The Ignition Interlock Program for Drunk Drivers: A Multivariate Test

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The ignition interlock has been touted as a "high-tech" intervention to reduce drunk-driving recidivism. However, it has been difficult to evaluate because outcomes may be a result of program selection. In the study reported here, a random sample of interlock cases was contrasted against a comparison group of impaired drivers in a retrospective analysis. Program effects were tested through a series of logit regressions, and program and comparison group drunk-driving survival rates were also compared. Program participants had lower recidivism rates and higher survival rates, indicating that the program has strong potential to protect the public and to change offender behavior.

In both Canada and the United States, fully 40% to 50% of all traffic fatalities are alcohol related (National Highway Traffic Safety Administration 1995; Simpson and Mayhew 1992; Statistics Canada 1995), and despite a decline in overall drinking and driving, the costs of this behavior continue to be high (Miller and Blincoe 1994). In the face of this continuing social problem, government policies are increasingly directed at reducing recidivism, particularly for chronic cases (Hedlund and Fell 1995; Simpson and Mayhew 1992). However, policy direction is lacking, because researchers have been unable to identify effective strategies to reduce recidivism.

Punitive sanctions and treatment programs have had mixed results. License suspension and jail terms have been imposed to deter and incapacitate impaired drivers. Treatment interventions have attempted to change offender behavior through required attendance at rehabilitation programs, such as alcohol counseling. License suspension is generally acknowledged as the most effective sanction, even though some of the incapacitation effects may be spurious. That is, investigators have discovered that some suspended drivers continue to drive, although their efforts to avoid detection do appear to result in more prudent driving behavior (Ross and Gonzales 1988). As part of "get tough" campaigns against drunk drivers, the use of custodial sanctions has increased over the last decade, with the aim of reducing drunk driving

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through individual deterrence. Yet the effects of incarceration have been found to be equivocal at best, which is of particular concern when the high costs and intrusiveness of custody are considered (Mann, Vingilis, Gavin, Adlaf, & Anglin 1991; Nichols and Ross 1990; Ross 1992). The deterrent effects of incarceration are difficult to assess because "short and sharp" mandatory jail terms may go unserved. Legislators generally fail to commit resources for more prison beds when passing tough drunk-driving laws (Ross and Voas 1989) and as a consequence, impaired drivers are turned away from jail. When county facilities become overcrowded, administrators give greater priority to predatory offenders and those awaiting trial.

There is an ongoing debate in the traffic safety field over the relative effectiveness of punitive sanctions versus rehabilitation programs. In the short term, compared to treatment, license suspension is more effective in reducing drunk-driving recidivism and subsequent collisions. However, the impact of taking away a driver's license appears to diminish over time, and alcohol rehabilitation programs are more effective in the long term in reducing repeat drunk driving (McKnight and Voas 1991; Peck 1991; Sadler, Perrine, and Peck 1991). Despite the greater long-term benefits of treatment programs and the relative ineffectiveness of jail terms, rehabilitation has generally not shown large effects. A recent meta-evaluation, focusing on reasonably well designed evaluations, found that—compared to jail, fines, or no treatment—treatment programs reduced recidivism by a modest 8% to 9% (Wells-Parker, Bangert-Drowns, McMillen, & Williams 1995).

Given the lack of strong effects from traditional interventions and growing concern over the persistent drinking driver, practitioners and scholars have proposed alternative driving under the influence (DUI) interventions. Some of these are *individual based*, such as intermediate sanctions. To reduce reliance on costly incarceration, programs using some combination of treatment, punishment, and surveillance—such as probation, house arrest, and/or electronic monitoring—have been developed. Individual-based sanctions rely on an assumption that intervention can effect a behavioral change in individuals (Jones, Lacey, and Byrne 1995). Other programs are *vehicle based*, such as vehicle impoundment for suspended drivers, seizure or restriction of offender license plates, and imposition of the ignition interlock device (Ross, Stewart, and Stein 1995). These programs assume that the intervention (no vehicle, no license plate, car will not start if drinking) will incapacitate or limit the driver's ability to drive while drunk. Little is yet known about the use of individual-based alternative sanctions using multiple interventions, although earlier studies of probation (Wells-Parker, Anderson, Landrum, & Snow 1988) and electronic monitoring (Lilly, Ball, Curry, & McMullen 1993) have provided promising results. Vehicle impoundment appears limited by

legal difficulties in confiscation; the costs of vehicle storage; and offenders driving cars owned by spouse, family, or friends, who typically have their vehicles returned because they claim to have been unaware that the offender was driving.

The ignition interlock program, a high-tech intervention making use of new technology, has been proposed as a means to reduce DUI recidivism for even the most difficult, chronic cases. Ignition interlock prevents operation of a vehicle when an individual is drunk but still allows driving when the operator is sober. It provides education by requiring the driver to change life habits related to drinking and driving. As a behavioral reinforcer, it provides consistent and immediate feedback on inappropriate alcohol consumption. The vehicle will not start in any situation where an individual has imbibed too much. Ignition interlock performs an additional deterrent function akin to fines, license suspension, and custody, through payment of program fees by the offender. Some critics argue that use of such devices constitutes a "largely negative program" (Langworthy and Latessa 1993). Yet, when viewed against lengthy periods of license suspension, residential treatment, or incarceration, ignition interlock presents a most attractive alternative. In most programs, participants can live a normal life, with few restrictions on movement and ample opportunity for employment and support of dependents.

The present evaluation of an ignition interlock program operated in Alberta, Canada since 1990, addresses several questions. Is the ignition interlock program effective in reducing impaired driving recidivism? Does it have an impact on more serious, persistent impaired drivers? Finally, does the program continue to be effective, even after the interlock device is removed?

ISSUES IN IMPAIRED-DRIVING EVALUATION AND THE IGNITION INTERLOCK PROGRAM

Selection bias and a lack of randomized experimental designs are the most serious recurring problems in conducting sound impaired-driving program evaluations (Fitzpatrick 1992; Peck 1994; Wells-Parker et. al. 1995). Policymaker pressure to demonstrate results quickly results in treatment programs being required of all offenders, which precludes comparison, let alone random assignment. A "flip side" of this problem is that when programs are voluntary, comparison groups are frequently made up of drunk drivers who have refused to participate, which severely compromises the comparability of study groups.

Evaluations of ignition interlock programs have often suffered from selection bias, and attempts to create comparison groups of license-suspended

impaired drivers have been fraught with difficulties (Morse and Elliott 1992; EMT Group 1990). In studies done in Ohio and California, researchers attempted to create matched program and comparison samples. Both studies subsequently discovered that the "matched" groups were not equivalent on most legal and demographic characteristics. This discovery unfortunately tainted the findings, which were positive in both evaluations. In California, using a follow-up period based on sanction length (up to 36 months), the EMT group found a lower impaired reconviction rate of 3.9% among ignition interlock cases ($N = 584$) compared with 5.9% for license-suspension cases ($N = 508$). In Hamilton County, Ohio, Morse and Elliott (1992) conducted a quasi-experimental longitudinal study comparing 30-month survival rates of ignition interlock participants to a matched group of license-suspension drivers (total $N = 546$). They found a failure rate of 9.8% for the license-suspension group, almost three times as high as the 3.4% rate for ignition interlock cases.

The California and Ohio evaluations were also limited by the direct comparison of license-suspension cases against ignition interlock. As most jurisdictions use some form of license suspension alone or in conjunction with other measures to deter impaired drivers, a more relevant test of program effects would involve comparison with at least some impaired drivers who had had licenses reinstated for time periods comparable to ignition interlock. Having both samples "on the road" would equalize the opportunity to reoffend, increasing the equivalency of the comparison and better measuring the program effects of ignition interlock versus no intervention.

A quasi-experimental study using reinstated drivers was conducted in Oregon by Jones (1992), who compared DUI rearrest for ignition interlock treatment group and comparison group drivers, statistically controlling for possible confounding factors through analysis of covariance (ANCOVA). The treatment group consisted of all reinstated drunk drivers (minimum of 2 impaired driving convictions in the last 3 years) who applied for, and received, 6 months on the ignition interlock program to earn early license reinstatement ($N = 648$) during 1989 in a pilot program region in Oregon. A control group was created using reinstated drivers from adjoining regions that did not offer the program ($N = 1,543$). A second comparison group was created by taking most of the remainder of reinstated drunk drivers in 1989 ($N = 773$) in the interlock pilot region, who served their final 6 months of license reinstatement rather than paying for installation of the device. Jones found that during the 6 months when ignition interlock was in operation, the DUI rearrest rate was lower per 100 drivers for ignition interlock cases (4.63) compared to the control region (8.18), a statistically significant difference. When a longer follow-up period was examined (average 586 days), the ignition interlock

cases still had a lower recidivism rate, but the difference was smaller and nonsignificant (8.94 ignition interlock device vs. 10.55 control).

This study had a number of problems. Jones (1992) indicated that recidivism differences between ignition interlock and the control group could have been due to differences between the pilot and control regions. The choice of ANCOVA, a multivariate technique for use with continuous dependent variables, was inappropriate. DUI recidivism is typically a dichotomous outcome, more suited to a logistic regression. Despite controlling for age, gender, prior driver record, and urban-rural location, there also may have been systematic before-group differences in prior DUI and criminal convictions, two consistently strong predictors of recidivism (Peck, Arstein-Kerslake, and Helander 1994). Analysis of the effects of past impaired-driving convictions also would have assisted in assessing the possible relevance of the program for the more chronic drinking driver. Jones apparently did not control for differences in time after reinstatement, referring only to a general mean of 586 days. Differences in exposure rates following license reinstatement may have affected drunk-driving recidivism, because the follow-up period was relatively brief.[1]

Rather than focusing only on repeat impaired driving, multiple outcome measures would more vigorously test program effects (Fitzpatrick 1992). Collisions are the most serious outcome associated with impaired driving, and high-risk driving behaviors (moving violations, dangerous driving, or hit-and-run) are a concern because of their strong relationship with crash outcomes (Peck 1993; Evans and Wasielewski 1983).

THE IGNITION INTERLOCK PROGRAM IN ALBERTA

Alberta is currently the only Canadian province using interlock. Repeat license suspensions for high-risk and impaired drivers are administered by the Alberta Driver Control Board (DCB), which consists of two full-time civil servants and 30 community members appointed by the legislature. To help manage impaired drivers, the DCB began a pilot program involving the ignition interlock device in 1990, with 48 cases considered for use that year. The ignition interlock device is currently required before license reinstatement for drunk drivers under certain circumstances. Imposition of the device may result in licenses being returned earlier for first or second offenders. In other situations, interlock may be a mandated requirement for serious multiple repeat impaired drivers before any type of license reinstatement. To start his or her car, the driver must blow into the device, mounted on the dashboard, and blow randomly each hour after that to keep the vehicle running. Any

reading of .04 milligrams of alcohol per 100 milliliters of blood will prevent the automobile from starting or continuing to operate. The DCB receives a monthly report of each participant's interlock Breathalyzer™ readings to help monitor cases. The board administrator may suspend drivers whose Breathalyzer™ readings show a pattern of alcohol abuse. The in-car device is installed and managed by a private firm, Guardian Interlock. Installation costs the driver $133.75, followed by a monthly maintenance fee of $101.65.

After the pilot program, regular use of the ignition interlock program by board members increased slowly. The interlock device was not uniformly assigned throughout the province during the program's first few years of operation. Its use varied between board members and by region. More stringent policy guidelines have been put in place, and the ignition interlock program is presently used extensively by all board members: 550 cases were active in March 1995.

RESEARCH DESIGN AND METHOD

Sampling and Data Collection

For the ignition interlock program evaluation, a disproportionate stratified random sample of license-suspended Alberta impaired drivers was selected from computer files covering the years 1989-94. The sample comprised 994 offenders age 20 and older, including all female drunk drivers from those years (125), a random selection of 701 male drivers (sampling frame of 4,394), and 189 ignition interlock cases (sampling frame of 441) from the years 1990-94. Subsequent reclassification resulted in a final breakdown of 168 ignition interlock program cases and 826 impaired drivers in the comparison group.

The comparison group was likely to include cases equivalent to the ignition interlock ones, because it included impaired drivers from a year (1989) when the program was not available and drivers from a pilot year (1990) when the program was available to very few drivers. Impaired drivers seen by the DCB in 1989 and 1990 might have been put on the ignition interlock program if it had been uniformly available. No special legislation, programs, or police action are known that may have made cases from 1989 higher or lower risk than those selected from the years 1991-94.

Information about factors that might affect driving outcomes was collected for the period immediately *preceding* the DCB decision to reinstate or not. Driving recidivism outcomes (driving offenses or collisions) were collected for the follow-up period *after* a decision was made, until September

1994. A total of 803 (80.8%) subjects were reinstated, including all 168 ignition interlock cases. Inclusion of 191 nonreinstated cases increased outcome variation and provided an additional measure of long-term license-suspension impact.

Explanations for Impaired-Driving Recidivism

Impaired driving has been explained by social psychological theories that include it among a constellation of general problem behaviors (Gottfredson and Hirschi 1990; Gould and Gould 1992; Jonah 1990; Keane, Maxim, and Teevan 1993). To control for potential alternative explanations when examining outcomes of the ignition interlock program, these theoretical perspectives and the related impaired-driving literature (Beerman, Smith, and Hall 1988; Gould and Gould 1992; Hemenway and Solnick 1993; Jonah 1990; Peck et. al. 1994) were used to guide collection of social and attitudinal measures. Demographic data included age, gender, ethnicity, marital and employment status, and rural or urban residence. Clinical measures were obtained for addictions dependency (assessed by treatment staff) and driver attitude (determined by board members at DCB hearings). Prior convictions were recorded for criminal offenses (e.g., theft, assault, drugs), impaired driving, demerit suspensions (for excessive moving violations), hit-and-run, collisions, and injury collisions. To control for differences in opportunities to drink and drive, the number of months of follow-up was calculated for both study groups. Finally, controls were put in place for those offenders who did not meet license reinstatement criteria by the DCB ($N = 191$) and for drunk drivers who refused ($N = 44$) or were denied ignition interlock ($N = 19$).

To extend the types of program outcomes considered, recidivism outcomes recorded for the follow-up period included (1) new impaired-driving convictions; (2) new convictions for hit-and-run, dangerous driving, driving while suspended or demerit point license suspensions (for excessive moving violations); and (3) new injury collisions. New convictions for high-risk driving behaviors other than impaired driving were obtained because of their strong relationship to collision behavior (Peck 1993). Background demographic and legal information as well as recidivism outcomes were manually coded from official DCB client files and automated databases maintained by provincial Motor Vehicles, Transportation and Corrections Departments, and the federal Royal Canadian Mounted Police. Data sources were cross-checked to enhance data reliability and validity. The measurement design was thus strengthened by (1) the use of multiple data sources, (2) the inclusion of assessments of attitude and addictions dependency, (3) the lengthy follow-up period, and (4) the use of multiple outcome measures.

RESULTS

Study Sample

Study cases consisted primarily of men (87%) in their thirties (mean = 32.4 years), who were employed (75%) when they saw the DCB. About 43% were married or living in a common-law relationship; and 57% were single, divorced, or widowed. Half the sample (50%) lived in rural or small-town Alberta, whereas the other half lived in the moderate-sized cities (500,000+) of Edmonton and Calgary. About 17% were aboriginal, although adult aboriginals comprise only about 5% of the Alberta population. When appearing before the board, approximately 78% of impaired drivers were considered to have a positive attitude, and 70% of those who went through treatment were classified as alcohol dependent. With respect to criminal and driving history, cases averaged 2.6 prior criminal convictions, 2.8 prior drunk-driving convictions, 1.9 collisions, and just under 1 (.93) previous demerit suspension. Average prior hit-and-runs and injury collisions were less than 1. The study follow-up period varied from 6 to 64 months with a mean of 43 months, or almost 4 years.

Testing for Selection Bias

Zero-order correlations between participation in ignition interlock and a variety of risk variables were generally very small, indicating little selection bias in program assignment (correlations not shown, results available on request). Although several correlations achieved statistical significance, this was attributable to the large sample size ($N = 994$). The only correlation over .20 was for months of follow-up ($-.32$, $p > .001$). This effect reflects the differences in follow-up periods, which averaged 34.1 months for ignition interlock, in contrast to 44.3 for the comparison group. Consequently, months of follow-up were included as a control variable in the logistic regression, and survival rates were calculated to make time at risk equivalent for both groups. Despite the rather weak correlations, all background risk factors were also controlled in multivariate analysis.

Ignition interlock cases (77%) were only slightly more likely to be employed than were members of the comparison group (74%), a small difference that was not significant ($r = -.03$). This may seem surprising, as those working should have an advantage because they can more easily afford program fees. However, all suspended drivers face a large financial burden when becoming reinstated through fees and insurance. To get back on the road, many impaired drivers, particularly those with collision histories, are likely to pay in excess

of $2,000 per year in vehicle insurance, usually for minimal coverage (no collision insurance) on an older vehicle.

Recidivism Outcomes

Observed differences in recidivism rates between ignition interlock program participants and the comparison group were striking (Table 1). Only 10% of the ignition interlock cases recorded a new impaired-driving conviction, compared with 25% of the other high-risk drivers. For new high-risk driving violations, 2.4% of the interlock program cases reoffended, compared with 13.7% of the comparison group. Injury collision outcomes showed a similar pattern: Only 1% of the ignition interlock cases were involved in an injury collision, compared with 7% of the other high-risk drivers. Considered as odds, ignition interlock cases were almost 3 times *less likely* than the comparison group to drink and drive again. Program participants were 6.5 times less likely to record a new serious driving violation and about 5.8 times less likely to be involved in an injury collision. On the face of it, ignition interlock appeared to substantially reduce recidivism.

In the logistic regression model with controls, ignition interlock still had a substantial *negative* effect on all three recidivism outcome measures, net of the effects of risk factors such as age, prior criminal record, bad driving, and collision histories. Even after adjustments, program participants were 2.2 times less likely to drink and drive again than were members of the comparison group. The observed odds ratio of 2.95 was adjusted to 2.17 when controls were entered, introducing a reduction of about 26%. The adjusted odds ratios also showed that ignition interlock device program cases were about 4½ times less likely to be involved in a serious driving violation, whereas the odds of an injury collision were about 4 times lower.[2]

The control variables in the impaired-driving equation showed statistically significant but only moderate effects on recidivism. Offenders with more prior impaired driving, criminal convictions, hit-and-run episodes and those who had longer follow-up periods were more likely to be detected drinking and driving again (full regression results are not shown, available on request).

Chronic Drunk Drivers

Policymakers often focus on hard-core cases (Hedlund and Fell 1995). Are the effects of ignition interlock more or less pronounced for chronic drunk drivers? The study group of 994 ignition interlock and comparison group drunk drivers had driving records that were serious enough to warrant

TABLE 1: Recidivism Outcomes for Ignition Interlock and Comparison Group Cases

		Ignition Interlock N = *168*	*Comparison Group* N = *826*	*Total* N = *994*	*Program Odds Ratio*[a]	*Adjusted Odds Ratio*[b]	*Difference*
New impaired conviction	No	151	620	771			
		90%	75%	78%			
	Yes	17	206	223			
		10%	25%	22%	2.95	2.17	–26%
New serious driving offense	No	164	713	877			
		98%	86%	88%			
	Yes	4	113	117			
		2%	14%	12%	6.50	4.55	–30%
New injury collision	No	166	772	938			
		99%	93%	94%			
	Yes	2	54	56			
		1%	7%	6%	5.81	3.85	–34%

NOTE: All chi-squares were significant at $p < .001$.

a. To calculate the odds of an ignition interlock case avoiding a new drunk driving conviction relative to the comparison group, it is simple to calculate the odds ratio, which is the cross product of columns 1 and 2 and rows 1 and 2 for new impaired-driving convictions in Table 1 ($206 \times 151/17 \times 620 = 2.95$). This could be expressed as odds of 3 to 1.

b. Odds ratios are adjusted for criminal and driving history, follow-up period, and age.

appearance before the DCB, but the sample still included many drivers with one or two prior drunk-driving convictions. To assess program effects for more chronic cases, recidivism outcomes were determined for impaired drivers with three or more prior DUI convictions (ignition interlock, $N = 82$; comparison, $N = 369$; total, $N = 451$). Use of three priors to define chronic or hard-core impaired drivers is subject to a degree of measurement error, given undetected impaired-driving episodes, and debates within the addictions field over accurate definitions of problem drinkers versus seriously dependent drinkers. Lacking self-report data, it was felt that the certainty of 90 days' incarceration in Canada on the third impaired-driving conviction was a reasonable indicator of difficulty or reluctance to change behavior. More pragmatically, the use of three priors allowed for the retention of sufficient program and comparison cases for analysis. Using four or five DUI priors would shrink the available pool for analysis and also limit the generalizabilty of the data to a select group of very hard-core cases.

To assess and control for group differences, bivariate correlations and separate regressions were rerun for program and comparison chronic groups. The mean number of drunk-driving convictions for the chronic DUI subsample was 4.2 with a standard deviation of 1.8. The comparison group had only a marginally higher mean number of DUIs than the ignition interlock group (4.3 to 4.0), and this difference was not statistically significant. Bivariate correlations between ignition interlock assignment and risk factors such as age and driving history were again small, showing little evidence of selection bias.

Substantial program effects for ignition interlock were again observed for recidivism outcomes (Table 2). Ignition interlock cases were far less likely to drink and drive again (11% to 28%), to commit a new driving offense (2.4% to 10.8%), or to become involved in an injury collision (1.2% to 4.6%). The odds of success for ignition interlock cases presented in Table 2 were consistent with those presented in Table 1 for DUI recidivism (2.95 all impaired drivers to 3.10 for chronic). Differences for high-risk driving offenses (6.50 to 4.86) and injury collision (5.81 to 3.91) were somewhat smaller but still highly favored program participants.

As indicated by the adjusted odds ratios in Table 2, the logistic regressions for recidivism outcomes on chronic impaired drivers also showed similar effects to those observed when offenders with one or two convictions were included. After introducing controls, ignition interlock had an almost identical negative effect on impaired-driving recidivism (odds decreased by 2.2), repeat high-risk driving (odds decreased by 4.4), and injury collisions (odds decreased by 3.9). Multivariate controls resulted in a reduction of the odds for ignition interlock of 29% for repeat DUI, a smaller decrease of 11% for

TABLE 2: Recidivism Outcomes for Ignition Interlock and Comparison Group Chronic (DUI[a] > 3) Cases

		Ignition Interlock N = *82*	*Comparison Group* N = *369*	*Total* N = *451*	*Program Odds Ratio*	*Adjusted Odds Ratio[b]*	*Difference*
New impaired conviction	No	73	267	340			
		89%	72%	75%			
	Yes	9	102**	111			
		11%	28%	25%	3.10	2.22	–29%
New serious driving offense	No	80	329	409			
		98%	89%	88%			
	Yes	4	40*	42			
		2%	11%	12%	4.86	4.35	–11%
New injury collision	No	81	352	938			
		99%	95%	94%			
	Yes	1	17	56			
		1%	5%	6%	3.91	3.85	–2%

NOTE: Chi-square significant at $*p < .05$; $**p < .01$.
a. DUI = driving under the influence.
b. Odds ratios are adjusted for criminal and driving history, follow-up period, and age.

bad driving, and only 2% for injury crashes. These results indicate that ignition interlock was as effective for chronic drunk-driving cases as it was for first- and second-time DUI offenders.

Survival Rates

Survival rates estimated the number of reinstated drivers who had not reoffended or who had "survived" to various follow-up intervals (i.e., no DUI to 6 months, 12 months, 18 months, etc.). Survival rates provided another means of gauging the relative effectiveness of DUI sanctions on recidivism, better informing policy and program design. To more closely match risk to recidivism, time to failure (in months) was assessed for a subset of 794 reinstated drivers (ignition interlock, $N = 161$; comparison group, $N = 633$). The period of 24 months was chosen to ensure a reasonable follow-up period while maintaining sample size.

At 6 months, 93% of the comparison group had not recidivated, compared with 99% of ignition interlock cases (Figure 1). By 12 months, survival rates were 87% for comparison cases and 95% for interlock participants, and at the 18-month mark, 84% of the comparison group still survived compared with 93% of interlock. Finally, at 24 months, only 81% of the comparison group remained successful, compared with 91% of interlock cases. The 10% difference in survival rates at the 2-year mark again demonstrated the tangible impact of the ignition interlock program.

Participation in the ignition interlock program increased the probability of survival, but how much of the success of interlock was due to the device in the car (incapacitation or deterrence effect) versus a postprogram learning (rehabilitative) effect? Survival rates were estimated for program cases for the 15- month period *after* removal of the ignition interlock (ignition interlock, $N = 149$) and contrasted against the license-reinstated comparison group. Because of data limitations, a longer follow-up period for interlock participants was not possible without losing too many cases.

Results again showed lower recidivism rates for offenders who were involved in the ignition interlock program (see Figure 2). Over the first 6 months, survival rates were roughly even (97% program, 95% comparison), but differences increased over time. By 9 months, the program group survival rate was 4% better (97% versus 95%), and by 12 months it was 5% better (92% versus 87%). At the end of 15 months, the DUI survival rate was 92% for ignition interlock cases compared with 87% for the comparison group: This 5% difference provided some modest support for a rehabilitative program effect. The 10% difference in survival rates between program and comparison groups at 24 months was statistically significant (Wilcoxon

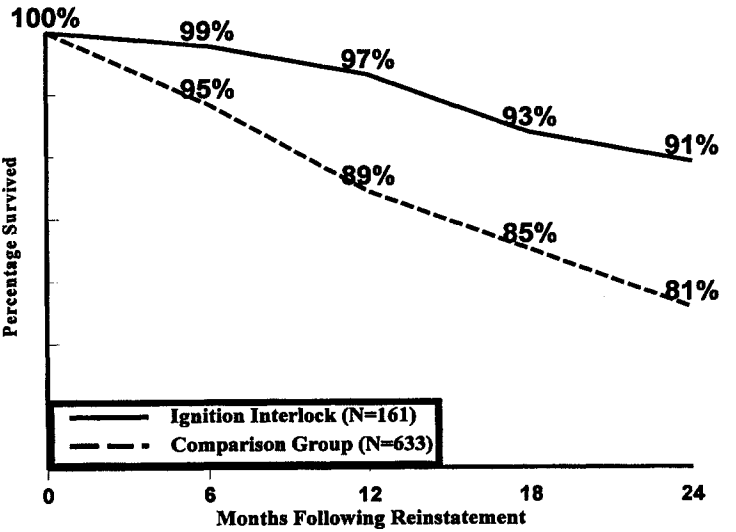

Figure 1: 24-Month DUI[a] Survival Rates
NOTE: Wilcoxon statistic = 11.52, $df = 1$, $p < .001$.
a. DUI = driving under the influence.

statistic = 11.52, 1 *df*, $p < .001$), as was the 5% difference for "after-interlock" and comparison cases (Wilcoxon statistic = 7.28, 1 *df*, $p < .01$). Both 24- and 15-month survival rates were tested in a Cox regression, with significant DUI control variables (prior criminal, impaired, and hit-and-run convictions) to see if the ignition interlock influence was maintained. Ignition interlock retained its effect, doubling the odds of DUI survival for 24 months (ignition interlock device, $b = -.724$, $SE = .258$, $p < .01$, exp(b) = .49) and 15 months (ignition interlock device, $b = -.713$, $SE = .281$, $p > .01$, exp(b) = .49).

DISCUSSION AND CONCLUSION

For the Alberta program, net of the effects of other risk factors, participation in an ignition interlock program reduced the likelihood of recidivism for impaired driving, high-risk driving, and injury collisions. When compared with a group who received only license suspensions, ignition interlock program participants were twice as likely to successfully avoid repeat drunk driving. Ignition interlock cases were 4.4 times less likely to record a new

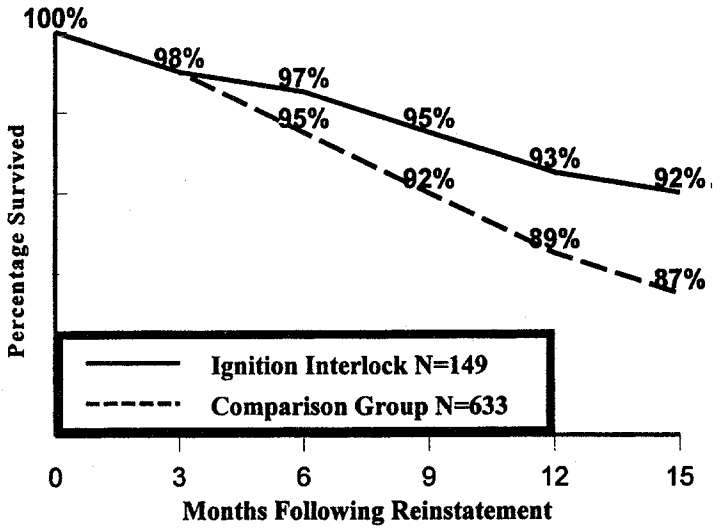

Figure 2: 15-Month DUI[a] Survival Rates—After Interlock Device Removed
NOTE: Wilcoxon statistic = 7.28, $df = 1$, $p < .01$.
a. DUI = driving under the influence.

serious driving violation and 3.9 times less likely to be involved in an injury collision. Similar program effects were observed for a subsample of chronic impaired drivers. Program effects for injury collisions were particularly noteworthy, as these crashes inflict the most long-term pain and suffering, both fiscally and emotionally. Comparisons of lifetime medical, law enforcement, motor vehicle agency, and insurance cost of crashes place average property collisions at only $2,000 and minor injuries at $5,000. Lifetime costs for major injuries rank highest at $515,000 (Alberta Transportation 1994).

Survival rates for licensed reinstated drivers displayed evidence of program effectiveness, even after the ignition interlock device was removed. A difference of 10% in DUI recidivism at the 24-month mark indicated overall program effectiveness, whereas a 5% difference at the 15-month mark for after-interlock cases showed some evidence of postprogram treatment effects. Ignition interlock succeeded as both a vehicle-based and individual-based sanction. The overall benefits of ignition interlock appear to warrant continued operation of the program in Alberta.

Despite statistical significance, was the 5% DUI survival rate improvement, after the ignition interlock device was removed, "large enough?" The

decline in effectiveness after the interlock was removed suggests that longer periods on ignition interlock would have increased survival rates. Whether program assignment periods increase significantly or modestly, the extent of increases must weigh costs to participants against public safety benefits.

The results of this evaluation were more supportive of ignition interlock than evaluations conducted in Ohio and California and much more consistently positive than outcomes observed in Oregon. Comparison of programs was difficult, because factors affecting road safety varied among jurisdictions (e.g., demographic factors, miles driven, urban/rural concentrations, topography). Yet a potentially confounding factor, program operation, also offered a plausible explanation for the Alberta ignition interlock program's greater success. There were several operational differences between Alberta and Oregon interlock programs. Oregon used a voluntary 6-month interlock period for all drivers who wished their licenses back before the end of a 3-year suspension. Alberta provided a similar program option for drivers with one and usually two DUI convictions, but the DCB also used the program extensively for chronic repeat cases who were license suspended for indeterminate periods. Ignition interlock was (and remains) part of a larger assessment process by the DCB, which can vary the length of program assignment for more serious cases and require offenders to take driver education and alcohol/drug programs. As mentioned, drivers who continue to drink and fail their ignition interlock Breathalyzer™ test too often may be suspended or have their program length extended. Put simply, the success of Alberta's program likely was due to more individualized management of impaired drivers than was the case in Oregon and perhaps other programs. Reduction of recidivism through better matching of program interventions to individuals has found increasing support in the impaired-driving literature (Langworthy and Latessa 1993, Wilson 1991).

NOTES

1. The most unusual finding reported in the Oregon study concerned a comparison group of nonparticipating drunk drivers who refused interlock ($N = 773$). They had significantly *lower* driving under the influence (DUI) recidivism rates than ignition interlock participants (ignition interlock device/9.94 vs. interlock refused/5.72). However, these figures included the 6-month period when the interlock-refused group was still under suspension, contrasted with time when the interlock group was on the road. If the first 6 months of license reinstatement for both groups were compared, program participants had lower rearrest rates (ignition interlock device/4.63 arrests per 100 drivers vs. interlock-refused group/7.91).

2. The inclusion in the comparison group of 191 impaired drivers with licenses still suspended, as well as the 63 cases who refused or were denied interlock, might be thought to overly favor the ignition interlock group. Drivers who were refused reinstatement or the interlock

program by the Driver Control Board, or who themselves refused interlock, may have been more negative and less motivated to avoid drunk driving—perhaps in ways the board's assessment of attitude failed to capture. However, controls introduced for license suspension and interlock refusal/denial status were unrelated to any of the three recidivism outcomes. When models were reestimated with possible "negative" license suspended and program refusal/denial cases removed (results available on request), standard errors were slightly larger (smaller sample size), but the magnitude and direction of effects were very similar. Removing potentially negative cases in the comparison group did *not* change the impact of ignition interlock in reducing recidivism.

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