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Effect of Child Occupant Protection Laws on Fatalities

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16. Abstract <p>In 1978, child safety seats and adult safety belts used by children under five years old saved 3 percent of those who would have been killed if no one had used the devices. By 1988, children's use of safety seats and belts had risen enough that 26 percent of those at risk were saved. During these eleven years, the number of states with child occupant protection laws increased from one (in 1978) to fifty (in 1985) plus the District of Columbia.</p> <p>The 1981 to 1984 fatality experience was used to estimate the incremental benefit to a state of having a child occupant protection law in any one year. During these four years, 19 percent of those who would have been killed (if no one used a safety seat or belt) in states with child occupant protection laws were saved by safety seats and belts. In contrast, only 10 percent were saved in states without laws. The difference between these two numbers (9 percent) is an estimate of the immediate benefit to a state of passing a child occupant protection law. However, because these laws contribute to the increasing use of safety seats and belts by young children, their cumulative and potential benefits are much greater.</p>					
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Effect of Child Occupant Protection Laws on Fatalities

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August 1989

Findings

In 1978, child safety seats and adult safety belts used by children under five years old saved 3 percent of those who would have been killed if no one had used the devices. By 1988, children's use of safety seats and belts had risen enough that 26 percent of those at risk were saved. During these eleven years, the number of states with child occupant protection laws increased from one (in 1978) to fifty (in 1985) plus the District of Columbia.

The 1981 to 1984 fatality experience was used to estimate the incremental benefit to a state of having a child occupant protection law in any one year. During these four years, 19 percent of those who would have been killed (if no one used a safety seat or belt) in states with child occupant protection laws were saved by safety seats and belts. In contrast, only 10 percent were saved in states without laws. The difference between these two numbers (9 percent) is an estimate of the immediate benefit to a state of passing a child occupant protection law. However, because these laws contribute to the increasing use of safety seats and belts by young children, their cumulative and potential benefits are much greater.

Background

In January 1978, the first state child occupant protection law went into effect, in Tennessee. Other states were initially slow to follow. The second law went into effect in Rhode Island, in July 1980; the third went into effect in West Virginia in July 1981. However, between January 1982 and June 1985, laws went into effect in the remaining forty-seven states and the District of Columbia. The date of the original child occupant protection law in each state is shown in Appendix Table A. Most original laws did not cover all children under five years old. Many of these laws have been strengthened since their original enactment, and thirty-four states plus the District of Columbia now also have general safety belt use laws that apply to all ages.

Data

In the last eleven years (1978 through 1988), between 536 and 700 children under five years old were killed in passenger vehicles each year. The agency's Fatal Accident Reporting System (FARS) provided counts of young occupants killed in cars, pickups, vans, and multipurpose vehicles. These vehicles were identified as FARS Body Type codes 1-9, 39, 43, and 50-52 for data from years 1978 through 1981 and codes 1-12, 40-41, 48-51, 53-56, 58-59, and 67-69 for data from years 1982 through 1988.

Each fatality was classified by whether it occurred when and where a state child occupant protection law was in effect. For this purpose, all child passenger vehicle occupant fatalities that occurred in a state whose law went into effect sometime that month were considered to have been covered by the law. All children under five years old were included, whatever the specific age or other coverage provisions of the law in that state at that time. The children were separated into two age groups: "infants" (those under one year old) and "toddlers" (those one through four years old). This distinction was made because of differences, by age, in the types of child occupant protection devices that are available (safety seat type) and the type chosen (safety seat or adult safety belt).

Each child was classified by his use of a safety seat or belt, as reported by the police. There were a few children reported to have been protected by an unspecified type of device. These children were grouped with children in safety belts. There were many more children for whom it was unknown whether they were using any type of device at all. These were prorated among the categories of no device, safety seat, and safety belt.

Results

The fatality data, classified by year, law coverage, child age, and police-reported occupant protection device are shown in Appendix Table B. The estimated number of child fatalities by type of device used (with unknown data prorated among the categories for none used, safety seat, and safety belt) are shown in Appendix Table C. These estimates are shown with one decimal place to help the reader follow the subsequent calculations of lives saved.

It has been estimated that safety seats and belts save lives when used (Lives Saved by Child Restraints from 1982 through 1987, S. Partyka, NHTSA, DOT-HS-807-371, December 1988). Child safety seats are very effective in preventing fatality when the child is properly secured in the seat and the seat is properly attached to the vehicle. Unfortunately, many children do not receive the full benefit of their safety seat because of incorrect (or partially incorrect) use. However, even with the mix of correct, partially correct, and incorrect use of the 1980's, it is estimated that:

child safety seats prevented 69 percent of infant fatalities,
child safety seats prevented 47 percent of toddler fatalities, and
adult safety belts prevented 36 percent of child fatalities when used.

The number of children saved by safety seats and belts was estimated from the estimated effectiveness of these devices in preventing fatality as:

$$\text{Lives Saved} = \text{Fatalities} * \text{Effectiveness} / (1 - \text{Effectiveness}).$$

The theoretical number of children at risk of fatality can be defined as the number who would have been killed if no child used a safety seat or belt. This is the sum of the total number killed and the number of lives saved by safety seats and belts. The proportion saved was calculated as the number saved divided by the number at risk. These results are shown in Appendix Table C.

The percentage of children at risk of fatality who were saved by safety seats and belts increased from an estimated 3 percent in 1978 to 26 percent in 1988. The results are shown in Table 1 and Figure 1. Comparing the estimated lives saved for children covered, versus not covered, by state occupant protection laws suggests the incremental benefit to a state of having a law that year. The results are summarized in Table 2 and Figure 2.

Table 1: Young Child Occupants Saved by Safety Seats and Belts

Year	Percent Saved, of those at Risk of Fatality		
	Overall	With Law	Without Law
1978	3.4	0.0	3.5
1979	6.0	0.0	6.2
1980	6.2	25.9	5.5
1981	9.6	18.2	9.4
1982	10.5	15.8	9.4
1983	14.7	17.7	11.8
1984	18.6	20.6	9.1
1985	21.2	21.2	-
1986	21.6	21.6	-
1987	23.9	23.9	-
1988	26.5	26.5	-

Figure 1: Young Child Occupants Saved by Safety Seats and Belts

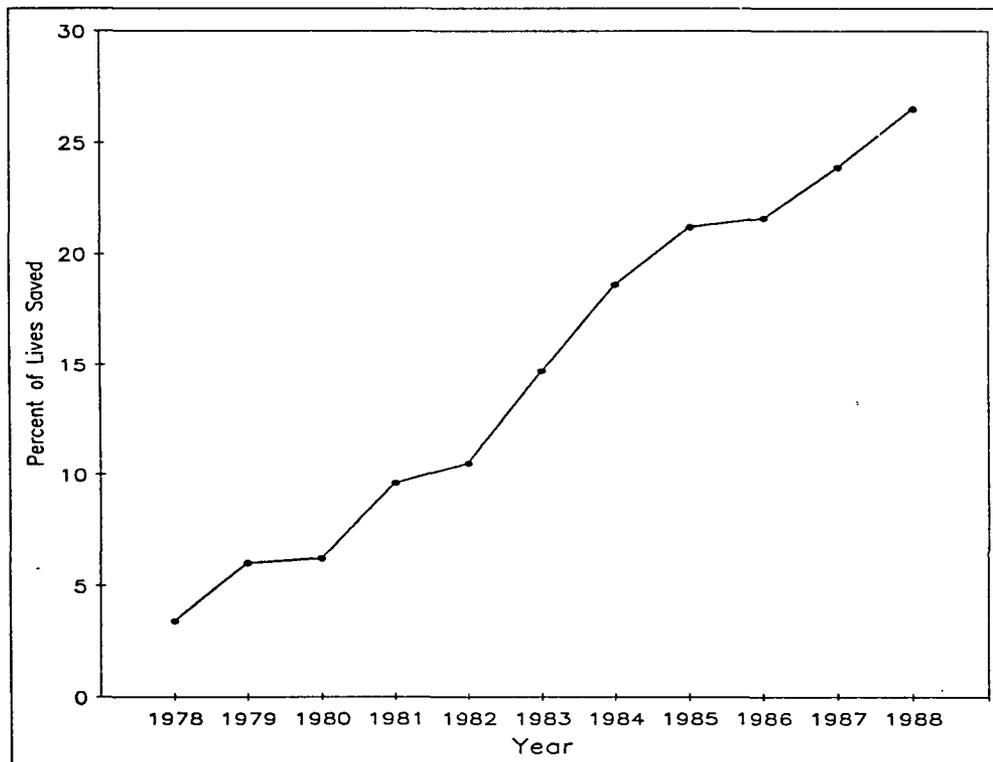
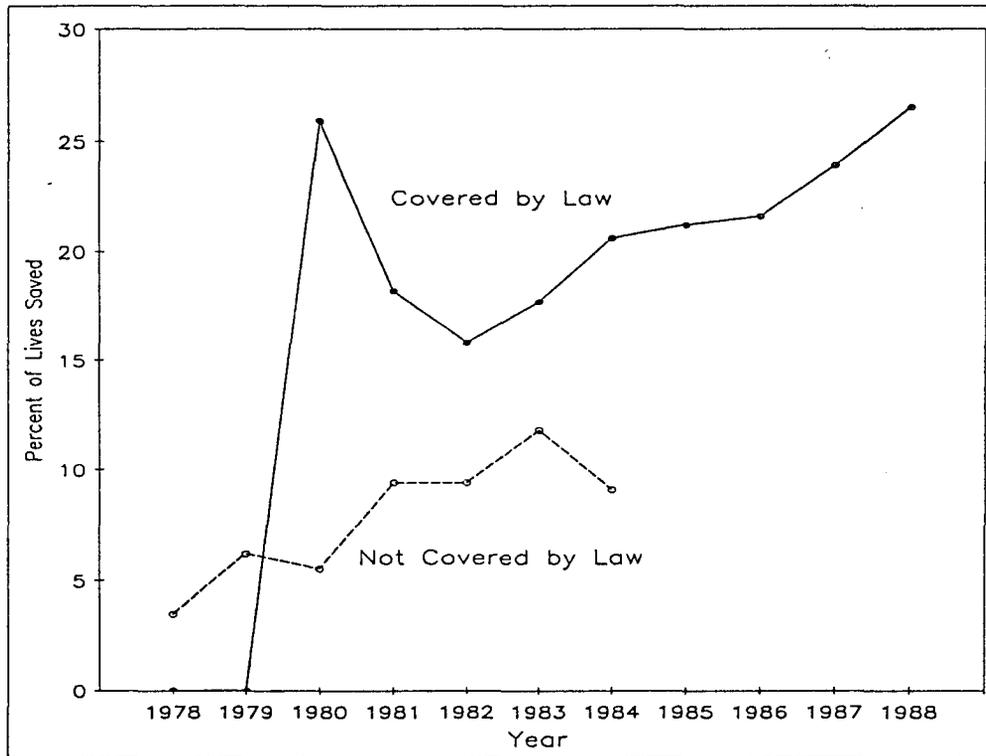


Table 2: Comparison of Percentage of Child Occupants Saved

Percent Saved:	Year				Four Years
	1981	1982	1983	1984	
With Law	18.2%	15.8%	17.7%	20.6%	19.0%
Without Law	9.4%	9.4%	11.8%	9.1%	9.9%
Difference	8.8%	6.4%	5.9%	11.5%	9.1%

Figure 2: Young Child Occupants Saved by Safety Seats and Belts
 -- by State Law Coverage



From 1981 to 1984, the percent of children saved by safety seats and belts in states with child occupant protection laws was 9 points higher than in states without laws. The 1978 through 1980 results vary widely because they are based on a small number of fatalities in one or two states with laws. Four states implemented laws in 1985, but the laws were implemented early enough and the states were small enough that all child occupant fatalities occurred under laws that year. After 1985, all states had child occupant protection laws, and no further comparisons are possible.

Appendix of Detailed Data

Table A: Original Date of State Child Occupant Protection Law

<u>State</u>	<u>Original Date</u>	<u>State</u>	<u>Original Date</u>
Alabama	July 1982	Missouri	January 1984
Alaska	June 1985	Montana	January 1984
Arizona	August 1983	Nebraska	August 1983
Arkansas	August 1983	Nevada	July 1983
California	January 1983	New Hampshire	July 1983
Colorado	January 1984	New Jersey	April 1983
Connecticut	May 1982	New Mexico	June 1983
Delaware	June 1982	New York	April 1982
District of Columbia	July 1983	North Carolina	July 1982
Florida	July 1983	North Dakota	January 1984
Georgia	July 1984	Ohio	March 1983
Hawaii	July 1983	Oklahoma	November 1983
Idaho	January 1985	Oregon	January 1984
Illinois	July 1983	Pennsylvania	January 1984
Indiana	January 1984	Rhode Island	July 1980
Iowa	January 1985	South Carolina	July 1983
Kansas	January 1982	South Dakota	July 1984
Kentucky	July 1982	Tennessee	January 1978
Louisiana	September 1984	Texas	October 1984
Maine	September 1983	Utah	July 1984
Maryland	January 1984	Vermont	July 1984
Massachusetts	January 1982	Virginia	January 1983
Michigan	April 1982	Washington	January 1984
Minnesota	August 1983	West Virginia	July 1981
Mississippi	July 1983	Wisconsin	November 1982
		Wyoming	April 1985

Table B: Use of Safety Seats and Adult Safety Belts
by Children Killed as Occupants of Passenger Vehicles

<u>Year, Coverage</u>	<u>None Used</u>	<u>Some Type Used</u>			<u>Unknown If Used</u>	<u>Total</u>
		<u>Child Seat</u>	<u>Adult Belt</u>	<u>Unknown Type</u>		
1978, Law						
Infants	4	0	0	0	2	6
Toddlers	5	0	0	0	5	10
Combined	9	0	0	0	7	16
1978, No Law						
Infants	132	5	2	0	47	186
Toddlers	382	5	3	1	107	498
Combined	514	10	5	1	154	684
1979, Law						
Infants	9	0	0	0	2	11
Toddlers	12	0	0	0	4	16
Combined	21	0	0	0	6	27
1979, No Law						
Infants	119	9	0	2	30	160
Toddlers	385	12	5	1	82	485
Combined	504	21	5	3	112	645
1980, Law						
Infants	4	2	0	0	1	7
Toddlers	8	1	0	0	2	11
Combined	12	3	0	0	3	18
1980, No Law						
Infants	144	8	1	1	29	183
Toddlers	382	6	10	4	67	469
Combined	526	14	11	5	96	652
1981, Law						
Infants	2	1	0	0	0	3
Toddlers	10	1	0	0	0	11
Combined	12	2	0	0	0	14
1981, No Law						
Infants	114	15	3	2	35	169
Toddlers	342	11	7	0	66	426
Combined	456	26	10	2	101	595
1982, Law						
Infants	20	5	0	0	1	26
Toddlers	57	5	2	1	6	71
Combined	77	10	2	1	7	97
1982, No Law						
Infants	104	10	0	1	23	138
Toddlers	301	18	9	3	47	378
Combined	405	28	9	4	70	516

Table B (continued): Use of Safety Seats and Adult Safety Belts
by Children Killed as Occupants of Passenger Vehicles

<u>Year, Coverage</u>	<u>None Used</u>	<u>Some Type Used</u>			<u>Unknown If Used</u>	<u>Total</u>
		<u>Child Seat</u>	<u>Adult Belt</u>	<u>Unknown Type</u>		
1983, Law						
Infants	59	14	0	0	13	86
Toddlers	145	19	5	3	26	198
Combined	204	33	5	3	39	284
1983, No Law						
Infants	58	9	1	0	3	71
Toddlers	212	16	8	3	8	247
Combined	270	25	9	3	11	318
1984, Law						
Infants	77	23	1	1	8	110
Toddlers	217	40	17	6	46	326
Combined	294	63	18	7	54	436
1984, No Law						
Infants	19	2	0	0	1	22
Toddlers	69	4	3	0	2	78
Combined	88	6	3	0	3	100
1985, Law						
Infants	85	29	2	2	12	130
Toddlers	301	59	26	5	32	423
Combined	386	88	28	7	44	553
1986, Law						
Infants	83	30	5	0	12	130
Toddlers	318	56	41	15	39	469
Combined	401	86	46	15	51	599
1987, Law						
Infants	109	35	5	3	6	158
Toddlers	311	82	57	12	38	500
Combined	420	117	62	15	44	658
1988, Law						
Infants	105	60	3	2	14	184
Toddlers	338	61	55	9	29	492
Combined	443	121	58	11	43	676

Table C: Estimates of Children Saved
by Child Safety Seats and Adult Safety Belts

<u>Year, Coverage</u>	<u>Children Killed While Using:</u>				<u>Children Saved by:</u>			<u>Total At Risk</u>	<u>Percent Saved</u>
	<u>None Used</u>	<u>Child Seat</u>	<u>Adult Belt</u>	<u>Total</u>	<u>Child Seat</u>	<u>Adult Belt</u>	<u>Either Device</u>		
1978, Law									
Infants	6.0	0.0	0.0	6.0	0.0	0.0	0.0	6.0	0.0
Toddlers	10.0	0.0	0.0	10.0	0.0	0.0	0.0	10.0	0.0
Combined	16.0	0.0	0.0	16.0	0.0	0.0	0.0	16.0	0.0
1978, No Law									
Infants	176.6	6.7	2.7	186.0	14.9	1.5	16.4	202.4	8.1
Toddlers	486.5	6.4	5.1	498.0	5.6	2.9	8.5	506.5	1.7
Combined	663.2	13.1	7.7	684.0	20.5	4.4	24.9	708.9	3.5
1979, Law									
Infants	11.0	0.0	0.0	11.0	0.0	0.0	0.0	11.0	0.0
Toddlers	16.0	0.0	0.0	16.0	0.0	0.0	0.0	16.0	0.0
Combined	27.0	0.0	0.0	27.0	0.0	0.0	0.0	27.0	0.0
1979, No Law									
Infants	146.5	11.1	2.5	160.0	24.7	1.4	26.0	186.0	14.0
Toddlers	463.3	14.4	7.2	485.0	12.8	4.1	16.9	501.9	3.4
Combined	609.8	25.5	9.7	645.0	37.5	5.4	42.9	687.9	6.2
1980, Law									
Infants	4.7	2.3	0.0	7.0	5.2	0.0	5.2	12.2	42.6
Toddlers	9.8	1.2	0.0	11.0	1.1	0.0	1.1	12.1	9.0
Combined	14.4	3.6	0.0	18.0	6.3	0.0	6.3	24.3	25.9
1980, No Law									
Infants	171.1	9.5	2.4	183.0	21.2	1.3	22.5	205.5	10.9
Toddlers	445.7	7.0	16.3	469.0	6.2	9.2	15.4	484.4	3.2
Combined	616.8	16.5	18.8	652.0	27.4	10.5	37.9	689.9	5.5
1981, Law									
Infants	2.0	1.0	0.0	3.0	2.2	0.0	2.2	5.2	42.6
Toddlers	10.0	1.0	0.0	11.0	0.9	0.0	0.9	11.9	7.5
Combined	12.0	2.0	0.0	14.0	3.1	0.0	3.1	17.1	18.2
1981, No Law									
Infants	143.8	18.9	6.3	169.0	42.1	3.5	45.7	214.7	21.3
Toddlers	404.7	13.0	8.3	426.0	11.5	4.7	16.2	442.2	3.7
Combined	548.5	31.9	14.5	595.0	53.7	8.2	61.9	656.9	9.4
1982, Law									
Infants	20.8	5.2	0.0	26.0	11.6	0.0	11.6	37.6	30.8
Toddlers	62.3	5.5	3.3	71.0	4.8	1.8	6.7	77.7	8.6
Combined	83.1	10.7	3.2	97.0	16.4	1.8	18.3	115.3	15.8
1982, No Law									
Infants	124.8	12.0	1.2	138.0	26.7	0.7	27.4	165.4	16.6
Toddlers	343.7	20.6	13.7	378.0	18.2	7.7	25.9	403.9	6.4
Combined	468.5	32.6	15.0	516.0	44.9	8.4	53.3	569.3	9.4

Table C (continued): Estimates of Children Saved
by Child Safety Seats and Adult Safety Belts

<u>Year, Coverage</u>	<u>Children Killed While Using:</u>				<u>Children Saved by:</u>			<u>Total At Risk</u>	<u>Percent Saved</u>
	<u>None Used</u>	<u>Child Seat</u>	<u>Adult Belt</u>	<u>Total</u>	<u>Child Seat</u>	<u>Adult Belt</u>	<u>Either Device</u>		
1983, Law									
Infants	69.5	16.5	0.0	86.0	36.7	0.0	36.7	122.7	29.9
Toddlers	166.9	21.9	9.2	198.0	19.4	5.2	24.6	222.6	11.0
Combined	236.4	38.4	9.3	284.0	56.1	5.2	61.3	345.3	17.7
1983, No Law									
Infants	60.6	9.4	1.0	71.0	20.9	0.6	21.5	92.5	23.2
Toddlers	219.1	16.5	11.4	247.0	14.7	6.4	21.1	268.1	7.9
Combined	279.7	25.9	12.4	318.0	35.6	7.0	42.6	360.6	11.8
1984, Law									
Infants	83.0	24.8	2.2	110.0	55.2	1.2	56.4	166.4	33.9
Toddlers	252.7	46.6	26.8	326.0	41.3	15.1	56.4	382.4	14.7
Combined	335.7	71.4	28.5	436.0	96.5	16.3	112.8	548.8	20.6
1984, No Law									
Infants	19.9	2.1	0.0	22.0	4.7	0.0	4.7	26.7	17.5
Toddlers	70.8	4.1	3.1	78.0	3.6	1.7	5.4	83.4	6.4
Combined	90.7	6.2	3.1	100.0	8.3	1.7	10.0	110.0	9.1
1985, Law									
Infants	93.6	31.9	4.4	130.0	71.1	2.5	73.6	203.6	36.1
Toddlers	325.6	63.8	33.5	423.0	56.6	18.9	75.5	498.5	15.1
Combined	419.3	95.8	38.0	553.0	127.7	21.3	149.1	702.1	21.2
1986, Law									
Infants	91.4	33.1	5.5	130.0	73.6	3.1	76.7	206.7	37.1
Toddlers	346.8	61.1	61.1	469.0	54.2	34.4	88.5	557.5	15.9
Combined	438.3	94.1	66.7	599.0	127.7	37.5	165.2	764.2	21.6
1987, Law									
Infants	113.3	36.4	8.3	158.0	81.0	4.7	85.7	243.7	35.2
Toddlers	336.6	88.7	74.7	500.0	78.7	42.0	120.7	620.7	19.4
Combined	449.9	125.1	82.5	658.0	159.7	46.7	206.4	864.4	23.9
1988, Law									
Infants	113.6	64.9	5.4	184.0	144.5	3.0	147.6	331.6	44.5
Toddlers	359.2	64.8	68.0	492.0	57.5	38.3	95.7	587.7	16.3
Combined	472.8	129.8	73.7	676.0	202.0	41.3	243.3	919.3	26.5