion.

And severe crashes in which the victim survived carry the biggest price tag, according to other figures cited by the Shock-Trauma researchers: $179,881 in direct treatment costs, compared with $1,471 in the average fatal crash.

In Maryland alone, car crash injury costs totaled $38.4 million in a single year, researchers found, citing figures from the state's Health Services Cost Review Commission.

"It's the injury that's driving that insurance bill up," says Dr. John H. Siegel, chief of the Shock-Trauma study. "You've got to reduce the injuries and reduce the cost of insurance."

The Shock-Trauma study takes a comprehensive look at the injuries sustained by actual crash victims, including the total cost of treatment.

According to figures drawn from a study of 42 patients for whom cost figures are available so far, head-on crashes resulted in average in-patient costs of $72,680 for hospitalization and doctor care.

Lateral or side crashes cost an average of $46,630. These victims also tended to sustain worse brain damage that lingered long after they had recovered from other injuries.

The 42 patients studied so far accounted for just 1 percent of all hospitalized car crash victims in Maryland — but for nearly 8 percent of all acute hospital costs and doctor fees resulting from car crashes.

And those figures do not include added costs for out-patient rehabilitation, job loss, long-term disability and legal fees that may result from an accident, Siegel notes.

According to one national estimate cited in the study, just 2 percent of all non-fatal crashes are likely to account for 44 percent of lifetime medical costs from such accidents.

Crash victims often are young, working-class people of limited means. Many of the victims in the study had no health insurance, and the cost of their treatment was borne by medical assistance programs.

Even victims with good insurance can sometimes use up their benefits. In the case of the injured scientist, the family eventually exhausted its savings and had to refinance their home.

All of that leads Siegel to conclude that medical and insurance savings would far outweigh the cost of making safer cars.

That fact may do more to alter car design than the annual body count, he says, adding that big dollar figures have "a tremendous impact in our society — far more than death and disability."

New vehicles now must meet federal crash test standards, based on a head-on crash into a fixed barrier at 30 mph. In addition, the government publishes 35 mph crash data on a limited number of cars, strictly for the benefit of consumers.

Seat belts and shoulder belts have long been required in passenger cars. As of the 1990 model year, all cars must be equipped with passive restraints, such as air bags or automatic seat belts.

Automakers are reluctant to speculate on how much it would cost to build a car capable of meeting a higher-speed crash test.

"We don't do a formal cost-benefit analysis," says Toni Simonetti, a spokeswoman for General Motors.

She says that virtually every part of the car, from the brakes to the windshield wipers, affects its safety. That makes it hard for car makers to put a price tag on the cost of safety equipment.

But Simonetti estimates that passive restraint devices, such as automatic seat belts and air bags, accounted for about a third of the company's 3 percent cost increase last year. Air bags alone cost several hundred dollars, she says.

In the 1990 model year, GM produced about 500,000 units with air bags, or about 15 percent to 17 percent of its fleet. The 1991 model year will include about 1.3 million cars with air bags.

Chrysler, which has driver's-side air bags in all vehicles made in the United States starting with the 1990 model year, estimates the manufacturer's cost for the devices at $300 per vehicle.

Simonetti mentions an experimental crash-resistant vehicle built back in the 1970s and says, "I don't think you or I would buy it. . . . It's very heavy, it's very ugly, it's very impractical."

Albert Slechter, a Chrysler Corp. regulatory expert, says the easiest way to build a more crash-resistant car is by increasing the amount of metal in the vehicle's structure.

But "adding safety adds weight," he says. "When you add weight, you lose fuel efficiency." And automakers must meet certain federal requirements on fuel efficiency, Slechter points out.

He also notes that even a simple increase in the barrier-crash standard from 30 to 35 mph "essentially requires a total redesign of the car."

However, some government-sponsored research suggests that a safer vehicle could be marketed for a moderate or nominal increase in price.

Donald Friedman is president of MCR Technology Inc., a Santa Barbara, Calif.-based firm specializing in car safety research and development.

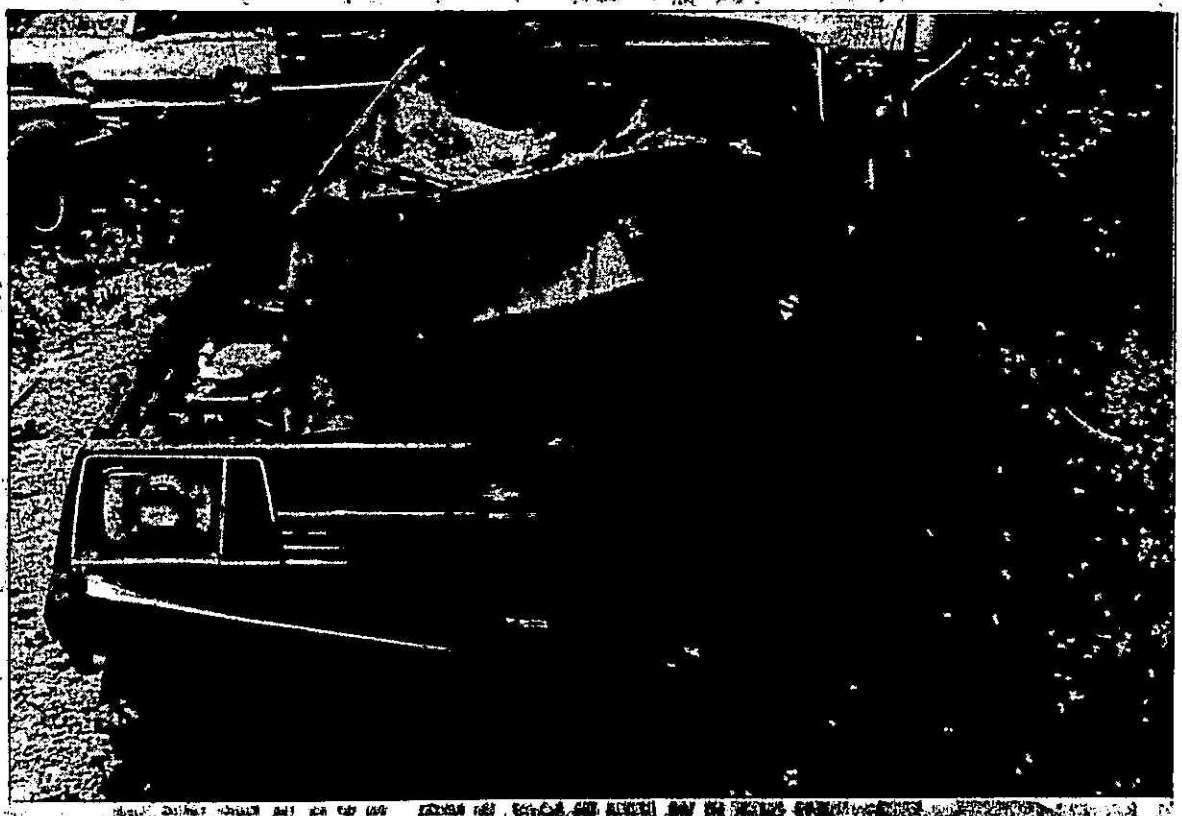
Working under contract to the National Highway Traffic Safety Administration in the 1970s, his company designed, from scratch, a car capable of passing a 50 mph crash test.

Researchers estimated that the car would cost consumers about 30 percent more than a comparable 1978 model year vehicle.

"The cost today to do the same thing would be not more than 10 percent," says Friedman, pointing out that the earlier estimate included start-up costs for air bags and other safety systems now fully developed and on the market.

Friedman's company also came up with design modifications for existing models that would have enabled them to pass a 40 mph crash test.

As for today, "I would say that the cost of improving the [test] performance from 30 mph to 40 mph is a few hundred dollars — no more than $400 — for both the passenger and the driver," Friedman says. "At the cost of today's cars, that's peanuts."



Side-impact crashes (top photo) often produce devastating injuries because the car door crushes in on the driver, causing fractures of the hip and pelvis and damaging internal organs such as the liver. Moreover, the roof pillar and side-window frame may hit the side of the driver's head, causing brain damage. In a head-on crash (photo at right) the car's windshield, steering column, lower part of the control panel and floor all can inflict severe injuries on the driver.

Photos by Irving H. Phillips Jr
Evening Sun Staff