Washington State's Alcohol Ignition Interlock Law: Effects on Recidivism Among First-time DUI Offenders

Anne T. McCartt
William A. Leaf*
Charles M. Farmer
Angela H. Eichelberger

March 2012

*Preusser Research Group, Inc.

INSURANCE INSTITUTE
FOR HIGHWAY SAFETY
1005 NORTH GLEBE ROAD ARLINGTON, VA 22201
PHONE 703/247-1500 FAX 703/247-1678
www.iihs.org

ABSTRACT

Objective: More than half of U.S. states require some DUI offenders to install ignition interlocks on their vehicles for a certain period of time if they want to drive. Increasingly states are strengthening these laws to apply to all offenders, including first-time offenders. The current study evaluated two changes in Washington state's interlock law: moving the issuance of interlock orders from the courts to the Department of Licensing in July 2003, and extending the interlock requirement to cover all convicted offenders, including first-time offenders with blood alcohol concentrations (BACs) lower than 0.15 percent ("first simple DUI offenders"), in June 2004. The primary focus was whether or not these law changes affected rates of recidivism among first-time DUI offenders.

Method: Trends in the types of convictions resulting from a DUI arrest, rates of interlock orders and installations, and rates of recidivism were examined, using data extracted from driver license records. The main focus was first-time convictions (simple, high-BAC, and test refusal DUI; deferred prosecution; or alcohol-related negligent driving) stemming from arrests on DUI charges occurring during January 1999-June 2006. Regression analyses examined the effects on rates of recidivism of the law changes and of interlock installation rates. Possible general deterrent effects of the law changes on alcohol-impaired driving were examined by comparing trends in single-vehicle nighttime (9 p.m.-6 a.m.) police-reported crashes and fatal crashes in Washington with trends in California and Oregon.

Results: Throughout the study period, about three-quarters of DUI offenses were first offenses. Simple DUI convictions and alcohol-related negligent driving convictions each accounted for about 30-40 percent of first DUI-related offenses. After interlocks were required for simple DUIs in 2004, the proportion of simple DUI convictions trended somewhat downward, while the proportion of alcohol-related negligent driving convictions continued a slow, long-term upward trend. The interlock installation rate among first simple DUI offenders increased dramatically as a result of the 2004 law change, going from less than 5 percent before the law change to about one-third after; increases in installation rates were observed among other first DUI offenders as well.

Extending the interlock requirement to first simple DUI convictions was estimated to have lowered the cumulative rate of recidivism during the 2 years following arrest by about 12 percent among people with such convictions (e.g., from an expected 10.6 percent without the law change to 9.3 percent among

offenders arrested in the second quarter of 2006, the last part of the study period) and by about 11 percent (from an expected 10.2 to 9.1 percent) among all first-time DUI offenders. There was an estimated 0.06 percentage point decrease in the 2-year cumulative recidivism rate for each percentage point increase in the proportion of first simple DUI offenders who installed interlocks. If the interlock installation rate had been 100 percent rather than 34 percent for first simple DUI offenders arrested in the second quarter of 2006, and if the linear relationship between the recidivism rate and the rate of interlock installations continued, the 2-year cumulative recidivism rate could have been reduced from 9.3 to 5.3 percent. Similarly, if the interlock installation rate had been 100 percent rather than 24 percent for all first DUI offenders arrested in the second quarter of 2006, their 2-year cumulative recidivism rate could have been reduced from 9.1 to 3.2 percent.

Although interlock installation rates increased somewhat after moving responsibility for issuing interlock orders to the Department of Licensing in 2003, that action did not significantly affect recidivism rates, perhaps due to the short follow-up period before the second law change.

The 2004 law change was associated with a 4.8 percent reduction in the risk of single-vehicle nighttime crashes in Washington, but the change was not significant given the variability in the data. A smaller and likewise non-significant reduction in the risk of single-vehicle nighttime fatal crashes was estimated.

Conclusions: Extending an interlock requirement to all first-time DUI convictions reduces recidivism among the cohort of affected offenders, even with relatively low interlock use rates, and additional gains are likely to be achievable with higher use rates. Jurisdictions should seek ways to increase installation rates among offenders required to install interlocks and should re-consider policies that allow reducing DUI charges to other traffic offenses that do not have an interlock requirement.

Keywords: Alcohol-impaired driving; DUI; DUI recidivism; Alcohol ignition interlocks; DUI penalties

INTRODUCTION

Following substantial decreases in the 1980s, the proportion of drivers involved in fatal crashes who were alcohol-impaired and the proportion of deaths that occurred in these crashes have changed little since 1994. In the United States, 31 percent of highway crash deaths in 2010 occurred in crashes where at least one driver was alcohol-impaired (i.e., with a blood alcohol concentration (BAC) at or above 0.08 percent) (Insurance Institute for Highway Safety (IIHS), 2012a). People with prior convictions for alcohol-impaired driving are overrepresented among drivers in fatal crashes (Fell, 1991). Thus, reducing recidivism among those convicted of alcohol-impaired driving potentially could reduce alcohol-related fatalities.

Alcohol ignition interlocks are devices that analyze a driver's breath and prevent the vehicle from starting if the BAC is above a specified amount. More than half of U.S. states require drivers convicted of alcohol-impaired driving offenses to install ignition interlocks on their vehicles in order to drive during a license suspension and/or require the devices for specified time periods before fully relicensing offenders (IIHS, 2012b). In 15 states and 4 California counties, such a restriction is applied to all offenders, including first-time offenders. Twenty-two states apply the restriction to offenders with very high BACs (usually 0.15 percent or higher) and/or to repeat offenders. In states without mandatory interlock laws, courts or departments of motor vehicles have the discretion to require them. The numbers of interlocks in use on the vehicles of offenders increased substantially during the past decade, reaching an estimated 249,000 interlocks in 2011 (Roth, 2011).

Two reviews of the research on interlock programs concluded that interlocks reduce recidivism while installed on offenders' vehicles (Elder et al., 2011; Willis et al., 2004). Most studies compared recidivism rates among offenders who installed interlocks and those who did not install them. In the most recent studies, recidivism rates were reduced by 60 percent (Bjerre and Thorsson, 2008) and by 80 percent (Voas et al., 2010) while interlocks were installed. Reductions were found for both repeat and first-time offenders (e.g., Roth et al., 2007; Vezina, 2002; Voas et al., 1999), but there were no lasting effects after interlocks were removed. Most study designs did not fully control for potential differences between drivers who elected to get interlocks and those who did not. Even when laws require convicted offenders to install the devices to regain their licenses, participation remains voluntary because offenders

can opt for a license suspension instead. Interlocks assigned by courts also may introduce selection bias because judges may choose offenders with certain characteristics to participate in interlock programs.

In the only randomized control trial, Beck et al. (1999) assigned multiple offenders who had been recommended for license reinstatement to an interlock program or control program. Participants assigned to the interlock program could reinstate their driver's licenses only if they agreed to a restriction prohibiting them from operating a vehicle without an interlock device for 1 year. Participants in the control group were eligible for the usual license reinstatement coupled with the conventional treatment program. Participants in both programs were monitored by the state motor vehicle administration. Sixty-four percent of the interlock group had interlocks installed for some part of the year. There was a 64 percent reduction in the risk of committing an alcohol-related traffic violation during the 1-year interlock program among the interlock group compared with the control group. During the following year, there were no significant differences between the two groups, but there was a significant 36 percent reduction in the re-arrest rate for the treatment group for the combined 2-year follow-up.

In addition to Beck et al. (1999), two other studies examined the effects of interlock programs for an entire intent-to-treat group (DeYoung et al., 2004; Voas et al., 2002). Voas et al. examined a county program mandating interlocks for all offenders with vehicles, using the threat of jail or house arrest as the alternative to compliance. About 62 percent of offenders were recruited into the interlock program. First–time offenders were 40 percent less likely and multiple offenders were 22 percent less likely to recidivate in the study county after the mandatory interlock policy, relative to offenders in similar nearby counties. In a study of a court-based interlock program, DeYoung et al. found that rates of recidivism did not differ among either multiple or first-time offenders with interlock orders compared with offenders without orders. However, the rate of interlock installation was as low as 20 percent.

A few studies have examined the effects of interlocks on crashes among offenders. Bjerre (2005) examined crash rates among interlock users before and after installation; the rate of crashes per 1,000 drivers declined from 22 to about 4, which was the rate for the general population of drivers. Vezina (2002) found no significant difference in single-vehicle nighttime crashes for offenders with interlocks installed compared with those without them. DeYoung et al. (2004) and Vezina found higher overall crash rates among offenders with interlocks installed compared with those without the devices, but the

crash rates among offenders with interlocks were not different from those for the general population of drivers. DeYoung et al. found lower overall crash rates among offenders with orders to install interlocks compared with offenders without orders.

The current study examines the effects of changes in Washington state's law requiring ignition interlock requirements for first-time alcohol-impaired driving offenders. It extends the research on the effects of interlock requirements in several respects. It is one of the few studies to focus on a statutory interlock requirement for first-time alcohol-impaired driving offenders (Roth et al., 2007; Voas et al., 2010). The primary measure of effectiveness is a reduction in the rate of recidivism after the law change among the cohort of offenders affected by the interlock law, whereas most studies have compared the rates of recidivism among offenders who did or did not install interlocks. The study is the first to conduct an in-depth examination of the association between the proportion of first-time offenders who install interlocks and the rates of recidivism among all first-time offenders. Finally, the possible general deterrent effects of the interlock law on alcohol-impaired crashes are examined.

Overview of Washington's Ignition Interlock Law

The Washington law pertaining to ignition interlocks for persons convicted of driving under the influence of alcohol (DUI) has progressed from allowing interlocks to requiring them, while expanding the types of offenders covered and shifting the responsibility for imposing the interlock requirement from the courts to the Department of Licensing. Effective July 1987, courts were authorized to require interlocks for a minimum period of 6 months for any DUI offender. At that time, a post-conviction license suspension for first-time offenders provided a 90-day license suspension, 30 days of which were mandatory. At the end of the mandatory suspension period, offenders could apply for an occupational/restricted license lasting for the rest of the suspension; the restricted license permitted driving under specified conditions, e.g., driving to and from work.

Effective January 1999, the law took on much of its present form. The *per se* BAC threshold was lowered from 0.10 to 0.08 percent. In addition, the law allowing courts to order interlocks for any offender was strengthened to require courts to order interlocks, following conviction, for repeat offenders, first-time offenders with "high BACs" (0.15 percent or higher), and offenders who refused the alcohol test. For first offenders who had high BACs or refused testing, there was a 1-year suspension, 30 days of which were

mandatory. An interlock restricted license was available after the 30 days. The interlock restriction was required for 1 year. Offenders who did not obtain an interlock were required to serve the full 1-year license suspension.

Pre-conviction license suspension triggered by an arrest for DUI also went into effect in Washington on January 1, 1999. This provision, commonly called administrative license suspension (ALS), required the arresting officer to serve notice on the offender that effective 60 days from the date of arrest the license would be suspended for 90 days for a first offense, that the offender could request a hearing to contest the suspension, and that if the suspension was not contested or if it was upheld at the hearing, the offender would be able to apply for an occupational/restricted license 30 days after the suspension began.

Complicating the sanction structure is a deferred prosecution program, which Washington has had since 1975. Available to DUI offenders who cooperate with alcohol breath testing, deferred prosecution allows offenders in need of treatment for alcohol-related problems to avoid license, jail, and fine penalties if they successfully complete a 2-year alcohol and/or drug education and treatment program followed by a 3-year probation period, all under court monitoring. If an offender does not follow the prescribed treatment program, the court is to reinstate criminal penalties for the DUI offense. Deferred prosecution is available only once. The 1999 interlock requirement applied to qualified offenders (i.e., repeat offenders or first-time offenders with high BACs) who chose the deferred prosecution track. A successfully completed deferred prosecution program counts as a prior offense for determining repeat offender status for any subsequent DUI arrest.

Effective July 27, 2003, the responsibility for imposing the interlock requirement was moved from the courts to the state's Department of Licensing. Upon receipt of orders of convictions from courts, the department notifies offenders that for the statutorily required period the department may not issue any license to them that does not have an interlock restriction. Further changes took effect on June 10, 2004, when the 1-year interlock provision was applied to first-time offenders convicted of DUI with BACs below 0.15 percent. Also at that time offenders who had not yet been convicted could reduce the 90-day ALS. Thirty days into the ALS, they could get an interlock-restricted license allowing them to drive anywhere as

long as the vehicle was interlock-equipped, and that interlock-equipped period counted against any post-conviction interlock requirement.

On January 1, 2009, the interlock program was expanded further, by making it available to offenders immediately after arrest, thereby avoiding the 30-day mandatory ALS. On January 1, 2011, another major change took effect. Prior to this date, drivers who failed to install an interlock could wait out the interlock-required period, and then apply for reinstatement of their unrestricted license. Now the interlock order is lifted only after drivers convicted of DUI have had an interlock installed for at least the last 4 months of their interlock period without any reports of noncompliance from the interlock provider (attempts to start the vehicle with a prohibited BAC, failure to take or pass a required test, or failure to report as required to the interlock provider for maintenance and calibration). For example, an offender with an interlock order for 1 year could immediately get an interlock and if there were no interlock-related offenses for the 9th through the 12th month, the interlock restriction could be removed at the end of the 12th month. A driver wishing to minimize the amount of time the interlock was installed could wait out the first 8 months of the suspension (or more) and then get an interlock installed. The unrestricted license interlock could be legally restored only after the driver's interlock provider could certify that at least 4 months had elapsed immediately prior to application for reinstatement of the full license with no noncompliance reports.

Study Objectives

The current study examined the effects of the law changes occurring in July 2003, when administration of the interlock requirement moved to the Department of Licensing, and in June 2004, when the requirement was extended to all first-time DUI convictions. Subsequent law changes are too recent to evaluate. Data from driver license records were used to answer the following questions: 1) How did the law changes affect the distribution of types of first-time DUI convictions? 2) How did the law changes affect the issuance of orders to install interlocks and actual installations? 3) How did the law changes affect the overall recidivism rates of the cohort of first-time DUI offenders and the cohorts of first-time offenders with different conviction types? 4) What was the association between trends in interlock installation rates and recidivism rates? 5) How did the law changes affect trends in alcohol-impaired

crashes? Of particular interest were the effects of the 2004 law changes on people with first-time DUI convictions without the aggravating circumstances of a high BAC or alcohol test refusal, hereafter referred to as "first simple DUI convictions." Interlocks were not required for these offenses prior to June 2004.

METHODS

Changes in First-offense DUI Offenses, Interlock Installations, and Recidivism

Description of Data. The complete file of driver license records as of July 22, 2010, was obtained from Washington's Department of Licensing. The records include information on convictions for DUI convictions and on convictions for non-alcohol offenses that resulted from an arrest on a DUI charge and qualify as a prior DUI offense if the driver is subsequently arrested for DUI. During the study period defined below, these latter convictions, tagged as DUI-related offenses on the driver license records, were convictions for alcohol-related negligent driving (often referred to as "wet negs"). The driver records do not include information on alcohol-impaired driving arrests that resulted in court dismissals or acquittals or decisions not to prosecute.

Complete driver records, including earlier DUI-related convictions, were extracted for people whose record contained at least one qualifying conviction resulting from a DUI-related arrest on or after January 1, 1999. Prior and subsequent offenses were calculated with reference to the date of arrest of the current offense and the date of arrest of the prior or subsequent offense. In keeping with Washington statutes, a 7-year window was used to define first-time offenses. That is, an offense was considered a first-time offense if the violation code of the conviction did not indicate it was a repeat offense and there was no prior conviction on the record with an arrest date within the 7 years prior to the current arrest date. In studying trends in recidivism, DUI arrests leading to subsequent convictions after the first offense were tallied. Recidivism, convictions, and interlock orders and installations were tracked, indexed to the date of arrest for the focal offense.

Analyses tracked all first-time DUI-related convictions and the following types of first offenses: high-BAC (BAC of 0.15 percent or higher) DUI, simple DUI (no BAC specified or BAC below 0.15 percent), test refusal DUI, deferred prosecution, and alcohol-related negligent driving. All these

convictions count as a prior offense should a driver commit a subsequent DUI offense. For simplicity, the term “first DUI offense” is used in the paper; it refers to these five types of first-time convictions resulting from a DUI-related arrest.

Trends in all first DUI offenses and the different types of first DUI offenses were examined by quarter of the year of arrest for three study periods: 1) January 1999-June 2003, when courts were required to order interlocks upon conviction for a repeat offense or a first-offense high-BAC or test refusal DUI conviction; 2) July 2003-June 2004, when the issuance of interlock orders became the purview of the Department of Licensing; and 3) July 2004-June 2006, when the interlock requirement applied to all first-time DUI convictions. Trends in the issuance of orders to install interlocks and in interlock installations also were examined.

Changes in Recidivism. Trends in recidivism were analyzed using linear regressions on recidivism rates (SAS Institute, Inc., 2009, REG procedure). Recidivism was defined as the first re-arrest on a DUI charge after the initial arrest resulting in a DUI or DUI-related conviction. The proportions of DUI offenders in each arrest quarter who recidivated within 6 months of arrest were modeled as a function of three time trend variables (number of quarters since January 1999, number of quarters squared, number of quarters cubed), a count of the total number of DUI arrests for the quarter, an indicator variable coded as 1 for arrests occurring during or after the third quarter of 2003, and an indicator variable coded as 1 for arrests occurring during or after the third quarter of 2004. The regression models were repeated for recidivism rates: (a) up to 12 months after arrest, (b) up to 24 months after arrest, and (c) up to 36 months after arrest. The quarterly counts of the total number of arrests for DUI were obtained from Washington’s Administrative Office of the Courts and were based on DUI case filings; this included all arrests for DUI offenses, even those that subsequently were dismissed, not prosecuted, or had other dispositions not recorded as alcohol-related on the driver record. This variable served as a control for potential variation in alcohol-impaired driving enforcement that, if occurring, could result in changes in re-arrest rates.

Linear regressions on recidivism rates also were conducted using interlock installation rates as a predictor rather than the indicators of law changes. The proportions of DUI offenders in each arrest quarter who recidivated were modeled as a function of three time trend variables (number of quarters

since January 1999, number of quarters squared, number of quarters cubed), a count of the total number of DUI arrests for the quarter, and the proportion of offenders who actually installed interlocks.

Crash Trends

Trends in crashes occurring in Washington during 2001-07 were compared with those in Oregon and California, which did not experience important changes in DUI laws during these years.

Description of Data. Information on police-reported crashes occurring in Washington and California during 2001-07 was obtained from the State Data System (SDS), a collection of state crash files coded from police crash reports. Electronic files of police-reported crashes occurring in Oregon during these years were obtained from the Crash Analysis & Reporting Unit of the Oregon Department of Transportation. Information on fatal crashes in these three states during these years was obtained from the Fatality Analysis Reporting System (FARS), a census of police-reported fatal crashes occurring on public roadways in the United States.

Analyses. The trend over time for single-vehicle nighttime crashes in Washington was compared with the trends for California and Oregon using a time series cross-sectional regression (TSCSREG procedure in SAS). Single-vehicle nighttime crashes are an accepted surrogate for crashes involving alcohol. Looking at alcohol-involved crashes is believed to be unreliable because alcohol testing is conducted for only a small percentage of drivers in less serious crashes. The dependent variable in the model was the logarithm of the seasonally adjusted percentage of single-vehicle nighttime (9 p.m.-6 a.m.) crashes for each state and each of the 28 quarters during 2001-07. Predictor variables included time parameters for each quarter, cross-sectional parameters for each state, and indicator variables for Washington beginning in the third quarter of 2003 and the third quarter of 2004.

Comparable analyses were conducted for single-vehicle nighttime fatal crashes in the three states, although the number of these crashes occurring in each quarter in these states was small.

RESULTS

Trends in First DUI Offenses

The number of DUI offenses (i.e., qualifying convictions resulting from a DUI-related arrest recorded on driver license records) by quarter of arrest fluctuated between 8,000 and 11,000 from 1999

through the second quarter of 2006. The number of first offenses was consistently about three times the number of repeat offenses. A possible effect of the interlock law changes would be a change in the types of convictions resulting from DUI arrests. For example, the extension of the interlock requirement to first simple DUI convictions might lead to more offenders seeking convictions for non-alcohol offenses to avoid the interlock order. Figure 1 shows the trends in the percent distribution of first DUI offenses by the type of conviction for arrests occurring during the study period January 1999-June 2006. Throughout the study period, simple DUI convictions and alcohol-related negligent driving convictions each accounted for about 30-40 percent of all first DUI offenses. The proportion of alcohol-related negligent driving convictions trended upward, especially after the 2003 and 2004 law changes. The proportion of simple DUI convictions trended upward until around mid-2002, remained stable, and then trended downward beginning in 2004. High-BAC and test refusal DUI convictions and deferred prosecutions trended downward throughout the study period.

Table 1 summarizes the distributions of first DUI offense types, aggregated for each of the three study periods.

Trends in Interlock Orders and Installations

Figure 2 shows the percentage of all first DUI offenses and the percentage of each conviction type for which orders to install interlocks were recorded on the driver records, tracked by the quarter of arrest. For first-offense high BAC and test refusal DUI convictions — required to install interlocks effective January 1999 — the percentage of court interlock orders increased steadily from about 35 percent in January-March 1999 to nearly 90 percent in April-June 2003; the percentage of interlock orders then rose to 97 percent in July-September 2003, when the interlock orders became the purview of the Department of Licensing, and was 99 percent in April-June 2006. The percentage of deferred prosecution cases with interlock orders increased steadily from 13 percent in January-March 1999 to about 90 percent in January-March 2005 and then leveled off. Although interlocks were not required for first simple DUI convictions until June 10, 2004, about 4-6 percent of these offenders consistently received interlock installation orders through 2003. The percentage increased to 9 percent in the first quarter of 2004; to 27 percent in the second quarter, when a small percentage of these offenders were covered by the interlock requirement taking effect June 10, 2004; and then to 87 percent in the third

quarter after all were covered. Less than 1 percent of alcohol-related negligent driving convictions had interlock orders recorded until about 2003, when the percentage began to increase, topping out at 7-8 percent. Although interlocks were not required for these offenders, an interlock installation could be a condition of the plea reduction agreement with the court.

For all convictions resulting from a first-time DUI arrest, the proportion with interlock orders was about 55 percent after the 2004 law change. When alcohol-related negligent driving convictions are excluded, the proportion was about 90 percent.

Figure 3 shows the percentage of all first DUI offenses and the percentage of each first-offense conviction type for which interlocks were recorded as installed on the driver records. During the third study period, when the interlock requirement was extended to cover all convictions for DUI, the rate of interlock installations was by far the highest for deferred prosecutions. About 60 percent of deferred prosecutions had interlock installations recorded, compared with about one-third of simple DUI convictions, 30 percent of high-BAC DUI convictions, and 22 percent of test refusal DUI convictions. Interlocks were installed by 8 percent of people convicted of alcohol-related negligent driving. Interlock installations were recorded for less than one-quarter of all first DUI offenses, including alcohol-related negligent driving convictions, and about 35 percent when alcohol-related negligent driving convictions are excluded.

It is apparent from Figure 3 that the 2004 law change extending the interlock requirement to first simple DUI convictions had a substantial effect on the proportion of these offenses with interlock installations. The proportion was very small prior to 2004. It then increased to 6 percent in the first quarter of 2004 and to 13 percent in the second quarter, during the period when the issuance of interlock orders had become the responsibility of the Department of Licensing, and to 30 percent after first simple DUI offenders were covered by the interlock requirement. The proportion then remained around one-third. The percentage of installations for first high-BAC and refusal DUI convictions gradually increased from 1999 to about 2005 and then remained fairly steady. For deferred prosecutions, there was a general upward trend in installations throughout the study period.

Time elapsed between arrest and interlock installation. In Washington, the time period between an arrest and the installation of an interlock could vary widely, depending on several factors,

including the time elapsed between the arrest and the conviction. For example, the 2004 law allowed first-time simple DUI offenders to obtain an interlock-restricted license after their 30-day hard administrative license suspension, which began 60 days after arrest if the suspension was not appealed. An offender also could serve the 90-day ALS suspension, or whatever portion of the suspension occurred before conviction, and begin the 1-year interlock requirement upon conviction. If the conviction occurred before the ALS had been served, the interlock could have been installed as soon as the interlock order was received from the Department of Licensing. Alternatively, these offenders could elect not to install the interlock at all and wait out the 1-year license suspension they received upon conviction.

Figure 4 summarizes the number of months elapsed between the date of arrest and the date of conviction for first simple DUI for arrests occurring in each study period. Each line shows the cumulative percentage of convictions that occurred within a given number of elapsed months. For example, in all three study periods approximately 45 percent of the first simple DUI convictions had occurred within 3 months after the arrest dates, and approximately 70 percent occurred within 6 months. The graph shows a slight lengthening of the time between arrest and conviction across the three study periods. It also is apparent that a small percentage of the arrests were not adjudicated for a long period of time; for example, almost 5 percent of the convictions had not occurred within 2 years after the date of arrest.

Figure 5 provides a similar graphical summary for the cumulative percentage of first simple DUI offenders who installed interlocks during each month following arrest, based only on offenders arrested after the all-offender interlock law took effect. Thirty-two percent of the offenders had installed an interlock within 3 years after the date of arrest. The cumulative percentage installing interlocks was 10 percent at the end of 6 months after arrest, 16 percent at the end of 8 months, and 22 percent by the end of one year. Given that the law required either an interlock-restricted license or a license suspension for 1 year following conviction, Figure 5 indicates that more than two-thirds of the installed interlocks would have been removed by the end of the 2-year period following arrest. Thus, assuming interlocks affect recidivism largely when they are installed, their effects primarily would occur during the first 2 years following arrest.

Recidivism

The analyses of recidivism focused primarily on people with first-time simple DUI convictions, as these offenders were first required to install interlocks in June 2004, and on all first-time DUI offenses.

Recidivism rates by type of conviction. The rates of recidivism varied considerably by type of conviction. Based on arrests occurring in the study period after the 2004 law change, Figure 6 shows that 8 percent of all first DUI offenders were re-arrested within the 2 years following their arrest date (and subsequently convicted). The 2-year cumulative rate of recidivism ranged from 3 percent for first-offense deferred prosecution outcomes to 12 percent for first test refusal DUI convictions and 13 percent for first high-BAC DUI convictions. The recidivism rate was 9 percent for first simple DUI convictions. The rate was somewhat lower, 7 percent, for alcohol-related negligent driving convictions.

Comparison of recidivism among offenders who did or did not install interlocks. As noted above, most studies of the effects on recidivism of interlock laws have compared rates of recidivism among offenders who did or did not install interlocks. These studies have found significantly lower recidivism rates among the offenders who installed interlocks. This type of comparison produced a similar result for the current study sample.

Figure 7 shows the cumulative monthly rate of re-arrests among first simple DUI offenders who were arrested after the all-offender interlock law took effect. The cumulative recidivism rates up to 2 years after arrest are displayed for offenders who installed interlocks, offenders who received an order to install an interlock but did not do so, and offenders who neither received an order to install an interlock nor installed one. Offenders who installed interlocks had much lower rates of recidivism than offenders who were ordered to install an interlock but did not do so. For example, at the end of 2 years, 3 percent of offenders with interlocks had been re-arrested compared with 13 percent of offenders who had received an interlock order but did not install one.

The lower recidivism rate for first simple DUI offenders who installed interlocks, compared with first simple DUI offenders who did not install interlocks despite being ordered to do so, appears to suggest that interlock installations reduce recidivism. This difference was consistent for all first DUI offenders, first high-BAC DUI offenders, first test refusal DUI offenders, and first deferred prosecution offenders. However, there is an inherent bias in this comparison because offenders who choose to install interlocks likely differ in important unknown respects (e.g., attitude toward penalties, motivation not to re-

offend, socio-economic status) from offenders who do not install interlocks. The primary measure of effectiveness in the current study is whether the interlock law changes led to a change in the rate of recidivism among all offenders affected by the law change. The following analyses address this central research question.

Effects of law changes on recidivism rates. Figures 8-10 plot the rates of recidivism for first simple DUI convictions, first alcohol-related negligent driving convictions, and all first DUI offenses, respectively, classified by quarter of arrest during January 1999-June 2006. In Figure 8, for example, for those arrested in the first quarter of 1999 and convicted of first simple DUI, the recidivism rate during the subsequent 6 months was 2.6 (56 out of 2,114). This is the first plot point in Figure 8 (lowest line). The 6-month recidivism rates appeared to trend up slightly beginning in about 2004. The 2-year and 3-year recidivism rates trended upward up to the first quarter of 2004 and then generally declined through the second quarter of 2006, the final cohort of offenders included in the study.

Results of the regression analysis of recidivism rates by law period are shown in Table 2 for first simple DUI convictions. Models are given for recidivism rates for 6 months, 1 year, 2 years, and 3 years following arrest. The parameters for the two law changes generally are not significant for the recidivism rate in any time period with one exception. The model for the 2-year cumulative recidivism rate estimates a reduction of 1.3 percentage points after the 2004 law change ($p=0.04$). So, for offenders arrested during the second quarter of 2006 (April-June 2006), the last part of the study period, the model estimates a 12 percent reduction in the recidivism rate (from an expected 10.6 percent without the law change to 9.3 percent).

Similar models were developed for first-offense alcohol-related negligent driving convictions and all first DUI offenses (including alcohol-related negligent driving). Table 3 summarizes the parameters for the 2003 and 2004 law change predictors. The model for all first DUI offenses estimates a reduction in the 2-year cumulative recidivism rate of 1.1 percentage points ($p=0.02$). For offenders arrested during the second quarter of 2006, this means an 11 percent reduction in the recidivism rate (from an expected 10.2 percent without the law change to 9.1 percent). In the model for first alcohol-related negligent driving convictions, the parameters for the law changes are not significant during any time period following arrest.

To assist in interpreting the model results, Figure 11 shows the trends in the rates of 2-year cumulative recidivism rates for first simple DUI convictions in the absence of the 2004 law change and the rates of recidivism in the presence of the law change (after adjustment for covariates). The recidivism rates were generally increasing until the third quarter of 2004. They would have been expected to continue increasing and later level off (as in the dashed line) if there had been no law change. Instead, the rates declined. The difference between the dashed and solid lines is 1.3 percentage points.

Models built for repeat DUI offenses yielded non-significant parameters for the law change indicators, as expected, as the consequences for these offenders did not change during the study period.

Regression analyses of effects of interlock installation rates on recidivism rates. Table 4 summarizes the regression of cumulative recidivism among first simple DUI offenders using the interlock installation rate as a predictor rather than the 2003 and 2004 law change indicators. The interlock installation parameter was barely positive for re-arrests (resulting in convictions) occurring within 6 months of the initial arrest and negative for re-arrests occurring up to 1 year, 2 years, and 3 years after the initial arrest. The parameter for re-arrests occurring up to 2 years after the initial arrest was significant ($p=0.02$); an estimated 0.06 percentage point decrease in the recidivism rate for each percentage point increase in the proportion of offenders who installed interlocks is predicted. So, if the interlock installation rate had been 100 percent rather than 34 percent for first simple DUI offenders arrested in the second quarter of 2006, and if the linear relationship between the rates of recidivism and interlock installations continued, the 2-year recidivism rate could have been reduced from 9.3 to 5.3 percent.

Similar models were developed for first alcohol-related negligent driving offenders and all first DUI offenders (including alcohol-related negligent driving) (Table 5). In the model for all first DUI offenses, the parameter for re-arrests (resulting in convictions) occurring up to 2 years after the initial arrest was significant ($p=0.05$); an estimated 0.08 percentage point decrease in the recidivism rate for each percentage point increase in the proportion of offenders who installed interlocks is predicted. So, if the interlock installation rate had been 100 percent rather than 24 percent for all first DUI offenders arrested in the second quarter of 2006, and if the linear relationship between the recidivism rate and the rate of interlock installations continued, the 2-year recidivism rate could have been reduced from 9.1 to 3.2

percent. In the model for first alcohol-related negligent driving offenses, none of the parameter estimates was significant.

Crash Trends

Figures 12-13 show trends in police-reported single-vehicle nighttime crashes and the percentage of police-reported crashes that were nighttime and single-vehicle during January 2001-December 2007 in California, Oregon, and Washington.

Table 6 presents a regression model of the percentage of crashes that were single-vehicle nighttime by state and quarter during 2001-07. Figure 14 shows a plot of predicted values from the model. The model includes cross-sectional parameters for each state, indicator variables for Washington beginning in the third quarter of 2003 (when the Department of Licensing began to issue interlock orders) and the third quarter of 2004 (when the interlock requirement was extended to all first-time offenders), and time-series parameters for each quarter (not shown). The inverse logarithms of the cross-sectional parameters in Table 6 represent the predicted percentage of crashes that would be single-vehicle nighttime at the end of the time series if the trends were similar across states, i.e., 7.4 for California, 6.8 for Oregon, and 9.2 for Washington. The coefficient of the Department of Licensing parameter is -0.02834, which can be interpreted as a 2.8 percent decrease in single-vehicle nighttime crash risk in Washington beginning in the third quarter of 2003, relative to trends in California and Oregon. The coefficient of the parameter for the all-offender interlock requirement is -0.0478, which can be interpreted as a 4.8 percent decrease in single-vehicle nighttime crash risk in Washington beginning in the third quarter of 2004. However, given the variability in the data, neither of these parameter estimates is statistically significant.

Figure 15 shows the trends in fatal single-vehicle nighttime crashes during 2001-07 in the three states. Figure 16 shows the predicted trends in the percentage of all fatal crashes that were single-vehicle and nighttime based on a regression model, summarized in Table 7, of the percentage of fatal crashes that were single-vehicle and nighttime by state and quarter during 2001-07. The coefficients for the 2003 and 2004 law changes indicate a small decrease (about 1 percent) in the fatal single-vehicle nighttime crash risk in Washington coincident with each law change, relative to trends in California and Oregon. Neither of these predicted changes is statistically significant.

DISCUSSION

To help combat the persistent problem of alcohol-impaired driving crashes, more than half of U.S. states require at least some convicted DUI offenders to install interlocks. States initially passed laws requiring interlocks only for repeat offenders or offenders with very high BACs, typically 0.15 percent or higher, but increasingly states are extending interlock requirements to cover all DUI convictions. The current research confirms that the application of mandatory interlocks can be effective, even among first-time offenders whose BACs exceed the legal threshold of 0.08 percent but are less than 0.15 percent. With the extension of mandatory interlocks to this group of offenders, the rate at which they recidivated in the two years following their first arrest was reduced by 12 percent. Had all such offenders actually installed interlocks (instead of only the third that did so), the reduction in recidivism may have approached 50 percent.

These reductions are important because drivers with previous impaired-driving convictions are overrepresented in alcohol-related fatal crashes (Fell, 1991). It has been estimated that keeping all drivers with a single DUI conviction in the prior three years from driving after drinking could have prevented nearly 650 crash deaths in 2010 (IIHS, 2012a).

Prior research on statutory interlock requirements found lower rates of recidivism among offenders who installed interlocks compared with those who did not (Elder et al., 2011; Willis et al., 2004). The current study of Washington DUI offenders found the same pattern. Among all types of first DUI convictions required to install interlocks, offenders who installed the interlocks had a much lower recidivism rate than offenders who did not install them. The primary focus of the current study, however, was the broader impact of amendments to the Washington law among the entire cohort of affected offenders, not just those who installed interlocks. The entire effect of the law includes the effects of interlock installations, a longer license suspension among offenders who did not install interlocks, and any potential shifts in conviction types to avoid the interlock requirement. In fact, there were indications that the 2004 law change resulted in a shift of convictions away from first simple DUI offenses to alcohol-related negligent driving. Although alcohol-related negligent driving offenders were not required to install interlocks, a small percentage did so; their installation rate increased beginning in

about 2003, topping out at about 8 percent in 2005. Regression analyses did not find significant changes in recidivism among alcohol-related negligent driving offenders associated with the 2004 law change. It is likely that the interlock installations among this group represented special circumstances, and it is unknown to what extent the higher installation rate among these offenders may have offset some of the shift in convictions toward alcohol-related negligent driving.

The records of interlock installations among first-time simple DUI offenders show that two-thirds of the interlocks would have been removed by the 25th month following arrest. Also, the primary effect of the 2004 law change on recidivism occurred during the first 2 years following arrest, with a lesser, non-significant decrease in the 3-year cumulative rate of recidivism. This is consistent with the results of earlier studies that the effects of interlocks are largely confined to the period when they are installed on vehicles (e.g., Roth et al., 2007; Vezina, 2002; Voas et al., 2010).

The finding that an interlock requirement reduces overall recidivism among the affected offender group is consistent with the findings of Beck et al., (1999), the only random control study of the effects of an interlock program on recidivism. As in the current study, Beck et al. examined recidivism among all the offenders required to get interlocks. The authors reported a 64 percent reduction in recidivism, whereas the current study found an 11 percent reduction among all first DUI offenders. The studies have important differences. The current study focused on first-time offenders, whereas the earlier study included only multiple offenders who had been recommended for license reinstatement. In addition, both the program and control groups in Beck et al. were monitored closely by the state motor vehicle administration. Importantly, the earlier study reported a 64 percent interlock installation rate; this is more than double the rate among all first DUI offenders in the current study. Given the findings of the current study that higher rates of installations lead to larger reductions in recidivism, it makes sense that there was a much larger reduction in recidivism among the interlock group in Beck et al.

An important finding from the current study is the strong inverse association between the interlock installation rate and the rate of recidivism. If all offenders had installed interlocks, and if the linear relationship between the recidivism rate and the rate of interlock installations continued, recidivism would have fallen much more steeply. This finding held true for first simple DUI offenses and for all first DUI offenses. This lends strong support for the approach taken by Washington and other

states to extend the interlock requirement to all DUI convictions and to adopt measures to increase the interlock installation rate. Effective January 1, 2009, Washington allows an interlock-restricted license in lieu of the mandatory administrative license suspension. Effective January 1, 2011, persons convicted of DUI cannot reinstate their driver's licenses until it is demonstrated that they have had a violation-free interlock installation for no less than the last 4 months of their suspension period. Future studies will examine the effects of these law changes on interlock installation rates and recidivism rates. Washington and other states also may wish to re-consider allowing people arrested for DUI to plead to lesser charges such as alcohol-related negligent driving that do not require interlocks. In the current study, the 2-year cumulative rate of recidivism among persons whose DUI arrests were reduced to alcohol-related negligent driving (7 percent) was only slightly less than the rate of recidivism for first simple DUI offenders (9 percent) or the rate for all first DUI offenders (8 percent).

The current study sheds light on the patterns of interlock installations among first-time DUI offenders. Consistent with earlier studies of interlock programs (e.g., DeYoung et al., 2004), the current study found that many offenders required by the law to install interlocks do not do so. The highest installation rate – 60 percent – occurred among first offenders receiving deferred prosecution; this is not surprising given the close monitoring received by these offenders and the added incentive that failure to comply with the treatment and interlock conditions leads to reinstatement of the conviction. One-third of first offenders convicted of simple DUI and high-BAC DUI and less than one-quarter of offenders convicted of test refusal DUI installed interlocks. It is unknown how many offenders in the current study had license suspensions unrelated to the DUI offense that prevented them from obtaining an interlock-restricted license; interlock orders were recorded on the driver license records after conviction, whether or not the drivers had other outstanding license suspensions.

During the study period following the 2004 law change, interlock orders were recorded on the driver license records of almost all first-time high-BAC and test refusal DUI convictions but only about 87 percent of first-time simple DUI convictions. Washington law allows courts to waive the requirement for an interlock-restricted license and order alcohol monitoring for the same period. It is unknown whether such an exception was made for these offenders.

As part of the current study, trends in single-vehicle nighttime police-reported crashes, which are often used as a surrogate for alcohol-related crashes, were examined as a way to assess the general deterrent effects of the law change on alcohol-impaired driving. The lack of strong effect on crashes is not surprising, given that the large majority of drivers that crash while impaired by alcohol have no prior DUI record. States may wish to consider publicizing interlock programs more widely. If there is a wider perception among the general population that convicted DUI offenders must install interlocks, interlock laws may act as deterrents for drivers who have never had a DUI arrest.

A limitation of the study is that the driver license records include information only on DUI arrests that result in convictions for DUI or other traffic offenses that qualify as prior DUIs in the event of a subsequent arrest. However, during the study period the trends in first-time DUI offenses based on the driver license records largely paralleled the trends in the number of arrests for DUI reported to Washington's Administrative Office of the Courts. The difference between the totals from the driver license records and the Administrative Office of the Courts presumably represent cases that are dismissed, result in acquittal, etc. These cases increased during the early part of the study period and then remained consistently at about 10 percent. Another limitation is that in the analyses relating interlock installation rates to rates of recidivism, it is assumed that offenders who did not install interlocks would have responded to them in the same way as the offenders who did go through with the installations. If this is not the case, the projected reductions in recidivism may have been over-estimated or under-estimated.

Opponents of laws requiring interlocks for all offenders argue that resources should be directed toward repeat offenders and offenders with very high BACs, claiming that these offenders cause "the vast majority of alcohol-related fatalities" (Miller, 2012). In fact, of the impaired drivers involved in fatal crashes in 2010, nearly a third had BACs less than 0.15 percent, and only 1 percent had more than one prior DUI conviction within the last 3 years on their driving record. Further, as illustrated in the current study of DUI convictions in Washington state, the large majority of DUI convictions are first-time offenses. When convictions reduced to alcohol-related negligent driving are excluded, most first-time DUI convictions involved offenders with BACs below 0.15 percent.

Summary. This study of the 2004 law extending an interlock requirement to all first-time DUI convictions in Washington state indicates a substantial reduction in recidivism among the cohort of affected offenders, even with relatively low interlock installation rates. It is likely that additional gains can be attained with higher rates. The higher the interlock installation rate the lower the recidivism rate, suggesting that jurisdictions should seek ways to increase interlock installations. Jurisdictions also should reconsider policies that allow reducing DUI charges to other traffic offenses that do not have an interlock requirement.

ACKNOWLEDGEMENTS

The authors would like to thank the following agencies and individuals in Washington state. We would like to thank the Washington Traffic Safety Committee for all their help and support in conducting this study, and we acknowledge in particular the assistance of Lowell Porter, Director; Shelly Baldwin, Impaired Driving Program Manager; Dick Doane, Research Investigator; and Phil Salzberg, Research Consultant. The Department of Licensing provided electronic driver license records on which much of the study is based, and the department was invaluable in helping us interpret the information on the records. We especially thank Judy Groezinger, Driver Records Administrator, Carla Weaver, and Craig Sloan. We appreciate all the information about Washington law and the interlock program from the following staff of the Washington State Police: Steve Luce, Interlock Enforcement Officer; Courtney Popp, DUI Resource Prosecutor; and Rod Gulberg, Data Analyst. We obtained a file of BAC test results maintained by the Washington State Police, and we are grateful for that information. We thank Beth McGrath, Senior Integrator, Data Management, from the Administrative Office of the Courts for providing data to us on DUI cases filed and for her help in understanding those data.

We also would like to acknowledge Michele Fields and Mike Fagin, legal staff at the Insurance Institute for Highway Safety, for their assistance in summarizing and interpreting Washington DUI law. We also thank Mark Solomon of Preusser Research Group, Inc., for his help in setting up the study.

This work was supported by the Insurance Institute for Highway Safety.

REFERENCES

Beck, K.H.; Rauch, W.J.; Baker, E.A.; and Williams, A.F. 1999. Effects of ignition interlock license restrictions on drivers with multiple alcohol offenses: a randomized trial in Maryland. *American Journal of Public Health* 89:1696-1700.

Bjerre, B. 2005. An evaluation of the Swedish ignition interlock program. *Traffic Injury Prevention* 4:98-104.

Bjerre, B. and Thorsson, U. 2008. Is an alcohol ignition interlock programme a useful tool for changing the alcohol and driving habits of drink-drivers? *Accident Analysis and Prevention* 40:267-273.

DeYoung, D.J.; Tashima, H.N.; and Masten, S.V. 2004. An evaluation of the effectiveness of ignition interlock in California: report to the legislature of the State of California (CAL-DMV-RSS-04-210/AL0357). Sacramento, CA: California Department of Motor Vehicles.

Elder, R.W.; Voas, R.; Beirness, D.; Shults, R.A.; Sleet, D.A.; Nichols, J.L.; Compton, R.; and the Task Force on Community Preventive Services. 2011. Effectiveness of ignition interlocks for preventing alcohol-impaired driving and alcohol-related crashes, a community guide systematic review. *American Journal of Preventive Medicine* 40(3):362-376.

Fell, J.C. 1991. Repeat DWI offenders: their involvement in fatal crashes. Washington, DC: National Highway Traffic Safety Administration.

Insurance Institute for Highway Safety. 2012a. [Unpublished analysis of data from the Fatality Analysis Reporting System]. Arlington, VA.

Insurance Institute for Highway Safety. 2012b. DUI/DWI laws, January 2012. Arlington, VA. Accessed at: http://www.iihs.org/laws/dui.aspx.

Miller, J.R., Restaurant lobby seeks to put ignition interlock provision on ice. FoxNews.com, February 8, 2012

Roth, R. 2011. 2011 survey of currently installed interlocks in the U.S. Available: http://www.rothinterlock.org/2011surveyofcurrentlyinstallednterlocksintheus.pdf.

Roth, R.; Voas, R.; and Marques, P. 2007. Interlocks for first offenders: effective? *Traffic Injury Prevention* 8:346-352.

SAS Institute, Inc. 2009. SAS/STAT 9.2 User's Guide, Second Edition. Cary, NC.

Vezina, L. 2002. The Quebec alcohol ignition interlock program: impact on recidivism and crashes. In: Mayhew, D. and Dussult, C., eds. Proceedings of Alcohol, Drugs and Traffic Safety; 2002 Aug 4-9. Vol. 1. Quebec City: Societe de L'assurance Automobile du Quebec, 9

Voas, R.B.; Blackman, K.O.; Tippetts, A.S.; and Marques, P.R. 2002. Evaluation of a program to motivate impaired driving offenders to install ignition interlocks. *Accident Analysis and Prevention* 34:449-455.

Voas, R.B.; Marques, P.R.; Tippetts, A.S.; and Beirness, D.J. 1999. The Alberta interlock program: the evaluation of a province-wide program on DUI recidivism. *Addiction* 94(12):1849-1859.

Voas, R.B.; Tippetts, S.S.; Fisher, D.; and Grosz, M. 2010. Requiring suspended drivers to install alcohol interlocks to reinstate their licenses: effective? *Addiction* 105(8):1422-8.

Willis, C.; Lybrand, S.; and Bellamy, N. 2004. Alcohol ignition interlock programmes for reducing drink driving recidivism. *Cochrane Database of Systematic Reviews* 2004, Issue 4. Art. no.: CD004168. Oxfordshire, England: The Cochrane Collaboration.

Table 1. Percent distribution of first DUI offenses by conviction type for three study periods

Conviction type	Court-based partial interlock law Jan 1999-June 2003 (N=116,410) percent	Interlock orders moved to Department of Licensing Jul 2003-Jun 2004 (N=29,269) percent	Interlock requirement extended to first simple DUI offenses Jul 2004-Jun 2006 (N=54,634) percent
Simple DUI	35.5	39.0	37.0
High-BAC DUI	11.3	9.0	8.7
Test refusal DUI	5.6	4.8	4.1
Alcohol-related negligent driving	34.0	36.4	40.9
Deferred prosecution	13.7	10.7	9.2
Total	100.0	100.0	100.0

Table 2. Regression of proportion recidivating of first simple DUI offenders with 2003 and 2004 interlock law changes and all DUI arrests as predictors

	Within 6 months		Within 12 months		Within 24 months		Within 36 months	
Predictor variable	Estimate	p value	Estimate	p value	Estimate	p value	Estimate	p value
Intercept	0.04290	0.0012	0.07280	0.0012	0.10339	0.0003	0.13783	<0.0001
Time period (quarter)	-0.00080446	0.4362	-0.00153	0.3818	-0.00084298	0.6910	0.00063589	0.7852
Time period ^ 2	0.00008634	0.3164	0.00020040	0.1730	0.00017549	0.3234	0.00010485	0.5893
Time period ^ 3	-0.00000194	0.2826	-0.00000507	0.1024	-0.00000470	0.2091	-0.00000420	0.3054
Total DUI arrests	-0.00000155	0.1826	-0.00000237	0.2250	-0.00000176	0.4573	-0.00000215	0.4101
Change, Dept of Licensing issuing interlock orders	0.00165	0.5834	0.00075421	0.8815	0.00607	0.3307	0.00442	0.5175
Change, all offender interlock requirement	0.00147	0.6307	0.00052489	0.9188	-0.01330	0.0433	-0.00763	0.2768

Table 3. Parameter estimates for 2003 and 2004 interlock law changes from regressions of proportion recidivating of first alcohol-related negligent driving offenders and proportion recidivating of all first DUI offenders with law changes and all DUI arrests as predictors

	Within 6 months		Within 12 months		Within 24 months		Within 36 months	
Predictor variable	Estimate	p value	Estimate	p value	Estimate	p value	Estimate	p value
First alcohol-related negligent driving offenses								
Change, Dept of Licensing issuing interlock orders	0.00105	0.6933	0.00276	0.4827	0.00432	0.4424	0.00931	0.1229
Change, all offender interlock requirement	0.00027198	0.9201	0.00082119	0.8364	-0.00340	0.5522	-0.00024279	0.9677
All first DUI offenses								
Change, Dept of Licensing issuing interlock orders	0.00053660	0.7786	0.00062576	0.8316	0.00212	0.6233	0.00369	0.4459
Change, all offender interlock requirement	0.00026944	0.8897	-0.00249	0.4095	-0.01057	0.0229	-0.00713	0.1541

Table 4. Regression of proportion recidivating of first simple DUI offenders with interlock installation rate and all DUI arrests as predictors

	Within 6 months		Within 12 months		Within 24 months		Within 36 months	
Predictor variable	Estimate	p value	Estimate	p value	Estimate	p value	Estimate	p value
Intercept	0.04475	0.0006	0.07485	0.0006	0.10778	<0.0001	0.14101	<0.0001
Time period (quarter)	-0.00115	0.2176	-0.00185	0.2311	-0.00235	0.2103	-0.00039492	0.8475
Time period ^ 2	0.00011492	0.1307	0.00022594	0.0775	0.00030858	0.0481	0.00019587	0.2466
Time period ^ 3	-0.00000242	0.1335	-0.00000542	0.0477	-0.00000707	0.0340	-0.00000583	0.1088
Total DUI arrests	-0.00000166	0.1455	-0.00000251	0.1865	-0.00000183	0.4189	-0.00000222	0.3798
Proportion interlock installation	0.00085575	0.9425	-0.00721	0.7160	-0.06134	0.0161	-0.03591	0.1860

Table 5. Parameter estimate for interlock installation rate from regressions of proportion recidivating of first alcohol-related negligent driving offenders and proportion recidivating of all first DUI offenders with interlock installation rate and all DUI arrests as predictors

	Within 6 months		Within 12 months		Within 24 months		Within 36 months	
Predictor variable	Estimate	p value	Estimate	p value	Estimate	p value	Estimate	p value
First-offense alcohol-related negligent driving offenses								
Proportion interlock installation	-0.02233	0.6970	0.01695	0.8417	-0.05963	0.6267	0.02177	0.8702
All first-offense DUI offenses								
Proportion interlock installation	0.00254	0.8743	-0.01106	0.6589	-0.07777	0.0470	-0.04225	0.3184

Table 6. Police-reported crashes during 2001-07 in California, Oregon, and Washington: time series cross-sectional regression of log of deseasonalized single-vehicle nighttime (9 p.m.-6 a.m.) crash percent

Variable	Parameter estimate	Standard error	t value	Pr > |t|
Cross sectional effect, California	2.000265	0.0257	77.70	<0.0001
Cross sectional effect, Oregon	1.917846	0.0257	74.50	<0.0001
Cross sectional effect, Washington	2.214806	0.0301	73.66	<0.0001
Change, DOL issuing interlock orders	-0.02834	0.0310	-0.92	0.3641
Change, all offender interlock requirement	-0.0478	0.0297	-1.61	0.1132

Table 7. Fatal crashes during 2001-07 in California, Oregon, and Washington: time series cross-sectional regression of log of deseasonalized single-vehicle nighttime (9 p.m.-6 a.m.) crash percent

Variable	Parameter estimate	Standard error	t value	Pr > |t|
Cross sectional effect, California	3.207138	0.0782	40.99	<0.0001
Cross sectional effect, Oregon	3.105682	0.0782	39.70	<0.0001
Cross sectional effect, Washington	3.326088	0.0914	36.40	<0.0001
Change, DOL issuing interlock orders	-0.00596	0.0941	-0.06	0.9497
Change, all offender interlock requirement	-0.01437	0.0902	-0.16	0.8740

Figure 1. Percent distribution of first DUI offenses by type of conviction, by quarter of arrest, January 1999-June 2006

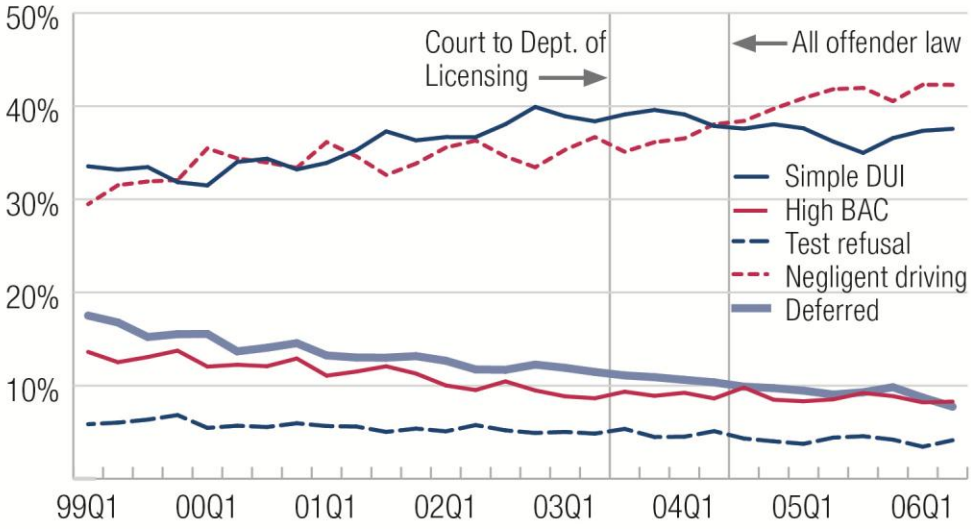

Figure 2. Percentage of each first DUI offender type ordered to install interlocks by quarter of arrest, January 1999-June 2006

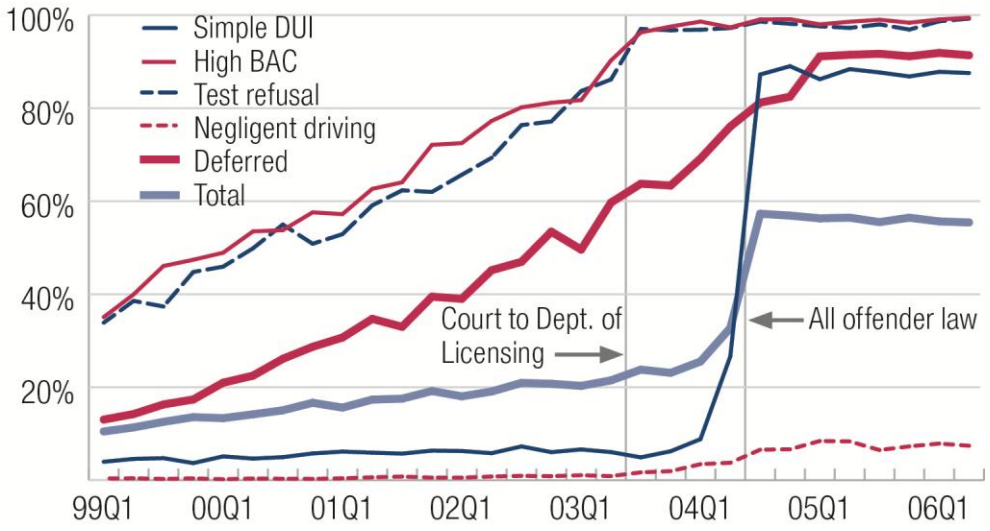

Figure 3. Percentage of each first DUI offender type with interlock installations by quarter of arrest, January 1999-June 2006

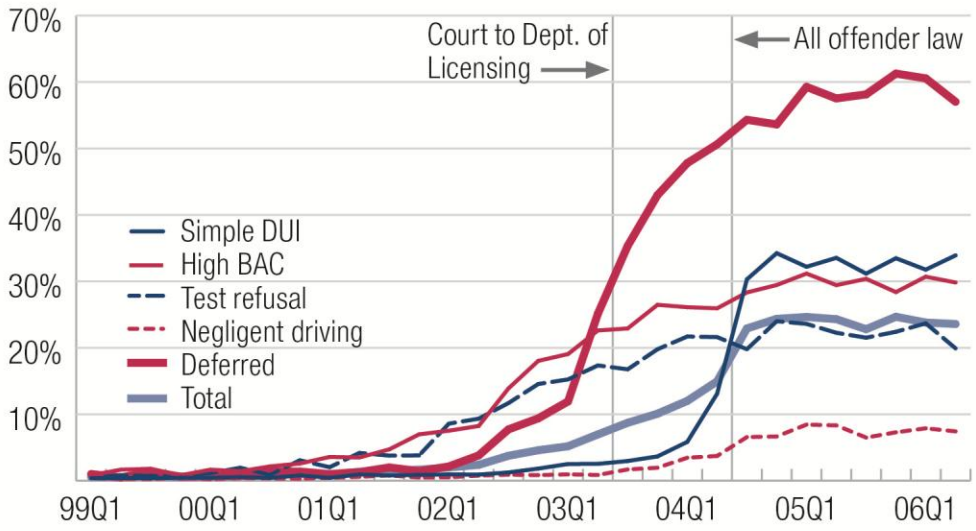

Figure 4. Cumulative percentage of convictions by number of months elapsed between arrest and conviction for first simple DUI offenses, by study period

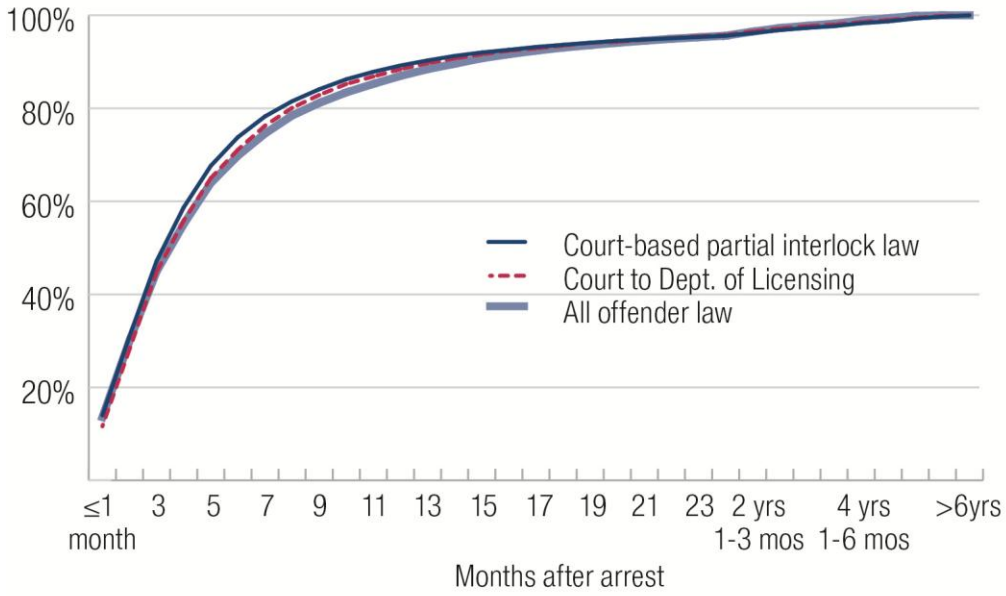

Figure 5. Cumulative percentage of interlock installations by number of months elapsed between arrest and installation among first simple DUI offenders who were arrested after interlock requirement (July 2004-June 2006)

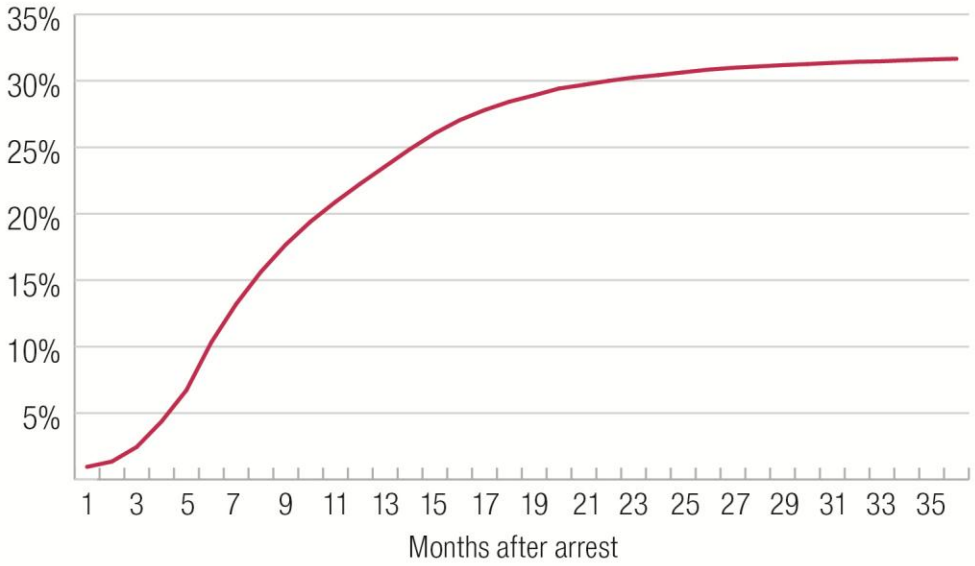

Figure 6. Percentage of each first DUI offender type who recidivated within two years after DUI arrest date (and subsequently convicted), among offenders arrested after all-offender interlock requirement (July 2004-June 2006)

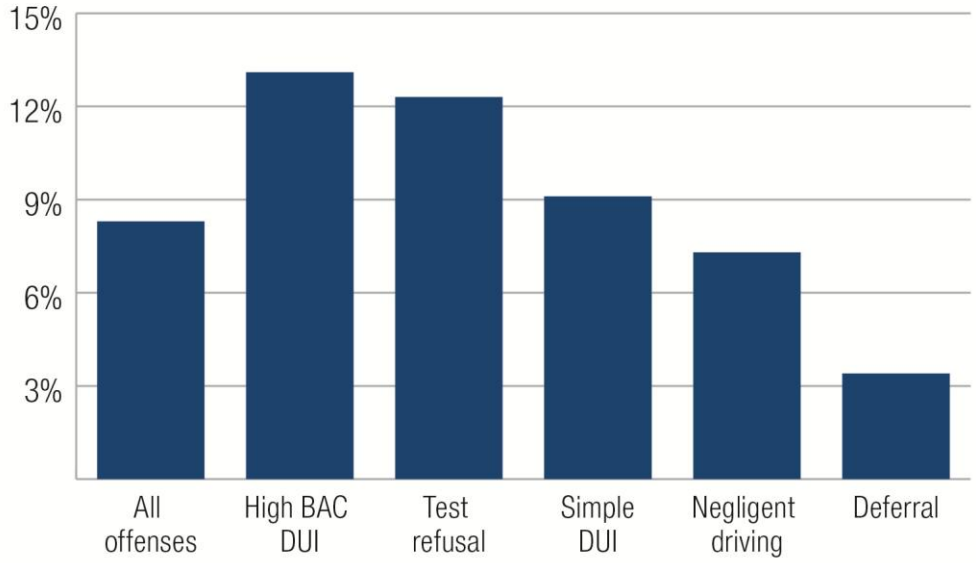

Figure 7. Cumulative percentage of first-time simple DUI offenders who recidivated up to two years after DUI arrest date, by interlock status: Offenders arrested after all-offender interlock requirement (July 2004-June 2006)

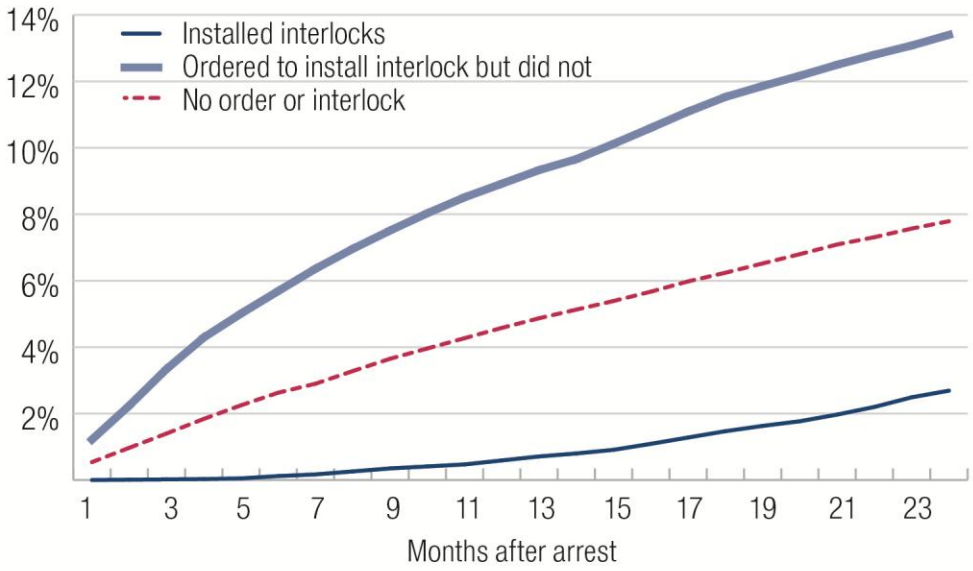

Figure 8. Trends in cumulative recidivism rate for first simple DUI convictions, by quarter of arrest, January 1999-June 2006

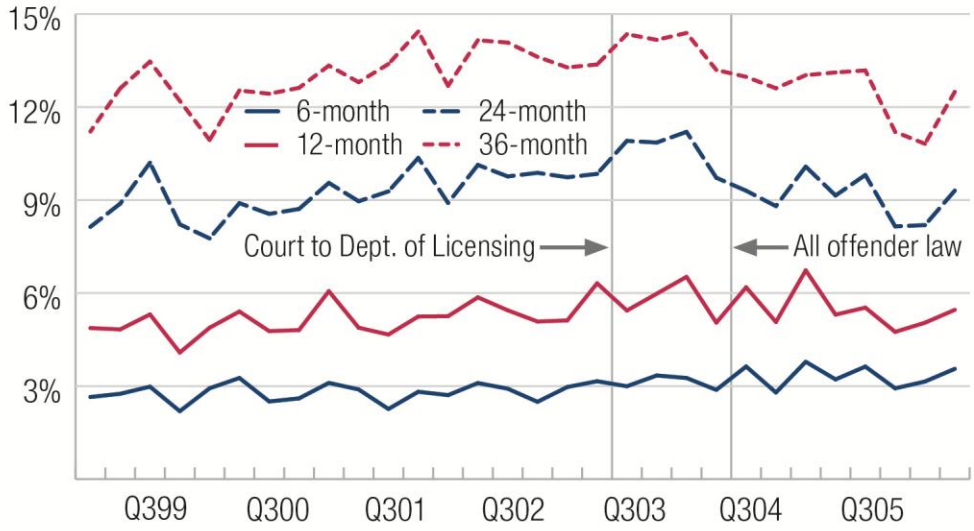

Figure 9. Trends in cumulative recidivism rate for first alcohol-related negligent driving convictions, by quarter of arrest, January 1999-June 2006

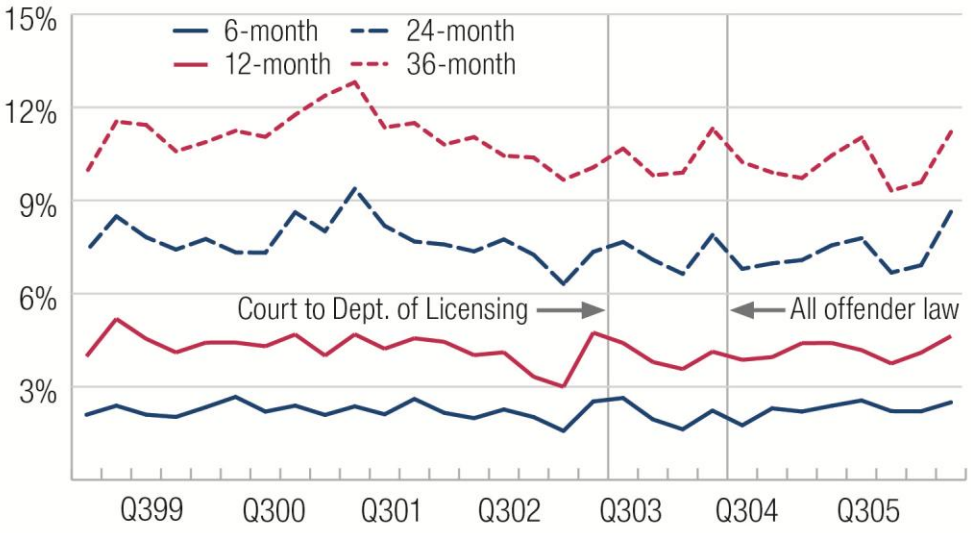

Figure 10. Trends in cumulative recidivism rate for all first DUI offenses, by quarter of arrest, January 1999-June 2006

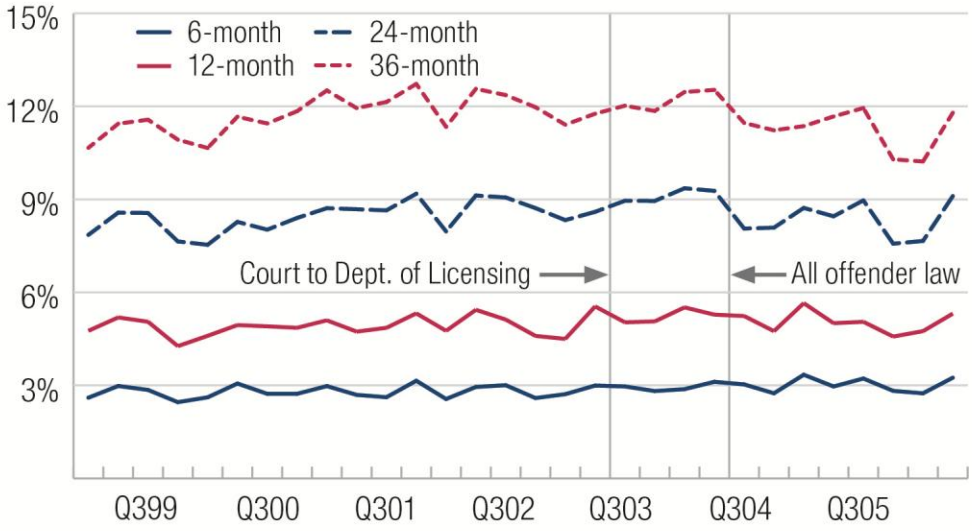

Figure 11. Predicted cumulative 2-year recidivism rate for first simple DUI convictions with and without 2004 law change, by quarter of arrest, January 1999-June 2006

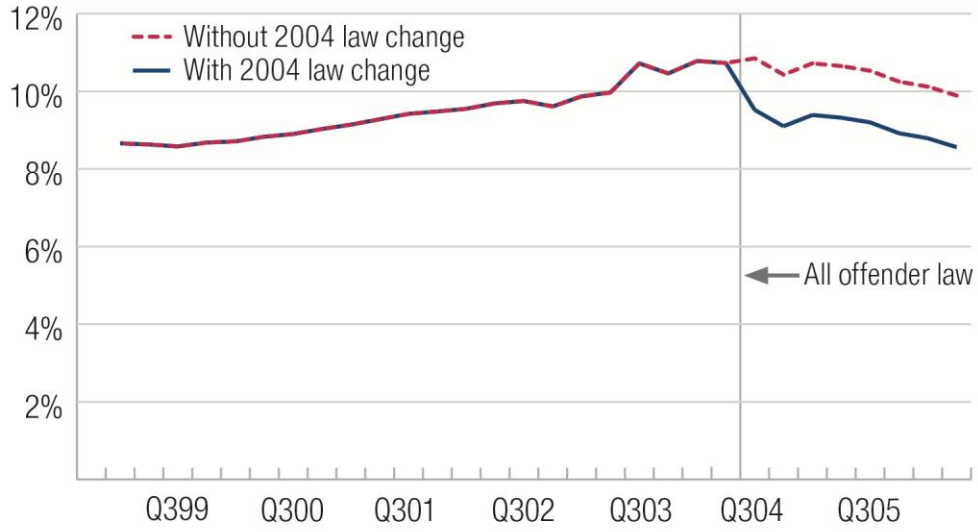

Figure 12. Number of police-reported single-vehicle and nighttime (9 p.m.-6 a.m.) crashes during 2001-07 in California, Oregon, and Washington, by quarter

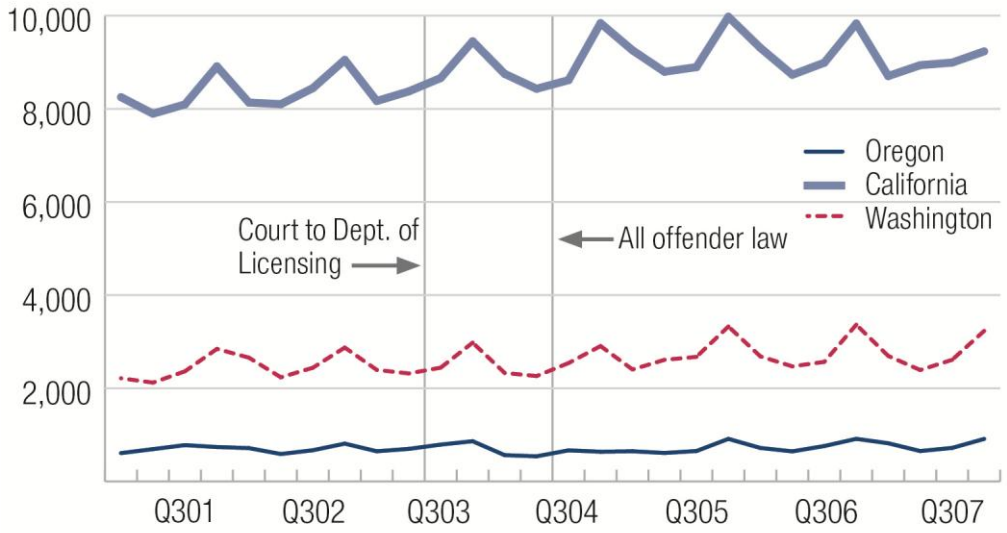

Figure 13. Percentage of police-reported crashes during 2001-07 in California, Oregon, and Washington that were single-vehicle and nighttime (9 p.m.-6 a.m.), by quarter

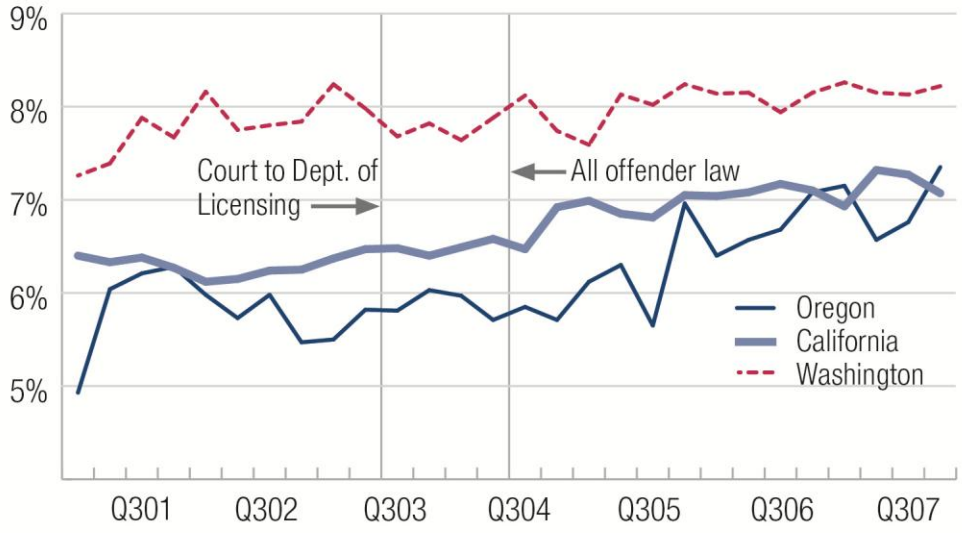

Figure 14. Predicted values from time series cross-sectional regression of log of deasonalized police-reported crashes during 2001-07 in California, Oregon, and Washington: percentage that were single-vehicle and nighttime (9 p.m.-6 a.m.)
, by quarter

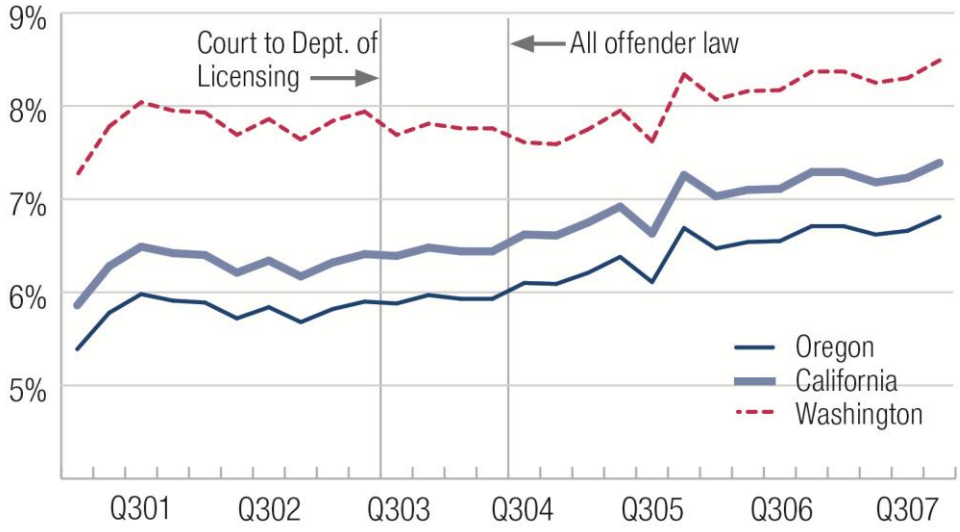

Figure 15. Number of single-vehicle and nighttime (9 p.m.-6 a.m.) fatal crashes during 2001-07 in California, Oregon, and Washington, by quarter

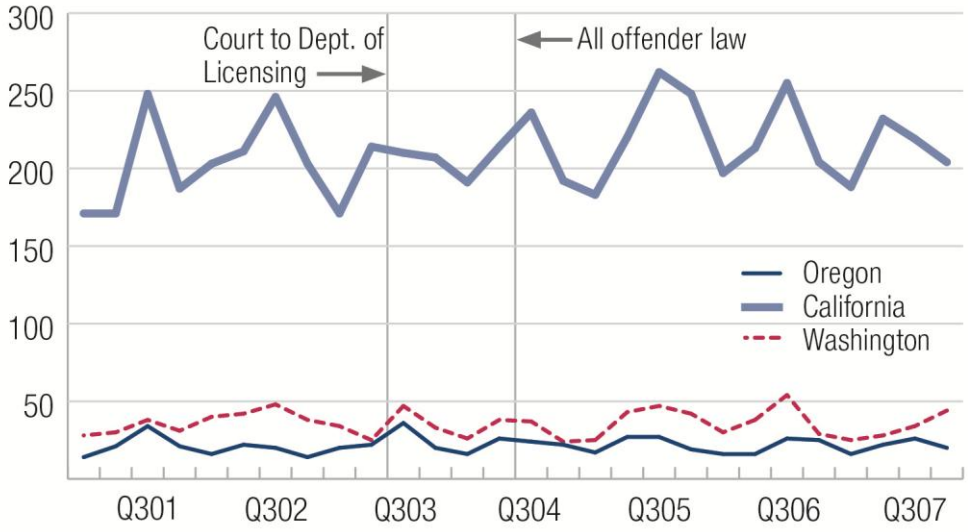

Figure 16. Predicted trends in fatal crashes during 2001-07 in California, Oregon, and Washington: percentage that were single-vehicle and nighttime (9 p.m.-6 a.m.), by quarter