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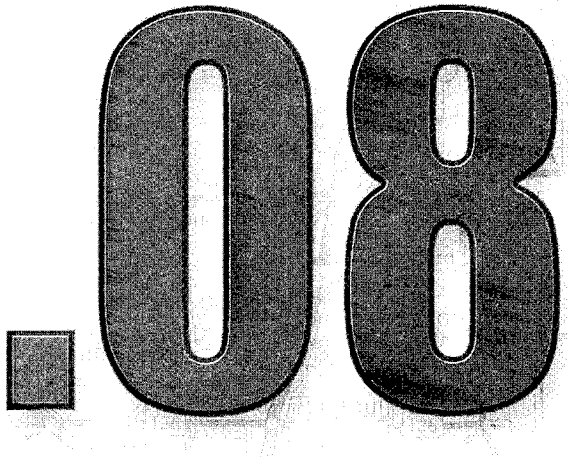
PB2002-104681

Evaluation of the Illinois .08 Law:

An Update with the 1999 FARS Data



DOT HS 809 382
December 2001

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT HS 809 382		

4. Title and Subtitle	5. Report Date
Effectiveness of the Illinois .08 Law: An Update with 1999 FARS Data	December 2001
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
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9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Pacific Institute for Research and Evaluation 11710 Beltsville Drive, Suite 300 Calverton, MD 20705-3102 Phone: 301-755-2700 Fax: (301) 755-2799	11. Contract or Grant No. DTNH22-98-D-35079

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Highway Traffic Safety Administration Office of Research and Traffic Records 400 7th Street, SW Washington, DC 20590	Second Interim – May 2001 14. Sponsoring Agency Code

15. Supplementary Notes

Amy Berning was the Contracting Officer's Technical Manager for this project.

16. Abstract

In December 2000, NHTSA published a report on the effectiveness of the .08 law implemented by Illinois in July 1997. That report covered data from the Fatality Analysis Reporting System (FARS) through 1998. It indicated that there was evidence that the .08 law reduced the number of drinking drivers in fatal crashes by 13.7%. Although the number of alcohol-related fatalities increased in Illinois in 1999, these levels remained considerably lower than projections based on trends from before the change in the law. This current analysis used the additional 12 months of FARS data now available to determine whether there was evidence to indicate that the .08 law was still having an effect in Illinois. The results, using a **covariate** analysis over a 30-month period, reaffirm the findings of the original analysis of the effectiveness of the Illinois .08 law introduced in 1997. The 30-month analysis found a reduction of 13.65% in the predicted percentage of drinking drivers involved in fatal crashes; for the 2-year period (1998 and 1999), the .08 law is associated with a reduction of approximately 105 alcohol-related deaths. An additional analysis, using the **ratio** approach, found a similar effect (12.3%). While the results of the **covariate** analysis remained statistically significant (p = .035), the analysis using the **ratio** approach was only marginally statistically significant (p=.082).

17. Key Words	18. Distribution Statement
Drunk Driving Legislation; .08 Blood Alcohol Concentration (BAC); DWI; DUI	Copy available from National Technical Information Service, Springfield, VA 22160. Also, see www.nhtsa.dot.gov for a copy.

19 Security Classif. (of this report)	20. Security Classif. (of this page)	21 No. of Pages	22. Price
Unclassified	Unclassified		

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Introduction

Prior to the evaluation of Illinois' .08 BAC law (Voas, et al., 2000), eight studies on the effect of .08 laws on crashes had been reported in the research literature (NHTSA, 1991; Hingson, Heeren, & Winter, 1996, 2000; Johnson & Fell, 1995; Rogers, 1995; Foss, Stewart, & Reinfurt, 1998; Apsler, Char, & Harding, 1999; Voas, Tippetts, & Fell, 2000). The preponderance of evidence from these studies demonstrates that .08 Blood Alcohol Concentration (BAC) legislation consistently appears to produce a modest (about 8%) reduction in alcohol-related fatal crashes. In some states, it has been difficult to evaluate the effectiveness of .08 laws because they were enacted in conjunction with other drunk-driving legislation, particularly administrative license revocation (ALR) laws that are known to be effective in reducing crashes. Further, because most states are actively involved in drunk-driving programs, alcohol-related crashes have been declining in most jurisdictions. As a result, it has been hard to find an appropriate comparison for States that adopt this legislation. Illinois provided a special opportunity to evaluate the .08 law because an ALR law had been enacted on January 1, 1986, more than 11 years before the implementation of the .08 law in July 1997. Further, none of the five States that border Illinois, all of which also have ALR, had yet enacted a .08 law. These States provided a good comparison for the analysis of the impact of the Illinois law.

NHTSA published a report entitled *Effectiveness of the Illinois .08 Law* (Voas et al., 2000). It found that, during the first 18 months the .08 law was in effect, DUI arrests increased by 10.8%, and that the average BAC of arrested drivers decreased from .18 to .16. In addition, the number of drinking drivers in fatal crashes who had BACs less than .10 decreased by 22%. Overall, there was a 13.7% decrease in drinking drivers involved in fatal crashes relative to the number that would have been predicted to occur.

The recent report on the effectiveness of the Illinois law was written before the 1999 Fatality Analysis Reporting System (FARS) data were released. The 1999 FARS data for Illinois show an increase in the number of drinking drivers involved in fatal crashes and in the total number of alcohol-related fatalities during that year. The number and percentage of Illinois drivers in fatal crashes who had been drinking (BAC> .00) from 1995 through 1999 are shown in Table 1, along with the number and percentage of alcohol-related fatalities.

Table 1: Drinking Drivers in Fatal Cashes and Alcohol-Related Fatalities in Illinois From 1995 to 1999[1]

Year	Drinking drivers in fatal crashes BAC >.00		Alcohol-related fatalities BAC >.00	
	Number	% of all drivers	Number	%of all fatalities
1995	561	25.9%	682	43.0%
1996	552	27.2%	665	45.0%
1997	499	26.1%	587	42.9%
1998	487	25.1%	599	43.0%
1999	*529*	*26.1%*	*637*	*43.8%*

An update with 1999 FARS data

Although the reported increase in alcohol-related fatalities is undesirable, it does not mean that the .08 law is no longer having an effect. Figure 1 presents a graph of the monthly percentage of drinking drivers (BACs >. 00) in fatal crashes in Illinois from 1988 through 1999. This graph is produced by means of a mathematical modeling procedure (ARIMA) used in time series analysis (Box & Tiao, 1975). This procedure accounts for trends and other processes that affect monthly variations in percentages and corrects for seasonal effects. Between 1989 and 1993, the percentage of drivers with positive BACs in fatal crashes in Illinois varied from a low of 28% to a high of 34%. It then fell to between 23% and 26% in 1995, after which it began to rise, reaching between 28% and 29% in the year before the .08 law became effective in 1997. The decrease in the percentage of drivers in fatal crashes just before new DUI laws are passed is a common occurrence. The high level of publicity about impending changes in the law often creates a deterrent effect.

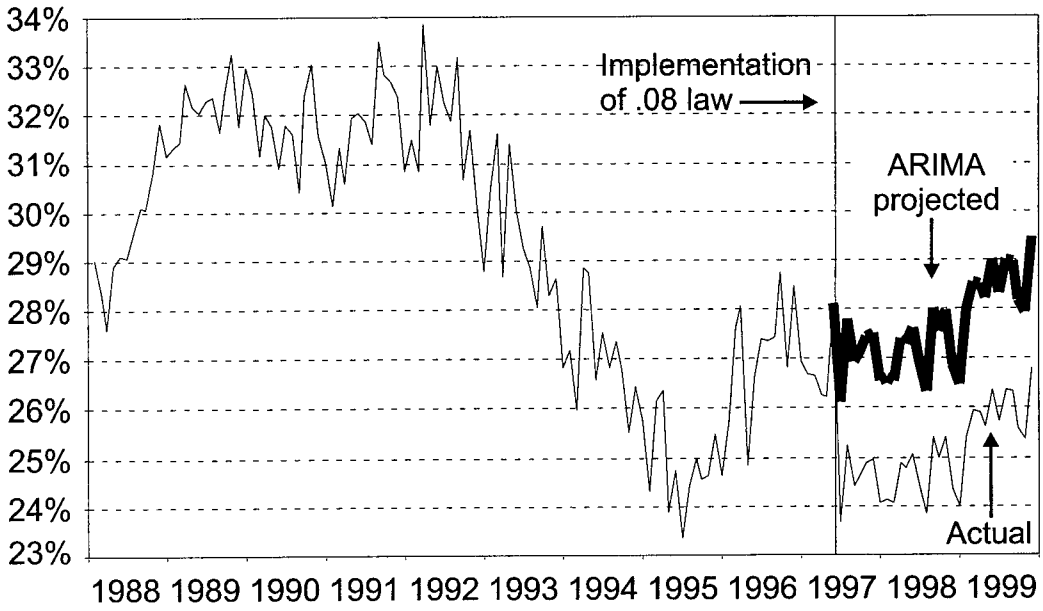
The time series analysis model (ARIMA) predicted that, had there not been an abrupt reduction associated with the July 1997 implementation of the .08 law, the 1999 percentage of drinking drivers in fatal crashes would have been 28% to 29%. The actual percentage was 25% to 27%. Figure 1 suggests that the .08 law was associated with an immediate reduction (shift in level) in the percentage of drinking drivers involved in fatal crashes but not a change in the slope or trend. Consequently, the percentage of drinking drivers involved in fatal crashes continued to rise at about the same rate as it had been rising before the .08 law, but the reduction in level that occurred in 1997 was sustained in 1998 and 1999.

The percentage, rather than the actual number of drinking drivers, is used in Figure 1 to account for factors not related to alcohol that produce fatal crashes. Among these factors are the safety features of vehicles and roadways, the economy, and the price of gasoline. All of these factors are reflected in the number of fatal crashes that involve *nondrinking* drivers. By relating the number of drinking drivers to the number of nondrinking drivers, we control, to some extent, for the influence of the factors not related to alcohol consumption. This measure is commonly

[1] The final FARS data revealed an additional one or two cases, after these analyses were performed.

used in evaluating the association between alcohol safety laws and alcohol-related crashes. It is one way to help ensure that one is measuring primarily crashes involving drinking drivers as opposed to crashes involving nondrinking drivers.

Figure 1: Percentage of All Drivers in Fatal Crashed in Illinois Who Had Positive BACs Using Monthly Percentages (ARIMA Model Fit)



Another method for controlling for non-alcohol-related factors is to analyze the data series separately for drinking and nondrinking drivers and then compare the results of the two analyses. This approach, which involves two separate time series analyses, is generally less powerful statistically because both series typically share common patterns of error variance. A more parsimonious procedure is to consider both drinking and nondrinking driver series in one analysis. This can be done in two ways. The series for drinking drivers can be analyzed using the series for nondrinking drivers as a **covariate** in the analysis, thereby regressing out effects of any unmeasured factors that affect both groups. Alternatively, the series of the **ratio** of drinking to nondrinking drivers can be used in the analysis. The latter approach involves the direct analysis of the odds (the ratio of drinking to nondrinking drivers) of a crash being alcohol related. It is often preferable in certain situations because unexplained fluctuations in the drinking driver series are frequently correlated with similar fluctuations in the nondrinking driver series; the ratio series often reduces this unexpected variance, providing greater statistical power.

Both the ratio and the covariate methods were used in analyzing the FARS data for the original report on the Illinois .08 law (Voas et al., 2000). Only the results from the covariate analysis were reported in the first study because, with only 18 months of data after the enactment of the .08 law, the month-to-month variation in the ratio series was too great to permit the development of a stable model analysis. With the additional year's data available from the 1999 FARS, both the covariate and the ratio data can now be satisfactorily modeled.

In the earlier report, the time series analysis of drinking drivers in fatal crashes in Illinois found a statistically significant (p= .040) 13.7% *decrease* in the predicted number of alcohol-positive

drivers in Illinois. This was compared to a combined 2.5% *increase* in the number of alcohol-positive drivers in the five States (Indiana, Iowa, Kentucky, Missouri, and Wisconsin) surrounding Illinois, all of which had .10 laws. When the 1999 data are added to the previous data set, 30-months of data (rather than just 18) are available for analysis following the implementation of the Illinois .08 law. Using the same **(covariate)** time series methodology reported in the original report (i.e., in which the drinking driver series is analyzed using sober drivers in fatal crashes as a regressor series), we find that the intervention effect of .08 is essentially the same, for the 30-month follow-up period, as for the first 18 month follow-up period. As shown in Table 2, the reduction in the number of drinking drivers involved in fatal crashes in Illinois is 13.65%, which is statistically significant (p=.038). Analysis of the comparison States showed a 3.38% nonsignificant *increase* in the number of drivers with positive BACs. When the Illinois results are contrasted with the comparison States, the estimated net reduction becomes 15.33%, which is statistically significant (p= .035).

Table 2: Illinois .08 – ARIMA Intervention Analysis for Illinois and Five States: Indiana, Iowa, Kentucky, Missouri and Wisconsin Combined, Using Covariate Approach

Series	b(coef)	effect	Se(b)	t-ratio	1-tail prob
Illinois	-.14681	-13.65%	.08232	.-1.783	.038
Comparisons	.03320	+3.38%	.03383	0.981	.164
Contrasted models	**Diff(b)**	**Cumulative effect**	**Pooled se(diff)**	**t-ratio**	**1-tail prob**
Illinois vs. comp	-.16645	-15.33%	.09123	-1.825	.035

With the additional 1999 data, it was possible to analyze the Illinois series using the **ratio** method. These results are shown in Table 3. As can be seen, the results are very similar to those obtained using the **covariate** procedure. The change from the pre-law to the post-law period in Illinois produced an estimated 12.30% reduction in the ratio of drinking drivers to nondrinking drivers. This was marginally statistically significant (p= .082). The change from the same pre-July 1997 period to the post-July 1997 period for the neighboring States (combined) was a nonsignificant *increase* of 1.98% in the ratio of drinking to nondrinking drivers in fatal crashes. If we contrast the analysis of the five comparison States with that for Illinois, we obtain an overall net reduction of 14.01% (p= .07).

The ratio approach, which usually provides for more parsimonious and better fitting statistical models when the two series are highly correlated in a linear fashion, proved to be less reliable than the covariate approach in this instance. When the denominator series is highly volatile or has large amounts of error uncorrelated with that in the numerator series, the error can actually be compounded in the resulting ratio series, which appeared to be the case with Illinois' FARS data within this time frame.

Table 3: Illinois .08 – ARIMA Intervention Analysis for Illinois and Five States: Indiana, Iowa, Kentucky, Missouri, and Wisconsin Combined, Using Ratio Approach

Series	b(coef)	effect	se(b)	t-ratio	1-tail prob
Illinois	-.13126	-12.30%	.09361	-1.402	.082
Comparisons	.01965	+1.98%	.03931	0.500	.309
Contrasted models	**Diff(b)**	**Cumulative effect**	**pooled se(diff)**	**t-ratio**	**1-tail prob**
Illinois vs. comp	-.15091	-14.01%	.10153	-1.486	.070

Estimating the lives saved by .08

Although different studies use different measures to evaluate laws such as this, it is important to convert the findings to a common measure (e.g., fatalities reduced). To do this, we determined the number of fatalities associated with each drinking driver. To estimate the average number of fatalities associated with each drinking driver involved in a fatal crash, pedestrian fatalities were eliminated when the pedestrian had a positive BAC. These cases were eliminated because the drinking pedestrian, rather than a driver, may have contributed to the cause of the crash. Next, it was necessary to estimate the number of fatalities attributable to each driver in the crash. If there were two drivers, then half the fatalities in that crash were attributed to each driver. The fatalities attributable to sober and drinking drivers were aggregated separately and only the fatalities attributed to the drinking driver (BAC >.00) were used in the calculation of the number of fatalities that could be attributed to the .08 law. These two steps likely produce a smaller number of fatalities identified as being "alcohol-related" because drinking pedestrians have been eliminated and responsibility for the crash has been attributed equally to drinking and nondrinking drivers even though it has been shown that drinking drivers are significantly more likely to cause fatal crashes than sober drivers. Thus, this approach produces a somewhat conservative estimate of the lives saved by the .08 law.

For the Nation as a whole, the FARS files[2] indicated that during the 2-year period from 1998 to 1999, there were 26,228 alcohol-positive drivers who, using this attribution method, accounted for 22,622 fatalities. This produces a rate of .863 fatalities per drinking driver. Considering the State of Illinois alone, there were 1,016 alcohol-positive drivers to whom this procedure attributed 876 fatalities yielding a rate of .862 fatalities per alcohol-positive driver, which is almost identical to the national rate (.863) during the same 2-year period. (The previous report on the Illinois .08 law used a rate of .8991 fatalities per drinking driver, which included alcohol-involved pedestrians, who were likely to have been at least partly responsible. The newer rate, therefore, produces an even more conservative estimate of lives saved.)

The time series analyses results were used to estimate the number of alcohol-involved drivers that would have been involved in fatal crashes had the .08 law not been implemented in Illinois. These estimates for 1998 and 1999 are shown in the second column of Table 4. Based upon the

[2] After these analyses were performed, an additional 59 drivers nationwide were determined to be alcohol positive in the final FARS data for a total of 26,287. One of these was from Illinois, making their final total 1,017.

attribution rate of .862 fatalities per drinking driver in Illinois, the estimated number of deaths that would have occurred in 1998 and 1999, without the .08 law, would have been 981 (fourth column) as opposed to the 876 (third column) that actually occurred. Thus, the estimated number of lives saved during the 2 years was 105, as shown in the last column.

The predicted number of fatalities varied little by whether the prediction was based on the covariate or the ratio analysis approach. The values in the table were derived from the ratio analysis. The estimated number of drinking drivers in fatal crashes based on the covariate analyses was 538 (rather than 540) for 1998 and 595 (rather than 598) for 1999 - - less than five lives difference between the two estimation procedures across a 2-year period.

Table 4: Actual and Predicted Number of Drinking Drivers in Fatal Crashes and Fatalities Attributed to Drinking Drivers in Illinois in 1998 and 1999[3]

Year	Drinking drivers in fatal crashes		Fatalities attributed to drinking drivers[4]		Lives saved
	Actual	Predicted	Actual	Predicted	
1998	487	540	418	463	45
1999	529	598	458	518	60
1998/1999	1,016	1,138	876	981	105

Summary

The results, using a **covariate** analysis over a 30-month period, reaffirm the findings of the original analysis of the effectiveness of the Illinois .08 law introduced in 1997. The 30-month analysis found a reduction of ~~12.30%~~ 13.65% in the predicted percentage of drinking drivers involved in fatal crashes. That change in level remains, even though the percentage of drinking drivers in crashes has continued to trend upward as it did before the implementation of .08. For the 2-year period (1998 and 1999), the .08 law is associated with a reduction of approximately 105 deaths. An additional analysis, using the **ratio** approach, found a similar effect (12.3%) . While the results of the **covariate** analysis remained statistically significant ($p = .035$), the analysis using the **ratio** approach was only marginally statistically significant ($p=.082$).

[3] The final FARS data revealed an additional one or two cases after these analyses were performed.

[4] The number of fatalities in a crash were attributed proportionally among all drivers in that crash. This assumes that all drivers played an equally causative role in the crash. The proportional attribution necessarily produces a smaller number of fatalities than obtained by simply counting all fatalities in a crash in which any driver was alcohol-involved.

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