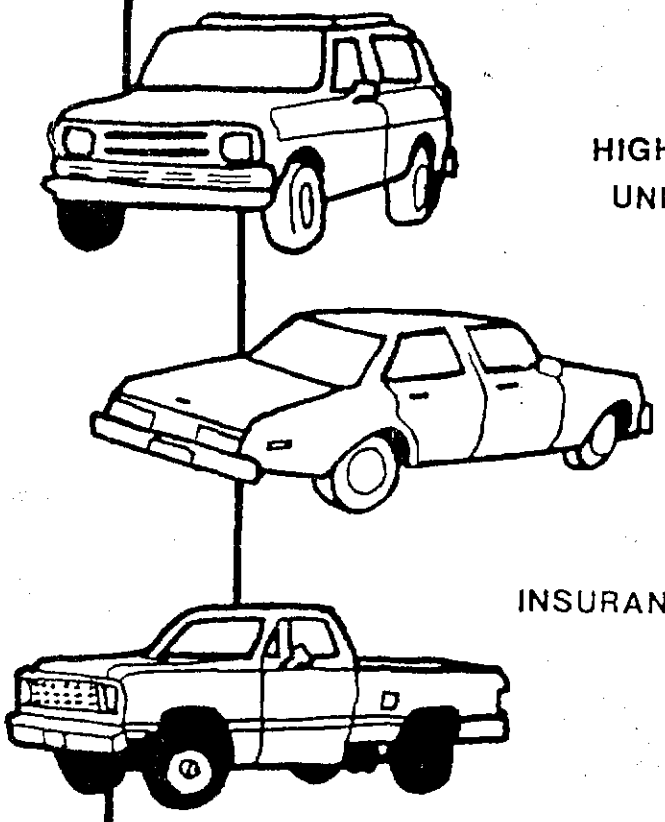
A Comparison of the Crash Experience of Utility Vehicles, Pickup Trucks and Passenger Cars



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ACKNOWLEDGEMENTS

This study would not have been possible without the help of a number of people who provided the accident data and registration data. The authors would particularly like to express their appreciation to personnel in the North Carolina Division of Motor Vehicles and the Maryland Department of Motor Vehicles for providing the multi-year statewide accident data base used in this investigation.

In addition, the authors are especially grateful to both their programming staffs and their secretarial staffs at the Highway Safety Research Center and the Insurance Institute for Highway Safety for their valuable assistance in this study.

Although the report reflects the efforts of many, the authors are solely responsible for its contents, including whatever shortcomings there may be.

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CHAPTER I. INTRODUCTION

For some time it has been alleged that the small, multi-purpose military vehicles commonly referred to by millions of World War II servicemen as "jeeps" are more suceptible to rollover than other four-wheeled motor vehicles. In fact, in the early 1970's, the U.S. Army ended its practice of selling these surplus military vehicles to the public because of their "high rollover accident rates" (Department of Transportation, 1971). A variety of civilian modifications of these multi-purpose vehicles, referred to as utility vehicles, has become increasingly common on the highways. Of this type of vehicle, the most popular models have been the AMC Jeep CJ-5, the Ford Bronco, and the Chevrolet Blazer. With the crash experience of military "jeeps" as background, it is of interest to examine the crash experience of these civilian utility vehicles and to contrast it with the experience of other motor vehicles.

Although the technical literature is sparse in this area, Synder, McDole, Ladd, and Minahan (1980) have reported the on-road crash experience of civilian utility vehicles based on 1975-78 accident data from Arizona, Maryland, Michigan, New Mexico, New York, North Carolina, Texas and Washington. They concluded that utility vehicles "...experience rollover at a rate that is at least five times higher than that experienced by the average passenger car." The study also indicated that some individual utility vehicle models are more likely to overturn than others, and that the Jeep CJ-5 is the least stable of the models studied.

The purpose of the present study is to examine in detail the crash experience of leading utility vehicle models to determine the extent to which there are variations in their crash experience and whether specific models appear to have particular problems.

This study focuses on the three leading utility vehicles -- the AMC Jeep CJ-5, the Ford Bronco and the Chevrolet Blazer -- that represent well over half of the utility vehicles currently in use. For the Jeep CJ-5 the model years studied were 1972 to 1978; for the Chevrolet Blazer, 1973 to 1978 (prior to the 1973 model the Blazer was smaller); and for the Ford Bronco, 1972 to 1977 (the 1978 and later model Broncos were larger). Results were not obtained separately for other popular utility vehicles such as the Jeep CJ-7, which was not sold until 1978, or 1978 and later model Ford Broncos, because at the time there were not sufficient numbers of them on the highways for reliable results concerning their crash experience to be obtained although they are included in the "all utility vehicles" group.

For comparison purposes, the crash experience of a number of leading small (half-ton) pickup truck models was used. These were the Ford F-100 and F-150, the Chevrolet C-10 and K-10, and the smaller Toyota and Datsun pickup trucks. In addition, the crash experience of four passenger car size groups -- subcompacts, compacts, intermediate, and full-sized -- was examined.

The overall crash experience of these vehicles in Maryland and in North Carolina, together with the national fatal crash experience as recorded by FARS (the Fatal Accident Reporting System), were studied.

CHAPTER II. THE DATA

Background

In order to examine the accident and injury experience of drivers of utility vehicles, pickup trucks, and passenger cars, the following data was needed: crash data and some corresponding measure of exposure. Since vehicle-specific mileage was not available as a measure of exposure, registration frequencies provided by R. L. Polk & Co. were used as the best alternative source.

Mileage data would, of course, have been preferable because of the possibility of the annual mileage exposure of the different classes of vehicles differing significantly. To the extent that that occurred, utilizing registration data could have either obscured differences that actually existed or tended to show differences where they truly did not exist. For example, two vehicles could have had the same registration involvement rate; but if one vehicle class was only driven half as many miles per year as the other, then that would indicate that on a mileage basis one vehicle was much more involved in accidents than the other. Similarly, where considerable differences occurred, it could have happened that a vehicle that showed a higher accident rate per unit registration might in fact have had no truly higher accident rate because it was driven more miles per year. However, as was stated, this mileage data was not available and therefore registration data was the best available alternative.

For the crash data, the following data files were used: statewide police-reported crash data for North Carolina during 1973-1978; statewide police-reported crash data for Maryland during 1974-1978; and FARS (Fatal Accident Reporting System) data for the United States during 1978-1979.

Vehicle registration data was available from R. L. Polk & Co. for the period beginning with 1975. Thus, with the exception of the fatality rates which utilize only 1978 and 1979 national registration and fatality frequencies, crash rates based on registration counts used registration and crash data beginning with 1975.

As stated in Chapter I, the purpose of this study is to contrast the crash experience of several types of vehicles as well as the leading models or vehicle sizes within these groups. Half-ton pickup trucks were used as a comparison group for the utility vehicles, since they have somewhat similar vehicle characteristics such as wheelbase length and may also be used for similar trip

purposes. Passenger cars by size were used as an additional comparison group because of the general familiarity of the driving population with these vehicles. Thus, these three vehicle classes cover a range of use and exposure characteristics.

To select the specific makes, models, and model years of utility vehicles and pickup trucks needed for the analysis (see Appendix A for a detailed listing), Vehicle Identification Number (VIN) patterns were used to identify the various subgroups. For example, the Jeep CJ-5 VIN for the model years studied (1972-78) was a 13-character string with the following pattern:

Characters	Pattern
1-6	J _ _ 83 _
7-8	Alpha characters
9-13	Numeric production number sequence

For all study groups, additional checks were carried out to remove any vehicles with acceptable patterns but clearly incompatible make designations. The makes and models of utility vehicles and pickup trucks used in this study (see Appendix A) were extracted primarily by using such VIN pattern specifications.

Car size groups were defined by wheelbase length (subcompact < 102 in., compact 102-111 in., intermediate 112-120 in., full-size > 120 in.) which were determined from the VIN's using available VIN-decoding packages.

The following are details concerning the accident and registration data files used in this analysis.

Accident Data

FARS (Fatal Accident Reporting System). This file is a census of fatal motor vehicle accidents occurring throughout the United States. A fatality is defined as death within 30 days resulting from a motor vehicle crash. FARS assembles and standardizes information from police accident reports, driver licensing files, motor vehicle registration files, state and federal highway department files, and medical files. Of particular importance to this study is that FARS includes VIN information.

North Carolina Data. This file is a data base of recorded accidents during the years 1973 to 1978.* Accidents involving three vehicle types--utility vehicles (multi-purpose vehicles usually designed for both on-road and off-road use), pickup trucks, and passenger cars--were identified.

The North Carolina study file was created from the State's accident files by using VIN patterns and model years as criteria for identifying accidents involving the utility vehicle and pickup truck groups of interest. An edit check was performed to identify any mismatches between the vehicle make or type and the VIN pattern. When discrepancies were found, vehicles were removed from the study file. With such cases removed, the study file consisted of accidents involving the three leading utility vehicles (Jeep CJ-5, pre-1978 Ford Bronco, and Chevrolet Blazer) and four groups of half-ton pickup trucks (Ford F-series, Chevrolet C-series, Toyota, and Datsun). The 1978 Ford Bronco was included in the Other Utility Vehicle group as it has undergone considerable design changes. Appendix A provides a more detailed listing of these vehicle groups, as well as information on the model years included and the registration counts.

Because most of the utility vehicles and pickup trucks included in the study file were from model years 1972 to 1978, the passenger cars included in this study were selected for the same model year range. Passenger cars were also grouped by wheelbase length as follows: subcompact (< 102 inches), compact (102 - 111 inches), intermediate (112 - 120 inches) and full-size (>120 inches). Due to the large number of passenger car accidents in the file, a systematic sample of one in three single vehicle passenger car accidents and one in six multi-vehicle passenger car accidents were selected. Single vehicle car accidents were over-sampled because of the special interest in single vehicle accidents and their lower frequency compared to multi-vehicle accidents. All pickup truck accidents and utility vehicle accidents were used in the analysis.

The variables extracted from the North Carolina accident files for analyses included the following officer-reported factors: crash type (including rollover and non-collision overturn in road), driver injury, age, and belt usage.

Crash type (that is, whether the officer characterized the accident as single vehicle or multi-vehicle) was created by counting the number of vehicles

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*In North Carolina, any accident resulting in death or injury or total property damage in excess of $200 must be reported to the State (see Appendix B for a copy of the North Carolina Accident Report Form).

involved in each accident. Single vehicle accidents included all accidents involving only one vehicle, while multi-vehicle accidents were defined as collisions of motor vehicles with at least one other vehicle(s), excluding collisions involving pedestrians, bicycles, or trains.

"Rollover" is one of the events coded under the variable, "point of initial contact" (see Appendix B). A check box is provided on the accident form for officers to indicate whether rollover occurred. If this box is not marked, it is necessarily assumed that rollover did not occur.

"Non-collision overturn in road" is one of the accident types coded on the North Carolina accident form. Since it applies to non-collision events only, the overturn-in-road analysis was performed only for single vehicle crashes. However, because there is no separate code for overturn off the road, it could be that some off-road rollovers are recorded by the officers as overturns in the road. Thus, caution should be exercised when interpreting the data concerning the "overturn in road" variable.

In North Carolina, driver injury is coded as follows (see ANSI D16.1, National Safety Council, 1976):

K = killed

A = incapacitating injury, that is, any injury other than a fatal injury which prevents the injured person from walking, driving or normally continuing the activities he was capable of performing before the injury occurred

B = non-incapacitating injury other than K or A injury evident at the scene

C = no visible sign of injury but complaint of pain, momentary unconsciousness

O = not injured

In addition, North Carolina makes a distinction between "driver not present" and injury "not stated." In all computations involving the driver injury variable, cases which had been indicated by the investigating officer as "driver not present" or for which injury information was "not stated" were excluded.

Like driver injury information, belt usage by drivers is recorded by the officer at the scene. Belt usage can be classified into seven categories: no belt, lap belt, lap and shoulder belts, shoulder belt, child restraint, driver not present, and not stated. For the present analyses, "driver not present" and "not stated" were eliminated from the computations and the remaining categories were combined into two groups -- "not belted" and "belted".

Finally, the actual age of the driver on the date of the accident is usually recorded on the accident form. For simplicity of analysis, these ages were grouped as follows: under 20, 20 to 24, 25 to 29, 30 to 34, and over 34 years of age. This age variable was later used to examine the characteristics of drivers involved in crashes in various kinds of vehicles.

Maryland Data. In many respects, the Maryland and North Carolina accident data files are very similar; and, when this is the case, the previous details will not be repeated for Maryland. Accidents during calendar years 1974 to 1978 reported to the State constituted the data base.* Although the accident report form was revised (effective January 1, 1977), the data elements of interest for this study did not change; data from the two periods were thus comparable and appropriate to combine.

As in North Carolina, utility vehicle and pickup truck makes and models were identified using VIN patterns and various edit checks. Also, the passenger car size groups were constituted using the VIN-decoding computer package.

Similar variables were extracted from the Maryland accident file (e.g., crash type including rollover, driver injury and age). "Non-collision overturn in road" was not available in this file. "Rollover" was determined from the code "overturned" indicated in either the "accident type" or the "areas damaged" sections of the form (see Appendix B). Both codes were examined for all cases since, for example, in some instances "accident type" was listed as "overturned" while "areas damaged" was coded as "totaled." Contrarily, other cases listed "accident type" as "hit fixed object" as the first event; but "areas damaged" was coded as "overturned." Obviously both cases involved rollovers and should have been included as such.

Injury is categorized as in North Carolina as fatal, incapacitating, non-incapacitating, possible injury, or no injury. Comparisons of accident data in the two states suggest that the officers use the same injury definitions.

Finally, actual driver age at the time of the accident is available on the crash form and for this analysis was grouped into the following age categories: under 20, 20 to 24, 25 to 29, 30 to 34, and 35 and over.

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*In Maryland, any accident resulting in death or injury or total property damage in excess of $100 must be reported to the State Police or the Motor Vehicle Administration (see Appendix B for a copy of the Maryland Accident Report Form).

Vehicle Registration Data

Vehicle registration data were used in this study because they constitute the best available exposure measure for calculating crash involvement rates. Such data, obtained from R. L. Polk & Co., were generated using copies of computerized registration files from the various states.*

Registration counts for each of the vehicle groups included in the accident file were obtained using the R. L. Polk & Co. description of vehicle make, model and body style. Some vehicle groups included several models. For example, the registration counts for the Ford Broncos in the accident file included Bronco, Bronco pick-up utility, and Bronco wagon. Similarly, the registration counts for the Ford series pickup trucks included the F-100, F-100 Super Cab, F-150, and F-150 Super Cab.

Upon resolving the constituents in each vehicle group, the vehicle registration counts were summed to provide the total number of utility vehicles, pickup trucks, and cars registered in Maryland and North Carolina during 1975-1978, and in the United States during 1978-1979, respectively (see Table A-1 in Appendix A).

In addition to the counts for the individual utility vehicle, pickup truck, and passenger car size subgroups examined in this study, registration counts were obtained for "other" utility vehicles (e.g., Dodge Ramcharger, International Scout II), and for "other" pickup trucks (e.g., Dodge D-100, International Scout) so that registration-based rates could be computed for "all" utility vehicles and "all" pickup trucks.

*Starting in 1975, R. L. Polk & Co. has produced a detailed profile of vehicle registration counts by make, model, and model year for each state (as of July 1 each year), as well as for the entire United States. This information is summarized in the company's publication series, "National Vehicle Population Profile." The registration data used in this study for utility vehicles, pickup trucks, and passenger cars for the study period (1975 to 1979) were obtained from these population profiles.

CHAPTER III. RESULTS

Table 1 presents the overall crash involvement rates per 10,000 registered vehicles per year by vehicle type for Maryland and North Carolina during the years 1975-1978. Rates are presented for three different types of vehicles -- utility vehicles, pickup trucks and passenger cars -- as well as within the pickup truck and utility vehicle groups for some of the leading models.

Table 1 provides overall crash rates together with separate rates for single vehicle and multi-vehicle crashes for the utility vehicle class and for the leading utility vehicle models (Jeep CJ-5, pre-1978 Ford Bronco, Chevrolet Blazer); for pickup trucks and separate rates for the leading models (Ford F-100, F-150, Chevrolet C-10, K-10, Toyota, and Datsun -- all half-ton pickup trucks); and for passenger cars with that group divided into subcompact (<102 inch wheel base), compact (102-112 inch wheelbase), intermediate (113-120 inch wheelbase), and full-size cars (>120 inch wheelbase). Thus, for example, Table 1 shows that the overall crash rate of utility vehicles for Maryland was 807 per 10,000 registered vehicles. The 2422 which follows in parentheses indicates the number of utility vehicles involved in crashes in Maryland. The corresponding denominator or exposure data is shown in Table A.1 in Appendix A.

As indicated earlier, analyses comparing the leading models within vehicle types exclude the 1978 and later model Ford Broncos which had a substantially different wheelbase length than the earlier Broncos. The results for the Chevrolet Blazer include the GMC Jimmy which is an essentially similar vehicle with the same wheelbase length, but they exclude the 1972 model Blazer and Jimmy which had a different wheelbase length.

This table shows that utility vehicles as a group had the lowest overall crash involvement rate among the three vehicle groups in Maryland and was in the middle in North Carolina. This was also true with respect to multi-vehicle crash rates. On the other hand, utility vehicles as a group had the highest single vehicle crash rates among the three vehicle groups in both Maryland and North Carolina. Among the utility vehicles, the Jeep CJ-5 had an overall accident rate which was highest among the utility vehicles in North Carolina, but was in the middle of the three named in Maryland. For multi-vehicle crashes the Jeep CJ-5 was in the middle position in both Maryland and North Carolina. With respect to single vehicle crashes, the Jeep CJ-5 had the highest single vehicle crash rate in both Maryland and North Carolina. With respect to single vehicle crashes, the rates for the Ford Bronco were between those of the Jeep CJ-5 and the Chevrolet Blazer.

Table 1. Crash involvement rates (per 10,000 registered vehicles) by type of crash.

Maryland 1975-78; North Carolina 1975-78

Type of Vehicle	MARYLAND[1] Single Vehicle Rate	Multi-Vehicle Rate	Overall Rate (N)	NORTH CAROLINA[1] Single Vehicle Rate	Multi-Vehicle Rate	Overall Rate (N)
Utility Vehicles	145	662	807 (2422)	145	358	503 (3823)
Jeep CJ-5	273	666	939 (578)	228	382	610 (1484)
Ford Bronco[2]	142	487	629 (177)	162	275	438 (465)
Chevrolet Blazer[3,4]	120	860	981 (1076)	95	447	542 (998)
Pickup Trucks	95	745	840 (29318)	62	353	415 (38441)
Ford F-100, F-150	96	789	885 (9682)	72	397	470 (14197)
Chevrolet C-10, K-10	98	718	816 (6903)	65	390	455 (12746)
Toyota	147	944	1091 (788)	138	582	720 (1365)
Datsun	133	837	970 (1562)	85	461	546 (1290)
Passenger Cars	84	1,012	1115 (407062)	119	472	591 (283725)
Subcompact	103	1,034	1138 (115448)	160	503	663 (77472)
Compact	88	968	1056 (88375)	150	504	654 (53829)
Intermediate	84	1,102	1186 (119292)	111	466	577 (83790)
Full-Size	62	998	1060 (83947)	73	434	507 (68634)

[1]Excludes crashes with pedestrians, bicycles, trains, etc.
[2]Excludes 1978 models which had a different wheelbase.
[3]Includes the GMC Jimmy, an essentially identical vehicle.
[4]Excludes 1972 models which had a different wheelbase.

In single vehicle crashes, pickup trucks had considerably lower crash rates than utility vehicles with the Ford and Chevrolet trucks being very similar and having lower rates in both states. Somewhat higher rates were found for the Datsun pickups with Toyota pickups higher yet. Among passenger cars, the single vehicle crash rates increased as passenger car wheelbase length decreased, i.e., the subcompact cars had the highest single vehicle crash rates among the passenger car groups.

The degree to which these rate differences would change if mileage data were available is not known. Thus, passenger car overall rates may be higher than the other two groups in both North Carolina and Maryland because passenger cars have greater mileage exposure each year than do pick-up trucks or utility vehicles. It is therefore possible that the somewhat lower overall rates of pickup trucks and utility vehicles would not be evident if mileage were taken into account. This, of course, cannot be known in the absence of mileage data.

Table 2 and Figures 1 and 2 show the numbers of rollovers per 10,000 registered vehicles. The results for Maryland and for North Carolina were similar across vehicle types and within the leading models. As was observed by Snyder et al.(1980), the rollover rate for both single vehicle crashes and multi-vehicle crashes was much higher for utility vehicles than for passenger cars and pickup trucks. The data in Table 2 show that utility vehicle rollover rates were approximately four to five times higher than the rates of pickup trucks or passenger cars. Among utility vehicles, in both states rollover rates were the highest for the Jeep CJ-5's, although the rate for the Ford Bronco was also considerably higher than that of the Chevrolet Blazer. Among pickup trucks, the Toyotas and Datsuns had rollover rates that were higher than the Chevrolet and Ford pickup trucks, but not as high as those for the Jeep CJ-5 or the Ford Bronco. Among the passenger car groups, the rollover rates decreased considerably as passenger car wheelbase increased for both single vehicle and multi-vehicle crashes.

It would be well to interject at this point a consideration that the reader should keep in mind throughout this paper. When the rather substantial differences in rollover frequencies are observed, it is not immediately evident what the contributing sources for these rollover differences may be. Common sense would indicate that the reason that a vehicle rolls over is likely to be some combination of vehicle, driver and roadway factors (e.g., the vehicle's own resistance to overturn, the age and experience characteristics of the driver who is driving the vehicle, the kind of driving that's being done, and the roadway

Table 2. Rollover rates (per 10,000 registered vehicles) by type of crash.

Maryland 1975-78; North Carolina 1975-78

Type of Vehicle	MARYLAND[1] Single Vehicle Rate	MARYLAND[1] Multi-Vehicle Rate	NORTH CAROLINA[1] Single Vehicle Rate	NORTH CAROLINA[1] Multi-Vehicle Rate
Utility Vehicles	71.0	10.0	55.5	6.2
Jeep CJ-5	180.2	32.5	95.8	9.5
Ford Bronco[2]	88.8	7.1	68.6	8.5
Chevrolet Blazer[3,4]	31.0	0.9	21.7	3.3
Pickup Trucks	17.3	1.9	11.8	1.2
Ford F-100, F-150	14.4	2.0	12.8	1.1
Chevrolet C-10, K-10	15.1	1.4	12.3	1.1
Toyota	41.5	4.2	38.0	7.4
Datsun	41.0	5.6	25.4	2.5
Passenger Cars	8.5	1.0	15.1	0.7
Subcompact	18.7	2.3	33.8	1.6
Compact	8.0	0.8	20.2	1.2
Intermediate	4.0	0.4	8.9	0.3
Full-Size	2.2	0.4	3.6	0.2

[1]Excludes crashes with pedestrians, bicycles, trains, etc.
[2]Excludes 1978 models which had a different wheelbase.
[3]Includes the GMC Jimmy, an essentially identical vehicle.
[4]Excludes 1972 models which had a different wheelbase.

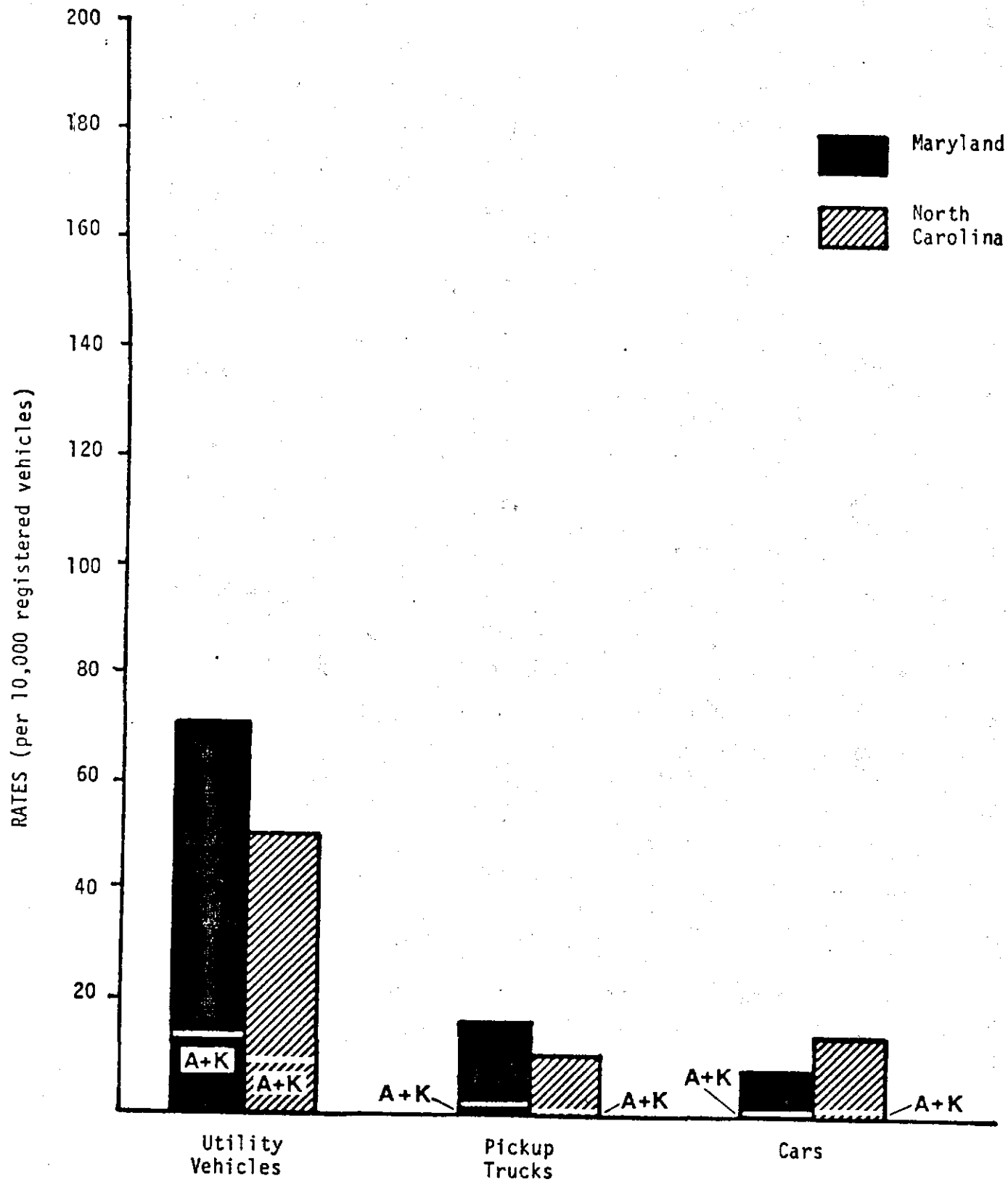

Figure 1. Single vehicle rollover and serious driver injury rates (per 10,000 registered vehicles) for various vehicle types.

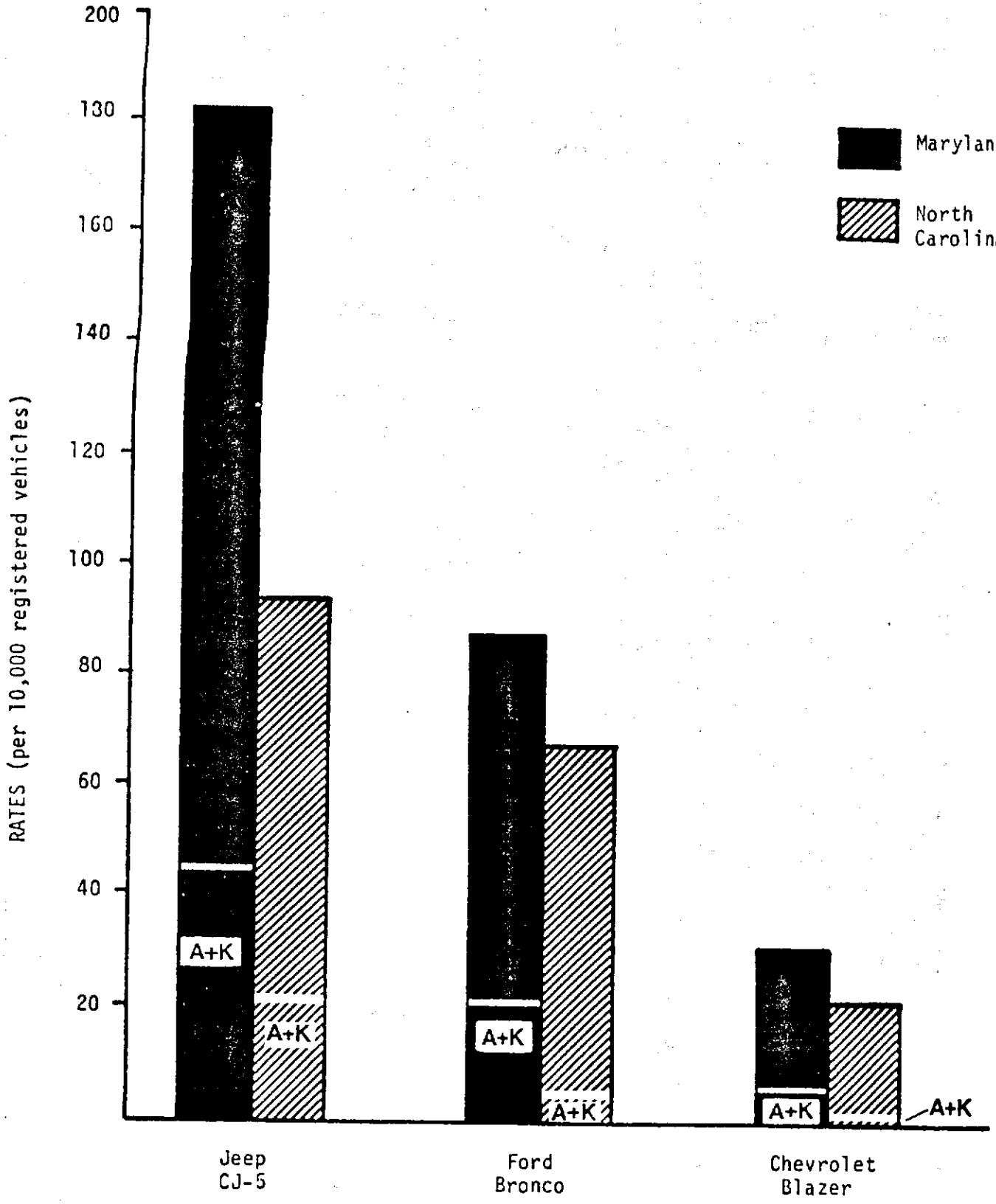

Figure 2. Single vehicle rollover and serious driver injury rates (per 10,000 registered vehicles) for the leading utility vehicle models.

and environmental conditions present at that time). It is not going to be possible in this study to distinguish with precision between these various factors although an examination is made of the effect that driver age itself has on these comparisons.

In addition to the rates of rollover per 10,000 registered vehicles, the percentages of crash-involved vehicles that rolled over provide a useful additional indication of the relative frequency of particular vehicles being in this kind of crash. The latter measure is perhaps much less dependent on the amount and types of mileage that various vehicles accumulate and thus may be a more straightforward descriptor of the rollover behavior of the vehicles being studied.

Table 3 presents the percentages of vehicles in single and multi-vehicle crashes that rolled over. Again, the results from Maryland paralleled those for North Carolina, and in both states the percentages of rollovers in single vehicle crashes were much higher than in multi-vehicle crashes. Likewise, the rollover percentage for crash-involved vehicles was about two to three times higher for utility vehicles than for pickup trucks and passenger cars. In both states, the Jeep CJ-5 and the Ford Bronco had the highest rollover percentages, followed by the Chevrolet Blazer. As with the rates per 10,000 registered vehicles, the Toyota and Datsun pickups had rollover percentages that resembled the Chevrolet Blazer, and that were between the rates for the Ford and Chevrolet pickup trucks and for the Jeep CJ-5 and Ford Bronco. As with the previous rates, the rollover percentages for passenger cars decreased as the wheelbase increased.

The percentage of vehicles that rolled over in multi-vehicle crashes was relatively small--generally less than one percent for pickup trucks and passenger cars. For utility vehicles, the rate was several times higher. In fact, the overturn percent in multi-vehicle crashes was five times higher for the utility vehicles than for the pickup trucks or passenger cars in both states. Elevated even more was the multi-vehicle overturn percent for the Jeep CJ-5 and the Ford Bronco. The ratio of percentages (utility vehicles vs pickup trucks or passenger cars) was higher in multi-vehicle crashes than in single vehicle crashes.

However, as Tables 2 and 3 indicate, rollovers in single vehicle crashes were much more frequent; therefore, the remainder of this report focuses on single vehicle crashes.

Table 4 presents the numbers of serious (A) and fatal (K) driver injuries per 10,000 registered vehicles in single vehicle crashes. Utility vehicles had serious and fatal driver injury rates that were approximately three times higher

than the rates for either pickup trucks or passenger cars. Among the utility vehicles, the Jeep CJ-5 had by some margin the highest serious or fatal driver injury rate of any vehicle shown and the Chevrolet Blazer the lowest. As before, the Toyota and Datsun pickup truck rates were between those of utility vehicles and the Ford and Chevrolet pickups. The rates for passenger cars decreased as wheelbase increased. Within the passenger car group, there was nearly a three-fold range from highest to lowest serious injury rate in Maryland and in North Carolina.

Note should be taken that the overall injury rates for all pickup trucks were based on the total pickup truck fleet, whereas the rates for individual makes were for the leading smaller pickup trucks. Although results for larger pickup truck models are not presented individually (see Table A.2 in Appendix A), their lower accident and injury rates contributed to the overall rates.

The percentages of drivers in single vehicle crashes with serious or fatal injuries (as shown in Table 5 and Figures 3 and 4) resemble those seen previously, although the differences among the three vehicle types are not as large. Overall, utility vehicle drivers sustained the greatest percentage of serious and fatal injuries--roughly 14 percent of the drivers in single vehicle crashes. The percentages were approximately twice as high as those for drivers of either pickup trucks or passenger cars. Within the utility vehicles, the data for Maryland and North Carolina were generally consistent in the sense that the Jeep CJ-5 had the highest rate of single vehicle serious injury crashes and the Chevrolet Blazer among the lowest rates. However, there was a considerable difference between states for the Ford Bronco -- 17.4 percent for Maryland vs 6.7 percent for North Carolina. As for pickups, there was not much difference among the four types in North Carolina, but a somewhat higher percentage of the drivers of Toyotas in Maryland sustained serious injury. Among passenger cars, percentages of seriously injured drivers again decreased as the car wheelbase increased.

The numbers of serious or fatal driver injuries in single vehicle rollover crashes per 10,000 registered vehicles are presented in Table 6. There was a much higher percentage of these injuries for drivers of utility vehicles compared to the other two vehicle types--an approximately five to six fold difference. The Jeep CJ-5 had, by quite a margin, the highest serious or fatal driver injury rates of any utility vehicle model, followed by the Ford Bronco and then the Chevrolet Blazer. The Toyota pickup and the Datsun pickup (Maryland only), had similar serious or fatal driver injury rates, followed by the Ford and Chevrolet

Table 5. Percentages of drivers in single vehicle crashes with serious(A) or fatal (K) injuries.

Maryland 1974-78; North Carolina 1973-78

Type of Vehicle	MARYLAND[1]	NORTH CAROLINA[1]
Utility Vehicles	14.5%	13.4%
Jeep CJ-5	19.5	16.3
Ford Bronco[2]	17.4	6.7
Chevrolet Blazer[3,4]	10.1	10.5
Pickup Trucks	8.2	8.1
Ford F-100, F-150	8.1	8.1
Chevrolet C-10, K-10	8.5	9.3
Toyota	15.5	8.0
Datsun	10.0	8.7
Passenger Cars	7.7	7.0
Subcompact	9.3	8.0
Compact	7.6	6.8
Intermediate	6.7	6.5
Full Size	5.9	6.0

[1]Excludes crashes with pedestrians, bicycles, trains, etc.
[2]Excludes 1978 models which had a different wheelbase.
[3]Includes the GMC Jimmy, an essentially identical vehicle.
[4]Excludes 1978 models which had a different wheelbase.