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Research Note

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Revised Estimates of Child Restraint Effectiveness

SUMMARY

NHTSA's National Center for Statistics and Analysis (NCSA) recently completed an analysis of data from the Fatal Accident Reporting System (FARS) to reexamine the effectiveness of restraints in saving the lives of children, ages 0 - 4. This analysis provides updated estimates of the effectiveness of child restraints for infants less than 1 year of age and for children 1-4 years of age. Effectiveness estimates were calculated separately for child restraints used in passenger cars (PCs) and in light trucks and vans (LTVs).

METHODOLOGY

This analysis updates the work published in *Lives Saved by Child Restraints from 1982 through 1987* by Susan C. Partyka (DOT HS 807 371, December 1988). Data from FARS for the period 1988 - 1994 for children involved in fatal crashes were used in the current analysis.

The first step in the analysis was selecting from FARS those fatal crashes involving PCs and LTVs for which the driver's and child's restraint use and the child's seating position were known. For each driver restraint status (in use or not in use) and each child seating position (front or rear), two ratios were compared. The first ratio, the numerator, was the number of fatalities among infants in child restraints, divided by the number of fatalities among their drivers. The second ratio, the denominator, was the number of fatalities among unrestrained infants divided by the number of fatalities among their drivers. The ratio of these ratios is called a paired comparison. This resulted in four paired comparisons, one for each combination of driver restraint status and child seating position. To determine relative risk of fatality for a restrained infant as compared to an infant who was unrestrained, the logarithms of the paired comparisons were calculated along with their variances and combined using the methodology described in *Statistical Methods for Rates and Proportions* by Joseph Fleiss (John Wiley and Sons, 1981). These combined log risk ratios control for the child's seating position and the driver's belt use. The combined estimates, along with the standard errors of the estimates, were used to construct confidence intervals for the relative risk. Estimates of restraint effectiveness were obtained using:

Effectiveness = 1 - exp[log (relative risk)]

This resulted in an effectiveness estimate for child restraints for infants. The same method was use to calculate child restraint effectiveness for older children and effectiveness of adult safety belts for older children.

RESULTS

Table 1 presents the estimates of the fatality-reducing effectiveness of child restraints for PCs and LTVs. All estimates shown in Table 1 were found to be statistically significant ($\alpha < .05$).

Table 1
Estimated Fatality Reducing Effectiveness
of Child Restraints

Vehicle Type	Age Group	
	Less than 1	1 - 4
Passenger Cars	71%	54%
Light Trucks and Vans	58%	59%

Adult seat belts were found to be 47% effective in PCs and 48% effective in LTVs for children aged 1-4.

In addition, it is estimated that children are 26% less likely to be fatally injured if seated in the rear of a passenger vehicle. This estimate was obtained by controlling for driver and child restraint use and was also found to be statistically significant ($\alpha < .05$).

Using data from 1982 through 1987, Partyka [1988] found that child safety seats were 69% effective against fatalities for infants and 47% effective for children aged 1-4. The present estimates based on data from 1988-94 for child restraint effectiveness appear to be consistent with the estimates reported in Partyka [1988]. In view of the increasing popularity of LTVs as family vehicles, separate estimates were calculated for LTVs. NHTSA plans to use these revised estimates for calculating the number of children's lives saved. These revised estimates will be reported beginning in 1997 using data for calendar year 1996.

Partyka [1988] found adult seat belts to be 36% effective for children. These revised estimates of adult seat belts (47% for PCs and 48% for LTVs) are substantially greater. It is not clear what factors may affect such an increase in adult belt effectiveness for children. One possible factor influencing the increase: as more states have enacted

mandatory belt use laws, a possible bias in reporting belt use may be present, thereby distorting estimates of adult belt effectiveness for passengers of all ages. (For more information on this, see *Report to Congress on Benefits of Safety Belts and Motorcycle Helmets, Based on Data from the Crash Outcome Data Evaluation System (CODES)* by Johnson, Sandra W. and Walker, Jonathan (DOT HS 808 347, February 1996) and *The Crash Outcome Evaluation System (CODES)* (DOT HS 808 338, January 1996).

Based upon this analysis, the maximum potential for reducing the risk of fatality for children occupying passenger vehicles is obtained by having the child restrained in a child restraint located in the rear seating position of the vehicle.

For more information regarding the methodology used in this analysis or questions regarding the findings, please contact Ellen Hertz, Ph.D. of NCSA, at (202) 366-5360. For additional copies of this research note, please contact NCSA at (202) 366-4198 or fax (202) 366-7078. This research note and other general information on highway traffic safety may be accessed by Internet users at http://www.nhtsa.dot.gov/people/ncsa.

To ensure that your children ride safely, remember these rules:
- **The *back seat* is the *safest* place for children of any age to ride.**
- **Make sure *all* infants and children are properly restrained in child safety seats or lap and shoulder belts for every trip.**
- ***Infants* riding in rear-facing child safety seats should *never* be placed in the front seat of a vehicle with a passenger-side air bag.**