

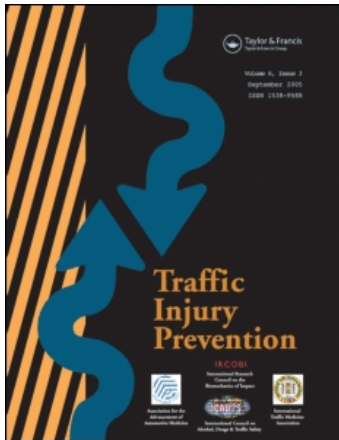
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### Interlocks for First Offenders: Effective?

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# Interlocks for First Offenders: Effective?

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**Objective.** Vehicle interlocks have been shown to effectively reduce the recidivism of multiple driving-while-impaired (DWI) offenders; however, the evidence for their effectiveness with first offenders has been mixed. Two Canadian studies found that the installation of an interlock reduced first DWI recidivism, but U.S. studies in West Virginia and California failed to find a significant reduction in recidivism for first DWI offenders in interlock programs. The objective of this study was to determine the extent to which such devices were effective with first offenders in New Mexico.

**Methods.** This study compared 1,461 first offenders, who installed interlocks in New Mexico between January 1, 2003, and December 1, 2005, with 17,562 first offenders convicted during the same period who did not install the units. Cox multivariate proportional hazards regression (CMVPHR) was used to compare recidivism rates during three periods:

- (1) while the interlock was on the vehicles of offenders who installed them,
- (2) after those offenders removed the units until the end of the study period (approximately 2 years), and
- (3) for the combined period (both while the interlock was installed and after it was removed).

**Results.** While the device was on the vehicles of the interlock group, their recidivism rate, 2.6% per year of exposure, was significantly less than the 7.1% per year rate of the comparison group (CMVPHR hazard ratio = 0.39,  $p < 0.0001$ ). After the device was removed, the annualized recidivism rate of the interlock group increased to 4.9% per year of exposure, which was less than the 6.7% rate of the comparison group, but the hazard ratio was not statistically significant (CMVPHR hazard ratio = 0.82,  $p = 0.16$ ). When the combined periods (interlock on and off) were considered, the interlock group had a recidivism rate of 3.9% per year, which again was significantly lower than the 6.8% rate for the comparison group (CMVPHR hazard ratio = 0.61,  $p < 0.0001$ ).

**Conclusion.** The study provides evidence that interlocks are as effective with first offenders (approximately 60% reduction in recidivism when on the vehicle) as they are for multiple offenders. In addition, the benefits of requiring an interlock for first offenders exceed the costs by a factor of three.

**Keywords** Alcohol; Interlock; DUI; DWI; First Offender

In the United States, vehicle alcohol interlocks have been most widely used for multiple driving-while-impaired (DWI) offenders based on the general belief that interlocks are most needed by and most effective with individuals who cannot control their drinking. Because a DWI arrest is a low-probability event, those who do become multiple DWI offenders have demonstrated their resistance to change and are subject to substantial periods of license suspension. Installation of an interlock

during this period has been shown to reduce recidivism substantially. In their meta-analysis of interlock studies, Willis et al. (2004), operating within the structure of the Cochrane Collaboration, found that, in six of eight evaluations of multiple-offender interlock programs, there were significant recidivism reductions. The evidence for the effectiveness of interlocks for first offenders is less clear, however. Arguably, first offenders have better control over their drinking and should be more likely to respond appropriately to license suspensions and other sanctions.

Studies of the influence of interlock programs on first DWI offenders have been limited. Several studies have mixed first and multiple offenders but have not reported separately on the first offenders. For example, in one of the earliest interlock evaluations (Morse & Elliott, 1992), 25% of the participants were first offenders. These were selected cases, however, with arrest

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**Table I** Selection of interlock groups for first conviction study

	First offender interlock subgroups	N	Number arrested during	% Arrested during	% at 1 Year
Interlocked first offenders	Total interlocked 1999–2005	3,039	30	1.0%	1.8%
Excluded groups:					
Out of state	No NM driver's license	223	2	0.9%	1.4%
No mandatory law	Convicted before 1/1/2003	870	4	0.5%	0.5%
Not mandated	Installed more than 90 days after conviction	1,292	7	0.5%	1.0%
No time for rearrest	Installed after 12/1/2005	321	0	0.0%	
Included in study	Interlock study group	1,461	21	1.4%	2.9%

BACs of .20 or higher or arrests for refusal to take the breath test. Separate results for the first offenders were not reported. Weinrath (1997) similarly studied a mixed group of first and multiple offenders. The 1992 Oregon study by Jones and the 2002 Illinois study by Frank et al. primarily included second offenders, and the 1999 study by Beck et al. was limited to multiple offenders.

In a West Virginia study, Tippetts and Voas (1998) compared 137 first DWI offenders on the interlock with 10,198 suspended first DWI offenders not on the interlock and found a small but not significant recidivism reduction among the interlock users. Over a 12-month period, Voas et al. (1999) compared the recidivism of 1,982 first offenders on the interlock with 17,587 fully suspended offenders not on the interlock in the Canadian Province of Alberta and found that the reoffense rate for the interlock group was 0.10% compared to 2.23% for the nonusers, which was strongly significant ( $p < .0001$ ). Vezina (2002) studied 8,846 first offenders, representing 26% of the first offenders in the Province of Quebec over 12 months. The interlock users maintained a 0.201 reoffense rate ratio ( $p = .0001$ ) relative to the fully suspended comparison first offenders who did not install interlocks.

In contrast to the results in the two Canadian provinces, DeYoung et al. (2005) found that first offenders ordered by the court to install interlocks exhibited recidivism rates that were not statistically different from similar offenders who did not receive such orders. Their study differed from the two Canadian studies, however, because interlock records were not available for their first-offender group. Consequently, they had to conduct their study based on records of a court order to install an interlock without assurance that a unit had actually been installed on the vehicle. As the authors pointed out, substantial proportions (up to 80%) of these offenders do not install the court-ordered interlocks on their vehicles. Thus, their study can be classified as a "program" evaluation of the impact of court orders to install interlocks rather than as a study of the effectiveness of the interlock when installed on the vehicle as most of the earlier interlock studies have been.

Recently, the State of New Mexico provided an opportunity to study the influence on first offenders who install court-ordered interlocks. The interlock providers are required to forward information on the installation and removal of all interlock devices to the author (Roth), who has matched 97.6% of the cases with the New Mexico Motor Vehicle Department's DWI Citation Track-

ing System (CTS). This allows the measurement of recidivism rates in two periods:

- (1) while the interlock is installed on the car and
- (2) after the interlock has been removed.

This paper reports on the recidivism of drivers convicted of a first DWI offense who installed interlocks in response to a court order.

## METHODS

### *Construction of the First Offender Interlock Group*

As of December 1, 2005, 3,069 first DWI offenders in New Mexico had installed interlocks following their convictions. Of these, 223 had never obtained a New Mexico driver's license and were eliminated from the study. In addition, 744 who were first convicted before the mandatory first-offender law<sup>1</sup> became effective on January 1, 2003, were dropped from the study because their motivations for installing the unit may have differed from those who installed it after the new law was implemented. One of New Mexico's interlock laws is unique in that it permits any revoked offender to drive an interlock-equipped vehicle legally. Accordingly, offenders who take advantage of that law are not court-mandated but nevertheless install interlocks on their vehicles.

To confine the study only to those offenders mandated by the court to install interlocks, 457 cases whose convictions were more than 90 days before installation also were dropped from the first-offender group. Finally, 84 cases whose installation date was after December 1, 2005 (the end of the study period), also were dropped. This left an interlock group of 1,461 court-ordered first offenders. These deletions from the interlock group are summarized in Table I. An analysis of recidivism in the year following interlock installation for those excluded from the interlock group demonstrated that they had lower rates during that period than those retained in the interlock group (see Table I). This

<sup>1</sup>Many first offenders did not install interlocks under the 2003 law because it only required interlocks on all vehicles driven by first *aggravated* offenders. *Aggravated* includes those who refuse to blow, those with a BAC  $\geq 0.16$ , and those who are involved in an injury accident. The interlock mandate was optional (up to the judge) for first offenders with a BAC  $< 0.16$ . Also the wording allowed offenders to escape the mandate by claiming "no vehicle" or "not driving." Finally, many *aggravated* DWI offenders are pled down to *nonaggravated*. These loopholes were partially closed in June 2005, when interlock licenses became mandatory for all convicted impaired drivers because, to get an interlock license, an offender had to have evidence of having installed an interlock.

confirmed that the cases eliminated did not bias the interlock group toward a lower recidivism rate.

**Construction of the Comparison Group**

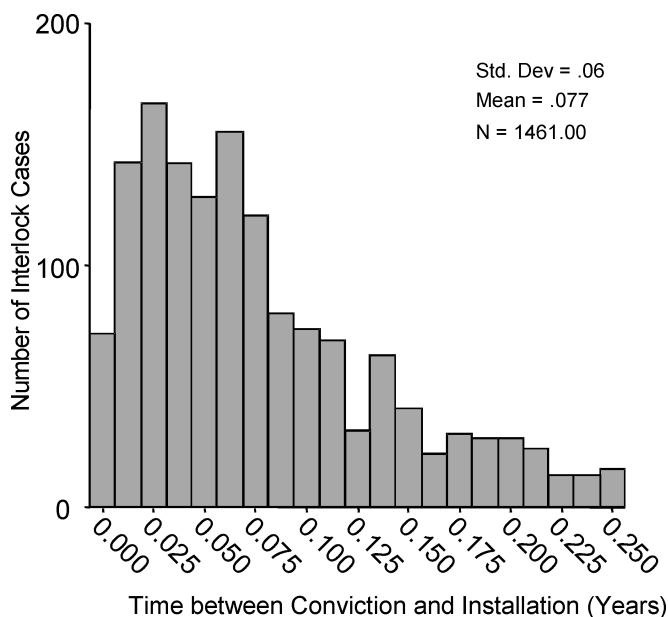
The comparison group was selected from the CTS, which contains data of 432,967 DWI arrests and 300,834 DWI convictions in New Mexico in the last 20 years. From records of 259,008 persons arrested for DWI, 22,348 noninterlock offenders who were convicted for the first time between January 1, 2003, and December 1, 2005, were selected for the study. To mirror the construction of the interlock group, 4,786 offenders who had never had a New Mexico driver’s license were deleted, leaving 17,562 first offenders for the comparison group.

**Establishing Index Dates for Interlock Group/Comparison Group**

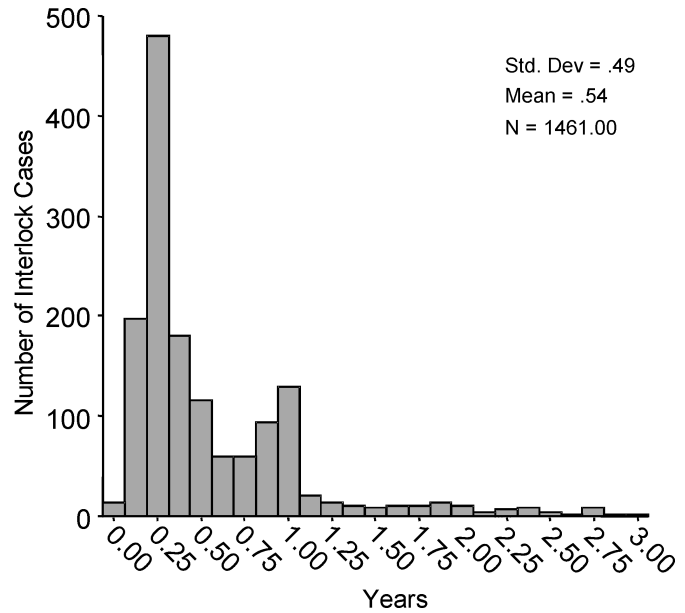
The objective of the study was to compare the recidivism rate of the interlock group with the comparison group over three periods:

- (1) while the interlock was on the vehicles of the interlock group,
- (2) after the interlock was removed to the end of the study period on December 1, 2005, and
- (3) for the two periods combined.

To accomplish this, the three periods for the comparison were defined based on the conviction, installation, and removal dates of the interlock group. Figure 1 is a histogram of the times between conviction and installation for the interlock group. The average delay was 0.077 years or 28 days. Figure 2 is a histogram of the lengths of time that interlocks were installed. The mean period during which the interlock was on the vehicle was 0.54



**Figure 1** Histogram of number of persons who installed interlocks as a function of time between conviction and installation.



**Figure 2** Histogram of the number of offenders with interlock durations of various lengths (in years).

years or 197 days.

Based on these data, the index date for the comparison group in the interlock-on period was defined as beginning 28 days after conviction. For the post-removal period, the index date for the comparison group was defined as 28 + 197 = 225 days after conviction. Finally, for the combined period, the index date for the comparison group was defined as 28 days following conviction.

**Equating Groups**

In a recent study of New Mexico multiple-offender interlock users (Roth et al., 2007), we selected the comparison group as a stratified random sample of all available noninterlocked offenders. The stratification was into 16 cells of age, gender, BAC, and priors. The proportion of comparison group members chosen from each cell was determined from the proportion of interlock group members in the same cell. We found that creation of the stratified random sample did not change the reoffense rate ratio obtained by simply using multivariate Cox regression on the entire available group of noninterlocked offenders. Consequently, for this study, we did not attempt to equate groups on covariates before applying Cox regression.

The characteristics of the interlock and comparison groups are shown in Tables II, III, and IV. The mean age of the comparison group members is 4 years less than that of the interlock group members. This would tend to give the comparison group a

**Table II** Age distributions of the comparison and interlock groups

Group	N	Mean	Standard deviation
Comparison	17,562	31.7	11.5
Interlock	1,461	35.7	12.7

**Table III** Arrest BAC and test refusal distributions of the comparison and interlock groups

			Group		Total
			Comparison	Interlock	
BAC group	<0.16	Count	7,549	519	8,068
		% Within group	43.0%	35.5%	42.4%
	≥0.16	Count	6,719	652	7,371
		% Within group	38.3%	44.6%	38.7%
	Refused or no BAC	Count	3,294	290	3,584
		% Within group	18.8%	19.8%	18.8%
Total	Count	17,562	1,461	19,023	
	% Within group	100.0%	100.0%	100.0%	

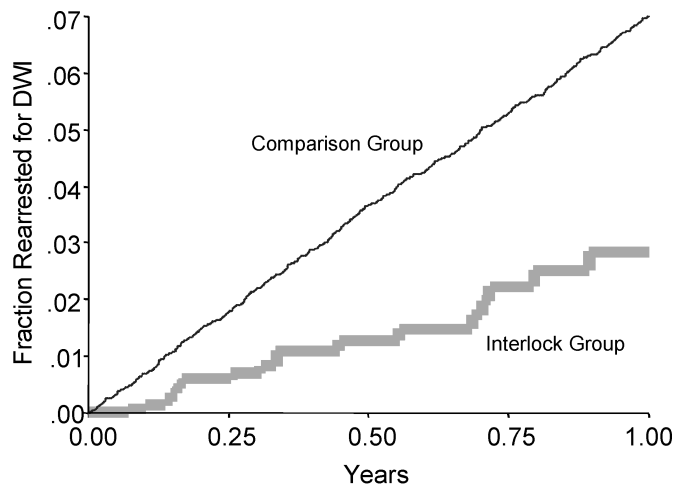
greater recidivism rate. Conversely, the proportion of high BAC arrestees and test refusers is greater in the interlock group. That would tend to make the interlock group have a higher recidivism rate. Finally, the proportion of males was slightly higher in the interlock group. That would tend to increase the recidivism rate of the interlock group. The inclusion of these covariates in the multivariate Cox regressions minimizes their influence on the ratio of the reoffense rate of the interlock group to that of the comparison group.

**Analysis**

Survival analysis was our method of choice for comparing recidivism rates because it uses all available data and accounts for the varying lengths of time available for following the offenders' driving histories. Cox regression has the particular advantage of allowing the inclusion of covariates to reduce the impact of potentially confounding factors. Three analyses were conducted using age, gender, BACs, and test refusals as variables (see Tables V, VI, and VII): one for the interlock-on period (28 to 225 days after conviction), one for the post-interlock period (225 days to 3 years after conviction), and one for the combined period (28 days to 3 years after conviction).

**Table IV** Gender distribution of the comparison and interlock groups

			Group		Total
			Comparison	Interlock	
Gender	Male	Count	13,025	1,101	14,126
		% Within group	74.2%	75.4%	74.3%
	Female	Count	4,537	360	4,897
		% Within group	25.8%	24.6%	25.7%
Total	Count	17,562	1,461	19,023	
	% Within group	100.0%	100.0%	100.0%	



**Figure 3** Survival curves for the interlock-on period for the interlock and comparison groups.

**RESULTS**

**Interlock-on Period**

Table V presents the results of the Cox regression analysis comparing the interlock and comparison groups while the interlock was installed. Gender, age, and BAC ≥ 0.16 were all significant recidivism predictors. Refusal of the test or a missing BAC was not a significant predictor of recidivism. The interlock group demonstrated a substantially lower recidivism rate (hazard ratio = .39) than the comparison group. The survival curves for the interlock and comparison groups are shown in Figure 3.

**Post-Interlock Period**

Table VI presents the results of the Cox regression analysis comparing the interlock and comparison groups during the period after the interlock was removed. Once again, gender, age, and BAC ≥ 0.16 were all significant recidivism predictors of recidivism, whereas test refusal was not a significant predictor. The interlock group had a lower, but not significantly lower, recidivism rate (hazard ratio = 0.82) than the comparison offenders. The survival curves for the interlock and comparison groups are shown in Figure 4.

**Recidivism for the Combined Period**

Table VII presents the results of the Cox regression analysis comparing the interlock and comparison groups for the total period from the index times to the end of the study period on December 1, 2005. All variables, except test refusals, were significantly related to recidivism. The reoffense rate of the interlock group was 0.61 of the comparison group's rate, a ratio significant beyond the p = 0.0001 level. The survival curves for the interlock and comparison groups are shown in Figure 5.

**Rearrest Rates per Year of Exposure**

Figure 6 summarizes the rearrest rates per year of exposure for the interlock group and the comparison group in each of the three periods. These rates are calculated directly from the raw

**Table V** Results of the Cox regression analysis for the interlock-on period

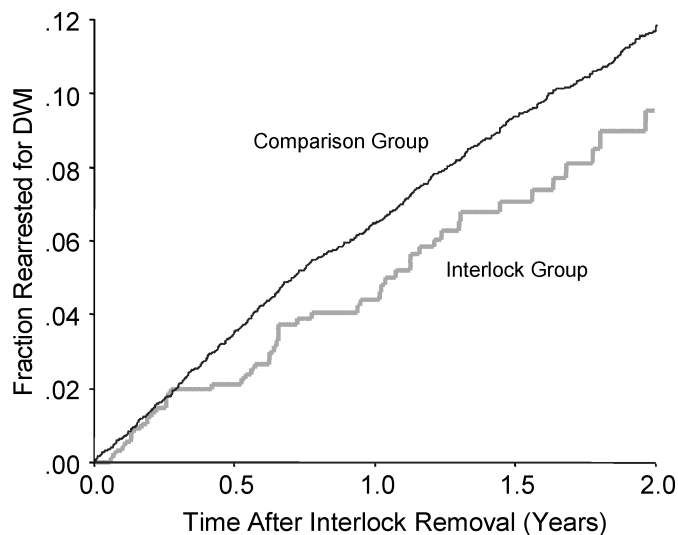
	B	S.E.	Wald	df	Sig	R	exp(B)
BAC:				2	0.0000	0.0429	
≥.16/<.16	0.4333	0.0689	39.5195	1	0.0000	0.0433	1.5423
Refused breath test/<.16	0.1559	0.0919	2.8784	1	0.0898	0.0066	1.1687
Female/male	-0.2208	0.0752	8.6071	1	0.0033	-0.0182	0.8019
Age (per year)	-0.0188	0.0030	38.2250	1	0.0000	-0.0425	0.9814
Interlock group/comparison group	-0.9477	0.2323	16.6388	1	0.0000	-0.0270	<b>0.3876</b>

**Table VI** Results of the Cox regression analysis for the post-interlock period

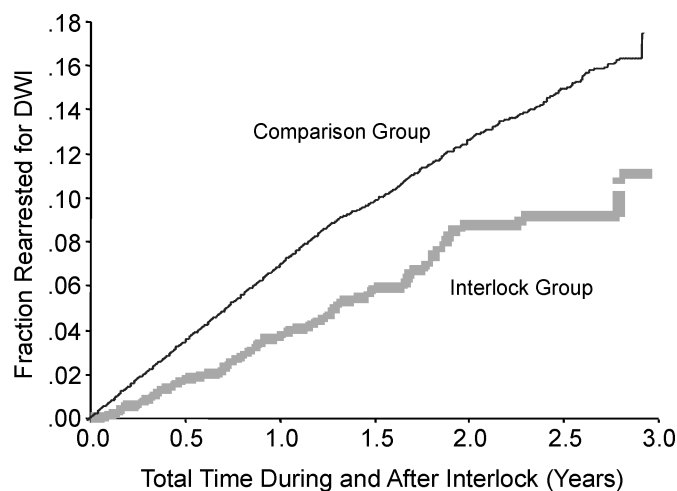
	B	S.E.	Wald	df	Sig	R	exp(B)
BAC:			37.4233	2	0.0000	0.0414	
≥.16/<.16	0.4019	0.0674	35.5888	1	0.0000	0.0415	1.4947
Refused breath test/<.16	0.1142	0.0923	1.5317	1	0.2159	0.0000	1.1210
Female/male	-0.2193	0.0743	8.7160	1	0.0032	-0.0186	0.8031
Age (per year)	-0.0265	0.0031	72.6256	1	0.0000	-0.0602	0.9739
Interlock group/comparison group	-0.2041	0.1440	2.0091	1	0.1564	-0.0007	<b>0.8153</b>

**Table VII** Results of the Cox regression analysis for the combined period from index to the end of the study on December 1, 2005

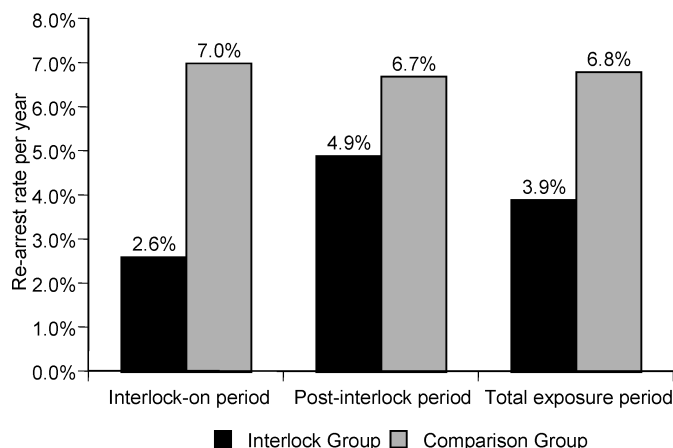
	B	S.E.	Wald	df	Sig	R	exp(B)
BAC:			51.8011	2	0.0000	0.0389	
≥.16/<.16	0.3855	0.0540	50.9849	1	0.0000	0.0394	1.4703
Refused breath test/<.16	0.1606	0.0718	5.0055	1	0.0253	0.0098	1.1742
Female/male	-0.1900	0.0585	10.5410	1	0.0012	-0.0164	0.8269
Age (per year)	-0.0218	0.0024	81.7090	1	0.0000	-0.0503	0.9784
Interlock group/comparison group	-0.4972	0.1208	16.9320	1	0.0000	-0.0217	<b>0.6082</b>



**Figure 4** Survival curves for the post-interlock period for the interlock and comparison groups.



**Figure 5** Survival curves for the combined period from 28 days after conviction to the end of the study on December 1, 2005.



**Figure 6** Comparison of rearrest rates per year of exposure between interlocked and noninterlocked first offenders in three periods.

data without using survival graphs or Cox regressions. For example, 1,461 offenders had interlocks installed for an average of 0.545 years and 21 of them were rearrested during that time. So the rearrest rate per year for the interlocked group during the interlock-on period was  $21/1461/0.545 = 2.6\%$ . The annualized rearrest rate for the comparison group during the 0.545 years after the index time was 7.0%.

## DISCUSSION

In this study, the DWI rearrest rate of first offenders while the interlock was on their vehicles was 60% lower than that of the comparison group. After the unit was removed, the recidivism rate increased and fell within the rate range of the comparison group. Over the entire period from installation to the end of the study, the recidivism of the interlock group was 31% lower than that of the comparison group. These results are typical of similar interlock studies (e.g., Willis et al., 2004) that demonstrated reductions on the order of 60% while the interlock is on the vehicle. The substantial 31% overall reduction in recidivism suggests that requiring first offenders to install interlocks is cost-effective. The argument is as follows.

The benefit-to-cost ratio (B/C) can be calculated using a simple formula.<sup>2</sup> For any treatment that is supposed to reduce drunk-driving rearrests,  $B/C = (U - 4T) * b/c$ , where T is the fraction of the treated group rearrested from the beginning of treatment to the end of the study period, U is the fraction of an untreated comparison group rearrested during the same period, b is the economic benefit per rearrest prevented,<sup>3</sup> and c is the average cost of treatment.<sup>4</sup> From Figure 5, the difference in the proba-

bilities of rearrest,  $U - T$ , is 0.032 at 1 year and .038 at 2 years, after interlock installation.

Using these values, the B/C at 1 year is  $B/C = 0.032 * \$50,000/\$540 = 3.0$ , and at 2 years,  $B/C = 0.038 * \$50,000/\$540 = 3.5$ . So there is an economic benefit of more than \$3 per \$1 of cost to these interlocked first offenders. The fact that  $U - T$ , and consequently B/C, is increasing in this study reflects the persistent difference, not only in the total recidivism of the two groups, but also in the recidivism rates after interlock removal.

Another feature of this study that is similar to previous results is the relatively small percentage of first offenders (see Table I) who install interlocks when there is no mandatory law requiring them to do so. Only about 10% did so, which is similar to the numbers reported by Voas et al. (1999) and Tippetts and Voas (1998). This may change in New Mexico because legislation passed in 2005 mandates 1 year on the interlock for all first DWI offenders, 2 years for second offenders, and 3 years for third offenders.

The substantial reduction in recidivism while the interlock is installed on the vehicle, followed by a return to the level of non-interlock users that is typical of other interlock studies, is generally cited as evidence that the interlock produces no "learning effect." Another interpretation is that the interlock principally has an incapacitating effect, like being in jail, but once the barrier is removed, the interlock offenders return to their previous behavior. With respect to the sanction of incarceration, this has been shown to be the case as there is no evidence of reduced recidivism once offenders are released from jail (Voas, 1986; Wagenaar, 2007, in press). If the offenders return to the recidivism risk status they had before installing the interlock, then their similarity to the comparison group of nonusers suggests that they are not a selected group of low-risk offenders.

This study appears to provide the clearest evidence for the effectiveness of interlocks with first offenders in the United States. The reduction in recidivism is consistent with that shown in the two Canadian studies (Vezina, 2002; Voas et al., 1999) but shows a stronger influence on first offenders than the Tippetts and Voas (1998) study in West Virginia. It is not surprising that the current results differ from those of DeYoung et al. (2005) because most of the first offenders in that study were under a court order to install an interlock but failed to do so. Thus, the first-offender "interlock group" in that study, unlike this study, included individuals who did not install interlocks, rendering DeYoung et al. (2005) an evaluation of the law, not the interlock.

Further, because he did not have information on interlock installation, he did not have a measure of recidivism that differentiated recidivism while the device was on the car and after it was removed. Thus, the closest comparison with his study would be the combined period in this study. Information on court orders to install interlocks during the study period was only available in the New Mexico court files and not to the investigators, so we do not know how many offenders were mandated to install interlocks but did not do so. If this occurred, such offenders would have been placed in our comparison group because they would not have appeared in the reports received from interlock

<sup>2</sup>Derivation of formula: Multiplying the numerator and denominator of the formula by the number of persons in the treatment group gives  $(N_T U - N_T T) * b / (N_T * c)$ , which is the total benefit, B, divided by the total cost, C. The term  $N_T U$  is the number of rearrests expected in the untreated group if it had not been treated.

<sup>3</sup>The Federal Highway Administration's estimate of the economic impact of drunk driving in 2003 in New Mexico was \$1,005,000,000 and the number of DWI arrests was 20,313. So the economic impact per DWI arrest prevented is ~\$50,000.

<sup>4</sup>Interlocks cost offenders about \$1,000/year, and this first-offender interlock group had them installed for an average of 0.54 years. So the average cost of treatment,  $c = \$540$ .

providers. Lacking information on court interlock orders, we could not repeat the DeYoung et al. study.

### FINAL NOTES

This study, like all nonrandom studies of court sanctions, has several weaknesses. Only four variables—age, gender, arrest BAC, and test refusal—were available for use in equating the interlock and comparison groups. Using those measures as covariates in the Cox regression may not have accounted completely for all differences between the groups. Moreover, this study considered only recidivism as there were too few cases to provide a measure of the differences in crash involvement between the interlock group and the comparison group. Thus, it is not clear whether the reduction in DWI recidivism is associated with a reduction in alcohol-related crashes, though logically, fewer impaired drivers on the road means fewer impaired-driving trips and that should result in fewer alcohol crashes. The relatively small proportion of offenders installing interlocks has limited the number of cases required to do strong studies of relatively rare events such as alcohol-related crashes.

Finally, as interlock research matures, investigators must be prepared to confront issues about the meaning of hazard ratios in an interlock sample relative to the larger population of noninterlock drivers. A reasonable person could ask whether the sample estimates, particularly the ratio of the interlock/noninterlock sample rates, are unbiased estimates of the population rates or ratios. At the person level, they may not be. However, the damage done by drunk drivers (i.e., crashes, injuries, and deaths) is proportional to the number of drunk-driving trips, not to the number of drunk drivers. It does not matter what the ratio of rearrests to drunk-driving trips is for the two groups; it just matters that the ratio is the same for both interlocked and noninterlocked offenders.

As long as the two groups have the same probability of arrest when driving drunk, then the hazard ratios of rearrest rates are unbiased estimates of the ratio of the number of drunk-driving trips per person in the two groups. A drunk-driving trip is both

- (a) the unit that produces risk to the public, and
- (b) the unit of exposure from which a terminal event (rearrest) can be “sampled.”

If we assume that the probability of being arrested is proportional to the number of vehicle miles of drunk driving, then the hazard ratios are unbiased estimators of the ratio of vehicle miles of drunk driving per person in the two groups. Drunk-driving trips and drunk-driving vehicle miles are the target for reduction. Stated differently, 52 drivers who drive after drinking once per year represent the same traffic hazard as 1 driver who drives after drinking each week.

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