EFFECTS OF THE NORTH CAROLINA CHILD PASSENGER PROTECTION LAW

JULY, 1982 - JUNE, 1984

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§ 20-137.1. Child restraint systems required.

(a) Every driver required to have a North Carolina driver's license who is transporting his own child of less than two years of age, when the driver is operating his own motor vehicle (or a family purpose vehicle), shall have such child properly secured in a child passenger restraint system which is of a type (and which is installed in a manner) approved by the Commissioner of Motor Vehicles. Provided, however, this section shall not apply unless such child is occupying a seating position where seat safety belts are required by federal law or regulation. The requirements of this section may be met when the child is one year of age or older by securing the child in a seat safety belt.

The provisions of this section shall not apply: (i) to vehicles registered in another state or jurisdiction; (ii) to ambulances or other emergency vehicles; (iii) when the child's personal needs are being attended to; or (iv) if all seating positions equipped with child passenger restraint systems or seat safety belts are occupied.

(b) Any person violating this section during the period from July 1, 1982, to June 30, 1984, shall be given a warning ticket only. Thereafter a fine of ten dollars ($10.00) will be levied against violators. No driver license points shall be assessed for a violation of this section.

(c) A violation of this section shall not constitute negligence per se or contributory negligence per se. (1981, c. 804, ss. 1, 4, 5.)

Editor's Note. — Session Laws 1981, c. 804, s. 6, provides: "This act shall become effective on July 1, 1982, and shall expire on June 30, 1985."

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Much work has been done in North Carolina since 1977 to make parents aware of the need to protect children in cars and to convince them to provide proper protection for their children. There has been a shift towards greater utilization of the network of local child passenger safety advocates established during preceeding years to transmit these messages to parents in their communities. In 1982 state and local child passenger safety advocates gained the most effective tool for prompting parents to protect their children with the implementation of the Child Passenger Protection Law.

The UNC Highway Safety Research Center (HSRC) has been evaluating the effects of the law through the analysis of accident data and through weekly monitoring of restraint usage and injury rates of accident involved children. A brief analysis of restraint usage rates for young children shows that ongoing educational activities, loaner/rental programs and the Child Passenger Protection Law have been successful, but that there is still much room for improvement.

Analysis of 1983 North Carolina Accident Data

In order to obtain a broad perspective of the NC accident experience for children over the past few years, data from the NC accident files from the Division of Motor Vehicles (DMV) was examined. Table 1 lists the percentage of restrained 0-5 year old occupants and number of fatalities in reported NC traffic accidents since 1974.

It can be seen that over the years the general trends are in the desired directions. Restraint usage has increased and the number of fatalities have decreased. As indicated by these figures, there are definite differences between the years prior to 1979 and later. For the years 1974-1978, the

Table 1. Restraint Usage for All 0-5 Year Old Occupants in North Carolina Crashes, and Number of Fatalities Per Year.

Year	% Restrained*	# Killed**
1974	5.4%	28
1975	5.0%	29
1976	4.6%	26
1977	5.9%	28
1978	4.7%	36
1979	7.0%	24
1980	10.5%	18
1981	11.0%	22
1982	17.4%	17
1983	25.1%	21

*Either by a safety seat or belt, DMV data.

**Four fatalities, one each in 1981 and 1982 and the other two in 1983 were restrained at the time of the accident. All of the other fatalities were unrestrained, Medical Examiner data.

percentage of restrained children under the age of six averaged 5.1 percent whereas during 1979-1983 the average was 14.2 percent, a 178 percent increase. At the same time, the average number of children under the age of six killed during 1974-1978 was 29.4. This average decreased 31 percent to 20.4 killed during the years 1979-1983. The significance of the difference between these time periods can be understood when viewed in light of the developments of the HSRC Child Restraint program. The first HSRC Child Restraint project started in October, 1977 with funding and assistance by the N.C. Governor's Highway Safety Program (GHSP). After initial background research, planning, and development of materials, the educational campaign was actually begun in the summer of 1978 and developed progressively. It appears that the initial intervention introduced by this program -- education -- was somewhat successful in reducing death and injury to children. While it would be a nice boost to the egos of the project staff members to claim that increases in restraint usage rates and accompanying decreases in deaths and injuries have been completely a result of this project,

there is no valid way to make this claim. Attention is focused on child passenger safety in the newspapers, magazines, television and radio, and in conversations among friends and relatives. Parents learn of the need to buckle up their children from those sources that may or may not be a part of the GHSP/HSRC project. However, it is felt that much of the increased attention to the car safety problem has been a result of this project. The climate of interest is fostered by the GHSP/HSRC and parents are being provided with accurate information to enable them to properly protect their children.

Also of interest in these figures is a plateau that was reached in terms of percentage of children restrained and, to some extent, the number killed. There were sharp increases in percent restrained, and decreases in number of children killed between 1978, 1979, and 1980. However, between 1980 and 1981, the percentage restrained remained virtually the same and there was actually an increase in the number killed. Although this "increase" probably reflects the instability in the limited data points, it appears that a plateau might have been reached with educational efforts alone. During 1982, another intervention mechanism, the new Child Passenger Protection Law, went into effect and the restraint usage rates increased nearly sixty percent from 11 to 17.4 percent in 1982 and increased another forty-four percent to 25.1 percent in 1983. (Note that the law affects only part of this group, the 0-1 year olds.) Unfortunately, there has been little, if any, effect on the number of fatalities since then. Possible reasons for this situation will be discussed later.

Table 2 more closely examines the 1983 accidents to identify relationships between restraint use, injury, and age. Past studies of observed restraint usage rates tend to show definite and large differences between restraint usage for infants (age 0-1) and usage for toddlers (2 years and older). This large difference shows up in these accident data as well. Of those children aged one

Table 2. Restraint usage by injury by age. 1983 N.C. accident files.

	Infants (Age 0-1)				Toddlers (Age 2-5)				Restraint Use (Age 0-5)
	K-A* Row %	B-C Row %	None Row %	Total Col %	K-A Row %	B-C Row %	None Row %	Total Col %	Col %
No Restraint	2.2% (26)	12.5% (148)	85.4% 1015)	51.7% (1189)	1.8% (154)	15.0% (1323)	83.3% (7343)	78.9% (8820)	74.2% 10009
Restrained (Belts and CRD's)	0.9% (10)	4.2% (46)	94.9% (1033)	47.4% (1089)	0.9% (20)	9.2% (210)	90.0% (2063)	20.5% (2293)	25.1% 3382
Adult Belts	0.9% (2)	9.9% (21)	89.2% (189)	9.2% (212)	1.0% (16)	8.8% (135)	90.2% (1392)	13.8% (1543)	13.0% 1755
CRD	0.9% (8)	2.9% (25)	96.2% (844)	38.2% (877)	0.5% (4)	10.0% (75)	89.5% (671)	6.7% (750)	12.1% 1627
Missing	0.0% (0)	15.0% (3)	85.0% (17)	0.9% (20)	5.6% (4)	62.5% (45)	31.9% (23)	0.6% (72)	0.7% 92
Total	36	197	2065	2298	178	1578	9429	11185	13483

* K = Killed

A = Incapacitating (Injury obviously serious enough to prevent carrying on normal activities for at least 24 hours: e.g., massive loss of blook, broken bone)

B = Nonincapacitating (injury other than K or A evident at the scene)

C = No visible sign of injury but complaint of pain or momentary unconsciousness

None = No injury

or less, 47.4 percent were restrained by adult belts or safety seats while only 20.5 percent of the 2-5 year olds were restrained in any manner.

A close examination of this data reveals that those children who were using some type of restraint were much less likely to be killed or seriously injured in crashes. Of the 21 children (10 infants and 11 toddlers) who were killed, two were restrained at the time of the accident. It should be noted, however, that the restraints used in these two cases were grossly misused. When fatalities and incapacitating injuries are combined (K+A), it can be seen that 2.2 percent of the unrestrained infants and 1.8 percent of the unrestrained toddlers were killed or seriously injured while 0.9 percent of the restrained infants and 0.9 percent of the restrained toddlers were killed or seriously injured. These figures roughly indicate that the use of safety seats or belts resulted in a 60 percent reduction in death or serious injury for infants and a 50 percent reduction in the same for toddlers. Conversely, there was 11 percent and 8.0 percent increase in the proportions of restrained infants and toddlers who received no injuries at all. The use of restraints also appears to result in approximately a 66 percent reduction in moderate and minor (B-C) injuries for infants and 39 percent reduction for toddlers.

Restraint Effectiveness Evaluation

During this project year an important study evaluating the effectiveness levels of safety seats and belts in reducing fatalities and serious injuries was carried out by HSRC.[1] Effectiveness estimates were based on a sample of 2000+ parents and/or drivers of children less than four years of age involved in North Carolina motor vehicle accidents who were interviewed by telephone after the

[1]Hall, W. L., Woodward, A. R., Ma, J. M., Fischell, T. R., Stewart, J. R. and Campbell, B. J. The Use of Telephone Interviews to Verify the Reliability of Police Accident Reports in Assessing the Effectiveness of Child Safety Seats (HSRC-PR 131), Chapel Hill: University of North Carolina Highway Safety Research Center, May 1984.

accident. These sampling and interviewing procedures, carried out in conjunction with the N.C. Division of Motor Vehicles, provided supplemental restraint and injury data for these children. The analysis of the data thus obtained verified previous estimates of the potential of safety seats and belts for preventing serious injuries and fatalities and also provided an estimate of the loss of protection related to the misuse of safety seats. When the rates of children less than age 4 suffering severe head or fatal injuries were compared across all levels of crash severity, safety belts were shown to be 59 percent effective in reducing severe head and fatal injuries, improperly used safety seats were 48 percent effective, and properly used safety seats were found to be 81 percent effective.

The reduced effectiveness levels for misused safety seats is tragically illustrated by the two fatalities to restrained children in 1983. In one case, a three-month old, fifteen pound infant was being carried in a household "feeder seat" that was placed front facing in the center rear position with the vehicle lap belt placed around the feeder seat and the child. The infant's car struck another car in the side at about 30 mph, an easily survivable accident as evidenced by a restrained two year old sitting beside the infant who received only minor injuries. Due to the type and front facing orientation of the carrier, this infant was in essence restrained only by the lap belt and died from internal injuries resulting from contact with the belt. Children less than 20 pounds should not be restrained by a lap belt only and are truly protected only when they are in a rear facing dynamically tested safety seat.

The second restrained fatality was to a five year old girl who was in an improperly installed toddler seat in the right front position of a Volkswagen struck head on by another car at a high rate of speed. Subsequent investigation revealed that the VW did not have front seat belts and the seat was installed by

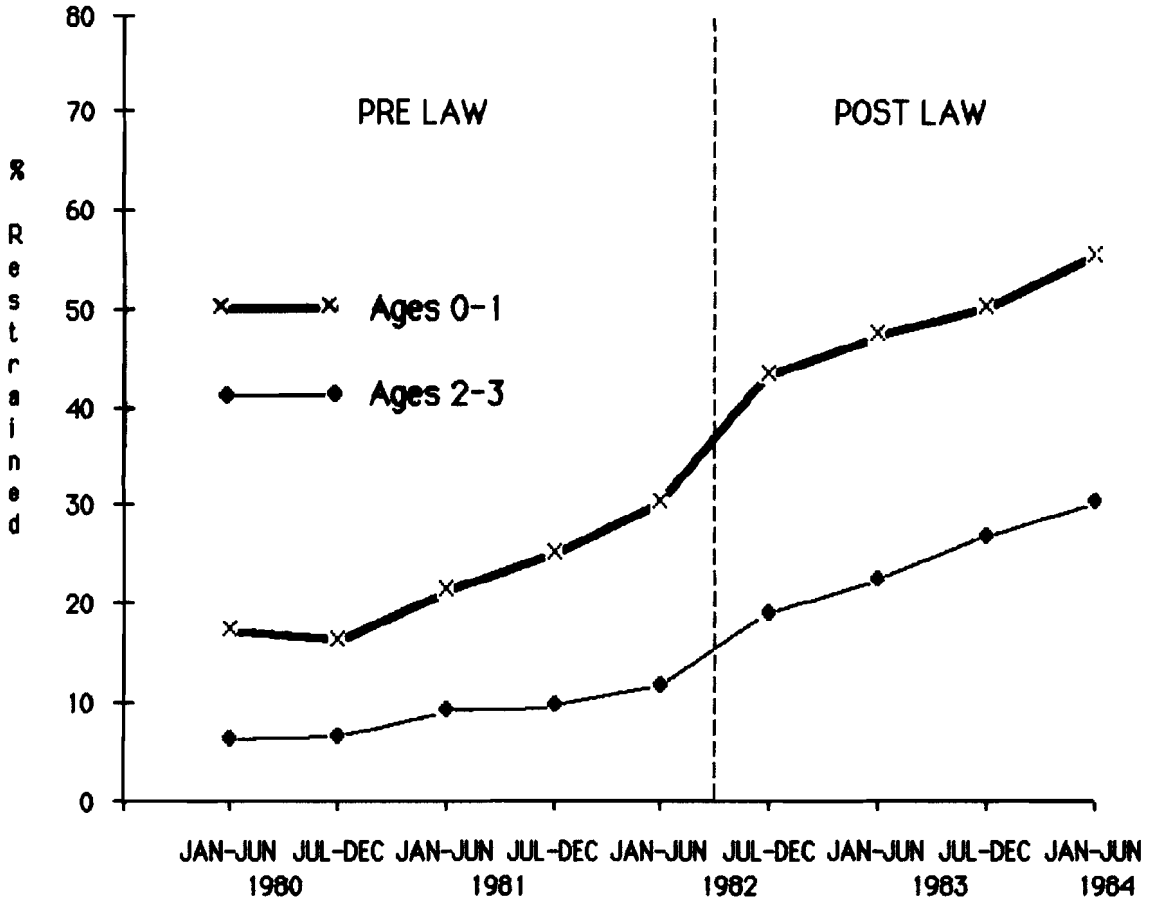
a homemade strap around the seat and the child. The seat in use required the use of a top tether strap to meet Federal Standards, but the tether was not used and the child outweighted the upper weight limit for the seat by 20 pounds. These factors combined led to internal and head injuries sufficient enough to prove fatal.

These two cases, along with the analysis showing 41 percent reduced effectiveness for misused safety seats, serve to indicate that efforts need to be continued to stress the importance of using safety seats properly to parents.

Evaluation of the N.C. Child Passenger Protection Law

Analysis of the N.C. Division of Motor Vehicles accident files since 1980 helps to reveal the impact of the N.C. Child Passenger Protection Law and the related efforts on restraint usage rates and on fatal and serious injury rates for young children involved in North Carolina accidents. Figure 1 plots restraint usage rates for children less than two covered by the law and two and three year old children, originally included in the law but later amended out, since 1980 through June, 1984. As can be seen, usage rates for both the 0-1 and 2-3 year olds gradually increased from 1980 through the first half of 1982 and then increased sharply in the second half of 1982 after the law went into effect and have continued to rise since. The extremely large difference between usage rates for the younger and older children across the years can readily be seen. For all time periods prior to July - December 1983, usage rates for the older children were less than half those of the younger children. It appears that the protection gap might be slowly closing, perhaps due to spillover from parents continuing to buckle up their children even after they are no longer subject to the law. These same trends can be more precisely examined when looking at weekly usage rates.

Figure 1 Restraint Usage Rates for Accident Involved Children Less than Four, 1980-1984



Beginning some months before the effective date of the Child Passenger Protection Law, HSRC and the Division of Motor Vehicles established a special procedure to assure timely monitoring of restraint usage rates in crashes involving children less than four years old.

Weekly summaries are shown in Figure 2. The higher trend line traces the growth of restraint use for children less than two years old who are subject to the law. The lower line shows the use trend among children two and three years old, an age group not subject to the law.

Bear in mind that these trends are based on crash data, and are not drawn from field observations of the population at large. This point is made because of previous findings that restraint use in crashes is often only about half of what is seen among drivers along the roads.

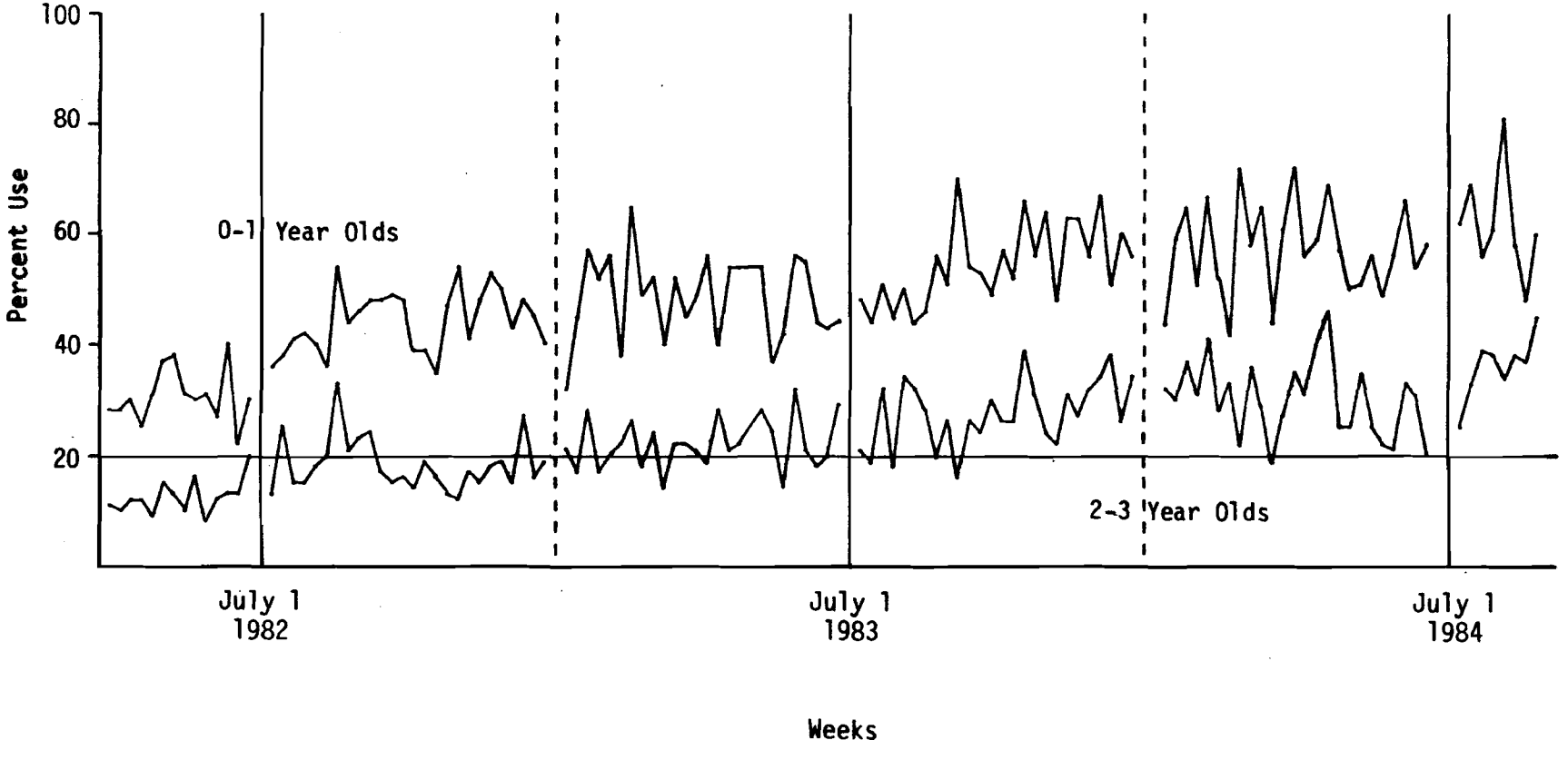
Also note that the "pre-law period" shown was the 15 week period immediately prior to the effective date. Thus, this pre-law period had experienced statewide publicity concerning the passage of the law and usage rates had already begun to increase.

During the pre-law period, restraint use for the younger group averaged about 30 percent, varying from 20 to 40 percent over the weeks. For the older group not subject to the law, restraint use was 10-15 percent.

During the first year of the law, the educational phase when only warning tickets were given out (and not many of them), restraint use increased dramatically among those subject to the law, and averaged nearly 50 percent for the second half of that year. For the older children, there was a gradual but steady growth reaching above 20 percent by the end of that first year of the law's existence.

During the second year of the law, also a warning ticket period, growth again spurted among the younger children, reaching near 60 percent on the

Figure 2. Weekly Child Restraint Usage Percentages



average. Again, use rate growth continued among the older children, reaching about 30 percent by year's end. Part of the reason for the growth in the older group is hopefully that some of the children previously subject to the law moved up to the group not required to be restrained, but some of the parents had the good judgment to continue to use protection devices for their children.

The enforcement phase of the law began July 1, 1984 and a fine plus court costs can now be assessed to violators. It is too early to see a solid trend developing, but at least in the first eight weeks, the values for both age groups appear to be up somewhat.

One point of emphasis is to consider the percent of children that would be restrained in NC crashes if there were perfect compliance with the law. That is, what overall proportion of children in the age group would be restrained if everyone subject to the law buckled up their children, and no one else did so. The figure would not be 100 percent because of exemptions to the law. For example, crashes involving out of state cars are not subject to the NC law. Likewise, anyone who is not a parent or guardian of the child being transported would not have to buckle up the child.

Of course, we cannot know with any certainty what that proportion is, but we estimate that 70 percent of children of the appropriate age exposed in crashes are subject to the law (parent driver of family vehicle with available seat belts). To the extent this statement is true, the use levels now being seen indicates very good compliance with the law.

Of course, the primary goal of prior and current educational and legislative activities is to decrease the number of children being killed and seriously injured in automobile accidents. As will be seen, these efforts have increased restraint usage rates enough to have saved a significant number of children from serious injury or death, but there is still much room for improvement.

If only the actual number of fatalities to children less than two are examined, then it would appear that the Child Passenger Protection Law has had little or no impact. There were seven children less then two killed in car crashes during each of the years 1980, 1981 and 1982. In 1983, this number increased to ten and there were six during the first half of 1984.

In contrast, if one compares the children who are now restrained (perhaps due to the law) to those unrestrained violators, large differences in death and injury rates are found. First, it is important to note that of the 22 children less than two who were killed since the law went into effect, only two were restrained. One of these two was the previously discussed three-month old improperly restrained and the other was a one year old properly restrained child involved in an accident that was unsurvivable for the rear seat occupants. As long as a large percentage of the children continue to ride unrestrained, these most unfortunate fatalities will continue to occur. Perhaps the most tragic aspect of this situation is that of the 20 unrestrained children who were killed, chances are that 16-18 of them would not have died if they had been restrained.

To further illustrate the beneficial effects of increased restraint usage, Figure 3 compares the fatal and serious injury rates for unrestrained vs. restrained children less than two since 1980 and Figure 4 makes this same comparison for 2 and 3 year olds. For both age groups, the children who are restrained at the time of the accident by either a safety seat or belt are much less likely to be killed or seriously injured. The average fatal and serious injury rate for unrestrained children less than two is 2.22 percent, but is only 0.67 percent for restrained children, a 70 percent reduction. For the older children, the average fatal and serious injury rate of 0.85 percent is a 50 percent reduction from the average rate of 1.74 percent for unrestrained two and three year olds.

Figure 3 Fatal and Serious Injury (K+A) Rates for
Accident Involved Children Less than Two, 1980-1984
Restrained versus Unrestrained

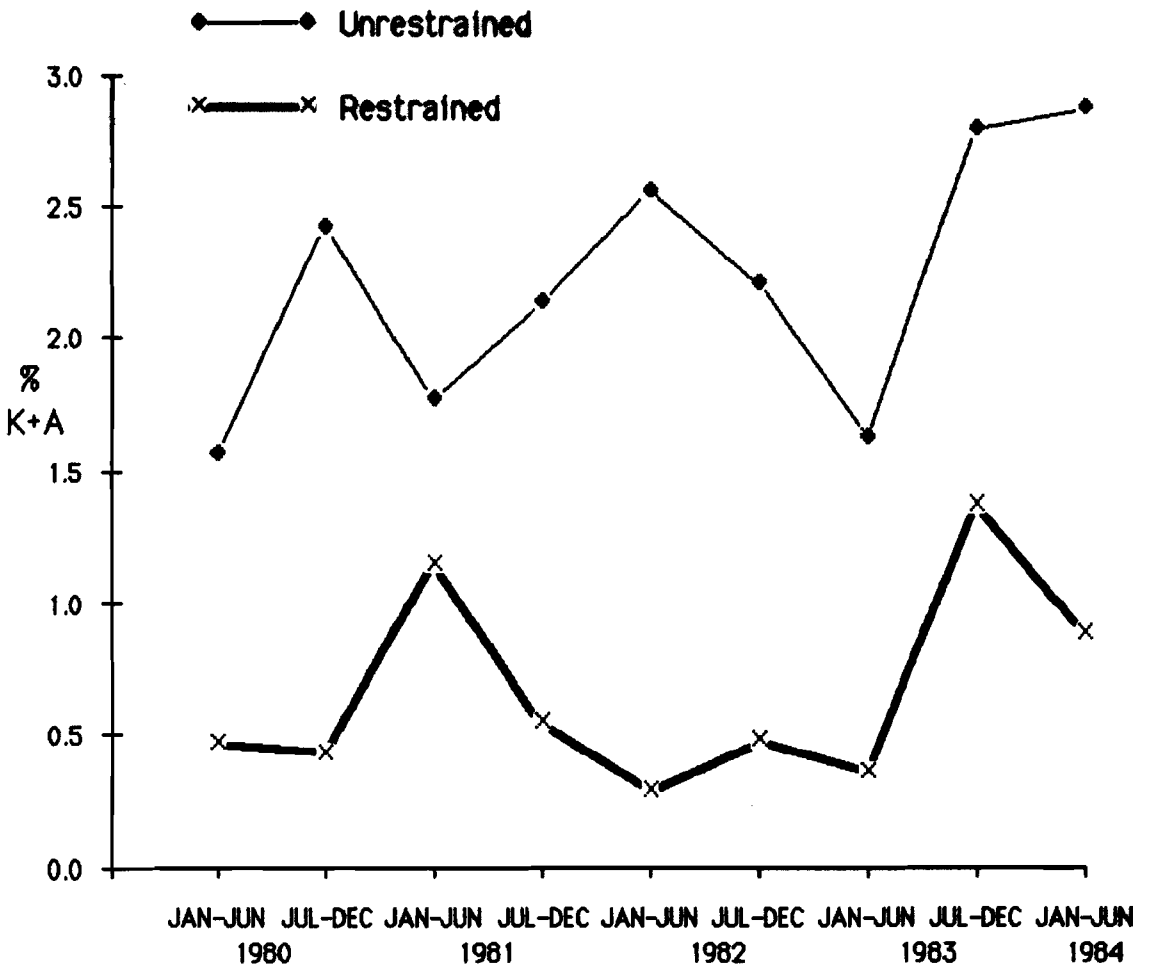


Figure 4 Fatal and Serious Injury (K+A) Rates for
Accident Involved Children Two and Three, 1980-1984
Restrained versus Unrestrained

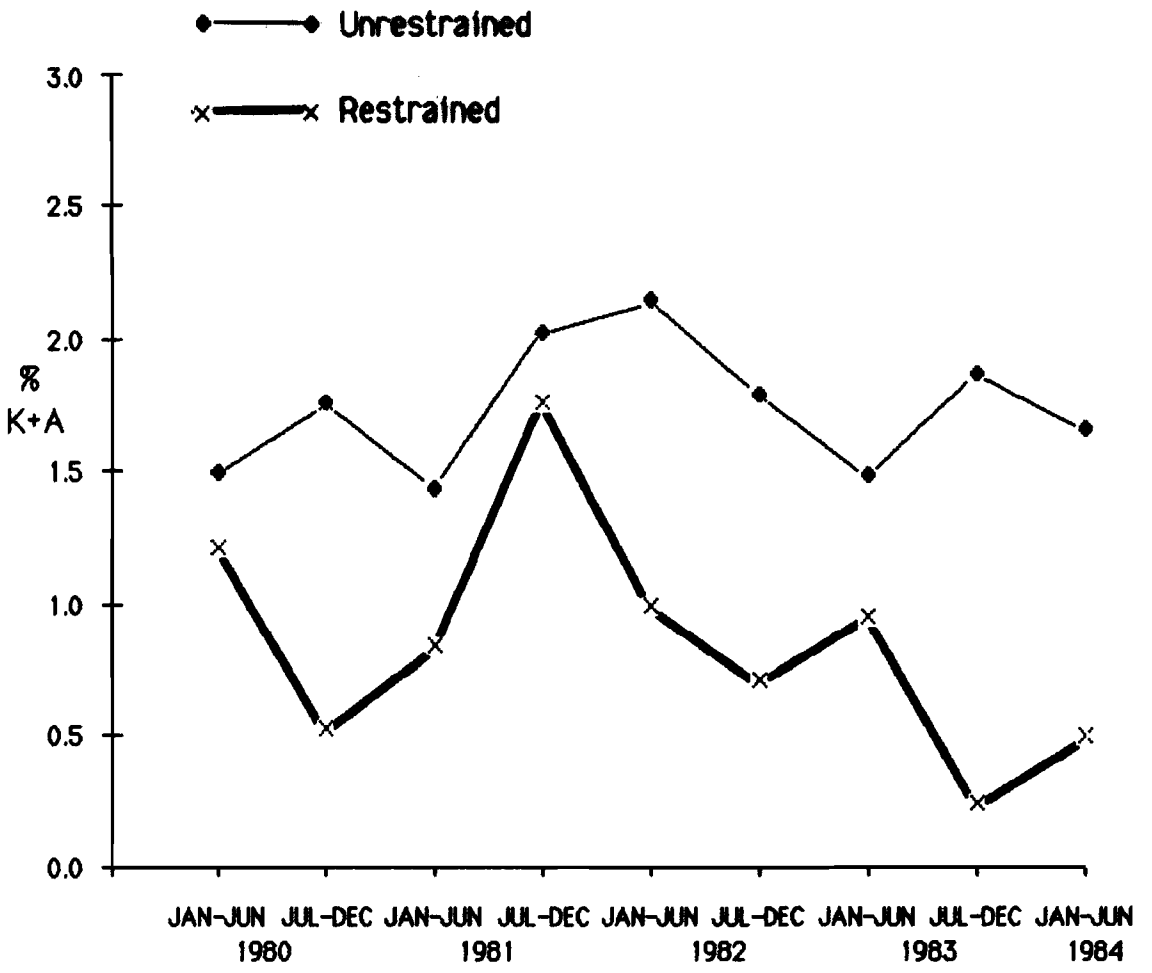
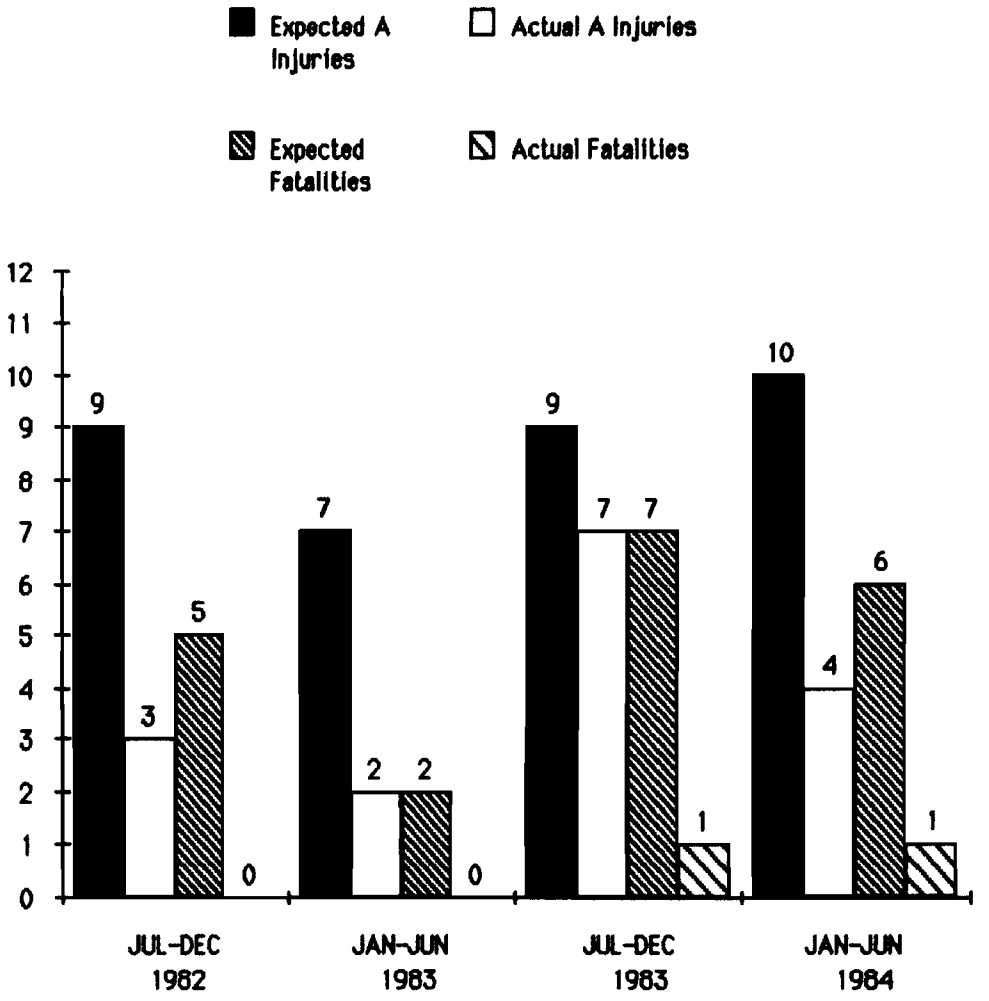


Figure 5 shows what these contrasting rates mean in terms of serious injuries prevented and lives saved since the enactment of the N.C. Child Passenger Protection Law. In order to make these estimates, the number of restrained children less than two during each six month time period was multiplied by the fatal and serious injury rate for unrestrained children during that same time period. This calculation yielded an estimate of the number of restrained children who would have been killed or seriously injured if they had not been restrained. By these estimates, we could have expected 35 serious injuries and 20 fatalities to restrained children less than two between July 1982 and June 1984. Instead, there were 16 serious injuries and 2 fatalities. Thus, it is estimated that 19 serious injuries have been prevented and 18 young lives have been saved since the enactment of the N.C. Child Passenger Protection Law.

It is obvious that this brief evaluation of the effects of the North Carolina Child Passenger Protection Law leads to some contradictory conclusions. On the positive side, restraint usage rates for children less than two involved in crashes have risen dramatically since the law went into effect and within this age group during the two year post-law period, 19 serious injuries were prevented and 18 lives were saved among those children who were restrained. On the other hand, the actual number of children less than two killed per year has not decreased as was hoped. The HSRC project staff will continue to closely examine the effects of the law in order to ascertain why this expected benefit has not been realized.

Several hypotheses will be examined in this more detailed evaluation. It is possible that the cars that young children are riding in are getting smaller and that as a result their crashes are becoming more severe. If this is the case, it would mean that the effect of increasing restraint usage has been to hold

Figure 5 Fatal and Serious Injury Prevented by Restraint Usage Since Law's Effective Date (July 1982 - June 1984) for Children Less Than Two



the number of children killed steady rather than allowing it to increase. It might also be the case that the 45 percent of children not restrained are being transported by drivers who are less careful drivers more likely to be violating other traffic laws, such as speeding, reckless driving, driving while impaired, as well as the Child Passenger Protection Law. It has been hypothesized in other studies of legislative effectiveness that restraint laws tend to protect already safe and law abiding drivers. If this is the case in North Carolina, we will need to find ways to get the chidlren of these less-safe drivers protected. These hypotheses will be closely examined in the process of preparing a detailed report by HSRC to the N.C. General Assembly.