

# An Assessment of the California Child Passenger Restraint Requirement

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**Abstract:** To evaluate the California Child Passenger Restraint Law requiring children under four years of age to be transported in car seats, we examined monthly injury and fatality levels from January 1978 to December 1983 for children 0–3 and 4–7 years of age using Box-Jenkins time series models. A significant 8.36 per cent reduction in injuries was found for the 0–3 year old age group, but no significant reduction in injuries was found for 4–7 year olds. No

significant reduction in fatalities was found for either age group. A similar analysis of injuries and fatalities in Texas, a state without a car seat law, showed no significant reductions in either injuries or fatalities. There was no change in the number of California 0–3 year olds in the years after the law was enacted. (*Am J Public Health* 1985; 75:142–144.)

## Introduction

Accidents are the leading cause of death in the United States among children past infancy and through age four.<sup>1</sup> Many state legislatures have passed laws requiring the use of restraint devices for children in an effort to reduce the number of injuries and fatalities due to motor vehicle accidents. Effective January 1, 1983, California law required that children less than four years or 40 pounds be transported in a properly used federally approved child passenger seat restraint system.<sup>2</sup> While several studies have assessed the impact of such legislation on car seat use,<sup>3,4</sup> no studies have addressed the ultimate variables of concern—the levels of injuries and fatalities. The present study assessed the impact of the legislation in California on the number of motor vehicle injuries and fatalities to young children using interrupted time series analyses. Comparisons were made both within the state (adjacent age groups) and between states (similar age groups) to assess possible alternative explanations for the results.

## Method

### Design and Analysis Plan

A statistical test of the impact of the California law within each series of data was assessed using the Box-Jenkins time series computer program BMDP 2T.<sup>5</sup> The Box-Jenkins method allows the modeling of seasonal cycles, trends, and other patterns in the time series resulting in more accurate estimates of intervention effects. Nonstatistical comparisons between the target series and suitable control series test the validity of the results of the statistical test of the intervention. An intervention effect is confirmed when a significant change in the dependent variable is evident in the target series but not in the control series. Explanations for changes in the dependent variable must be explanations that would affect only the target and not the control series.

Two approaches were selected to test the effectiveness of the law. First, within the state, the number of injuries and fatalities in two age groups of children were examined before and after the law went into effect. The younger group (0–3 year olds) was required to be transported in car seats, while

the older group (4–7 year olds) was not directly targeted by the law. If the law had a significant impact on injuries or fatalities, only the younger group would show a significant reduction. Such a reduction could also be due to a decrease in the number of individuals in this age group. The number of births in California was examined to explore this possibility.

Second, a between-state comparison to a state without a car seat law was made. Injury and fatality levels for children in Texas of similar ages to those affected by the California law were examined over the same time period to rule out such possible explanations as declining injury rates for car safety or other transportation changes specific to children in this age group. Texas has no child restraint law and is more like California in size than other states.

### Data Sources

**California Motor Vehicle Injuries and Fatalities**—The monthly numbers of injuries and fatalities of infants and children due to motor vehicle accidents for the 60 months from January 1, 1978 through December 1983 were obtained from the Public Affairs Office of the California Highway Patrol. This information was based on motor vehicle traffic accident reports received from local police jurisdictions and from California Highway Patrol field offices. Reports are currently required by California law to be filed for any motor vehicle accident involving injury or property damage in excess of \$500. It is assumed that all fatal and injury accidents that occurred were reported.

**California Births**—The number of births in California from January 1978 through December 1983 was obtained from the monthly vital statistics reports of the US Department of Health, Education, and Welfare.<sup>6</sup> The birth statistics were transformed to indicate the number of 0–3 year olds per year from 1981 to 1983.

**Texas Motor Vehicle Injuries and Fatalities**—The monthly numbers of injuries and fatalities of 0–4 year olds due to motor vehicle accidents for the 60-month period from January 1979 through December 1983 were obtained from the State of Texas Department of Public Safety, Statistical Services Office in Austin, Texas. These data are obtained from accident reports filed each month by Texas State Troopers. Reports are required for accidents resulting in injury, death, or damage of more than \$250 to vehicles. An injury is defined as a condition requiring medical care.

## Results

The traditional procedures of identification, estimation, and diagnosis were employed to model the preintervention data series. When an adequate preintervention model was

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**Editor's Note:** See also related editorial p 128 this issue.

obtained, the intervention component was added and the entire series was analyzed. Readers are referred to the Appendix for technical details relating to data analyses.

#### California Data

Neither series showed a significant change in the number of fatalities per month following the enactment of the law.

There was a significant reduction in injuries for the 0-3 year old group, but not for the control series of 4-7 year olds. Figure 1 shows the number of injuries recorded each month for each of the two age groups. In the 0-3 age group, the average number of injuries per month prior to the legislation was 398.6. During the 12-month period immediately following the enactment of the law, the average number of injuries per month was 366.13, indicating a significant reduction of 32.47 (8.36 per cent) injuries per month.

For the adjacent age group of 4-7 year olds, the average number of injuries per month was 401.0 prior to the enactment of the law. A nonsignificant increase in average monthly injuries of 28.71 was evident during the 12-month period immediately following enactment of the law.

The total numbers of 0-3 year olds in California during 1981, 1982, and 1983 were 1,187,109, 1,258,665 and 1,270,638, respectively. The number of 0-3 year olds was greater in 1983 than in prior years. Thus, the decrease in injuries in this age group cannot be attributed to a decrease in the number of 0-3 year olds in California after the enactment of the law.

#### Texas Data

Due to data recording procedures, the nearest comparison group in Texas consisted of 0-4 year olds. The time series analysis of the Texas data showed that this group did not experience a significant decrease in injuries during 1983 as was observed in California. Prior to 1983, the average number of monthly injuries to 0-4 year olds in Texas was 477.9; during 1983, a nonsignificant average increase of 10.09 injuries per month was observed.

#### Discussion

The recent enactment of the California Child Passenger Restraint Requirement was followed by a significant 8.36 per

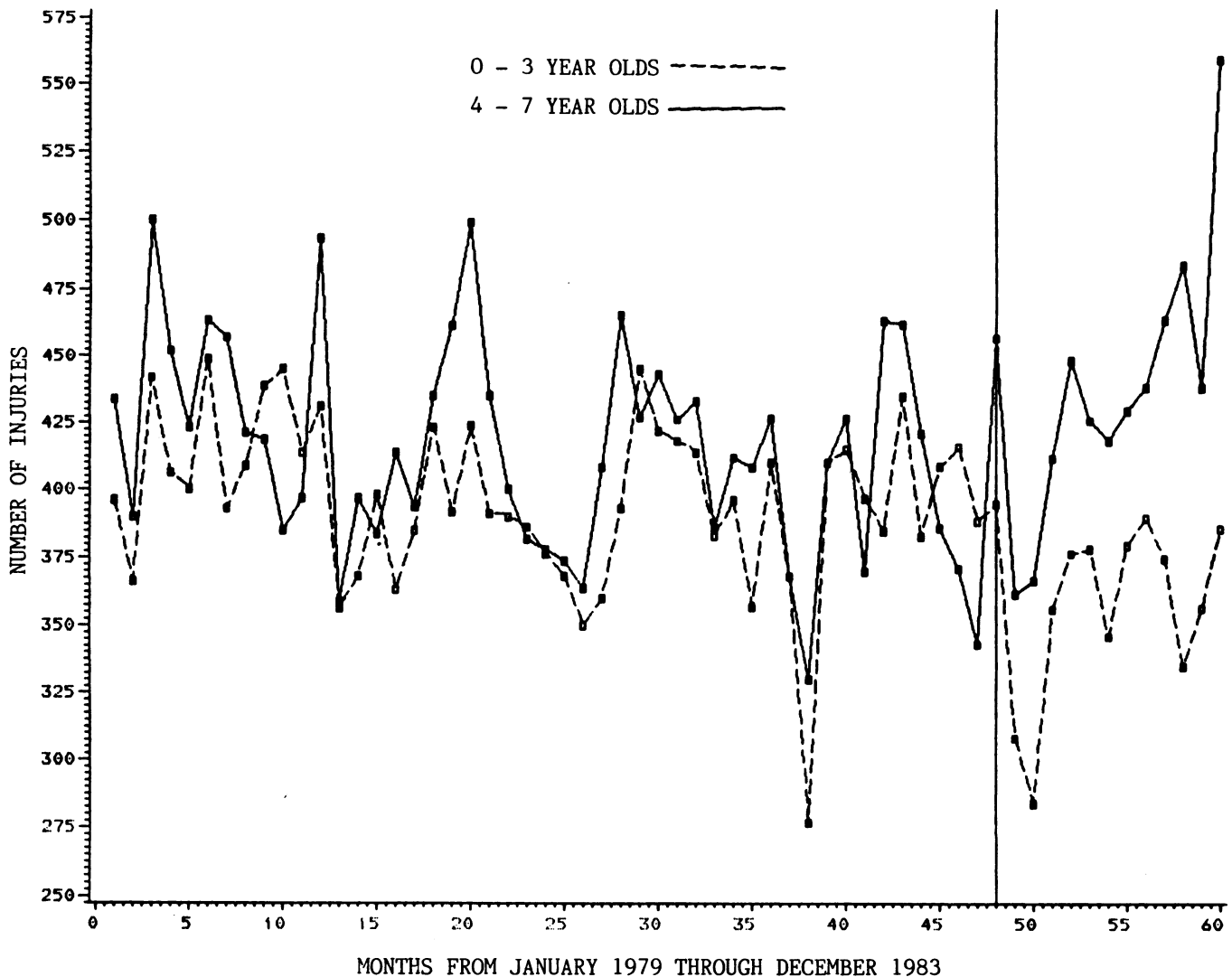


FIGURE 1—Number of Injuries per Month due to Motor Vehicle Accidents among Children in California aged 0-3 years and 4-7 years. (The legislation went into effect at the beginning of the 49th month.)

cent reduction in injuries to young children in motor vehicle accidents, not explained by changes in the number of 0-3 year olds. Analysis of motor vehicle injury data from Texas, a state without car restraint legislation, suggests that the reduction is not due to nationwide changes in driving patterns or vehicle safety specific to the younger group.

One possibility that cannot be determined by this study is whether differential reporting of accidents occurred. Although we have no reason to suspect this to be the case, it is possible that accidents involving young children who were not properly restrained are less likely to be reported for fear of penalty. In California, however, the first fine is often waived after proof of car seat purchase is presented.

The finding that the legislation did not reduce the number of fatalities in the intervention group is not surprising since changes in fatality rates are more difficult to detect over a relatively short time period. In the California intervention series examined in this study, the average number of fatalities was approximately four per month, while the average number of injuries was approximately 400 per month.

Legislation requiring the use of seat restraints may not necessarily lead to a reduction in injuries, as observed in California. California's legislation has strict requirements and penalties, and different legislation may not lead to comparable results. Future research should examine the impact of the severity and enforcement of the various laws enacted.

The finding that only the target group and not the control series of children aged four to seven years experienced a reduction in the number of injuries suggests that, at least initially, legislation may be required to encourage parents to buckle up older children as well. Even in states requiring restraint systems, compliance is usually less than 50 per cent.<sup>2,3</sup> Such findings indicate the need to implement programs aimed at increasing the use of restraint systems or seat belts. The effectiveness of hospital-based rental programs of child restraint devices<sup>7</sup> and of providing information to new mothers in-hospital and at well-baby checkups has been demonstrated.<sup>8,9</sup> Research indicating that car seat and seat belt use decline as the child ages<sup>4</sup> suggests a need for programs aimed at promoting the continued use of restraint devices for toddlers and older children as well as for infants.

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**ACKNOWLEDGMENTS**

Gratitude is extended to J. Arthur Woodward, PhD, and Allen W. Gottfried, PhD, for their support and helpful comments.

**APPENDIX**

The autocorrelation function (ACF) and partial autocorrelation function (PACF) plots at the identification and diagnosis stages for all injury series are available on request to author. The number of injuries among 0-3 year olds required a moving average model as follows:

$$y_t = (1 - \theta_{12}B^{12})a_t + \omega(I_t)$$

where  $a_t$  is the random error component,  $\theta_{12}$  is a moving average parameter of order 12 indicating a relationship between each observation and the error in the observation 12 months previous, B is the backshift operator, C is the mean of the series,  $\omega$  is the intervention component value, and  $(I_t)$  is a step function representing the California Child Passenger Restraint Requirement intervention. The model was considered adequate when the model parameters were all significant with low parameter correlations and the residuals resembled white noise with a nonsignificant Lyung-Box statistic.<sup>10</sup> The final model for the California 4-7 year old injury series included autoregressive parameters of orders 1 and 12, a constant and the intervention component. The Texas 0-4 year old injury series included autoregressive parameters of orders 1 and 12, a constant, and the intervention component. The parameter estimates yielded by the BMDP 2T program for each injury series are presented in Table A-1.

Per cent change values cited in the text are based on the first 12 months of available data after the California Child Restraint Requirement went into effect and were computed as follows:

$$\text{Per cent change} = (100) \frac{12 \omega}{\left( \sum_{i=1}^{12} f_i \right) + 12 \omega}$$

where  $\omega$  is the shift in the number of injuries estimated by the time series model and  $f_i$  is the actual number of injuries observed. The authors acknowledge that these data could be analyzed using other assumptions about the data. For example, we treated the data as generated by a Poisson process by adjusting the variance. This analysis yielded identical conclusions to those cited above.

**TABLE A-1—Parameter Estimates, Standard Errors, and t-values Yielded by Box-Jenkins Time Series Analyses of the Injury Series**

Parameter	Parameter Estimate	Standard Error	t
<b>California 0-3 Year Olds</b>			
$\theta_{12}$	-0.80	0.05	-16.20
C	398.60	6.03	66.08
$\omega$	-32.47	8.23	-3.94
<b>California 4-7 Year Olds</b>			
$\phi_1$	0.35	0.15	2.29
$\phi_{12}$	0.37	0.14	2.60
C	409.70	16.10	25.45
$\omega$	28.71	18.68	1.54
<b>Texas 0-4 Year Olds</b>			
$\phi_1$	0.50	0.13	3.78
$\phi_{12}$	0.76	0.11	6.66
C	593.00	69.91	8.48
$\omega$	3.25	24.33	0.13