An Evaluation of an Expansion of the Use of Ignition Interlock Devices through California Senate Bill 1046

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Abstract

California Senate Bill (SB) 1046 mandates that starting January 1, 2019, all persons convicted of a repeat driving-under-the-influence (DUI) offense as well as all persons convicted of an injury-involved DUI install an Ignition Interlock Device (IID) for a time period ranging from 12 to 48 months. The legislation also makes it possible for people to install an IID to avoid the preconviction revocation that typically occurs thirty days after an alcohol-impaired driving arrest. This report documents changes in IID installations and estimates the effects of IIDs on driving behavior and DUI recidivism outcomes before and after the implementation of SB 1046.

Our principal findings are the following:

- Alcohol related crashes, injuries and fatalities increase in the post-SB 1046 period relative to the pre-SB 1046 period. We observe a similar increase in fatality rates in the rest of the country.
- Total convictions among those arrested during the period spanning 2014 through 2023 declined in the post-SB 1046 period. This trend likely reflects an effect of the pandemic on the operations of courts throughout the state.
- Comparison of years before and after the implementation of SB 1046 reveals that IID installation rates among people arrested for DUI increased modestly. This aggregate pattern masks a more sizable increase in installation rates among arrests occurring in the 54 counties that were not part of an earlier pilot IID program that expired at the end of 2018 and a large decrease in installation rates in the four counties that were part of this earlier program.
- The pandemic dulled the effect of SB 1046 on installation rates by reducing conviction rates and making it difficult (at least early in the pandemic) to document installation and proof of insurance through an in-person visit to a DMV office.
- Installing an IID within two years of arrest reduces recidivism rates, whether measured by future DUI arrests, crashes, or crashes involving injury.
- The effect of installing an IID on future DUI arrests is greatest for people arrested for the first time. The effects on crashes and crashes with injuries are largest for people with priors.
- The impacts of SB 1046 on overall recidivism rates, although in the desired direction, are modest.
- Increasing IID installation rates among those arrested for a DUI would increase the effectiveness of policy requiring IID installations.

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Executive Summary

California Senate Bill (SB) 1046 mandates that starting January 1, 2019, all persons convicted of a repeat driving under the influence (DUI) offense, as well as all persons convicted of an injury-involved DUI offense, install an ignition interlock device (IID) for a time period ranging from 12 to 48 months. The legislation also makes it possible for people to install an IID to avoid the preconviction revocation that typically occurs thirty days after an alcohol-impaired driving arrest.

An IID is an individualized breathalyzer installed in one's vehicle that prevents a car from starting unless the driver's blood alcohol content (BAC) reading is below a set level (typically 0.02 grams per 100 mL). The device also requires periodic rolling retests to ensure that the driver does not drink after starting the vehicle and while driving.

This report documents changes in IID installations and estimates the effects of IIDs on driving behavior and DUI recidivism outcomes before and after the implementation of SB 1046. The analysis has three main components.

First, we provide a descriptive analysis that focuses on documenting key patterns regarding DUIs, crash, injury, and fatality trends, IID installations, and recidivism among drivers arrested for an alcohol-related offense.[1]

Second, we estimate the effect of installing an IID on new DUI arrests[2] crashes, and crashes

[1]California Vehicle Code Section (CVC) 23575.5 requires reporting of the following data elements pertaining to the evaluation of SB 1046

1. The number of individuals who were required to have a functioning, certified ignition interlock device installed as a result of the program who killed or injured anyone in a crash while they were operating a vehicle under the influence of alcohol.
2. The number of individuals who were required to have a functioning, certified ignition interlock device installed as a result of the program who were convicted of an alcohol-related violation of Section 23103, as specified in Section 23103.5, or Section 23140, 23152, or 23153, or Section 191.5 or subdivision (a) of Section 192.5 of the Penal Code during the term in which the person was required to have the ignition interlock device installed.
3. The number of injuries and deaths resulting from alcohol-related motor vehicle crashes between January 1, 2019, and January 1, 2024, inclusive, and during periods of similar duration prior to the implementation of the program.
4. The number of individuals who have been convicted more than one time for driving under the influence of alcohol between January 1, 2019, and January 1, 2024, inclusive, and periods of similar duration prior to the implementation of the program.
5. Any other information requested by the Transportation Agency to assess the effectiveness of the statewide ignition interlock device requirement in reducing recidivism for driving-under-the-influence violations.

The descriptive analysis in the executive summary provides these statistics along with additional results that help contextualize and interpret the results. For reference, item (1) above is present in the column of panel A in Table ES5 labeled "Alcohol involved injury crash" and "Alcohol involved fatal crash," item (2) above is provided in the fourth column of Panel A in Table ES5 , the elements of item (3) are provided in Table ES1, and item (4) is presented in Figure ES5. Item (5) encompasses the remaining results and analysis presented in this report. Note that some outcomes are available only with a long time lag, such as information on convictions, and therefore, in some instances, we used DUI arrests instead.

[2]In this report, a DUI arrest refers to acase where a person is arrested for a DUI and an administrative perse (APS) action is initiated. An APS action involves an automatic suspension triggered by a DUI arrest with the

involving injury within two years of the original arrest date. The analysis draws on the very large difference in IID installation trends between counties to calculate these estimates.

Third, we analyze the overall effectiveness of the policy in reducing DUI recidivism relative to the counterfactual where SB 1046 was not implemented. We also present projections of the potential efficacy of future versions of this policy under different IID installation rates. This executive summary provides a high-level synthesis of the findings.

General Trends in Alcohol-Related Crashes, Injuries, and Convictions

Table ES1 presents statewide annual totals for the period 2014 through 2023 for all crashes, alcohol-related crashes, fatalities and non-fatal injuries caused by alcohol-related crashes, fatalities and serious injuries caused by alcohol-related crashes, and two measures of the number of fatalities: alcohol-related fatalities as measured in the Statewide Integrated Traffic Records System (SWITRS) and annual fatalities reported in the National Highway Transportation Safety Administration Fatality Analysis Reporting System (FARS).[3] The provisions of SB 1046 apply to all DUI arrests with a date of January 1, 2019 or later. Hence, the period 2014 through 2018 corresponds to the pre-SB 1046 period, while the period from 2019 through 2023 corresponds to the postperiod.

Table ES1 reveals generally higher levels of alcohol-related crashes, injuries, and deaths in the post-SB 1046 period relative to the preperiod. Note that this increase occurs despite a sharp decline in the total number of crashes across the state that coincides with the onset of the pandemic.[4] While we see a decrease in 2020 for alcohol-related crashes and the overall number of injuries, the levels of these outcomes are higher in each of the years 2021, 2022, and 2023 relative to each of the values for the years 2014 through 2018. Similarly, while fatalities decline in 2019, they increase notably with the onset of the pandemic and remain at elevated levels in later years.[5]

While the table reveals generally worse outcomes in the post-SB 1046 period, one should not attribute this to SB1046 as we observe similar trends in other states. Although we do not have comparable data for most of the outcomes presented in the table for the remainder of the country, we can compare trends in alcohol-related crash fatalities in California to elsewhere in the country using the FARS data. Figure ES1 displays alcohol related crash fatalities per 100,000 state residents

suspension length dependent on the driver's history. We do not observe arrests where an APS action is not initiated (for example, an arrest for a drug DUI)

[3]The main difference between the two fatality estimates follows from the fact that the FARS data imputes blood alcohol levels for involved drivers where a BAC level is not reported by the states using other characteristics of the incident (for example, time of day). In addition, SWITRS data is continually updated as incident investigations are concluded and local agencies report data into the system. Hence, totals especially for fatalities in recent years, will change depending on the date that the data are queried. We include estimates from the FARS to facilitate comparison of California's recent trends with those of the rest of the nation.

[4]Over the period depicted, alcohol-related crashes as a percent of total crashes range from a low of 9.2 percent in 2017 to a high of 12.3 percent in 2021.

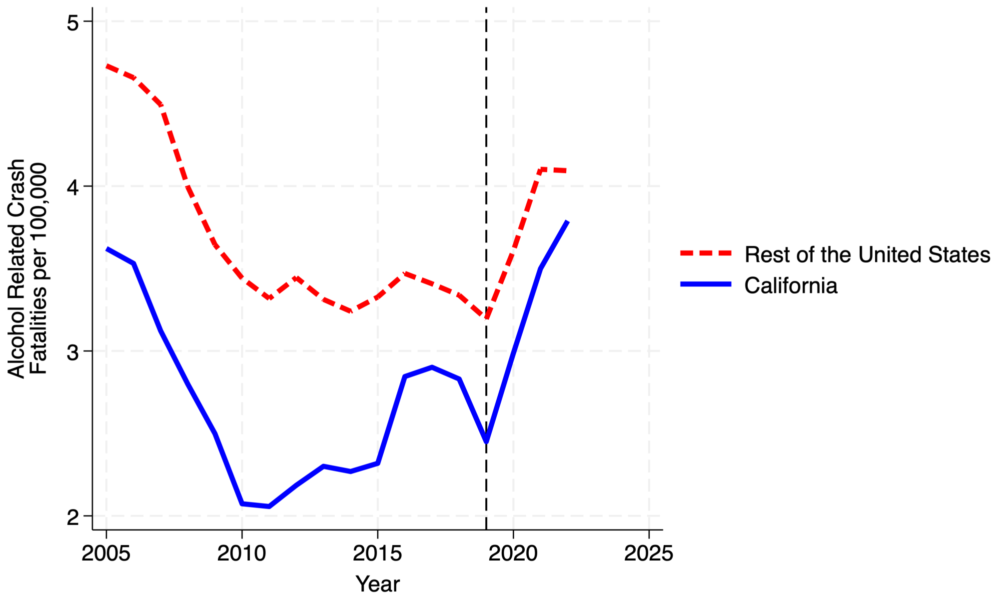
[5]The lower fatality value for 2023 in the SWITRS data likely reflects the fact that this is a preliminary total that will update when crash investigations are completed and the data elements are submitted to the state. Regarding the missing value for FARS data, these data files are currently publicly available through 2022.

Table ES1: **Annual Number of Crashes, Alcohol Involved Crashes and the Consequent Fatalities and Injuries, Fatalities and Serious Injuries, and Fatalities in California, 2014 through 2023**

Year	All crashes	Alcohol-involved crashes	All fatalities and injuries	Alcohol-involved fatalities and injuries	Alcohol-involved fatalities and serious injuries	Alcohol-involved fatalities	Alcohol-involved fatalities from the FARS data
2014	165,624	16,078	234,030	23,230	3,344	940	876
2015	181,837	16,995	257,996	24,574	3,481	917	902
2016	198,899	18,436	283,874	26,850	3,819	982	1,114
2017	197,146	18,155	281,064	26,591	4,014	1,050	1,141
2018	195,449	18,433	278,658	26,971	4,436	956	1,116
2019	190,649	18,468	272,768	26,922	4,434	929	966
2020	147,148	16,281	207,870	23,275	4,259	1,034	1,180
2021	162,036	19,850	229,586	28,695	5,115	1,166	1,370
2022	161,289	19,371	228,048	27,825	4,819	1,036	1,479
2023	163,071	18,774	229,941	27,283	4,412	938	-

Source: Transportation Injury Mapping System (TIMS) summary of California statewide crash and injury data from the Statewide Integrated Traffic Records System (SWITRS). Summary statistics accessed on December 5 2024. Fatalities from the Fatality Analysis Reporting System (FARS) files differ from those in the SWITRS data due to the imputation procedure used in FARS to impute whether alcohol was involved in fatalities where information pertaining to alcohol was not reported. FARS data are currently publicly available through 2022. The SWITRS data defines alcohol-involved incidents as those where the officer who filled out the crash report perceived that the party fell under one of the following categories: had been drinking, under influence; had been drinking, not under influence, or had been drinking, impairment unknown. This may or may not be determined with the help of a BAC measurement.

Figure ES1: **Alcohol Related Crash Fatalities per 100,000 State Residents for 2005 through 2022: California and the Remainder of the United States**



in California (the blue line) and for the remainder of the United States (the red dashed line) for each year from 2005 through 2022. The figure reveals several patterns. First, the fatality rate is lower in California each year. Second, the trends for California between 2014 and 2022 are fairly similar to what is observed in the remainder of the nation. That is, fatality rates decline in 2019 and then increase sharply in subsequent years both in California and other states.

Table ES2 presents annual totals for DUI convictions for persons arrested at any time between 2014 and 2023.[6] The table presents total convictions, as well as convictions for first, second, third, or fourth or higher offenses. In contrast to trends in crashes, injuries, and fatalities, convictions are generally higher in the pre-period years compared to the post-period years, with the lowest conviction levels for all years occurring in 2020.[7]

The decline in conviction totals most likely reflects the onset of the COVID pandemic. On March 4, 2020, 14 months after the implementation of SB1046, the state of California declared a state of emergency due to COVID-19. Most state and local government services went from in person to online, and life in general was greatly interrupted.

The pandemic impacted the operations of courts throughout the state in a manner that resulted in lower conviction rates in DUI cases holding constant time since arrest. To illustrate this fact,

[6]Specifically, the table totals convictions for CVC 23152, CVC 23153, and section 191.5 of the California Penal Code.

[7]Note, the low conviction levels in 2014 are due to the fact that the data extract used for this project is restricted to people arrested for a DUI in 2014 or later and thus we can only observe convictions for these persons – i.e., we do not observe convictions for people arrested prior to 2014 but convicted 2014 or later. In the main report, we find that nearly all people who are convicted are convicted within two years. Hence, this aspect of the data extract likely has little effect on conviction totals for later years.

Table ES2: **Annual Number of DUI Convictions in California Among Those Arrested for a DUI 2014 or Later: All, First, Second, Third, and Fourth or More Alcohol Related Conviction**

Year	All convictions	First	Second	Third	Fourth plus
2014	62,212	42,725	12,992	4,103	2,392
2015	90,333	60,703	19,352	6,515	3,763
2016	84,392	56,500	17,957	6,298	3,637
2017	80,006	53,619	16,968	5,900	3,519
2018	81,742	54,414	17,564	6,116	3,648
2019	80,367	53,406	17,258	6,077	3,626
2020	47,266	30,673	10,411	3,893	2,289
2021	63,397	40,980	14,090	5,186	3,141
2022	70,991	46,753	15,340	5,543	3,355
2023	67,887	44,644	14,440	5,326	3,477

Authors' tabulations from the Driver Record Master File.

Figure ES2 shows the percentage of DUI arrests that result in a conviction within two years by month of arrest. Note, since the figure depicts the percentage of DUI arrests where conviction occurs within two years, conviction rates for arrests occurring prior to March 2018 (24 months before the stay-at-home order) should not be impacted by the pandemic; arrests occurring between March 2018 and March 2020 have a two-year follow-up period extending into the pandemic, while arrests occurring March 2020 or later have their post-arrest observation windows occurring entirely after implementation of the stay-at-home order.

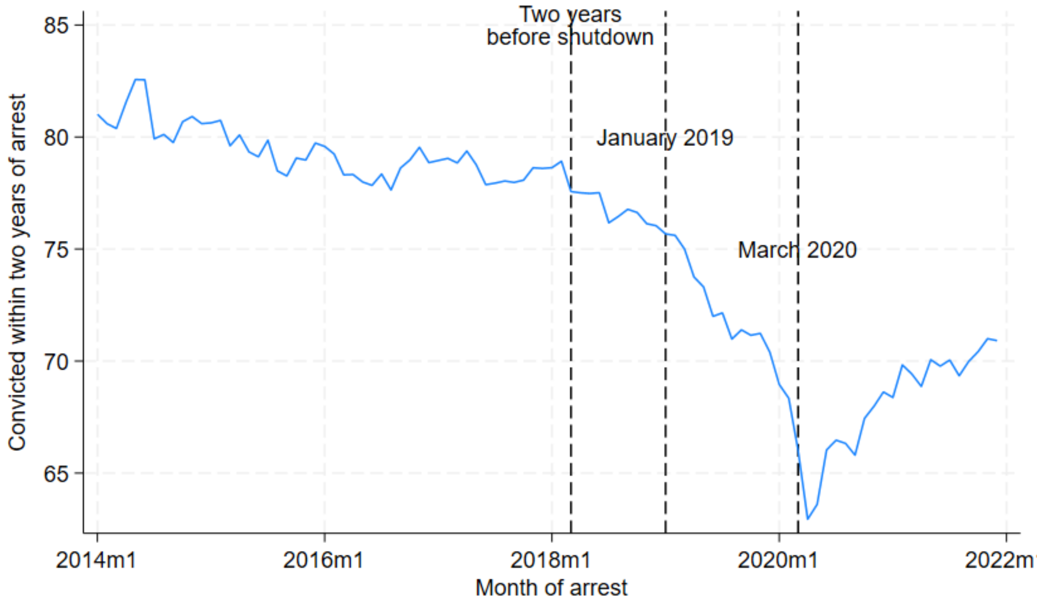
Although conviction rates exhibit a slight downward trend in the months where the two-year follow-up period does not extend into the pandemic (everything to the left of March 2018), we observe steep declines in conviction rates once we reach March 2018 (the first month where some arrests have a two-year post-arrest period extending beyond the pandemic stay-at-home order). By the time SB 1046 is implemented in January 2019 (fourteen months before the stay-at-home order), the two-year conviction rates are already trending downward, likely due to the impact of the pandemic on case dispositions. Two-year conviction rates hit a low in April 2020 and recover somewhat over the next few years.

Data from the California Judicial Council[8] corroborate what we observe in the data from the Driver Master File Records of the Department of Motor Vehicles (DMV) used to generate Figure ES2. Figure ES3 displays annual statewide court filings, dispositions, and dispositions as a percent of court filings for misdemeanor traffic offenses[9] for fiscal years 2014 through 2023. Filings and dispositions are trending downward even before the pandemic. We see record low filings in 2020 through 2022, coincident with the increase in alcohol-related traffic fatalities (documented in Table

[8] The Judicial Council of California Data Dashboard, accessed on August 22, 2024

[9] Note, most DUI arrests and cases fall in this category.

Figure ES2: **Percent of DUI Arrests Resulting in a Conviction Within Two-Year by Month of Arrest Relative to March 2020**

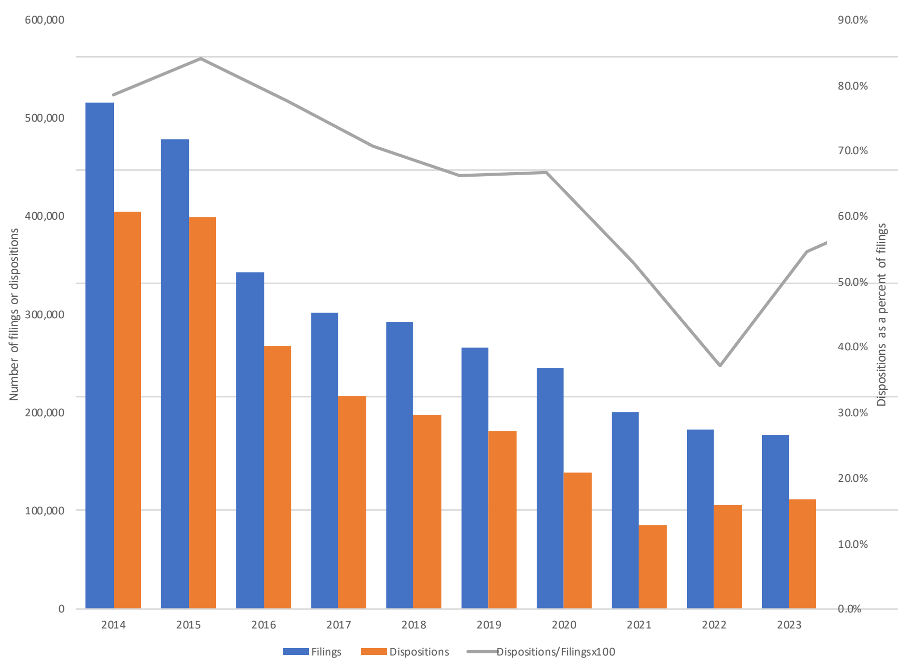


ES1). Consistent with the decline in two-year conviction rates seen in Figure ES2, the Judicial Council data shows sharp declines in dispositions relative to filings with the onset of the pandemic. This percentage decreases from 68.3 percent in 2019 to 56.4 and 42.7 percent in 2020 and 2021, respectively. By 2023, dispositions relative to filings partially recover, increasing from the pandemic low in fiscal year 2021 to 63.0 percent in fiscal year 2023.

To summarize,this sub-section documents the following:

- Alcohol related crashes, injuries and fatalities increase in the post-SB 1046 period relative to the pre-SB 1046 period.
- We observe a similar increase in fatality rates in the rest of the country.
- Total convictions among those arrested during the period spanning 2014 though 2023 decline in the post-SB 20146 period.
- Two-year conviction rates for DUI offenses decline sharply in a manner indicating that the disruption caused by the pandemic reduced convictions rates.
- Court records from the Judicial Council of California clearly show a decline in both filings for misdemeanor traffic offenses as well as disposition rates for these offenses coinciding in time with the onset of the pandemic.

Figure ES3: **California Statewide Misdemeanor Traffic Filings and Dispositions, FY2014 through FY2023**



The Judicial Council of California Data Dashboard, accessed on August 22, 2024.

Trends in IID Installation

The impact of S 1046 on IID installations operates through two channels. First, the legislation mandates IID installation for specific time periods as a pre-condition to restoration of driving privileges for a subset of DUI offense convictions. Second, the law creates an incentive for those arrested for a DUI to install an IID before being convicted.

Regarding the first channel, individuals convicted for a DUI involving an injury as well as individuals convicted of a DUI with prior alcohol related convictions (e.g., prior DUIs, reckless driving involving alcohol) are required to install an IID for specified periods of time as a precondition to full restoration of driving privileges. This requirement is tied to the date of arrest and applies to all arrests occurring on January 1, 2019 or later. Regarding the second channel, SB 1046 created a restricted license option by which by installing an IID in their vehicle the arrested person can avoid any pre-conviction license suspension and can drive without restrictions on time or location.[10]

Before the implementation of SB 1046, some individuals were required to install IIDs in their vehicles. First, judges had, and still have, the discretion to require the installation of an IID based on the specifics of the offense and the person's history.

Second, there were several classes of offenses in which a conviction led to a mandatory IID installation requirement. Since 1993, California has required mandatory IIDs for repeat offenders and since 1999 for people arrested for driving on a DUI-suspended license.

Third, there was a universal requirement in four counties (Alameda, Los Angeles, Sacramento, and Tulare) requiring that IIDs be installed for a set period of time for any DUI conviction, regardless of one's history. Specifically, in 2009 the state legislature passed Assembly Bill (AB) 91 creating a four-county pilot program to be implemented from July 1, 2010 through the end of calendar year 2016. The pilot required IID installation for all individuals arrested and convicted of a DUI within one of the four AB 91 counties (with or without injury and with and without priors) as a prerequisite for obtaining a restricted, reissued, or reinstated driver's licenses. SB 1046 authorized the extension of the four-county program through the end of 2018, after which the four counties would be subject to the requirements of SB 1046.

[10] Indeed, we see that the time between the violation date and the date that an IID is installed shortens with the implementation of SB 1046 among those who install within two years, an indicator that after the implementation of SB 1046 people are installing IIDs earlier and making use of this new option to avoid the APS suspension. For example, we observe seven percent of installations occurring within thirty days of the violation date after SB1046 is implemented, compared with 0.36 percent before. We also observe a decline in the median number of months between the violation and installation date from nine months in the pre-SB 1046 period to six months in the post period. Moreover, 36 percent of IID installations occur pre-conviction after SB 1046 is implemented, compared with less than one percent of installations in the pre-period. One might hypothesize that the ability to avoid the APS suspension, a tool often seen as an effective element of California's DUI countermeasure system, may lead to an increases in post-arrest DUIs and related crashes, as drivers will experience shorter pre-conviction suspensions or possibly none at all. That being said, the devices are designed to prevent drinking and driving, and to the extent that they do so they provide a substitute for a hard suspension. Below we devote much effort to estimating the overall effect of SB 1046 on recidivism outcomes operating through the various channel and find a net reduction in recidivism outcomes. However, this does not rule out the possibility that the various elements of SB 1046 may have opposing impacts on recidivism.

Table ES3: **Percent of DUI Arrests where an IID is Installed Within Two Years: All Arrests and Arrests with No, One, Two, or Three or More Prior Alcohol Related Convictions**

Year	All arrests	No priors	One prior	Two priors	Three plus priors
2014	13.2	11.9	18.4	14.9	7.5
2015	12.5	11.1	17.6	14.3	7.8
2016	12.1	10.6	17.5	15.5	7.4
2017	12.0	10.5	17.2	15.0	8.0
2018	11.4	9.7	17.1	14.0	7.2
2019	16.9	15.5	23.0	18.9	9.8
2020	13.6	11.7	19.8	16.6	9.5
2021	14.5	12.4	21.6	18.1	9.4

Authors' tabulations from the Drivers Master File Records.

Table ES3 documents the percent of DUI arrests where an IID is installed within two years of the arrest for calendar years 2014 through 2021.[11] The table presents installation rates for all DUI arrests, for people arrested with no prior convictions, and for people arrested who have one, two, or three or more prior convictions.

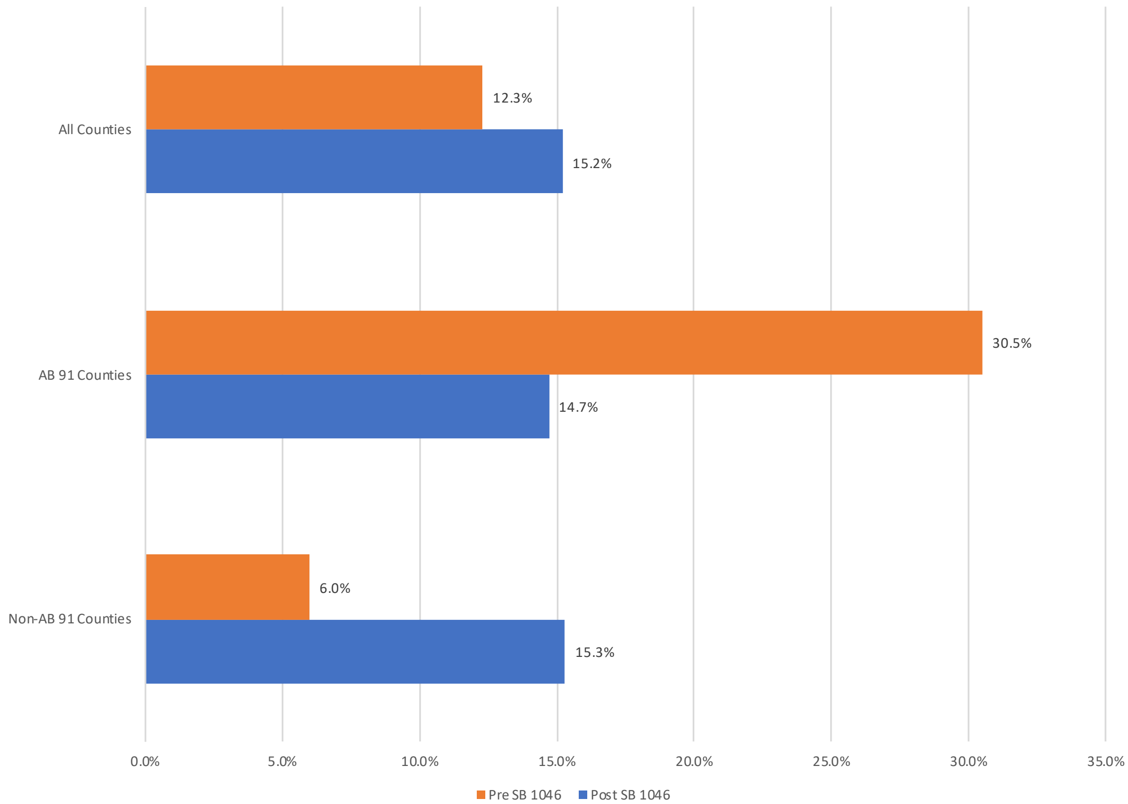
There are modest increases in the percentage of arrests where an IID is installed within two years. In the pre-period, the percentage is trending downward from 13.2 percent in 2014 to 11.4 percent in 2018. The installation rate jumps in 2019 to 16.9 percent, then declines to levels slightly above what we observe in the pre-period. We observe greater increases among arrests where the driver in question has previous DUI convictions. However, for all groups the increases are modest.

The relatively small increases in installation rates are driven by several factors, with a key factor being a difference in the effect of SB1046 on the four AB 91 counties relative to the non-AB 91 counties. The AB 91 pilot required mandatory installation for all DUI convictions while SB 1046 required mandatory installation for convictions where there is an injury or where the driver has priors. The expiration of the AB 91 pilot in conjunction with the provision of SB 1046 meant that in the four AB 91 counties, people convicted of first-time, non-injury offenses were no longer subject to mandatory installation requirement (although these individuals could opt to install an IID to avoid the APS suspension).

Figure ES4 displays the percentage of arrests where an IID is installed during the pre-SB 1046 period (2014 through 2018) and the post-SB 1046 period (2018 through 2021) for arrests in all counties combined, arrests occurring in the four AB 91 pilot counties, and for arrests occurring in the remaining 54 counties that were not part of the AB 91 pilot. The figure demonstrates modest overall increases in installation rates for all counties combined, from 12.3 to 15.2 percent installing an IID within two years. In AB 91 counties, however, the figure documents a sizable decrease in

[11]Since the figure tabulates installation rates within the two-year period following arrest and the data ends in calendar year 2023, we cannot calculate these figures for 2022 and 2023.

Figure ES4: **Percent of DUI Arrests Where an IID is Installed Within Two Years of Arrest Occurring Before (2014 through 2018) and After (2019 through 2021) Implementation of SB 1046: All Counties, AB 91 Counties, and Non-AB 91 Counties**



installation rates. In the preperiod nearly one third (30.5 percent) of DUI arrests result in an IID installation within two years. This declines to 14.7 percent following the expiration of the AB 91 pilot and the implementation of SB 1046. For the remaining 54 counties, two-year installation rates increase from 6 percent in the pre-period to 15.3 percent in the post-period.

Table ES4 documents comparable changes in the percent installing an IID within two years for first-time offenses without injury, first-time offenses involving an injury, and people arrested for a repeat offense (the offense categories specified in SB 1046). The table documents the largest decline in installation rates for first-time offenders in AB 91 counties (a decline of approximately 20 percentage points). We also observed pre-post SB 1046 declines in installation rates in the AB 91 counties for those arrested for a first time where the violation involves an injury (a decline of approximately 17 percentage points) and for repeat offenders (a decline of roughly 7 percentage points). Among the 54 non-AB 91 counties, two-year installation rates increase for all groups, with

Table ES4: **Percent of Arrests Where an IID is Installed Within Two Years of Arrest Between Non-AB 91 and AB 91 Counties: All and by Offense Group**

Panel A: All Offense Groups Combined			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	6.02%	15.28%	9.26%[a]
AB 91 counties	30.55%	14.75%	−15.80%[a]
Difference	−24.52%[a]	0.53%[a]	25.06%[a]
Panel B: No priors, no injuries			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	2.83%	13.22%	10.39%[a]
AB 91 counties	33.01%	13.37%	−19.64%[a]
Difference	30.17%[a]	-0.15%	30.32%[a]
Panel C: No priors, injury			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	3.35%	14.64%	11.29%[a]
AB 91 counties	31.28%	14.61%	−16.67[a]
Difference	27.92% [a]	0.03%	27.95%[a]
Panel C: Priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	12.85%	19.29%	6.44%[a]
AB 91 counties	24.69%	17.81%	−6.88%[a]
Difference	−11.84%[a]	1.47%[a]	13.31%[a]

a. Difference statistically significant at the one percent level of confidence.

increases of 10 percentage points, 11 percentage points, and 6.4 percentage points for first-time offenses without injury, first-time offense involving injury, and repeat offenses, respectively.

In the main text, we document the fact that installation rates were uniformly higher in the four AB 91 counties prior to the implementation of SB 1046. In other words, the relatively high average installation rate for these counties is not an artifact of a high rate in one of the counties that participated in the early pilot. In the post-period, the installation rates for these four counties are distributed throughout the distribution for all counties, with Alameda having one of the lowest installation rates, Tulare and Los Angeles being somewhere near the center, and Sacramento having a relatively high installation rate (yet no where near the highest as was the case in the pre-period). In addition, we document the fact that installation rates increased in each of the 54 non-AB 91 counties and decreased in each of the four AB 91 pilot counties (see Figures 6 through 8 in the main text).

Beyond the expiration of the AB 91 pilot, there are other factors that may have tempered the effect of SB 1046 on overall IID installation rates, mostly having to do with the pandemic. First, a mandatory installation requires both specific offense characteristics and an actual conviction. We have already documented a decline in two-year conviction rates driven by the pandemic, a factor that must certainly have reduced installation levels relative to what they would have otherwise been.

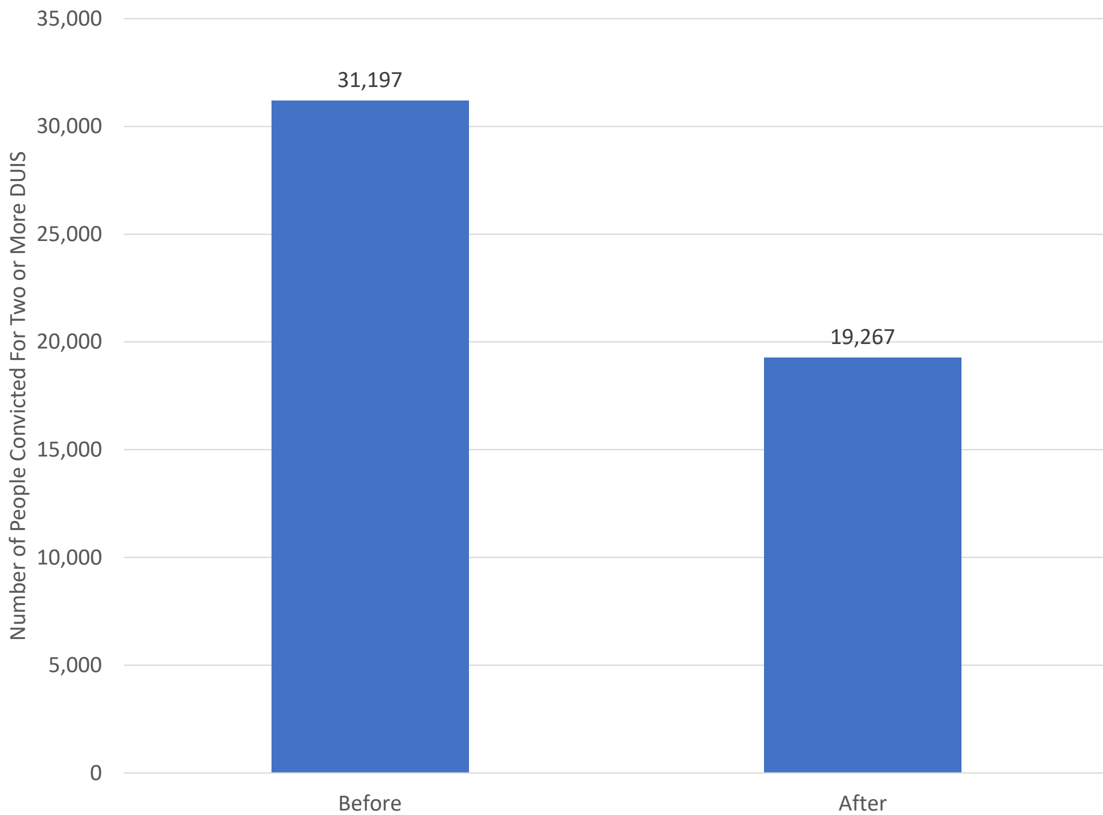
Second, obtaining an IID-restricted drivers license requires in-person presentation at a DMV office of proof of device installation and proof of insurance coverage. The shuttering of the DMV offices must have prevented some people arrested for DUI offenses from doing so.

Finally, with most non-essential workers staying at home during the early periods of the pandemic, the benefits of installing an IID to avoid an APS suspension may have been diminished during this time.

To summarize, this sub-section documents the following:

- Comparison of the years before and after the implementation of SB 1046 reveals that IID installation rates among persons arrested for a DUI increased modestly.
- The modest increase statewide masks a more sizable increase in installation rates among arrests occurring in the 54 counties that were not part of the earlier AB 91 pilot and a large decrease in installation rates in the four counties that were part of the earlier pilot.
- The pandemic dulled the effect of SB 1046 on installation rates by reducing conviction rates and making it difficult (at least early in the pandemic) to document installation and proof of insurance through an in-person visit to a DMV office.

Figure ES5: **Number of Persons Convicted of Two or More DUIs Before (2014 through 2018) and After (2019 through 2023) the Implementation of SB 1046**



Recidivism Outcomes Among People Required to Install an IID and Not Required to Install an IID Under the Provisions of SB 1046

California Vehicle Code (CVC) 23575.5 requires that this report document the number of persons convicted two or more times for a DUI during the period 2019 through 2023 as well as the comparable estimate for a period of comparable length preceding the implementation of SB 1046. The report must also report estimates of the total number of persons required under the provisions of SB 1046 to install an IID who recidivate. In this subsection, we present these tabulations.

Figure ES5 presents the number of people who have been convicted of two or more DUI offenses in the period 2014 through 2018 (labeled before) and the period 2019 through 2023 (labeled after). The figure declines from 31,197 in the preperiod to 19,267 in the postperiod. We caution against drawing conclusions pertaining to recidivism from these tabulations for several reasons. First, we have already documented the declines in misdemeanor traffic offense filings, disposition rates, and two-year convictions rates for DUI offenses, all occurring against the background of an increase in alcohol-related traffic fatalities. This pattern strongly indicates that a decline in the likelihood of being convicted for those who are arrested contributed to the observed decline in multiple convictions in Figure ES5. Second, the conviction data are reported with a delay from the counties to the DMV. Hence, conviction records in 2023 and perhaps even earlier may be incomplete as of the date of extraction for the records used in this report.

Regarding recidivism measures for those required to install an IID under the provisions of SB 1046, Table ES5 presents these tabulations. We define people who are required to install an IID under the provisions of the law as those who are arrested 2019 or later and who are convicted of a DUI with injury or convicted of a DUI and who have priors. In panel A of the table, we first present the total number of arrests that meet these criteria, the number that install an IID within two years, the number arrested for a subsequent DUI, the number involved in a car crash, the number involved in a crash where police indicate that alcohol is involved, the number involved in a crash where someone is injured, injuries that are alcohol-involved, the number involved in a crash involving a fatality, and finally the number of such fatalities where the investigation indicates that alcohol is involved. Panel B presents these outcomes expressed as a percentage of the total number of persons required. Finally, panels C and D present comparable tabulations for DUI arrests where the person is not required under the provisions of SB 1046 to install an IID (either because they were convicted of a first offense or were not convicted of the focal offense). We report totals by year for 2019, 2020, and 2021. We do not report results for later years, as the recidivism outcomes require two years of post-arrest observation, and our data ends in December 2023.[12]

The annual totals of people who are eventually required to install an IID to restore their driving privileges range from 20,088 to 26,209. These numbers are likely below what they will be in the future given the effect of the pandemic on convictions. Approximately 25 to 27 percent of these individuals install an IID within two years of arrest (see panel B). In terms of recidivism outcomes, 10 to 12 percent are re-arrested for a new DUI within two years, approximately seven to nine percent are involved in a crash within two years, three to four percent are involved in a crash involving an injury, and less than 0.2 percent are involved in a crash with a fatality.[13] Within crash categories (i.e., all crashes, injury crashes, fatal crashes), the number of crashes where alcohol is noted as a factor is generally less than the total crashes, though fatal alcohol-involved crashes are closer to the total number of fatal crashes for this group.[14]

[12]For cells where the count is fewer than 50 instances, we do not report a total. Our IRB approval for analysis of the data was conditioned on our not reported results for cells with fewer than 50 observations.

[13]The actual rate is considerably lower than 0.2 percent, which is roughly 50 observations (our cell size limit) divided by the annual number required to install an IID. Although we cannot report the actual number or percentages, the fatal crash figures for people required to install an IID are lower relative to those who are not required to do.

[14]Information on whether crashes are alcohol-involved is incomplete for several reasons. First, there are two main sources of crash reports to the DMV: crashes reported by the police and crashes reported by individual and their insurance companies in compliance with a California Financial Responsibility law, with the two sets of reports

The numbers of DUI arrests where the arrested person is not required to install an IID (either because the person is not convicted or because of the characteristics of the offense or their conviction history) are higher, ranging from approximately 73,000 in 2020 to 93,000 in 2019. IID installation rates are also much lower for this group, ranging from 10.6 to 14.1 percent. The percentages arrested within two years for another DUI offense are only slightly lower for this group relative to the individuals required, and the percentages involved in a subsequent crash and/or a crash with injury are slightly higher. In addition, the annual percentages of these drivers involved in crashes with and without an injury or death are higher relative to the comparable percentages for those who are required to install an IID.

To be sure, these descriptive statistics simply lay out facts pertaining to average recidivism outcomes for those required and not required by SB 1046 to install an IID and the differences in outcomes between these two groups should not be interpreted as a causal effect of being subjected to the requirement. In the following section, we layout how we estimate the causal effects of installing an IID and present a summary of the findings of this analysis.

To summarize, this sub-section documents the following:

- The number of persons convicted of two or more DUI's is lower during the five-year period following the implementation of SB 1046 relative to the five-year period preceding the implementation. We caution against drawing conclusions from this tabulation given the decline in convictions associated with the pandemic and the likely incompleteness of conviction data for the last several years.

- Most DUI arrests do not ultimately result in the requirement of a required IID installation prior to the restoration of privileges. Among those that are required, more than a quarter install IIDs, and a sizable minority are arrested for a DUI within two years of the original arrest. Subsequent crashes are also common, though they occur for less than ten percent. There are incidents where required persons are involved in crashes where a fatality occurs, though this is relatively rare.

- Among those who are not required to install an IID under SB 1046, installation rates are lower, though not zero. Although DUI recidivism is relatively lower among this group, they are slightly more likely to be involved in a crash, a crash with an injury, and crashes that involve a death.

sometimes overlapping. Only crashes reported by law enforcement contain information on the sobriety of involved drivers (with roughly 60 percent of crashes having either a police report or both a police report as well as a financial responsibility report). Second, even among crashes reported by police, information on alcohol involvement is likely to be incomplete. This may be due to lags in the completion of investigations, or failure to administer field sobriety checks or measure BAC levels following each and every crash, or failure of individual law enforcement agencies to report complete information to the California Highway Patrol. In fact, federal tabulations pertaining to the number of alcohol-involved traffic fatalities statistically impute whether alcohol is involved for fatalities where localities do not report information about whether one of the drivers was drinking due to incomplete information on whether alcohol was a factor.

Table ES5: **Two-Year IID Installation and Recidivism Outcomes by Year for People Required to Install an IID and People not Required to Install an IID under SB 1046**

Panel A: Two-year installation and recidivism outcome counts among people required to install an IID under SB 1046

Year	Total	Installed IID	DUI	Crash	Alcohol involved crash	Injury crash	Alcohol involved injury crash	Fatal crash	Alcohol involved fatal crash
2019	26,209	7,089	2,698	1,840	484	800	311	< 50	< 50
2020	20,088	4,934	2,365	1,747	422	804	327	< 50	< 50
2021	22,565	5,826	2,519	1,779	433	864	344	< 50	< 50

Panel B: Two-year installation and recidivism outcome percentages among people required to install an IID under SB 1046

Year	Total	Installed IID	DUI	Crash	Alcohol involved crash	Injury crash	Alcohol involved injury crash	Fatal crash	Alcohol involved fatal crash
2019	100.00	27.05	10.29	7.02	1.85	3.05	1.19	< 0.2	< 0.2
2020	100.00	24.56	11.77	8.70	2.10	4.00	1.63	< 0.2	< 0.2
2021	100.00	25.82	11.16	7.88	1.92	3.83	1.52	< 0.2	< 0.2

Panel C: Two-year installation and recidivism outcome counts among people not required to install an IID under SB 1046

Year	Total	Installed IID	DUI	Crash	Alcohol involved crash	Injury crash	Alcohol involved injury crash	Fatal crash	Alcohol involved fatal crash
2019	93,388	13,181	7,877	7,428	1,555	3,364	1,025	121	52
2020	72,683	7,716	7,530	6,941	1,565	3,324	1,132	131	55
2021	81,478	9,219	7,723	7,200	1,660	3,385	1,110	133	< 50

Panel D: Two-year installation and recidivism outcome percentages among people not required to install an IID under SB 1046

Year	Total	Installed IID	DUI	Crash	Alcohol involved crash	Injury crash	Alcohol involved injury crash	Fatal crash	Alcohol involved fatal crash
2019	100.00	14.11	8.43	7.95	1.67	3.60	1.10	0.13	0.06
2020	100.00	10.62	10.36	9.55	2.15	4.57	1.56	0.18	0.08
2021	100.00	11.31	9.48	8.84	2.04	4.15	1.36	0.16	< 0.06

The Effects of IID Installation on Recidivism Outcomes

A primary objective of this study is to assess whether the installation of an IID reduces the likelihood of future DUI arrests and other measures of recidivism. It is certainly the case that a simple comparison of recidivism outcomes among persons who install an IID to those who do not reveals lower recidivism outcomes among installers relative to non-installers, a fact we document in Table ES6. Panel A presents counts by year for those who install an IID within two years of arrest for the recidivism outcomes we discuss in Table ES5, while panel B presents the corresponding percentages.[15] Panels C and D present similar tabulations for cases where the person does not install an IID within two years of being arrested. Focusing on the percentage panels (panels B and D), we observe future DUI arrest rates for those who install an IID that are less than one-quarter the comparable rates for people who do not install IIDs. Moreover, for all crash outcomes in the tables, we observe markedly lower recidivism rates among people who install an IID within two years of arrest compared to those who do not.[16]

Of course, we cannot infer from the differences in recidivism in Table ES6 that the installation of an IID causes these declines in recidivism. There are likely many differences between those who install an IID and those who do not. For example, those who install an IID may be more intrinsically motivated to not drink and drive, with the installation of an IID an outward manifestation of this intrinsic motivation. In other words, installers may be inherently different from non-installers and have lower recidivism rates due to these inherent differences rather than due to the presence of an IID in their vehicle. Inferring that the differences in Table ES6 are due to the IIDs would probably erroneously over-attribute credit to the devices.

Addressing this likely selection bias in who installs an IID is a key challenge that our methodological strategy must address. An additional challenge concerns the strong trends in conviction rates, alcohol related crashes, and alcohol related crashes involving injury that likely reflect behavioral changes associated with the pandemic. While the timing of SB 1046 and the COVID pandemic is not perfectly aligned (SB 1046 was implemented in 2019 while the pandemic began in early 2020), most of the post-SB 1046 period coincides with the timing of the pandemic. Above we documented that in California and the rest of the United States alcohol-related traffic fatalities increased during the first few years of the p andemic. Simple before-after comparisons of recidivism outcomes in California that do not account for these nationwide trends would create a misleading impression concerning the effect of the SB 1046 on recidivism.

To address these methodological challenges, we employ a quasi-experimental research strategy to calculate the effect of installing an IID on the likelihood that persons arrested for a DUI

[15] Note, the persons described in the first two panels are those for whom we observe any installation of an IID during the two-year follow up period regardless of the length of installation. Moreover, the adverse outcomes listed in the table may or may not have occurred for these people while an IID was installed.

[16] While our cell-size reporting restriction prevents us from reporting the exact number of fatal crashes and the percentage involved in a fatal crash among those who install an IID, these values are indeed lower for drivers who install an IID relative to those who do not.

recidivate within two years of their violation date. Our strategy isolates and utilizes the variation in whether someone installs an IID that is policy-induced rather than driven by broader trends or differences in intrinsic motivation and other unobservable personal characteristics.

Our strategy exploits the natural experiment created by the very large differences in the changes in installation rates between counties that we documented in Figures ES4. Specifically, we observe sizable and opposite-signed changes in IID installation trends for AB 91 counties and non-AB 91 counties. Both county groups were subjected to the same larger forces influencing DUI outcomes in the state and the nation. Studying the relative changes in installation rates and the corresponding relative changes in recidivism rates permits estimation of the effects of installation rates on recidivism that accounts for both unobserved personal factors as well as the broader forces that impact outcomes in the postperiod relative to the preperiod.

Reconsideration of the patterns in Figure ES4 is helpful in understanding the estimation strategy. The figure documents a pre-post SB 1046 increase in IID installation rates of 9.3 percentage points in the 54 non-AB 91 counties. In contrast, IID installation rates in the four AB 91 counties decline by 15.8 percentage points. Taken together, installation rates in the non-AB 91 counties increase by 25.1 percentage points relative to the change observed in the AB 91 counties. All counties in the state experienced the pandemic and were subjected to all of the regional forces (e.g., changes in enforcement, lower case disposition rates, shifts in risky behaviors) that impacted recidivism outcomes throughout the state in the post-SB1046 period relative to the pre-SB1046 period. The key difference between these county groups, however is the relative change in the likelihood that a DUI arrest results in an IID installation, a pattern drive by changes in policy. To the extent that installing an IID impacts recidivism, we should observe a relative decline in recidivism rates for arrests made in the 54 non-AB 91 counties relative to arrests made in the four AB-91 counties. We use multivariate statistical methods to test for such relative changes in recidivism rates and a method known as two-stage-least-squares estimation to calculate the effect of installing an IID on recidivism outcomes.[17]

Figure ES6 displays our estimates of the percent reduction in three recidivism outcomes caused by the installation of an IID. All recidivism outcomes relate to recidivism events observed within two years of being arrested for a DUI offense.[18] Our calculations indicate that installing an

[17]To be specific, the conversation here describes a difference-in-difference analysis that estimates the relative pre-post change in recidivism outcomes in non-AB 91 counties relative to AB 91 counties. We use various methods to control for possible differences between the two county group in the types of arrests that are made in the pre and post period in each group. These include controlling for offense history, gender and the age of the driver, as well as allowing for county-specific differences in recidivism outcomes. We also present results using a sample where each arrest in an AB91 county is matched to arrests in a non-AB 91 county based on observable history, demographics of the arrested person, and the highest BAC reading taken at arrest. To generate estimates of the effect of an IID installation on recidivism outcomes, we estimate two-stage-least squares models where the second-stage dependent variable is the recidivism outcome, IID installation within two years is the endogenous right-hand side variable, and an interaction term between post-SB 1046 and being arrested in a non-AB91 county serves as the instrument for IID installation.

[18]These estimates are based on the decline in recidivism relative to what recidivism rates would have been if IID

Table ES6: **Two-Year Recidivism Outcomes by Year for People who Install an IID Within Two Years and People Who Do Not**

Panel A: Two-year recidivism outcome counts among people who install an IID within two years of arrest

Year	Total	DUI	Crash	Alcohol-involved crash	Injury crash	Alcohol-involved injury crash	Fatal crash	Alcohol-involved fatal crash
2019	20,270	433	1,136	123	491	67	< 50	< 50
2020	12,650	354	746	97	335	56	< 50	< 50
2021	15,045	404	878	110	405	70	< 50	< 50

Panel B: Two-year recidivism outcome percentages among people who install an IID within two years of arrest

Year	Total	DUI	Crash	Alcohol-involved crash	Injury crash	Alcohol-involved injury crash	Fatal crash	Alcohol-involved fatal crash
2019	100.00	2.14	5.60	0.61	2.42	0.33	< 0.2	< 0.2
2020	100.00	2.80	5.90	0.77	2.65	0.44	< 0.2	< 0.2
2021	100.00	2.69	5.84	0.73	2.69	0.47	< 0.2	< 0.2

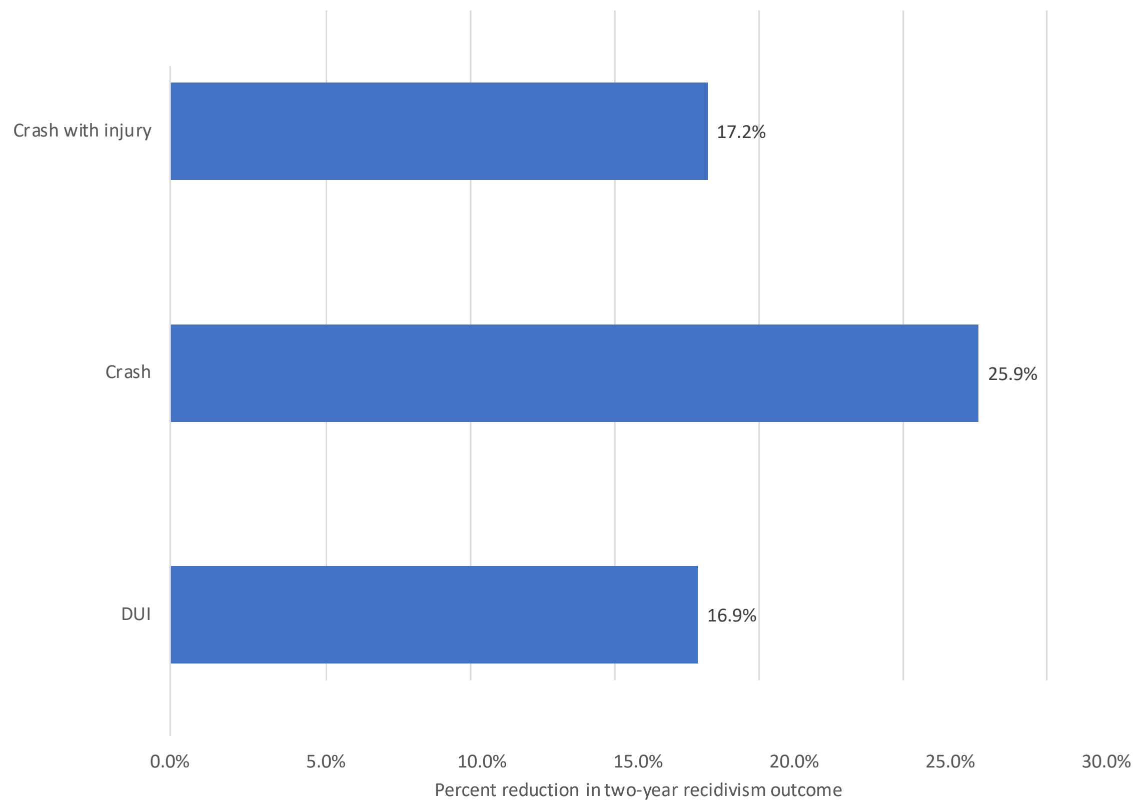
Panel C: Two-year recidivism outcome counts among people who do not install an IID within two years of arrest

Year	Total	DUI	Crash	Alcohol-involved crash	Injury crash	Alcohol-involved injury crash	Fatal crash	Alcohol-involved fatal crash
2019	99,327	10,142	8,132	1,916	3,673	1,269	130	66
2020	80,121	9,541	7,942	1,890	3,793	1,403	152	66
2021	88,998	9,838	8,101	1,983	3,844	1,384	146	< 50

Panel D: Two-year recidivism outcome percentages among people who do not install an IID within two years of arrest

Year	Total	DUI	Crash	Alcohol-involved crash	Injury crash	Alcohol-involved injury crash	Fatal crash	Alcohol-involved fatal crash
2019	100	10.21	8.19	1.93	3.70	1.28	0.13	0.07
2020	100	11.91	9.91	2.36	4.73	1.75	0.19	0.08
2021	100	11.05	9.10	2.23	4.32	1.56	0.16	< 0.05

Figure ES6: **Estimated Percent Reduction in the Likelihood of Recidivating within Two Years of Installing an IID Within Two Years of Arrest**



IID within two years of one's violation date reduces DUI recidivism rates by 16.9 percent, crash recidivism by 25.9 percent, and crashes-with-injury recidivism by 17.2 percent.

In addition to these results for all DUIs combined, in the main report we present estimates for the three offense groups defined by SB 1046: first offenses, first offenses involving an injury, and repeat offenses. The sample sizes are smaller when we estimate the models separately by subgroup, and as a result we lose estimation precision. However, we do observe some differences in results between the groups. The effect of installing an IID on DUI recidivism is greatest and statistically significant for those arrested for the first offense involving an injury, followed by other first offense arrests. The effect of an IID on subsequent crashes and crashes involving injuries is greatest for people arrested for a repeat offense.[19]

The full report below also provides a review of the existing empirical literature on the effects of IID installation on recidivism outcomes. The effect sizes presented here are consistent with the findings from this body of research.

To summarize, this sub-section documents the following:

- Installing an IID within two years of arrest reduces recidivism rates, whether measured by future DUI arrests, crashes, or crashes involving injury.
- The effect of installing an IID on future DUI arrests is largest for people arrested for the first time. The effects on crashes and crashes with injuries are largest for people with priors.
- The magnitude of the effects presented in this report is consistent with the findings of previous empirical research on the effects of IIDs.

Statewide Impacts of SB 1046 on Recidivism Outcomes

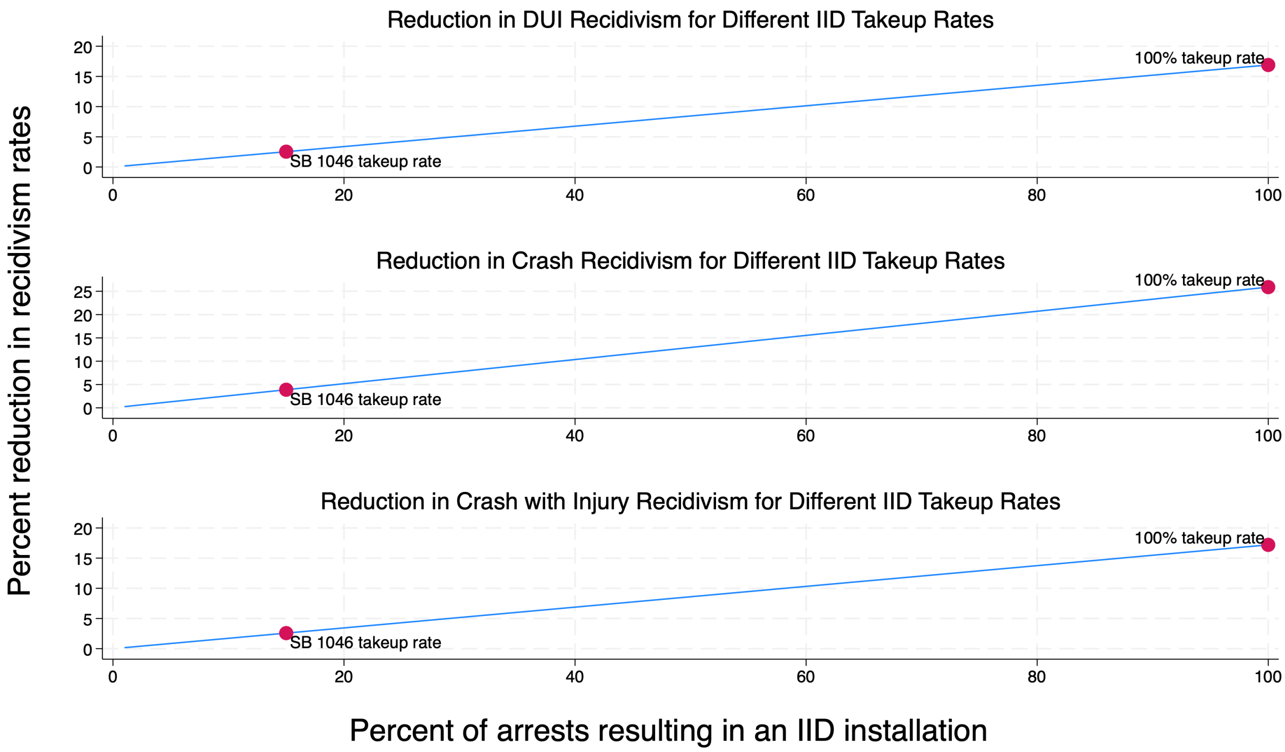
Our causal analysis finds sizable effects of IID installation on the various measures of recidivism among people arrested for DUI. Of course, these devices are effective only to the extent that persons who are required to install an IID actually install a device. The net effect of a mandatory IID requirement will be a function of both the effectiveness of the device in preventing future driving under the influence and the extent to which people comply with the requirements or respond to the opportunities to install a device in lieu of some other sanction.

What we observe in the post-SB1046 period is that most DUI arrests do not result in an IID installation (roughly 15 percent install). This low rate is due to many factors, including conviction rates that are less than 100 percent and lower in recent years, the non-universality of the mandatory IID requirements under SB 1046, and people choosing not to install an IID even when it is a requirement for restoring driving privileges.

installation rates were reduced to zero.

[19]The results by subgroup are presented in Tables 14 through 16 in the main text.

Figure ES7: **Reduction in Statewide Two-Year Recidivism Rates Among Those Arrested for a DUI as a Function of the Percent of Arrests where an IID is Installed Within Two Years**



What then is the ultimate impact of SB1046 on recidivism rates among persons arrested for a DUI? How does this effect depend on the proportion of people who install an IID? Although we cannot answer these questions with certainty, we can use the calculations from the previous section along with the installed rates observed under SB 1046 to evaluate the overall effect of the law and project what the impact would be with higher installation rates.

Figure ES7 presents the projected percent reduction in recidivism as a function of the percent of arrests that results in an IID installation for the three recidivism outcomes that are the focus of this study. While the line in each figure shows the complete projected relationship between the percentage reduction in recidivism and the IID installation rate, each figure also highlights two specific points: the recidivism reduction associated with a 100 percent installation rate, and the recidivism reduction associated with the statewide installation rates observed under SB1046 (roughly 15 percent). The recidivism reductions with 100 percent installation rates correspond to our calculations pertaining to the effect of installing a device presented in Figure ES6 (16.9 percent reduction for DUI recidivism, 25.9 percent reduction for crash recidivism, and 17.2 percent reduction for crash-with-injury recidivism).

This exercise suggests that the overall effects of SB 1046 on these recidivism measures are small. The declines among those arrested for a DUI during the post period are on the order of 2.5 percent for the likelihood of another DUI within two years, 3.9 percent for the likelihood of a crash within two years, and 2.6 percent for the likelihood of a crash with an injury within two years relative to a counterfactual with zero installations. The figure also illustrates that higher installation rates would correspond with higher recidivism reductions statewide.

To summarize, this sub-section documents the following:

- The impacts of SB 1046 on overall recidivism rates, while in the desired direction, are modest.
- Increasing IID installation rates among those arrested for DUI would increase the effective-ness of a policy that requires IID installations.

1 Introduction

In 2022, 13,524 people in the United States died in a car crash where a driver was under the influence of alcohol,[20] with the number of injuries resulting from drunk-driving crashes many multiples the number of fatalities.[21] The same year, 16,485 people were murdered.[22] Hence, the scale of loss and suffering resulting from drunk driving in the United States is comparable in magnitude to that resulting from the most serious violent crime.

State efforts to combat drunk driving and the associated social harms rely heavily on sanctions for those convicted of driving under the influence (DUI), tighter definitions of DUI through lower blood alcohol content (BAC) thresholds for establishing guilt, and swift and certain responses to drunk driving arrests and convictions. Although many of the sanctions might be characterized as creating a specific deterrent to DUI (Hansen, 2015), there are several sanctions that basically aim to address individual drivers by restricting driving privileges or employing technology to prevent driving while intoxicated.

One such sanction is the requirement that arrested and/or convicted drivers install an ignition interlock device (IID) in their vehicles. IIDs are essentially individualized breathalyzers that prevent people who have been drinking from starting or operating a vehicle. Currently, 31 states and the District of Columbia require all drivers convicted of a DUI to install an IID for a period prior to full restoration of driving privileges. The remaining states either require IIDs following repeat-offense convictions, or permit judges in DUI cases the discretion to impose IID orders post conviction.

In 2019, California implemented Senate Bill 1046 (Hill, Chapter 783, Statute 2016) mandating a period of IID installation after conviction for a repeat DUI offense or a DUI offense involving injury. The legislation also created an incentive for people arrested for a DUI to install an IID immediately after arrest to avoid the automatic license suspension that occurs 30 days after a DUI arrest in California. In this report, we document the changes in IID installations and driving behavior before and after the implementation of SB 1046. In addition to this descriptive documentation of patterns before and after the reform, we also leverage the large changes in the likelihood of installing an IID after arrest induced by SB 1046 to estimate the causal effects of IID installation on subsequent measures of recidivism among persons arrested for a DUI, including subsequent arrests, crashes, and crashes involving injuries.

The analysis has three main components. First, we provide a descriptive analysis that focuses on documenting key patterns regarding DUIs, crash, injury and fatality trends, IID installations, and recidivism among drivers arrested for an alcohol-related offense.

Second, we estimate the effect of installing an IID on new DUI arrests, crashes, and crashes

[20] See National Highway Traffic Safety Administration (NHTSA), accessed on August 11, 2024.

[21] For example, in California in 2022, total injuries in drunk-driving crashes are nearly 27 times the number fatalities recorded in the Statewide Integrated Traffic Records System (SWITRS) (see Table 1).

[22] See Federal Bureau of Investigation, Crime Data Explorer, accessed on August 11, 2024.

involving injury within two years of the original arrest date. The analysis draws on the very large difference in IID installation trends between counties to generate these estimates. Specifically, in 54 of California's 58 counties, SB 1046 induced a sizable increase in the likelihood that a DUI arrest is followed by an IID installation within two years. In the remaining four counties, the expiration of an earlier pilot program coinciding with the implementation of SB 1046 caused a large decrease in IID installation rates. We perform a difference-in-difference analysis of the relative pre-post SB 1046 changes in recidivism rates across these county groups to test for an effect of IID installation on recidivism, employing various empirical strategies to statistically control for possible factors that might confound the difference-in-difference analysis. We also use a two-stage least squares estimation to produce point estimates of the effects of installing an IID on the likelihood of recidivating for the three outcomes studied here.

Third, we analyze the overall effectiveness of the policy in reducing DUI recidivism relative to the counterfactual where SB 1046 was not implemented. We also analyze the relationship between the potential efficacy of future versions of this policy and the rate at which people required to install an IID actually do so.

Our principal findings are the following:

- Alcohol related crashes, injuries and fatalities increase in the post-SB 1046 period relative to the pre-SB 1046 period. We observe a similar increase in fatality rates in the rest of the country.

- Total convictions among those arrested during the period spanning 2014 through 2023 declined in the post-SB 1046 period. This trend likely reflects an effect of the pandemic on the operations of courts throughout the state.

- Comparison of years before and after the implementation of SB 1046 reveals that IID installation rates among people arrested for DUI increased modestly. This aggregate pattern masks a more sizable increase in installation rates among arrests occurring in the 54 counties that were not part of the earlier pilot IID program and a large decrease in installation rates in the four counties that were part of the earlier pilot.

- The pandemic dulled the effect of SB 1046 on installation rates by reducing conviction rates and making it difficult (at least early in the pandemic) to document installation and proof of insurance through an in-person visit to a DMV office.

- Installing an IID within two years of arrest reduces recidivism rates, whether measured by future DUI arrests, crashes, or crashes involving injury.

- The effect of installing an IID on future DUI arrests is greatest for people arrested for the first time. The effects on crashes and crashes with injury are largest for people with prior DUI convictions.

- The impacts of SB 1046 on overall statewide recidivism rates, while in the desired direction, are modest.
- Increasing IID installation rates among those arrested for DUI would increase the effectiveness of a policy that requires IID installations.

The remainder of the study is organized as follows. Section 2 presents a review of previous empirical research that analyzes the efficacy of IIDs and the determinants of take-up among those ordered to install an IID. Section 3 provides an overview of the changes in the IID policy in California and documents the overall patterns of installation for the period prior to and following the implementation of SB 1046. Section 4 details our methodological strategy for estimating the effects of IIDs on recidivism outcomes. The section also provides a description of the data used in this report along with the limitations of the data. Section 5 provides our estimation results. Finally, Section 6 presents a policy analysis projecting the impact of SB 1046 on statewide recidivism and explores the relationships between overall recidivism rates and IID installation rates.

2 Prior Research on the Effectiveness of IID Requirements

An IID is essentially an individualized breathalyzer installed in one's vehicle that prevents a car from starting unless the driver blows a test where the blood alcohol content (BAC) reading is below a set level (typically 0.02 grams per 100 ml). IIDs are typically calibrated to the individual, either through the machine being trained on the person's voice (e.g. humming while breathing into the machine) or through photos taken during testing to prevent using another person to start the car. IIDs usually also require rolling retests after the car has been started, as well as periodic visits to the installer for calibration, downloads of breath test results, and verification that the device has not been tampered with.[23] Devices are widely used in the United States (Teoh et al., 2021) as well as other countries (Negussie, Geller and Teutsch, 2018) as a post-conviction sanction as well as an alternative to hard license suspension and a restricted license. The cost of installation, calibration, and maintenance is born by the sanctioned driver, though installers are required to absorb the costs for people with very low income (with the ultimate incidence of these expenses presumably passed onto other drivers with incomes above the threshold).[24]

[23] In California, compliance requires that the IID be calibrated by the installer every 60 days.

[24] In California,\ person with household incomes below 400 percent of the poverty line can install an IID at reduced cost. For persons with incomes equal to 100 percent or less of the federal poverty line, they pay 10 percent of program costs and any costs associated with noncompliance. Persons with incomes 101 to 200 percent of the federal poverty line cover 25 percent of program costs as well as costs for noncompliance. This share increases to 50 percent for people with incomes 201 to 300 percent of the poverty line, and 90 percent for persons with incomes 310 to 400 percent of the poverty line. CalFresh recipients (the California Supplement Nutrition Assistance Program) qualify for a 50 percent subsidy to program costs. For basic information on the California IID SB 1046 program, see Statewide Ignition Interlock Device Pilot Program, accessed on October 1, 2024.

There are several systematic reviews of the literature on the impacts of IID on various measures of recidivism, including the review by Elder et al. (2011), Blais, Sergerie and Maurice (2013), and Willis, Lybrand and Bellamy (2004). These reviews arrive at the following conclusions:

- people are less likely to be arrested for a DUI while an IID is installed in their vehicle,
- people are less likely to be cited for driving on a suspended license when an IID is installed,
- alcohol-related crashes and subsequent injuries and fatalities go down in states with robust programs, and
- overall crashes may increase since IIDs are effectively a substitute for license suspension and likely leads to more driving.

Based largely on this research, a consensus report from the National Academies of Sciences on DUI policy in the United States recommends that IID installation be required for all DUI convictions (Negussie, Geller and Teutsch, 2018). Beyond the research included in these reviews, other researchers have studied factors that influence installation (for example, being able to avoid a hard suspension, alternative sanctions), the effects of monitoring of IID outcomes on compliance, and the predictive value of the data generated from IIDs. In this section, we provide a detailed and critical discussion of several of the key studies in this literature.

2.1 IIDs and recidivism while installed and after removal

Several researchers have studied the effects of IID installation on DUI recidivism. This research relies on a variety of methods including randomized control trials, observational analysis (usually pre-post installation and removal comparison of outcomes), analysis of drinking behavior while an IID is installed, and tests for heterogeneity in effectiveness associated with variation in how IID requirements are implemented (e.g, whether data are monitored, the severity of alternative sanctions).

The strongest evidence for a contemporaneous impact of IID installation on DUI recidivism is provided by Beck et al. (1999). The authors analyze the effects of IIDs on driving-while-intoxicated (DWI) recidivism among individuals with multiple DWIs in Maryland. The authors focus on individuals with multiple convictions who are recommended for relicensing by a Medical Advisory Board (MAB) tasked with reviewing all such requests. Importantly, receiving a recommendation requires that the individual show that they have been in treatment and that they have made and continue to make progress toward recovery. The MAB's recommendation is forwarded to the Motor Vehicle Administration which ultimately decides whether to accept the recommendation. The subjects in this study received an MAB recommendation which was subsequently approved.

In conjunction with the Maryland Motor Vehicle Administration, the authors implemented a randomized control trial where roughly half of nearly 1,400 individuals were randomly assigned to a treatment group requiring an IID to be installed for one year, while the other half of the participants were randomly assigned to a business-as-usual control group (requirement to not drink at all if driving and to check in with a probation officer). Compliance with the IID installation requirement was relatively high (57 percent installed the device promptly, 23 percent signed a waiver attesting to not owning a car but committing to only drive cars with IIDs installed, while 7 percent initially signed such a waiver but later installed a device). In addition, comparisons of demographics and other pretreatment outcomes (e.g., prior DUIs) across the treatment and control group revealed that randomization yielded similar individuals in the two groups.

In the first post-assignment year, 2.4 percent of treatment group members and 6.7 percent of control group members had another DWI violation, indicating that being assigned to treatment reduced the incidence of DWI's by 64 percent (with the effect size statistically significant. Among those who did not recidivate in year one, 3.5 percent of the treatment group members recidivated in year 2 (when most IIDs had been removed among those who complied in year 1) with a comparable figure for remaining control groups members of 2.6 percent (the difference not statistically significant). For the entire two-year period, 5.9 percent of the treatment group and 9.1 percent of the control group recidivated (with the difference significant at the five percent level of confidence).

There are several unique aspects to this study that merit comment. First, the study is a well-implemented RCT and hence the internal validity of the findings is not in doubt.

Second, the study focuses on a group of individuals who reveal through their actions that they are motivated to reacquire their driving privileges (and are, moreover, approved by Medical Board review intended to weed out risky drivers). This may explain the relatively low annual rates of recidivism among the control group (6.7 percent in year one which falls to 3.5 percent in year two). These selection mechanisms also likely explain the high level of compliance with the IID treatment provisions.

Third, while the difference in recidivism rates disappears for the sample that survives through year one without a new incident, it is notable that the baseline offending rate in the control group is much lower among those who survive to year two without a new offense relative to the year-one offending rates. To the extent that this pattern applies to DWI recidivism more generally, programs that temporarily suppress the recidivism hazard soon after license reinstatement may be reducing risk during a particularly high-risk period for the drivers in question. Hence, even short-term effects that die out over time can appreciably reduce the incidence of negative outcomes caused by drinking and driving.

There are non-experimental studies of several states that tend to find lower recidivism rates while IIDs are installed. McCartt, Leaf and Farmer (2018) use time series modeling and descriptive analysis to study a series of policy changes in Washington state pertaining to IID installation requirements. The first major change was a 2003 shift in responsibility from the courts to the department of licensing for issuing IID orders for those required under state law to install an IID(those with prior DUI convictions and first-time DUIs with BAC levels in excess of 0.15). In 2004, the legislature expanded the IID requirement to encompass all DUI convictions. In 2009, policy was changed to permit installation of an IID immediately following arrest to avoid an administrative, preconviction license suspension. Finally, in 2011 state policy was altered to require four months of IID installation without any noncompliance as a prerequisite to license reinstatement. The study documents a large increase in IID installations and a shortening time period between arrest and the installation date with each subsequent reform. There is some evidence of avoidance of the requirement by pleading down to reckless driving convictions. The strongest evidence of an impact on recidivism is observed for first-time DUI convictions, and more modest evidence for people with repeat DUIs.

Marques et al. (2010) study the expansion of IID requirements in New Mexico, first for first time offenses with aggravating circumstances (in addition to people with priors), and ultimately a universal requirement for all DUI offenses. In addition to studying the recidivism outcomes for people ordered to install IIDs statewide, the authors separately study Santa Fe, where local courts temporarily enforced electronic monitoring and home confinement for individuals who failed to install IIDs in their cars. Similarly to the results from prior studies, the authors find that IID installation suppresses DUI recidivism on the order of 68 percent relative to the recidivism rate for a non-experimental comparison group. Although compliance with the IID installation requirement hovered at around 50 percent statewide, compliance in Santa Fe while the harsh alternative sanctions were in place reached nearly 75 percent.

There are several evaluations of past policy experimentation with IIDs in California. DeYoung, Tashima and Masten (2004) evaluate the implementation and effectiveness of early California legislation that guides the use of ignition interlock devices. Effective as of 1999, California judges were mandated to order ignition interlock installations for all DUI offenders arrested or cited for driving on a DUI-suspended license (an offense with the abbreviation DWS-DUI). Judges also had discretion to order IIDs for other DUI offenders, although the evaluation by DeYoung (2002) suggests that they rarely used this option.[25] Beyond these provisions, people with a suspended license had the option to install an IID after serving half their suspension for earlier reinstatement of their driving privileges.

The authors test for effects of the intervention on subsequent DUIs and crashes using duration analysis. They find that people ordered to install an IID or restricted to driving only vehicles with IIDs due to a DUI-DWS were 24 percent less likely to experience a crash during a three-year

[25] DeYoung (2002) studies aspects of the implementation of an early California law that required IID orders for people convicted of driving on a suspended license due to a DUI. The study is primarily concerned with how frequently judges order IIDs in cases where the law requires, how often people subjected to these orders actually have one installed, and perception among judges, district attorneys, and citizens subject to an order regarding the effectiveness of the devices. The main finding is that judges more often than not fail to order the installation of IIDs in cases where such a requirement is required by law. The reasons given are (1) many DUI-DWS cases involve someone who does not own a car, and (2) beliefs that the devices are not affordable for many. Among the small number of people interviewed about their personal experience with IIDs, none tried to circumvent the device and many thought that the devices permanently altered their behavior.

observation period. There was no measurable effect on the likelihood of a subsequent DUI. In an analysis of individuals who actually install an IID, they find significant reductions in the likelihood of a subsequent DUI, but a higher risk of future crashes (likely reflective of more driving since the IID reinstates driving privileges). The authors find similar patterns for people who are repeat DUI offenders.

There are two evaluation studies of a four-county California pilot program that began in 2010. Assembly Bill 91 (Feuer, Chapter 217, Statute 2009) authorized a pilot program to be implemented from July 1, 2010, through January 1, 2016 requiring all persons convicted of a DUI in Alameda, Los Angeles, Sacramento and Tulare counties to temporarily install IIDs on all vehicles they own or operate. Chapman, Oulad and Masten (2015) assess whether the rate of DUI convictions (normalized by the number of licensed drivers) declines in pilot counties relative to other counties in the state. They test for differential impacts on the incidence of first-time DUIs per 100,000 licensed drivers, second-time DUIs, and third- or higher-time DUIs. Their DUI measures include actual DUI convictions, as well as convictions where the person pleads down to a reckless driving offense. The authors find a sizable increase in IID installations in pilot counties relative to nonpilot counties. However, they find no evidence of a relative decline in the rates of DUI convictions in pilot counties relative to nonpilot counties.

The Department of Motor Vehicles (2016) presents a subsequent evaluation testing for specific deterrence for people with DUI convictions in the pilot counties. Specifically, the study tests the impact of the AB 91 pilot on recidivism outcomes and the incidence of crashes among people convicted of DUI offenses who were ordered to install an IID in the pilot counties. The authors analyze microdata from the California DMV Driver Master Record File and use survival analysis to test whether the IID order reduces the likelihood of a subsequent DUI conviction, subsequent DUI incident, and subsequent crashes during predetermined post-conviction observations periods. They find no evidence of an intent-to-treat effect on DUI recidivism for first-time, second-time, and third- or greater DUI offenders (using propensity score analysis to identify a nonexperimental comparison group). There is some evidence of a higher crash incidence among people from pilot counties. In the analysis of people who comply with the IID order, they find much lower DUI recidivism (using both measures) but substantially higher crash rates. It is not clear what explains the higher crash rates, but the authors hypothesize that people with DUI convictions are at high risk of a crash independently of their drinking behavior. Given that the IID can be used to shorten the license suspension period, this suggests that IIDs may not be an effective substitute for a hard suspension in terms of traffic safety outcomes.

Voas et al. (2021) provide a novel analysis that differs from other studies of IIDs in that the authors focus directly on drinking behavior. Although the study is based on a very small sample in a specific region of the country, the analysis reveals some of the behavioral mechanisms that may be behind the suppression of DUI recidivism while devices are installed. The authors specifically study how drinking behavior changes with a DUI arrest, the installation of an IID, and the removal of the

IID. Based on interviews with people with DUI arrests who are ordered to install an interlock (the interviews were conducted as part of the Managing Heavy Drinking (MHD) study),[26] the authors measure average drinks per day, number of days drinking, number of days of heavy drinking, and the incidence of driving after drinking for a time period proceeding arrest, after arrest but prior to IID installation, while the IID is installed in one's vehicle, and following IID removal. On average, approximately three months elapse between arrest and IID installation, and IIDs are required for periods of six months to one year. The authors document sizable reductions in drinking and drinking and driving following arrest that are sustained throughout the IID installation period. In addition, while there is some rebound in these outcomes towards the prearrest level following the removal of the IID, all of the drinking outcomes as well as the propensity to drink and drive remain below pre-arrest levels following the removal of the IID. The primary limitations of this study are the very small sample, the focus on rural New York, the reliance on retrospective evaluations of prior drinking, and the relatively short study period.

2.2 IIDs, crashes, and fatalities

A clear goal that motivates the use of IIDs is to prevent dangerous driving that results in property damage, injuries, and deaths. Over the past decade, over 1,000 people in California a year die on average in alcohol-related traffic fatalities (see Table 1 below), equaling over half of the number of people who die annually by homicide in the state. If serious injuries are included, the number of Californians harmed in an alcohol-related crash is between 3,300 and 5,100. If we include all injuries, annual incidents typically fall in the 23,000 to 28,000 range. Alcohol-involved injuries and fatalities account for 10 to 12 percent of all such incidents in any given year.

Several researchers have investigated the extent to which the use of IIDs as an alternative sanction for DUI arrests and convictions impacts crash fatalities. Several have used aggregate data to test for changes in policy on overall fatality rates. These studies tend to find evidence that the expanded use of IIDs reduces fatalities. Other studies look at individual-level evidence to assess whether people who install IIDs after arrest or conviction for a DUI have a lower likelihood of a subsequent crash. The evidence from this research is mixed and suggests that people with DUI convictions may be riskier drivers overall.

An early example of research using aggregate data is provided by Voas, Tippetts and Fell (2000). The authors use state-level data to study the effects of laws that make driving a vehicle with a BAC above a given limit illegal per se as well as state laws that authorize administrative license suspensions following a DUI arrest. Although the study does not specifically explore the effects of IIDs, the methods are somewhat similar to later research exploiting interstate and over-time variation in policy choices made by states. The dependent variable studied is the ratio of

[26] The MHD study is a longitudinal analysis of subjects in Erie County New York with data collected between 2015 and 2020. In addition to the empirical findings in this and other studies, MHD subjects have also been studies using qualitative interview techniques (Romosz et al., 2021).

Table 1: **Annual Number of Crashes, Alcohol Involved Crashes and the Consequent Fatalities and Injuries, Fatalities and Serious Injuries, and Fatalities in California, 2014 through 2023**

Panel A: Outcome Annual Counts

Year	All crashes	Alcohol-involved crashes	All fatalities and injuries	Alcohol-involved fatalities and injuries	Alcohol-involved fatalities and serious injuries	Alcohol-involved fatalities	Alcohol-involved fatalities from the FARS data
2014	165,624	16,078	234,030	23,230	3,344	940	876
2015	181,837	16,995	257,996	24,574	3,481	917	902
2016	198,899	18,436	283,874	26,850	3,819	982	1,114
2017	197,146	18,155	281,064	26,591	4,014	1,050	1,141
2018	195,449	18,433	278,658	26,971	4,436	956	1,116
2019	190,649	18,468	272,768	26,922	4,434	929	966
2020	147,148	16,281	207,870	23,275	4,259	1,034	1,180
2021	162,036	19,850	229,586	28,695	5,115	1,166	1,370
2022	161,289	19,371	228,048	27,825	4,819	1,036	1,479
2023	163,071	18,774	229,941	27,283	4,412	938	-

Panel B: Outcome Levels as a Percent of the 2019 Value

Year	All crashes	Alcohol-involved crashes	All fatalities and injuries	Alcohol-involved fatalities and injuries	Alcohol-involved fatalities and serious injuries	Alcohol-involved fatalities	Alcohol-involved fatalities from the FARS data
2014	86.87	87.06	85.80	86.29	75.42	101.18	90.68
2015	95.38	92.02	94.58	91.28	78.51	98.71	93.37
2016	104.33	99.83	104.07	99.73	86.13	105.71	115.32
2017	103.41	98.31	103.04	98.77	90.53	113.02	118.12
2018	102.52	99.81	102.16	100.18	100.05	102.91	115.53
2019	100.00	100.00	100.00	100.00	100.00	100.00	100.00
2020	77.18	88.16	76.21	86.45	96.05	111.30	122.15
2021	84.99	107.48	84.17	106.59	115.36	125.51	141.82
2022	84.60	104.89	83.61	103.35	108.68	108.68	153.11
2023	85.53	101.66	84.30	101.34	101.34	99.50	-

Source: Transportation Injury Mapping System (TIMS) summary of California statewide crash and injury data from the Statewide Integrated Traffic Records System (SWITRS). Summary statistics accessed on December 5, 2024. Fatalities from the Fatality Analysis Reporting System (FARS) files differ from those in the SWITRS data due to the imputation procedure used in FARS to impute whether alcohol was involved in fatalities where information pertaining to alcohol was not reported. FARS data are currently publicly available through 2022. The SWITRS data defines alcohol-involved incidents as those where the officer who filled out the crash report perceived that party fell under one of the following categories: had been drinking, under influence; had been drinking, not under influence, or had been drinking, impairment unknown. This may or may not be determined with the help of a BAC.

alcohol-related crash fatalities to nonalcohol crash fatalities. They find significant effects of these policy levers on the dependent variable using data covering roughly the last twenty years of the twentieth century.

Kaufman and Wiebe (2016) use state panel data and difference-in-difference analysis to estimate the effect of a universal IID requirement for all DUI convictions on fatal alcohol-related crash rates. From 2004 through 2013, 18 states enacted and implemented legislation mandating such universal requirements. Using publicly available data from the Fatal Analysis Reporting System (FARS), the authors estimate a simple OLS model where the key explanatory variables are state and year fixed effects and an indicator for the presence of an IID law. They find an approximate 15 percent reduction in deaths from alcohol-related crashes.

Teoh et al. (2021) use FARS data to study the effects of state laws that mandate universal IID installation for all DUIs, IID requirements for repeat offenders, or IID requirements for repeat offenders and those with a BAC reading of 0.15 or higher on fatal crashes. The study includes all states and the District of Columbia with the exception of California. California is excluded since during the time period studied (2001 through 2019) California only had the AB 91 pilot universal IID program for four large counties. Their main estimation results involve a Poisson regression of the count of fatal alcohol-involved crashes on an indicator for the presence of a state law and a control variable measuring all other fatal crashes. They find a substantial and significant effect of state laws on alcohol-involved fatal crashes (roughly 26 percent fewer such fatalities in states with an IID law).

Regarding analysis focused on individual data for people with installed IIDs, we have already discussed the evaluations of previous policy changes in California that appear to show decreases in alcohol-related crashes but increases in the overall number of crashes for people ordered to install a device who comply (DeYoung, Tashima and Masten, 2004; Department of Motor Vehicles, 2016).

2.3 Determinants of take-up, the effects of monitoring on compliance, and the predictive value of data collected from IIDs

Beyond research on the effects of IIDs on recidivism and crashes, there are several other questions that are explored in the literature that are largely related to implementation issues encountered when states attempt to implement IID requirements. The first among these concerns is compliance. Almost all studies find imperfect compliance, and many people ordered to install an IID either claiming that they do not own a car or choosing not to install. Many of the studies reviewed above find compliance rates of roughly 50 percent. The New Mexico evaluation (Marques et al., 2010) finds very high compliance in Santa Fe county, where noncompliance with the installation order temporarily resulted in house arrest.

Although compliance rates are far below 100 percent, most of the research does find substantial increases in installation following legislation that expands IID requirements or that enables people to install an IID to avoid a hard suspension. For example, Mcknight and Tippetts (2020) study the effects of policy changes designed to increase the use of IIDs on overall installations, the number of IIDS in place, and, for one state, a measure of noncompliance. Using administrative data for Florida and West Virginia, the authors study the effects of several policy changes implemented within these states. First, Florida lowered the BAC limit for aggravated DUI (an offense for which first-time offenders are ordered to install an IID in order to reinstate their licenses) from 0.2 to 0.15. They study the effects of two policy changes in West Virginia: an earlier change in policy that removed DUI offenses from one's criminal record for first time offenders who successfully complete an IID-required period and a latter change in policy that permitted installation of an IID along with waiving an administrative hearing in exchange for avoidance of a hard license revocation. In Florida, the authors document a discrete increase in IID installations corresponding to the policy change. Similarly, in West Virginia, where the changes in policy effectively allowed people to opt for IID installations as an avenue to avoid a criminal history record or a suspension, the authors also document sizable increases in installation associated with the policy change.

There is at least one qualitative study (though based on a small number of participants) investigating why people do not install IIDs. Romosz et al. (2021) presents the results of qualitative interviews with six individuals in upstate NY who were ordered to install interlocks but chose not to. The interviews reveal that cost, stigma concerns, distrust of authorities, and the belief that the requirement would not be properly enforced are the primary reasons for not installing a device. Several of the participant indicated that they still drove their cars or the cars of others, but drove more carefully and took alternative routes where they believed they would be less likely to be detected by police.

Surprisingly, most states do not monitor the data generated by IIDs and do not take into account lockouts and attempts to tamper with the device in the process of restoring driving privileges. There is a very high-quality study that indicates that this information may be useful in achieving better outcomes for people who install IIDs. Zador et al. (2011) present the results of a randomized control trial in Maryland based on a sample of Maryland drivers very similar to those studied in Beck et al. (1999) who are ordered to install an IID as part of their journey toward full restoration of their driving privileges. Rather than studying the effects of an IID per se, this study investigates whether closer monitoring and modest graduated sanctions improve compliance with the IID restrictions (with the principal measures of compliance/noncompliance being failed breath tests with varying degrees of measured BAC, efforts to bypass the IID, refusals to retest, and retest failures). The treatment involved closer monitoring of noncompliance incidents, with noncompliance resulting in warning letters, increases in the frequency with which the driver would have to visit the installer to download data, referral to the Maryland Medical Advisory Board for evaluations of one's alcohol problems, potential lengthening of the required IID installation period, and possible revocation of driving privileges. Monitoring of the control group appeared to be nonexistent, with little consequences for failures to comply and the removal of the IID and full restoration of driving privileges once the period expired, which appeared to not be impacted by noncompliance incidents.

The authors find that individuals assigned to the treatment group had substantially fewer noncompliance issues (mostly initial failed breath tests), with the reduction on the order to 25 to 30 percent relative to control group levels. They also found (in terms of the results for variables included as controls) that violations decreased with time on the IID, suggestive of a learning process as time on the IID increased.[27]

There is also evidence from several studies that data generated by IIDs are predictive of future DUI events. Marques et al. (2001) use IID recorder data for roughly 2,500 individuals in Alberta, Canada to assess whether data collected while an interlock is in place can predict future DUI recidivism. They find that in addition to prior DUIs, IID warnings (BAC readings between 0.02 and 0.04) and IID lockouts for higher BAC readings are predictive of future violations. Marques et al. (2010) finds similar results in their analysis of data from New Mexico. Hence, better use of this information, in addition to improving compliance, can lead to more accurate assessments of future risk that could be used to individualize responses to a DUI offense.[28]

[27] California has a history of experimenting with graduated sanctions to improve outcomes for people who exhibit risky/negligent driving behavior. Moreover, the existing research on this topic suggests that these interventions are effective. Gebers (2009) presents the results from an RCT evaluation of the warning letter and sanctions deployed by the California DMV in response to the accumulation of points on one's driving record up to and through when one is deemed a negligent operator triggering a license suspension and a period of probation. The study tests for the effects of two lower level warning letters, one a standard letter that has been used for decades and the other a letter designed based on the transtheoretical model of behavioral changes, that addresses the stages of change and factors that might facilitate change through intrinsic motivation. For the two lower levels of warning (one when one receives a point due to a conviction and the second when one is on the cusp of a suspension), the study estimates the difference in the likelihood of a subsequent crash or citation, comparing the two letter treatment groups to a control group where intervention is delayed for the purpose of the study. The third intervention (suspension and a probation period) is also compared to an experimental comparison group where treatment is delayed. The author demonstrates significant and cost-effective impacts of all interventions, with the largest being for hard suspensions and evidence that the behaviorally-informed warning letters are more effective than the standard warning letter that has been used for much of the history of this program. Of course, whether such graduated sanction would work for people convicted of DUIs and based on information gleaned from IIDs is an open question

[28] While most people convicted of a DUI do not re-offend, a sizable minority do and being able to discriminate between high and low-risk cases would be helpful in fashioning diversion programs and identifying persons that require closer monitoring. Rauch et al. (2010) study the relative risks of subsequent drinking and driving violations among licensed drivers in Maryland after stratifying drivers by the number of prior violations. Studying the period from 1999 through 2004, the authors find a violations rate per 1,000 licensed drivers for those with one prior violation (24.3 per 1,000) that is over seven times the rate among drivers with no prior violations (3.4 per 1,000). While the re-offending rates for people with one prior is lower than those for drivers two or more priors, the findings suggest that people with one prior are at much higher risk of subsequent violation relative to drivers with no priors. Note, research from other states also indicates that people with one prior are at elevated risk of adverse subsequent driving outcomes. In a literature review of what is known about alcohol-impaired driving prepared by the National Highway Traffic Safety Administration, Jones (2000) presents estimates of average traffic crashes for the period 1985 through 1991 for California drivers by the number of prior DUI convictions. The incidence of crashes among people with one prior DUI is roughly 1.75 times the rate for people with no priors.

3 California's Recent Changes in IID Policy and Changes in Device Installation

In this section, we describe the provisions of California's SB 1046 with the aim of understanding how the law impacted the likelihood that a DUI arrest is followed by an IID installation. There are co-occurring changes in policy and other broader forces that mitigate this impact. In particular, the expiration of an earlier pilot IID program in four counties and the onset of the pandemic worked to reduce IID installations. Hence, we discuss the provisions of SB 1046, the expiration of the AB 91 program, and the likely effects of the pandemic on case dispositions and, in turn, IID installations. In addition, we document the variation in IID installation rates that we use to test for causal effects of IID installation on various recidivism outcomes. We defer the methodological discussion to the next section, as our estimation strategy is tailored to and driven by the implementation details of the legislation that we document here.

3.1 Provisions of SB 1046

The impact of SB 1046 on IID installations operates through two channels. First, the legislation mandates IID installation for specific time periods as a precondition to restoration of driving privileges for certain DUI offense convictions. Second, the law creates the option for those arrested for a DUI to install an IID before being convicted and to avoid the administrative per se (APS) license suspension that follows a DUI arrest (but precedes conviction).[29]

Regarding the first channel, people convicted for a DUI involving an injury, as well as individuals convicted of a DUI with prior alcohol related convictions (e.g., prior DUI, reckless driving involving alcohol) are required to install an IID for specified periods of time as a precondition to full restoration of driving privileges.[30] This requirement is tied to the date of arrest and applies to all arrests on January 1, 2019 or later. Note that this requirement is not operative until the person is convicted; and even when mandated a person can choose not to install an IID. However,

[29] When a person is arrested for a DUI in California, the arresting officer confiscates the persons driver's license and mails it to the DMV. The officer provides the driver with a temporary driver's license valid for thirty days following the arrest, after which the person's driving privileges are suspended for either four months (if a first offense) or a year (if the person has a prior alcohol-related driving convictions). The person has 10 days from the date of arrest to schedule a DMV hearing if they believe the arrest was unjustified. If they fail to schedule a hearing, the APS suspension goes into effect with the expiration of the temporary driver's license. Note, the APS suspension occurs whether or not the person is ultimately convicted. In addition, a subsequent conviction will often entail an additional revocation, often after driving privileges have been restored following an APS suspension. That being said, APS suspensions and post-conviction suspensions are served concurrently rather than consecutively and convicted persons typically receive credit for suspension time served prior to conviction.

[30] For people with prior alcohol related convictions convicted for a DUI without injury (CVC §23152), the required IID installation period is one year for persons with one prior, two years for persons with two priors, and three years for persons with three or more priors. Conviction for a DUI with injury or vehicular manslaughter (CVC §23153 or PC §191.5(b)) for people with priors adds an additional year to the IID requirement schedule. First offense convictions involving injury carry a mandatory IID installation period of one year.

those who are required to but do not install an IID will be unable to obtain a license until they have met the installation time requirement, even after any license suspension period associated with the conviction has expired.[31]

Regarding the second channel, prior to SB 1046 one could not avoid the full term of the APS suspension after an arrest. People arrested for a first offense were and still are eligible to apply for a restricted driver's license without an IID once they have served thirty days of the APS suspension, paid a fine, and obtained and provided in person at a DMV office proof of insurance. This restricted license allows driving only to and from work, as well as to DUI programming. For persons with priors, eligibility for a restricted license prior to the passage of SB 1046 required serving 90 days of the APS suspension (for a second offense) or six months (for a third offense) as well as other requirements.

SB 1046 created a second restricted license option during the APS revocation period that required the person to drive only an IID-equipped vehicle. This second option does not limit where or when the person can drive and can be exercised immediately, hence avoiding the first thirty days of the APS suspension period for first offenses, and the lengthier required suspensions for persons with priors. Note, for those with prior DUIs, the IID-restricted license is the only currently available option to avoid the preconviction APS suspension.

3.2 Provisions of the AB 91 four-county pilot program

In 2009, the state legislature passed AB 91 creating a four-county pilot program to be implemented from July 1, 2010 through the end of calendar year 2016. SB 1046 extended the provisions of the pilot program until the end of 2018, after which the four counties would be subject to the requirements of SB 1046. The pilot required IID installation for all individuals convicted of a DUI with or without injury in all vehicles they own and operate. The mandated IID installation periods ranged from five months for a first offense to four years for persons with three or more priors.

The pilot was in effect in Alameda, Los Angeles, Sacramento, and Tulare counties. Collectively, these four counties account for roughly one-third of the state's population and roughly 26 percent of state DUI arrests.

3.3 Mandatory IID Installation Requirements that Precede AB 91 and SB 1046

Even prior to 2010, there were several classes of offenses in which a conviction led to a mandatory IID installation requirement. Since 1993, California has required mandatory IIDs for repeat offenders[32] and since 1999 for people arrested for driving on a license suspended due to a DUI

[31]People can apply for an exception to the requirement, typically based on not owning a car or being an out-of-state resident.

[32]See Assembly Bill 2851 (Friedman, Chapter 694, Statute 1992).

violation.[33] Moreover, judges have the discretion to mandate IID installation upon conviction. There have been concerns that these mandatory requirements have not been enforced uniformly by the courts, a key finding in the study by DeYoung (2002) that we reviewed above. However, we do observe some IID installations in the pre-SB 1046 period in the counties that were not AB 91 counties that likely reflect these mandatory IID orders and/or discretion exercised by judges. Specifically, during the five-year period preceding the implementation of SB 1046, we observe IID installations for 2.8 percent of first-time arrests, 3.4 percent of first-time arrests involving an injury, and 12.9 percent of arrests for individuals with priors in the non-AB 91 counties (see Table 6). We discuss these patterns in greater detail below.

3.4 The Effects of SB 1046 and AB 91 on IID installation rates

Comparisons of IID installations before and after the implementation of SB 1046 reveal relatively small increases in installation rates. Table 2 presents the percent of arrests in which an IID is installed within two years by the year of arrest for 2014 to 2021 for all DUI arrests and by the number of previous convictions. There are modest increases in the percentage of arrests where an IID is installed within two years. In the pre-period, the percentage is trending downward from 13.2 percent in 2014 to 11.4 percent in 2018. The installation rate jumps in 2019 to 16.9 percent, then declines to levels slightly above what we observe in the pre-period. We observe greater increases among arrests where the driver in question has previous DUI convictions. However, for all groups, the increases are modest.

The relatively small increases in installation rates are driven by several factors. First, the expiration of the AB 91 pilot program caused net declines in installation rates in the four California counties that were part of the pilot. These declines were primarily driven by the fact that AB 91 required mandatory installation for all DUI convictions while SB 1046 requires mandatory installation for convictions where there is an injury or where the driver has priors.

Figure 1 illustrates this fact. The figure displays our calculations of the percent of arrests where a conviction would trigger an automatic IID requirement either due to a provision of AB91 or SB 1046. The figures show these calculations for AB 91 counties, non-AB 91 counties, and statewide for the period 2014 through 2023. In AB 91 counties, 100 percent of arrests are potentially exposed to the requirement prior to 2019, which then declines to roughly 37 percent for the years following. In non-AB 91 counties, none of the arrests are subjected to automatic IID requirements under AB 91, but SB 1046 requirements kick in in 2019, increasing the percentage to between 38 and 40 percent in the years following.[34] For the statewide series, the overall percent of arrests potentially exposed to an automatic IID requirement under these two programs ranges from 23 to 28 percent

[33] See Assembly Bill 762 (Torlakson, Chapter 756, Statute 1998).

[34] Note, repeat offenders were subject to automotive IID requirements upon conviction in all counties during the earlier period, through we note in the literature review above the concerns that this requirement was unevenly enforced across the state.

Table 2: **Percent of DUI Arrests where an IID is Installed Within Two Years: All Arrests and Arrests with No, One, Two, or Three or More Prior Alcohol Related Convictions**

Year	All arrests	No priors	One prior	Two priors	Three plus priors
2014	13.2	11.9	18.4	14.9	7.5
2015	12.5	11.1	17.6	14.3	7.8
2016	12.1	10.6	17.5	15.5	7.4
2017	12.0	10.5	17.2	15.0	8.0
2018	11.4	9.7	17.1	14.0	7.2
2019	16.9	15.5	23.0	18.9	9.8
2020	13.6	11.7	19.8	16.6	9.5
2021	14.5	12.4	21.6	18.1	9.4

Authors' tabulations from the Drivers Master File Records.

prior to 2019, and then increase to roughly 38 percent afterwards

Beyond the effect of the expiration of the AB 91 pilot, declining conviction rates and installation rates among those who are required to install an IID that are less than 100 percent also moderated the impact of SB 1046 on overall IID installation. We discuss each of these factors in turn.

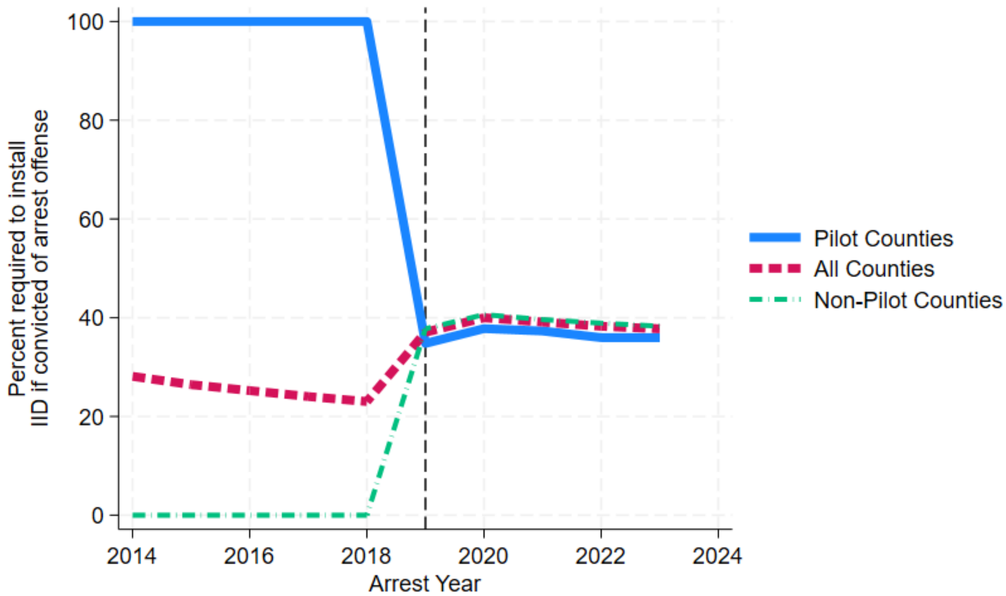
3.5 The effect of declining conviction rates on exposure to automatic IID requirements

Individuals arrested for a DUI may ultimately avoid an actual IID requirement and installation through several channels. First, individuals may have their cases dismissed and thus never be convicted of the offense. Second, individuals may plead guilty to lesser charges not requiring an IID (for example, reckless driving). Finally, individuals facing an automatic IID installation requirement may choose to not seek restricted or reinstated driving privileges.

Our analysis of data from the DMV Drivers Record Master File suggests that a non-trivial percentage of arrests do not result in a conviction and that this percentage increased around the time that SB 1046 goes into effect. Before documenting this pattern, we first empirically analyze the time between arrests and conviction, with the aim of establishing a cutoff time period within which most convictions occur. Table 3 shows the cumulative percent of arrests resulting in a conviction tabulated separately by arrest year. For each year the table displays the percent of arrests resulting in a conviction within six months, one year, 1.5 years, two years, etc. Given that we observe data through August 2024, the post-arrest observation period is shorter for more recent years.[35] For this analysis, we restrict the data to arrests where we can observe outcomes for at

[35] For each year in Table 3, we impose the minimum observations window for the year on all observations. For example, for the latest DUI arrest in 2022, we can observe whether a conviction occurs within 730 days (i.e., two years). The tabulations in Table 3 for that year thus tabulates convictions through two years at most.

Figure 1: **Percent Potentially Required to Install an IID if Convicted Under the Provisions of AB 91 and SB 1046: All Counties Combined, AB 91 Pilot Counties, and Non-AB 91 Counties**



least two years following the arrest. Hence, we drop all arrests that occur after August 2022.

Prior to 2019, roughly 80 percent of arrests result in a conviction, with nearly all convictions occurring within two years of arrest. For example, for arrests occurring in calendar year 2014 we observe convictions for 82.5 of these cases by August 2024 (roughly a decade later). For these arrests, 80.9 percent (or alternatively stated, 98 percent of the cases where there is a conviction) are convicted within two years of the arrest. We see similar patterns for calendar years 2015 through 2018. Based on this finding, we use a two-year post arrest observation window to assess whether a case results in a conviction in much of the empirical work below.

Conviction rates begin to decline in 2018, are lowest for arrests occurring in 2020, and plateau at lower levels through 2022. For example, in 2018 half of arrests result in a conviction within six months of the arrest. This figure declines to roughly 44 percent in 2019, bottoms out at 21 percent in 2020 and then increases to 32 percent for arrests in 2022. Similarly, we see a decline in the percentage of arrests resulting in a conviction within two years of arrest. In 2018, this figure stood at 77 percent. By 2022, roughly 70 percent of cases resolved through conviction within two years.

To get a sense of the nature of cases that do not result in a conviction, Table 4 presents tabulations of key percentiles of the maximum BAC reading at the time of arrest (25th, 50th, 75th), the percent of arrests where the BAC data are missing, and the proportion male and average age for arrests that result in a conviction within two years and arrests that do not. We also present similar descriptive statistics for the three offense groups that are specified in SB 1046:

Table 3: **Cumulative Distributions of Time Between DUI Arrest and Conviction by Arrest Year**

	Arrest Year								
Time to conviction, years	2014	2015	2016	2017	2018	2019	2020	2021	2022
0.5	60.0	57.1	54.1	52.1	50.1	44.2	21.5	28.3	32.2
1.0	76.1	74.0	72.0	70.9	70.1	61.3	48.2	55.2	56.4
1.5	79.7	78.1	77.0	76.6	75.5	68.7	61.0	66.0	67.2
2.0	80.9	79.5	78.6	78.5	77.1	72.7	66.7	69.8	70.3
2.5	81.4	80.1	79.4	79.2	78.0	74.8	69.5	-	-
3.0	81.7	80.6	79.8	79.6	78.6	76.2	71.0	-	-
3.5	81.9	80.8	80.1	79.9	79.1	77.0	-	-	-
4.0	82.1	81.0	80.3	80.1	79.5	77.5	-	-	-
4.5	82.2	81.2	80.4	80.3	79.7	-	-	-	-
5.0	82.3	81.3	80.5	80.4	79.9	-	-	-	-
5.5	82.4	81.4	80.6	80.6	-	-	-	-	-
6.0	82.5	81.4	80.7	80.7	-	-	-	-	-

Source: Authors' tabulations from the DMV Drivers Master Records

first-time offenses, DUI with injury, and offenses with prior convictions. Arrests where there is no conviction within two years tend to involve lower BAC readings, are more likely to have missing BAC data, and are more likely to involve female drivers. People with priors tend to be older, have higher BAC levels recorded at arrest, and are much more likely to be male relative to people without priors.

The facts that not all DUI arrests result in a conviction and that conviction rates have declined in recent years are likely to have dulled the effects of SB 1046 on IID installations. This, of course, begs the question of why conviction rates began to decline in 2018. The most obvious culprit is the onset of the COVID pandemic and the shutting down of in-person interactions. On March 4, 2020 – 14 months after the implementation of SB1046 – the state of California declared a state of emergency due to the COVID-19 pandemic. Most state and local government services went from in person to online, and life in general was greatly interrupted.

The pandemic may have impacted the operations of courts throughout the state in a manner that resulted in lower conviction rates conditional on time since arrest. While we cannot decisively pin the declining conviction rates on the pandemic, a higher frequency analysis of conviction rate trends strongly suggests that the pandemic had a sizable impact on conviction rates.

Figure 2 displays the percent of DUI arrests that result in a conviction within two years by month of arrest. Note, since the figure depicts the percentage of DUI arrests where conviction occurs within two years, conviction rates for arrests occurring prior to March 2018 (24 months before the stay-at-home order) should not be impacted by the pandemic; arrests occurring between March 2018 and March 2020 have a two-year follow-up period extending into the pandemic, while

Table 4: **Case Characteristics for DUI Arrests by Offense Category and By Whether the Case Results in a Conviction Within Two Years**

	Offense Category			Conviction Outcome	
	No priors, no injury	No priors, injury	Prior	Convicted of a DUI within two years	Not convicted of a DUI within two years
BAC Missing	0.10	0.12	0.14	0.17	0.10
BAC Percentile Values					
25th	0.11	0.11	0.12	0.09	0.12
50th	0.14	0.16	0.17	0.14	0.15
75th	0.19	0.20	0.22	0.19	0.20
Male	0.64	0.65	0.77	0.64	0.70
Average age	33.69	33.46	39.38	35.98	35.26

Source: Authors' tabulations from the DMV Drivers Master Records.

arrests occurring March 2020 or later have their post-arrest observation windows occurring entirely after implementation of the stay-at-home order.

While conviction rates exhibit a slight downward trend in the months where the two-year follow-up period does not extend into the pandemic (everything to the left of March 2018), we observe steep declines in conviction rates once we reach March 2018 (the first month where some arrests have a two-year post arrest period extending beyond the pandemic stay-at-home order). By the time SB 1046 is implemented in January 2019 (fourteen months before the stay-at-home order), two-year conviction rates are already trending downward, likely due to the impact of the pandemic on case dispositions. Two-year conviction rates hit a low in April 2020 and recover somewhat over the next few years.

Data from the Judicial Council of California[36], corroborate what we observe in the DMV Drivers Master file data. Figure 3 displays annual statewide court filings, dispositions, and dispositions as a percent of court filings for misdemeanor traffic offenses[37] for fiscal years 2014 through 2023. Filings and dispositions are trending downward even before the pandemic. However, in 2020 and 2021 we see sharp declines in dispositions relative to filings. This percentage decreases from 68.3 percent in 2019 to 56.4 and 42.7 percent in 2020 and 2021, respectively. By 2023, dispositions relative to filings partially recovered, increasing from a pandemic low in fiscal year 2021 to 63.0 percent in fiscal year 2023.

Beyond the decline in disposition rates, there are other ways in which the pandemic may have hampered the initial implementation of SB 1046 or indirectly impacted observable outcomes,

[36]The Judicial Council of California Data Dashboard, accessed on August 22, 2024.

[37]Note, most DUI arrests and cases fall in this category.

Figure 2: **Percent of DUI Arrests Resulting in a Conviction Within Two-Year by Month of Arrest**

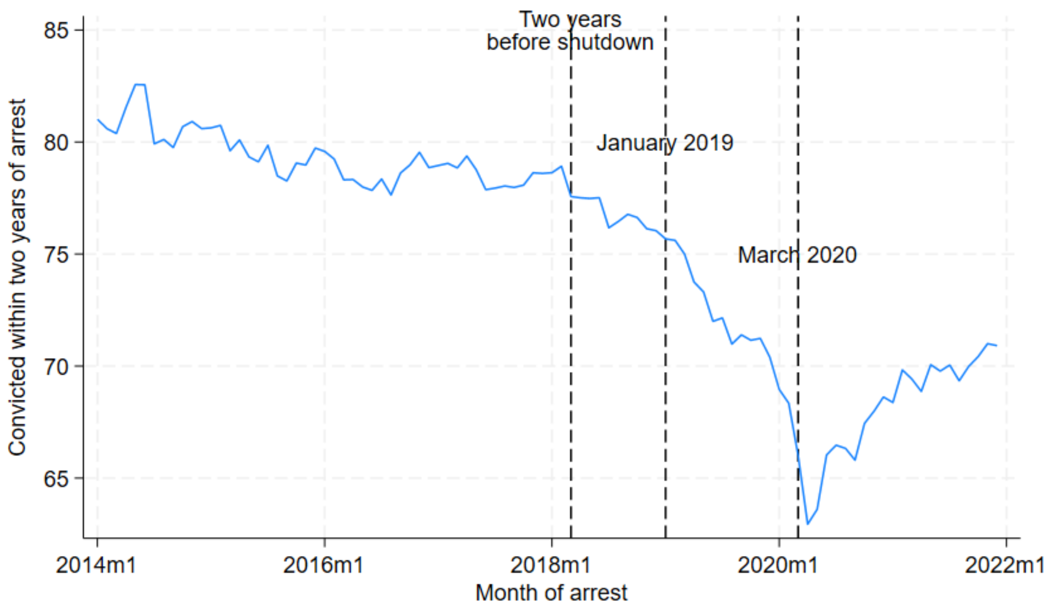
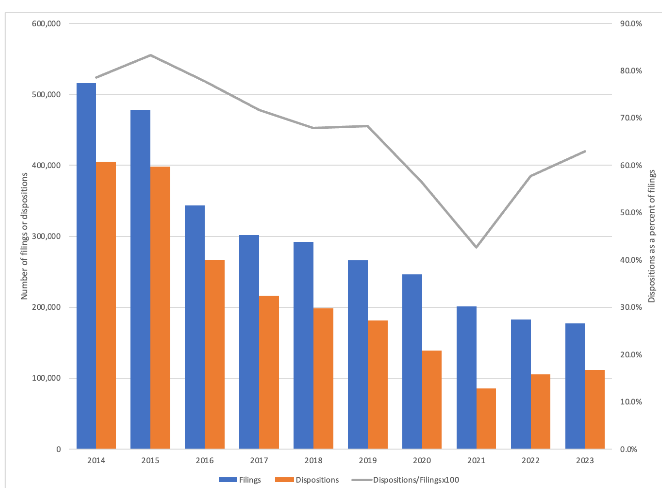


Figure 3: **California Statewide Misdemeanor Traffic Filings and Dispositions, FY2014 through FY2023**



The Judicial Council of California Data Dashboard, accessed on August 22, 2024.

such as crashes and DUI recidivism. First, obtaining an IID-restricted drivers license requires a presentation in person at a DMV office of proof of device installation and proof of insurance coverage. The temporary closures of DMV offices must have prevented or delayed some persons arrested for DUI offenses from doing so. Moreover, with most non-essential workers sheltering in place, the benefits of installing an IID to avoid an APS suspension were certainly diminished during the early COVID-19 period.

There also appeared to be important changes in driving behavior coinciding with the onset of the pandemic. There was a documented decrease in both traffic volume and total crashes at the beginning of the pandemic (Katrakazas et al., 2020; Lotan and Shinar, 2021; Islam et al., 2022). Associated with this decline in traffic volume was an increase in driving speed, but serious crashes appear to have declined. Early estimates of the effect of the pandemic on fatal crashes are conflicting (Vandoros, 2022; Barnes et al., 2020; Qureshi et al., 2020). Specifically, Islam et al. (2022) find a decline in alcohol-related crashes during the pandemic, while Thomas et al. (2020) finds an increase in crashes involving drugs. In a later analysis, Tefft and Steinbach (2024) generates an estimate of excess traffic deaths during the pandemic using pre-pandemic fatality trends to project future fatalities levels and then calculate excess deaths as the difference between actual observed fatality levels and projection. The study finds sizable increases in traffic fatalities during the pandemic beyond what would have been expected based on prepandemic trends. There is also evidence of an increase in risky driving behavior, such as a reduced use of the seat belt and consequently higher passenger ejection rates during automobile crashes (NHTSA, 2021).

To investigate this issue for California relative to other states, we downloaded the publicly available National Highway Transportation Safety Administration Fatality Analysis Reporting System (FARS) data for each year from 2005 through 2022 and tabulated alcohol-related traffic fatalities per 100,000 residents for California, for each of the remaining states, and for an average of all states other than California. Figure 4 presents these trends for all states (California highlighted in blue), while Figure 5 contrasts the California trend line with a population-weighted average trend line for the remaining 49 states. We observe clear increases in alcohol-related crash fatalities in California, in many of the other states, and certainly in the aggregate for states other than California. To the extent that the increase in fatalities in California reflected a higher incidence of driving under the influence among state residents, evident congestion in the courts may have been exacerbated by this pandemic-induced trend.

3.6 Changes in the timing of IID installation relative to the conviction date

We noted above that SB 1046 created a new restricted driver license that requires an IID but without a limit on where, when and for what purpose the person could drive. In addition, this new option permits drivers to fully avoid the pre-conviction APS suspension that follows all DUI

Figure 4: **Alcohol Related Crash Fatalities per 100,000 State Residents for 2005 through 2022 by State (California in Blue)**

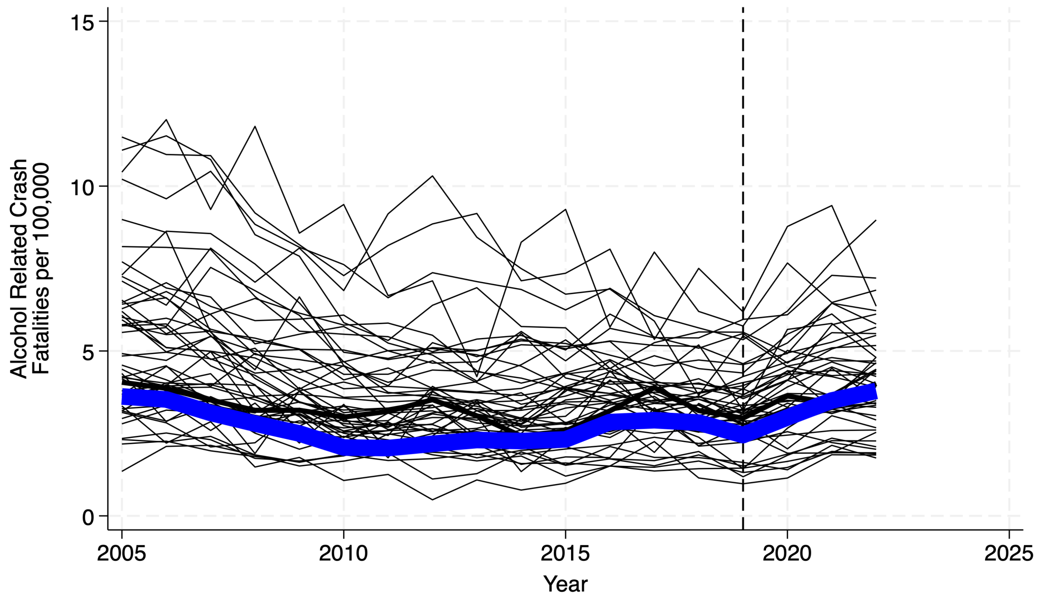


Figure 5: **Alcohol Related Crash Fatalities per 100,000 State Residents for 2005 through 2022: California and the Remainder of the United States**

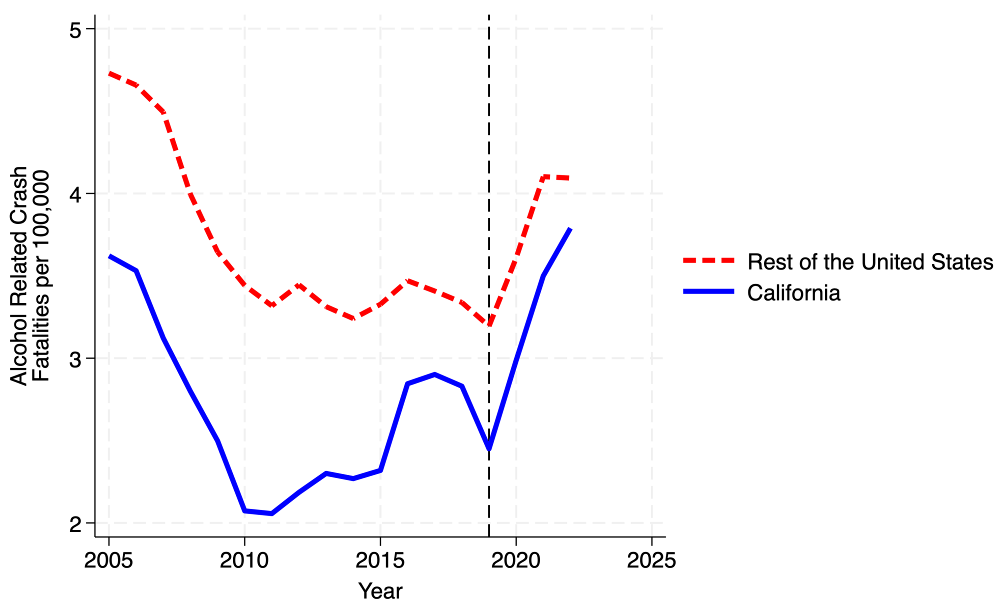


Table 5: **Distribution of IID Installations Relative to Conviction Date Before and After the Implementation of SB 1046**

Panel A: Pre SB 1046 (2014 through 2018)				
	All	No priors, no injury	No priors, injury	Priors
Pre-conviction	0.87	0.45	0.39	1.55
Post-conviction	95.38	95.42	97.75	95.00
No conviction	3.74	4.13	1.86	3.45
Panel B: Post SB 1046 (2019 through 2022)				
	All	No priors, no injury	No priors, injury	Priors
Pre-conviction	35.97	41.10	31.80	29.72
Post-conviction	55.04	49.21	62.53	61.69
No conviction	9.98	9.69	5.87	8.59

Source: Authors' tabulations from the DMV Drivers Master Records.

arrests. Here, we explore whether the timing of IID installation relative to the conviction date changes with the implementation of SB 1046. One would expect few instances of preconviction installation prior to 2019 and an increase in the pre-conviction installations in the years that follow.

Table 5 tabulates the percent of IID installations that occur before conviction, after conviction, or for DUI arrests where we do not observe a conviction. These tabulations involve only arrests where an IID is installed. The table presents separate tabulations of the pre-SB 1046 period (2014 through 2019), the post-SB 1046 period (2019 through 2022), and within these periods by offense group. The most salient pattern observed in Table 5 is the sharp pre-post change in the timing of IID installation. Before 2019, IID installation rarely occurred before conviction. After 2018, roughly 36 percent of cases have installations prior to a conviction date (with an additional 9 percent installed without an observable conviction date). This shift towards pre-conviction installation is largest for first-time offenses and the smallest for arrests where the person has prior convictions.

3.7 Trends in Actual IID Installation Outcomes and the Quasi-Experimental Contrast Between AB 91 Counties and Non-AB 91 Counties

The analysis thus far demonstrates that while SB 1046 expanded the mandatory IID requirement in some counties, the statewide effect of the legislation on installation trends was partially offset by the expiration of the AB 91 pilot program. Moreover, the preceding discussion further demonstrates how conviction rate trends have further attenuated the percentage of DUI cases where an IID requirement would be automatic.

Although the end result is a modest increase in IID installations statewide, there are much larger shifts in installation rates when we look at county groupings as well as individual counties.

This cross-county heterogeneity is of central importance to our strategy to estimate the effects of installing an IID on recidivism outcomes, which we detail in the next section. Here, we document this cross-county heterogeneity, establish that the relative changes that we observe are statistically significant, explore whether the changes in installation trends occur within offense groups defined by provisions of SB 1046, and ensure that the changes are broad based and not being driven by a single or small group of outlier counties.

Table 6 displays the proportion of arrests in which an IID is installed within two years of arrest by whether the arrest occurred before the implementation of SB 1046, after the implementation of SB 1046, and by whether the arrest occurred in an AB 91 county or in one of the remaining 54 counties. We present four cross-county group contrasts: tabulations for all offense groups combined (Panel A), tabulations for people arrested for the first offense (Panel B), people arrested for a first offense but where an injury occurs (Panel C), and arrested persons who have prior DUI convictions (Panel D).[38] The table also tabulates the pre-post SB 1046 change in installation rate for each group, the cross-group difference in installation rates within time period, and the relative pre-post change in installation rates for non-AB 91 counties relative to AB 91 counties. The tabulated differences in the table that are statistically significant are marked with a superscript.

Beginning with the results in panel A, we observe a pre-post increase in two-year installation rates in the non-AB 91 counties from roughly 6 percent to 15.3 percent. In the AB 91 counties, we observe a decline in the percent installing an IID within two years from 30.5 percent to 14.8 percent. The 9.2 percentage points increases in installation rates in non-AB 91 counties and the 15.8 percent decreases in AB 91 counties implies a 25 percentage point relative increase in the likelihood that an IID is installed for arrests occurring in the 54 non-AB 91 counties. This relative change is large and highly statistically significant.

The results for the different offense groups reveal several interesting patterns. Beginning with the results for first-offense arrests (panel B), installation rates are very low in the pre-period in the non-AB 91 counties (roughly 3 percent), while in the AB 91 counties, 33 percent of these arrests resulted in an IID installation. In the post-period, IID installations in non-AB 91 counties increases to 13 percent, most certainly reflecting individuals arrested for the first time taking advantage of the option to install an IID and avoid the APS suspension. In AB 91 counties, installations for this group fall by nearly 20 percentage points. Again, we see a large, statistically significant relative increase in installation rates of 30 percentage points.

The magnitude of the levels and changes in installation rates for people with no priors who injure someone (tabulations presented in Panel C) are comparable to those for first-time offenses without injury. Here, however, part of the increase in installation rates for those in non-AB 91 counties most likely reflects increased installations due to the mandatory installation requirement. Here again, the table documents a large relative increase in installation rates in non-AB 91 counties

[38] In appendix table ??, we present similar tabulations where people with priors are disaggregated into those with no priors, one prior, two priors, or three or more priors.

of 28 percentage points.

Finally, we see the same, yet more muted pattern among arrested persons with priors. In the non-AB 91 counties roughly 13 percent of arrests in the pre-period resulted in an IID installation. This increases 19.3 percent in the post period with the introduction of mandatory IID requirement for such arrests. In the AB 91 counties, we observe a seven percentage point decrease, yielding a relative increase in installation rates in the non-AB 91 counties of 13.4 percentage points. Again, the relative change is statistically significant.

The contrast between AB 91 and non-AB 91 counties documented in Table 6 is not driven by specific counties, but it reflects a broad-based difference between these two county groups. This is clearly evidence in Figures 6 through 8. Figure 6 shows the percent of DUI arrests in the pre-period that is followed by an IID installation within two years of arrest by county. Figure 7 presents comparable tabulations for the post-period, while Figure 8 displays the before-after change in installation rates. AB 91 counties are marked with red bars, while the remaining 54 counties are marked with blue bars. The counties in each figure are sorted from the highest to the lowest value.

In Figure 6 , we see that the installation rates were uniformly and substantially higher in the four counties of AB 91 prior to the implementation of SB 1046. In other words, the relatively high average installation rate for these counties is not an artifact of a high rate in one of the counties that participated in the AB 91 program. In the post-period (Figure 7) , the installation rates for these four counties are distributed throughout the distribution for all counties, with Alameda having one of the lowest installation rates, Tulare and Los Angeles being somewhere near the center, and Sacramento having a relatively high installation rate (but no where near the highest as was the case in the pre-period). Finally, in Figure 8 we document the fact that installation rates increased in each of the 54 non-AB 91 counties and decreased in each of the four AB 91 counties.[39]

[39] Appendix Table A1 presents two-year installation rates by year for each county. The table reveals clear pre-post SB 1046 shifts in installations for all counties.

Table 6: **Relative Changes in the Proportion of Arrests Where an IID is Installed Within Two Years of Arrest Between Non-AB 91 and AB 91 Counties: All and by Offense Group**

Panel A: All Offense Groups Combined			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0602	0.1528	0.0926^a
	(0.0003)	(0.0007)	(0.0007)
AB 91 counties	0.3055	0.1475	-0.1580^a
	(0.0011)	(0.0013)	(0.0019)
Difference	-0.2452^a	0.0053^a	0.2506^a
	(0.0009)	(0.0015)	(0.0017)
Panel B: No priors, no injuries			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0283	0.1322	0.1039^a
	(0.0003)	(0.0009)	(0.001)
AB 91 counties	0.3301	0.1337	-0.1964^a
	(0.0014)	(0.0015)	(0.002)
Difference	-0.3017^a	-0.0015	0.3032^a
	(0.0010)	(0.0018)	(0.0019)
Panel C: No priors, injury			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0335	0.1464	0.1129^a
	(0.0011)	(0.0027)	(0.003)
AB 91 counties	0.3128	0.1461	-0.1667^a
	(0.0046)	(0.0047)	(0.007)
Difference	-0.2792^a	0.0003	0.2795^a
	(0.0033)	(0.0055)	(0.0061)
Panel C: Priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.1285	0.1929	0.0644^a
	(0.0008)	(0.0014)	(0.002)
AB 91 counties	0.2469	0.1781	-0.0688^a
	(0.0020)	(0.0026)	(0.003)
Difference	-0.1184^a	0.0147^a	0.1331^a
	(0.0019)	(0.0031)	(0.0035)

Standard errors in parentheses.
a. Difference statistically significant at the one percent level of confidence.

Figure 6: **Percent of DUI Arrests Where an IID is Installed within Two Years of Arrest by County: Arrests Occurring 2014 through 2018**

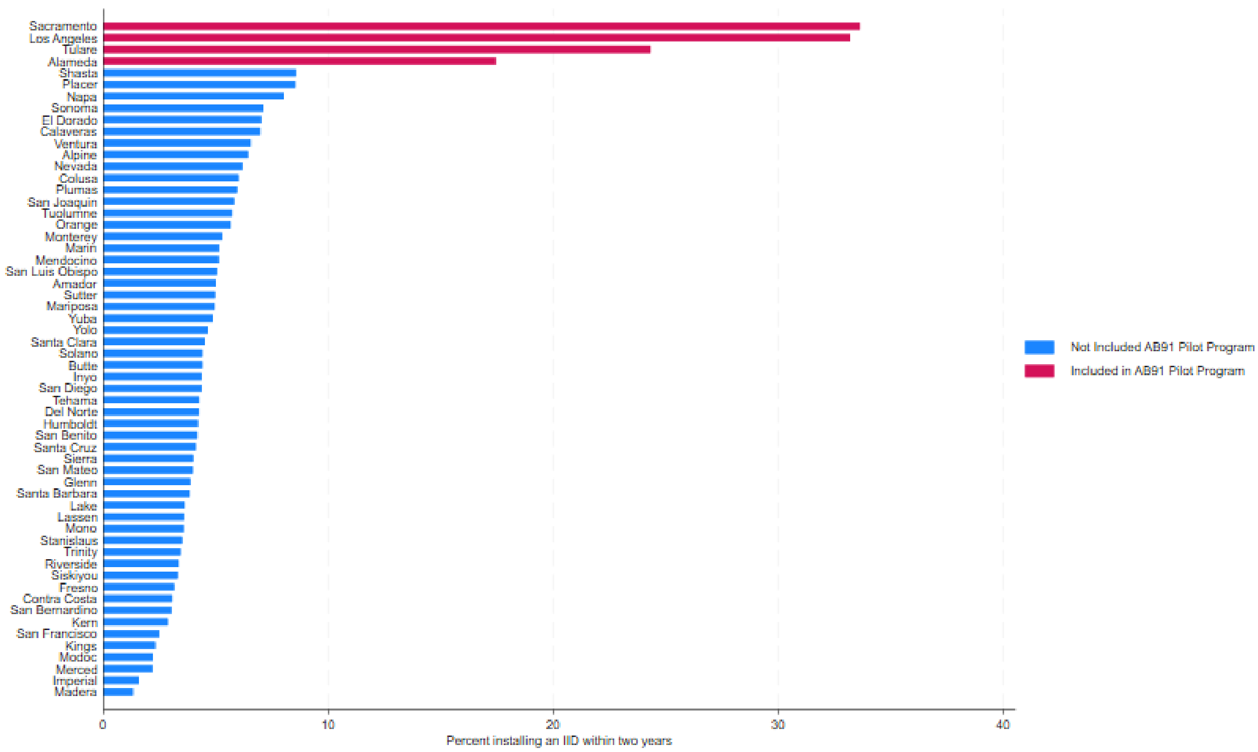


Figure 7: **Percent of DUI Arrests Where an IID is Installed within Two Years of Arrest by County: Arrests Occurring 2019 through 2022**

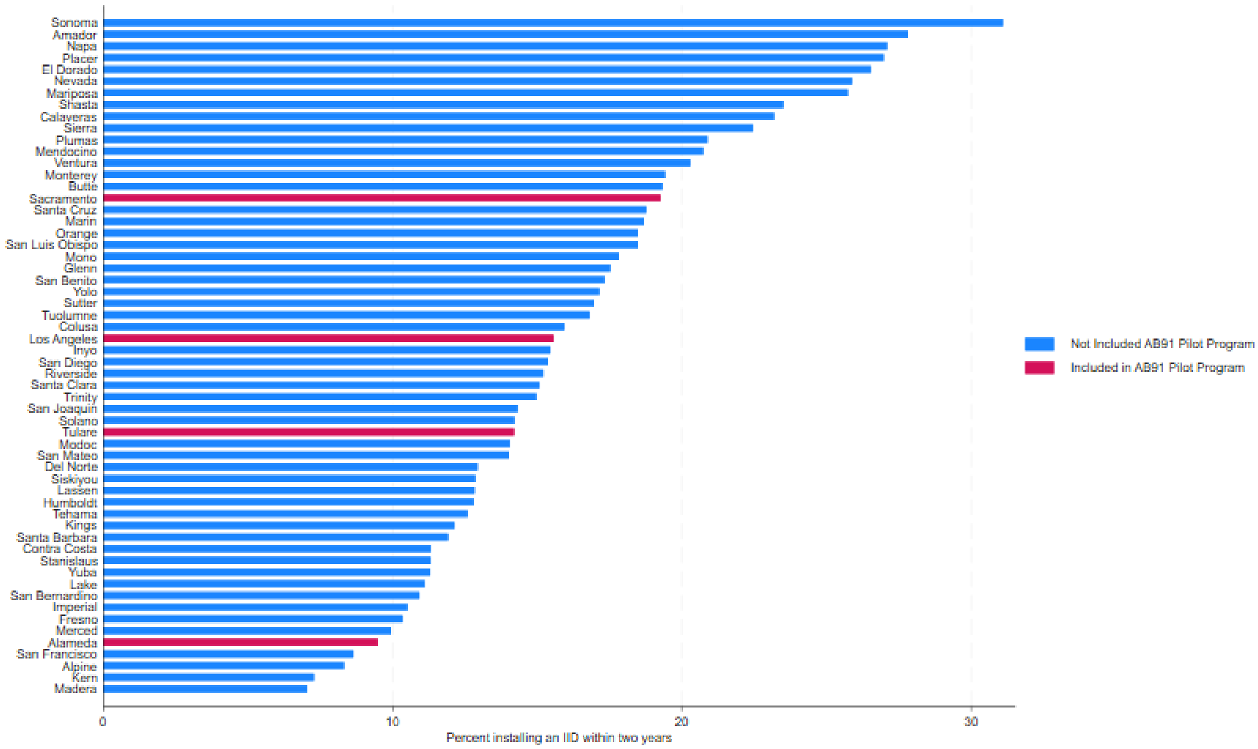
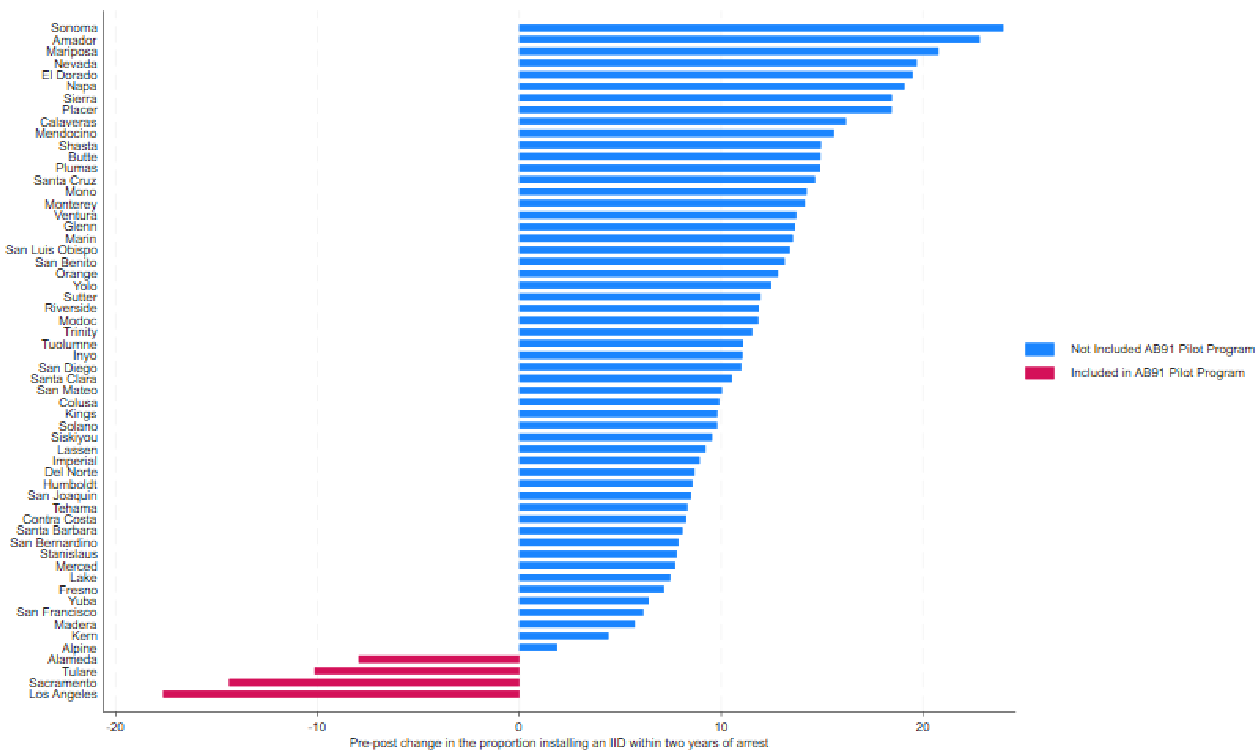


Figure 8: **Pre-Post SB 1046 Change in the Percent of DUI Arrests Where an IID is Installed within Two Years of Arrest by County**



Appendix Table A2 presents similar tabulations in which we stratify DUI arrests by the number of prior convictions using the categories no priors, one prior, two priors, and three or more priors. Again, we observe the largest relative increase in IID installations in non-AB 91 counties for those with no priors (a relative change of 29.8 percentage points). Although we observe statistically significant relative increases for those with priors as well, they are smaller and decline with the number of priors. Specifically, we observe relative increases in IID installations in non-AB 91 counties of 15.4 percentage points for those with one prior, 11.4 percentage points for those with two priors, and 6.4 percentage points for those with three or more priors.

In the following section, we lay out our strategy for estimating the causal effects of IID installation on DUI recidivism and crash outcomes based on the variation observed in Figures 6 through 8 as well as the relative changes in installation rates documented in Table 6.

4 Methodological strategy for estimating the causal effect of an IID on recidivism and crash outcomes

A primary objective of this study is to assess whether the installation of an IID reduces the likelihood of future DUI arrests and other measures of recidivism. It is certainly the case that a simple comparison of recidivism outcomes among persons who install an IID to those who do not reveals lower recidivism outcomes among installers relative to non-installers, a fact we document in Table 7. Panel A presents counts by year for those who install an IID within two years of arrest for the following recidivism outcomes (also measured within two years of the violation date): DUI arrests, crashes, alcohol-involved crashes, injury crashes, alcohol-involved injury crashes, fatal crashes, and alcohol-involved fatal crashes. Panel B presents these outcomes as a percentage of the total number of cases in each year. Panels C and D present similar tabulations for cases where the person does not install an IID within two years. Focusing on the percentage panels (panels B and D), we observe future DUI arrest rates for those who install an IID that are less than one-quarter the comparable rates for people who do not install IIDs. Moreover, for all crash outcomes in the tables, we observe markedly lower recidivism rates among people who install an IID within two years of arrest relative to persons who do not.

Of course, we cannot infer from the differences in recidivism in Table 7 that the installation of an IID causes these declines in recidivism. There are likely many differences between those who install an IID and those who do not. For example, those who install an IID may be more intrinsically motivated to not drink and drive, with the installation of an IID an outward manifestation of this intrinsic motivation. In other words, installers may be inherently different from non-installers and have lower recidivism rates due to these inherent differences rather than due to the presence of an IID in their vehicle. Addressing the likely selection bias in who installs an IID is a key challenge that our methodological strategy must address.

An additional challenge concerns the strong trends in conviction rates, alcohol related crashes, and alcohol related crashes involving injury that likely reflect behavioral changes associated with the pandemic. Although the timing of SB 1046 and the COVID pandemic is not perfectly aligned (SB 1046 was implemented in 2019 and the pandemic began in early 2020), most of the post-SB 1046 period coincides with the timing of the pandemic. Above we documented that in California and the rest of the United States alcohol-related traffic fatalities increased during the first few years of the pandemic. Simple before-after comparisons of recidivism outcomes in California that do not account for these nationwide trends would create a misleading impression concerning the effect of the SB 1046 on recidivism.

To address these methodological challenges, we employ a quasi-experimental research strategy to calculate the effect of installing an IID on the likelihood that persons arrested for a DUI recidivate within two years of their violation date. In this section, we provide the details of our strategy for estimating these causal effects.

4.1 Estimation Strategy

Table 6 documents very large and precisely measured relative changes in IID installation rates in non-AB 91 counties relative to the four AB 91 counties, both overall and within the broad offense groupings specified in SB 1046. We exploit these relative changes to perform a difference-in-difference analysis of recidivism outcomes. The intuition behind our strategy is relatively straightforward. We observe a large relative increase in IID installation rates in non-AB 91 counties coinciding with the implementation of SB 1046. To the extent that IID installation reduces recidivism, we should observe a corresponding relative decrease in recidivism in these counties. We estimate these relative changes in recidivism and employ a two-stage least squares estimator to convert these relative changes in recidivism patterns into estimates of the effect of IID installation on the likelihood of a subsequent DUI arrest, as well as other outcomes.

Regarding the specifics of the estimation strategy, define $NonAB91_i$ as a dummy variable equal to one for arrests made in one of the 54 non-AB 91 counties and equal to zero otherwise, where i indexes a specific arrest. Using all arrests for which we can observe two years of post-arrest outcomes, we estimate the following equation:

$$Y_i = \alpha_0 + \alpha_1 Post_i + \alpha_2 NonAB91_i + \alpha_3 Post_i x NonAB91_i + \gamma X_i + \epsilon_i, \tag{1}$$

where Y_i is an indicator variable for a recidivism outcome (subsequent DUI, subsequent crash, subsequent crash with injury, all measured within two years of arrest), $Post_i$ is a dummy variable indicating that the arrest occurred on January 1, 2019 or later, $NonAB91_i$ is as defined above, α_1, α_2, α_3, and γ are parameters to be estimated (γ being a parameter vector), X_i is a vector

Table 7: **Two-Year Recidivism Outcomes by Year for People who Install an IID Within Two Years and People Who Do Not**

Panel A: Two-year recidivism outcome counts among people who install an IID within two years of arrest

Year	Total	DUI	Crash	Alcohol-involved crash	Injury crash	Alcohol-involved injury crash	Fatal crash	Alcohol-involved fatal crash
2019	20,270	433	1,136	123	491	67	< 50	< 50
2020	12,650	354	746	97	335	56	< 50	< 50
2021	15,045	404	878	110	405	70	< 50	< 50

Panel B: Two-year recidivism outcome percentages among people who install an IID within two years of arrest

Year	Total	DUI	Crash	Alcohol-involved crash	Injury crash	Alcohol-involved injury crash	Fatal crash	Alcohol-involved fatal crash
2019	100.00	2.14	5.60	0.61	2.42	0.33	< 0.2	< 0.2
2020	100.00	2.80	5.90	0.77	2.65	0.44	< 0.2	< 0.2
2021	100.00	2.69	5.84	0.73	2.69	0.47	< 0.2	< 0.2

Panel C: Two-year recidivism outcome counts among people who do not install an IID within two years of arrest

Year	Total	DUI	Crash	Alcohol-involved crash	Injury crash	Alcohol-involved injury crash	Fatal crash	Alcohol-involved fatal crash
2019	99,327	10,142	8,132	1,916	3,673	1,269	130	66
2020	80,121	9,541	7,942	1,890	3,793	1,403	152	66
2021	88,998	9,838	8,101	1,983	3,844	1,384	146	< 50

Panel D: Two-year recidivism outcome percentages among people who do not install an IID within two years of arrest

Year	Total	DUI	Crash	Alcohol-involved crash	Injury crash	Alcohol-involved injury crash	Fatal crash	Alcohol-involved fatal crash
2019	100	10.21	8.19	1.93	3.70	1.28	0.13	0.07
2020	100	11.91	9.91	2.36	4.73	1.75	0.19	0.08
2021	100	11.05	9.10	2.23	4.32	1.56	0.16	< 0.05

of control covariates describing the arrest and the person arrested, and ϵ_i is a mean-zero error term. The coefficient α_3 measures the pre-post average change in Y_i in the non-AB 91 counties minus the comparable change for AB 91 counties (basically, the reduced-form effect of SB 1046 on the relative recidivism outcomes for the two county groups). Given the relative increase in IID installation rates in non-AB 91 counties, a significant negative estimate of α_3 would indicate that IID installation reduces recidivism.

We also employ this framework to estimate the effect of installation on recidivism using the second-stage equation

$$Y_i = \beta_0 + \beta_1 Post_i + \beta_2 NonAB91_i + \beta_3 Installation_i + \theta X_i + \varepsilon_i, \tag{2}$$

where the interaction term between $Post_i$ and $NonAB91_i$ is used as an instrument for $Installation_i$. Applying two-stage least squares to equation 2 provides the local average treatment effect for those whose installation outcome complies with the relative changes in policy (measured by the estimate of the parameter β_3).

The key identification assumption underlying the estimation strategy presented in equations 1 and 2 is that in the absence of SB 1046 the average recidivism outcomes in pilot and nonpilot counties would have followed parallel trends. This seems reasonable given that all counties are nested within the same state and the AB 91 counties are represented in the state's major southern and northern population centers. However, to assess whether the main estimation results are robust, we estimate several specifications of equations 1 and 2 with increasingly inclusive sets of covariates in the vector X_i. We also present model estimates where we first match each arrest in AB 91 county with an arrest in a non-AB 91 county using exact matching on age, sex, arrest date, and number of previous alcohol-related convictions and nearest-neighbor matching for the highest BAC reading at arrest.[40]

4.2 Outcome variables and data description

Our analysis focuses on three post-arrest outcomes: subsequent DUI arrests, subsequent automobile crashes, and subsequent automobile crashes that involve injuries to the driver or another person. All outcomes are measured over the two-year period after arrest. A priori, we hypothesize that IID installation should reduce the likelihood of a subsequent DUI arrest. Moreover, since IID installations increased overall in the state, and in non-AB 91 counties in particular, we hypothesize that DUI recidivism should be lower in the post-SB 1046 period relative to the counterfactual we would have observed in the absence of the implementation of SB 1046.[41]

[40] Each arrest typically has information on two BAC measurements.

[41] To be sure this does not necessarily mean that recidivism rates should decline in the post-period relative to the pre-period. Rather, any evidence that IID installations reduce recidivism implies that in a counter factual world

Regarding the two crash outcomes,the effects of SB 1046 could plausibly go in either direction. To the extent that IIDs prevent driving under the influence and driving under the influence increases the likelihood of an automobile crash (see Blomberg et al. (2009) and Peck et al. (2008) for evidence related to the relative risk of a crash at various BAC levels), an increase in IID installation rates would be expected to reduce crash rates. However, SB 1046 also creates a new opportunity for individuals arrested for a DUI to completely avoid the APS license suspension through the installation of an IID, likely increasing the time on the road during the two-year follow-up window. To the extent that people arrested for a DUI are on average more risky drivers even when not under the influence, or that crash risk increases with time driving, the legislation may increase crash rates.

In supplementary analysis, we also test for effects of IID installation on crashes (with and without injury as well as fatal crashes) where the accident record indicates that the driver has been drinking. However, we are cautious in interpreting these results given the very low incidence for some of the outcomes (deaths in particular) and the fact that information pertaining to the sobriety of the involved drivers is missing for a large share of the crashes. The DMV notes that data on alcohol involvement is incomplete due to the fact that the police do not always report information for this field and may also report with a 1 ag. In addition, crash records come from two sources: law enforcement (with records from individual law enforcement agencies reported to the California Highway Patrol who then provide information to the DMV) as well as reports by involved individuals (or their insurance companies) under a California Financial Responsibility law. Roughly 40 percent of crashes are reported by law enforcement alone, 40 percent by individuals or insurance companies only in compliance with their financial responsibility obligation, while 20 percent have reports from both law enforcement and individuals or their insurance companies. Information about whether drivers have been drinking is missing from all records that are not reported by law enforcement.[42]

The data from this project come from the California DMV Driver Record Master File. We received information for all drivers arrested for a DUI since 2014 from the drivers license basic record, the history sub-record, the arrest data sub-record, the drivers license abstract sub-record, and an abstract sub-record providing information on convictions. We also received information from the crash sub-record, a sub-record with information on IID installations and removals, and a sub-record providing information on drinking driver program participation. We focus on all arrests occurring between January 1, 2014 and the end of calendar year 2021. The end-date restriction ensures that we have a two-year post-arrest observation window for each arrest during which we measure IID installation and recidivism outcomes. During our study period, we observe 947,765

where SB 1046 was not implemented and the earlier AB 91 pilot was permitted to expire, recidivism levels would be higher.

[42]This information is drawn from a December 14, 2021, memo drafted by the Chief of the DMV Research and Development Branch, Bayliss J. Camp titled "Conceptual Overview of the Driver Record Master and Potential Sub-records of Interest for the Analysis of the Effects SB 1046."

Table 8: **Statewide Pre and Post SB 1046 Averages for IID Installation, DUI Recidivism, Post-Arrest Crashes, and Post-Arrest Crash with Injury for the Two-Year Period Following Arrest**

	Before SB 1046	After SB 1046	After-Before
IID Installed	0.1227	0.1516	0.0288[a]
	(0.0004)	(0.0006)	(0.0007)
DUI Recidivism	0.0848	0.0971	0.0123[a]
	(0.0004)	(0.0005)	(0.0006)
Crash	0.0698	0.0851	0.0154[a]
	(0.0003)	(0.0005)	(0.0006)
Crash with	0.0319	0.0396	0.0077[a]
Injury	(0.0002)	(0.0003)	(0.0004)

Standard errors in parentheses.
a. Difference statistically significant at the one percent level of confidence.

DUI arrests for which we can observe a complete two-year post-arrest observation window (631,354 arrests occurring during calendar years 2014 through 2018 and 316,411 occurring in calendar years 2019 through 2021).

Table 8 provides the averages before and after SB 1046 for the proportion of arrests where an IID is installed within two years, the proportion of arrests where we observe a subsequent DUI arrest, the proportion of arrests where we observe a subsequent crash, and the proportion of arrests where we observe a subsequent crash with injury. We observe an increase in the proportion of arrests resulting in an IID installation of 0.0288 (or 2.88 percentage points). The increase is statistically significant at the one percent level of confidence. Regarding the recidivism outcomes, in the pre-SB 1046 period, roughly 8.5 percent of people arrested for a DUI are rearrested for a DUI within two years of the original arrest. This figure increases to 9.7 percent post SB 1046. We observe a similar pattern for the percent of arrested persons who are involved in a crash within two years (6.98 percent in the pre period and 8.51 percent in the post period), and the percent of people involved in a crash with injury (from 3.19 percent to 3.96 percent). All of the pre-post changes are statistically significant.

However, these average changes cannot be attributed to SB 1046, since risky driving and alcohol-related crashes and fatalities increase both in California and the rest of the United States with the onset of the COVID pandemic (see Figures 4 and 5 above). In what follows, we will use our estimation results calculated from our analysis of the DMV Driver Record Master File data to generate an estimate of what recidivism rates would have been had SB 1046 not been implemented.

5 Estimation Results

5.1 Unadjusted Difference-in-Difference Estimates

We begin by presenting the simple average recidivism outcomes for non-AB 91 and AB 91 counties for the pre-SB 1046 period (that is, 2014 through 2018), the post-SB 1046 period (that is, 2019 through 2021), the pre-post changes in outcomes for each set of counties, and the extent to which the change for non-AB 91 counties differs from the comparable change for AB 91 counties. Recall that in Table 6 we document a large relative increase (25 percentage points) in the likelihood that an arrest is followed by an IID installation in the 54 nonAB 91 counties compared to the remaining four counties. To the extent that IID installation impacts recidivism outcomes, we should observe corresponding relative changes in recidivism in the opposite direction, i.e., recidivism rates should fall in the non-AB91 counties relative to the AB91 counties.

Tables 9, 10, and 11 present these tabulations for two-year DUI recidivism rates, two-year crash rates, and two-year crash-with-injury rates. Beginning with DUI recidivism, among the 54 non-AB91 counties we observe a statistically significant increase in DUI recidivism of 0.0110 (or 1.1 percentage points). Among AB 91 counties however, we observe a larger pre-post increase of 0.0152 (or 1.52 percentage points). The change for non-AB91 counties relative to AB 91 counties (the difference-in-difference estimate) is thus -0.0042 (or a 0.42 percentage point relative decline in recidivism). This relative decline is statistically significant at the one-percent confidence level.

The results by offense group reveal comparable relative declines in recidivism rates in the 54 non-AB 91 counties. We observe statistically significant difference-in-difference estimates for first-time offenses (a relative decline of 0.0044, statistically significant at the one per cent level of confidence) and for offenses where there are no priors but where an injury occurs (a relative decline of 0.0074, statistically significant at the ten percent level of confidence). While we observe a relative decline for repeat offenses as well (with a point estimate of -0.0031), this estimate is not statistically significant,

Table 10 presents the difference-in-difference analysis for the outcome measuring automobile crashes within two years of the focal arrest. The patterns are similar to what we observe for DUI recidivism, although new crashes are generally somewhat less likely than new DUI arrests. Among people arrested in the non-AB 91 counties, the proportion involved in a new crash increases by 0.0143 (1.43 percentage points) while among arrests in AB 91 counties the proportion increases by 0.0200 (2 percentage points). Together, these imply a pre-post SB 1046 relative change in new crashes of -0.0057 (or .57 percentage points). This relative decline is statistically significant at the one-percent confidence level.

The outcomes by offense group are notably different. Among persons arrested for a first offense, we observe a relative decline in two-year crash rates of 0.0042 (significant at the five percent level of confidence). Among those arrested for a first offense causing injury and those arrested for a

Table 9: **Relative Changes in the Proportion of Arrests Where a New DUI Arrest Occurs Within Two Years of Arrest Between Non-AB91 and AB 91 Counties: All and by Offense Group**

Panel A: All Arrests			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0879	0.0989	0.0110[a]
	(0.0004)	(0.0006)	(0.0007)
AB 91 counties	0.0756	0.0908	0.0152[a]
	(0.0007)	(0.0011)	(0.0012)
Difference	0.0123[a]	0.0081[a]	−0.0042[a]
	(0.0008)	(0.0013)	(0.0015)
Panel B: No priors, no injuries			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0803	0.0905	0.0102[a]
	(0.0005)	(0.0007)	(0.0009)
AB 91 counties	0.0670	0.0816	0.0146[a]
	(0.0008)	(0.0013)	(0.0014)
Difference	0.0133[a]	0.0089[a]	−0.0044[a]
	(0.0010)	(0.0015)	(0.0018)
Panel C: No priors, injury			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0602	0.0662	0.0060[b]
	(0.0015)	(0.0019)	(0.0024)
AB 91 counties	0.0466	0.0603	0.0137[a]
	(0.0021)	(0.0032)	(0.0037)
Difference	0.0136[a]	0.0059	−0.0077[c]
	(0.0027)	(0.0038)	(0.0046)
Panel D: Priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.1079	0.1217	0.0137[a]
	(0.0008)	(0.0012)	(0.0014)
AB 91 counties	0.1023	0.1191	0.0169[a]
	(0.0014)	(0.0023)	(0.0026)
Difference	0.0056[a]	0.0025	-0.0031
	(0.0017)	(0.0025)	(0.0030)

Standard errors in parentheses.

a. Difference statistically significant at the one percent level of confidence.

b. Difference statistically significant at the five percent level of confidence.

c. Difference statistically significant at the ten percent level of confidence.

Table 10: **Relative Changes in the Proportion of Arrests Where the Person is in a Crash Within Two Years of Arrest Between Non-AB91 and AB91 Counties: All and by Offense Group**

Panel A: All Arrests			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0682	0.0824	0.0143^{a}
	(0.0004)	(0.0006)	(0.0006)
AB 91 counties	0.0744	0.0943	0.0200^{a}
	(0.0007)	(0.0011)	(0.0012)
Difference	-0.0061^{a}	-0.0119^{a}	-0.0057^{a}
	(0.0007)	(0.0012)	(0.0014)
Panel B: No priors, no injuries			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0709	0.0834	0.0125^{a}
	(0.0005)	(0.0007)	(0.0008)
AB 91 counties	0.0785	0.0952	0.0167^{a}
	(0.0008)	(0.0014)	(0.0012)
Difference	-0.0076^{a}	-0.0118^{a}	-0.0042^{b}
	(0.0009)	(0.0015)	(0.0017)
Panel C: No priors, injury			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0604	0.0669	0.0065^{a}
	(0.0015)	(0.0020)	(0.0024)
AB 91 counties	0.0582	0.0742	0.0160^{a}
	(0.0023)	(0.0035)	(0.0040)
Difference	0.0021	-0.0073^{c}	-0.0094^{b}
	(0.0028)	(0.0039)	(0.0047)
Panel D: Priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0642	0.0839	0.0197^{a}
	(0.0006)	(0.0010)	(0.0011)
AB 91 counties	0.0684	0.0977	0.0293^{a}
	(0.0012)	(0.0021)	(0.0022)
Difference	-0.0042^{a}	-0.0138^{a}	-0.0096^{a}
	(0.0013)	(0.0022)	(0.0025)

Standard errors in parentheses.
a. Difference statistically significant at the one percent level of confidence.
b. Difference statistically significant at the five percent level of confidence.
c. Difference statistically significant at the ten percent level of confidence.

Table 11: **Relative Changes in the Proportion of Arrests Where the Person is in a Crash Involving an Injury Within Two Years of Arrest Between Non-AB 91 and AB 91 Counties: All and by Offense Group**

Panel A: All Arrests			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0310	0.0384	0.0075[a]
	(0.0003)	(0.0004)	(0.0004)
AB 91 counties	0.0346	0.0438	0.0092[a]
	(0.0005)	(0.0008)	(0.0009)
Difference	−0.0036[a]	−0.0054[a]	−0.0018[c]
	(0.0005)	(0.0008)	(0.0009)
Panel B: No priors, no injuries			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0321	0.0384	0.0063[a]
	(0.0003)	(0.0005)	(0.0006)
AB 91 counties	0.0371	0.0445	0.0075[a]
	(0.0006)	(0.0010)	(0.0010)
Difference	−0.0049[a]	−0.0061[a]	-0.0012
	(0.0006)	(0.0011)	(0.0012)
Panel C: No priors, injury			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0285	0.0332	0.0048[b]
	(0.0010)	(0.0014)	(0.0017)
AB 91 counties	0.0272	0.0360	0.0088[a]
	(0.0016)	(0.0026)	(0.0029)
Difference	0.0013	-0.0028	-0.0041
	(0.0019)	(0.0028)	(0.0033)
Panel D: Priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.0291	0.0395	0.0104[a]
	(0.0004)	(0.0007)	(0.0008)
AB 91 counties	0.0305	0.0442	0.0137[a]
	(0.0008)	(0.0014)	(0.0015)
Difference	−0.0015	−0.0047[a]	−0.0032[c]
	(0.0009)	(0.0015)	(0.0017)

Standard errors in parentheses.
a. Difference statistically significant at the one percent level of confidence.
b. Difference statistically significant at the five percent level of confidence.
c. Difference statistically significant at the ten percent level of confidence.

repeat offense, the relative declines are more than double the value for first timers. For those arrested for an offense with injury, we see a 0.0096 relative decrease in the proportion involved in a subsequent crash for non-AB91 counties relative to AB91 counties (statistically significant at the five percent level of confidence). The comparable estimate for people with prior convictions is a relative decline of 0.0096 (statistically significant at the one percent level of confidence). The larger estimate for those with priors is particularly striking given that we observe in Table 6 the smallest relative increase in IID installation for this group (13.32 percent, relative to 27.95 percent for first-time-with-injury arrests, and 30.03 percent for first arrests without injury). Combined these results suggest that IIDs have notably larger effects on subsequent crashes for those with priors, an issue we will return to in the two-stage-least-squared analysis below.

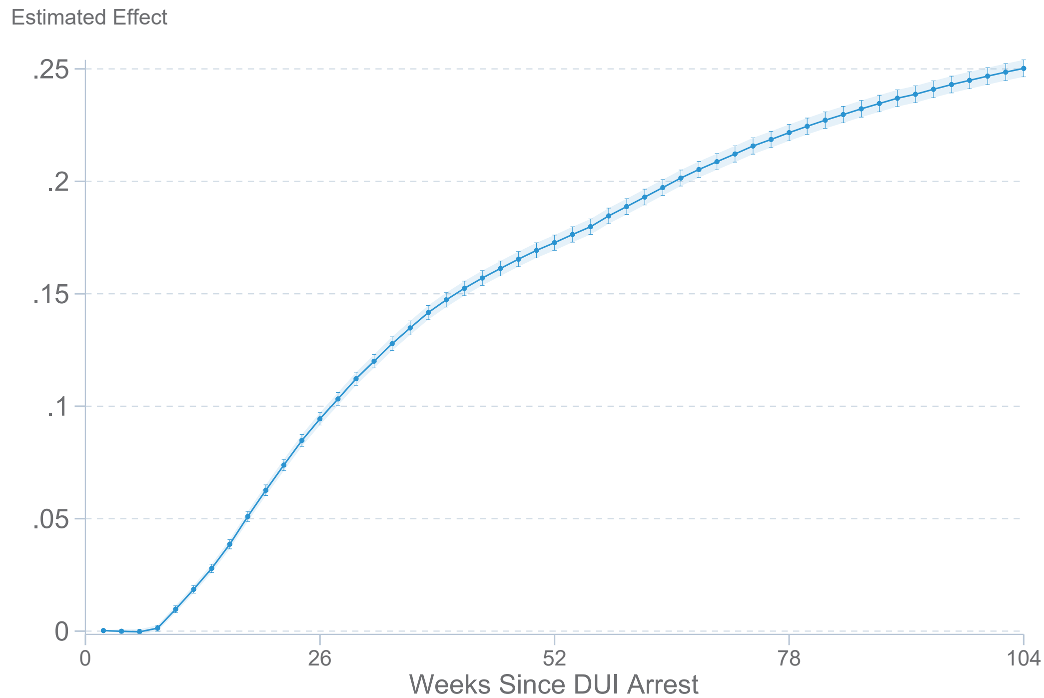
Finally, Table 11 presents the difference-in-difference analysis for crashes that result in an injury. Again, we see pre-post SB 1046 increases in this recidivism measure for both county groups, with the rate increasing by 0.0075 for non-AB91 counties and by 0.0092 for AB 91 counties, implying an overall relative decline in non-AB 91 counties of 0.0018 (statistically significant at the ten percent level of confidence). We observe relative declines within each offense group. However, the relative change is statistically significant (at the ten percent level of confidence) only for those who are arrested and who have priors.

Appendix Tables A3 through A5 reproduce this analysis by subgroups defined by the number of priors using the following groupings: no priors, one prior, two priors, and three or more priors. The results for those without priors are quite similar to what we observe in tables 9 through 11. This is not surprising given that those without priors basically combine first-timers without injury and first-timers who cause an injury. Among those with prior convictions, we see the strongest evidence of an effect of IID on the outcomes for people with a prior conviction. We find no evidence of a relative change in recidivism outcomes among people with two prior convictions and evidence of a relative decline in crashes for those with three priors. We should note, however, that we have much smaller sample sizes for these latter two groups and, as a consequence, our estimates of the relative changes for these groups are considerably less precise.[43]

Figures 9 through 12 visibly depict how the difference-in-difference estimates evolve with time since arrest. Specifically, each figure graphs the difference-in-difference estimate using different post-arrest time windows ranging from one to 104 weeks. Hence, in Figure 9 we observe the relative change in non-AB 91 counties in the proportion installing an IID within one week of arrest, within two weeks of arrest, and so on through two years. Note, the value for two years (the point estimate at 104 weeks) matches the installation difference-in-difference estimate presented in Table 6 for all offense groups combined, while the 104-week estimates for the recidivism outcomes in the subsequent figures match the difference-in-difference estimates for all offense groups combined

[43]In other words, we do not have enough statistical power to detect effects for these latter groups equal in magnitude to what we observe for those with no priors. Regarding specific sample size, we observe data for 654,112 observations where the person arrested has no priors, 187,339 where the person arrested has one prior, 65,843 where the person arrested has two priors, and 40,471 where the person arrested has three or more priors.

Figure 9: **Difference-in-Differences Estimated Effect on Probability of Having Installed a IID Within x Weeks of Arrest**



presented in Tables 9 through 11. Each figure also depicts the 95 percent confidence interval around the individual estimates.

In Figure 9 we see no relative difference in IID installation until about four weeks following arrest. The difference in IID installation rates increases steadily to 25 percentage points at the end of the two-year period. While our observation window ends at two years, the figure suggests that the installation difference-in-difference grows continuously through the end of the observation window (and perhaps would continue to grow beyond two years).

Turning to recidivism outcomes, the relative decline in subsequent DUI arrests in non-AB 91 counties (Figure 10) is basically zero for the first six months or so and then begins to emerge. By one year, we observe statistically significant relative declines that increase through year two though appear to stabilize.

Significant relative declines in crashes (Figure 11) and crashes with injury (Figure 12) appear more quickly. We observe statistically significant relative declines in both outcomes in non-pilot counties within a few months of arrest. The overall effect on crashes appears to grow larger with time, whereas the effect on crashes with injuries stabilizes after six months.

Figure 10: **Difference-in-Differences Estimated Effect on Probability of Another DUI Arrest Within x Weeks of Arrest**

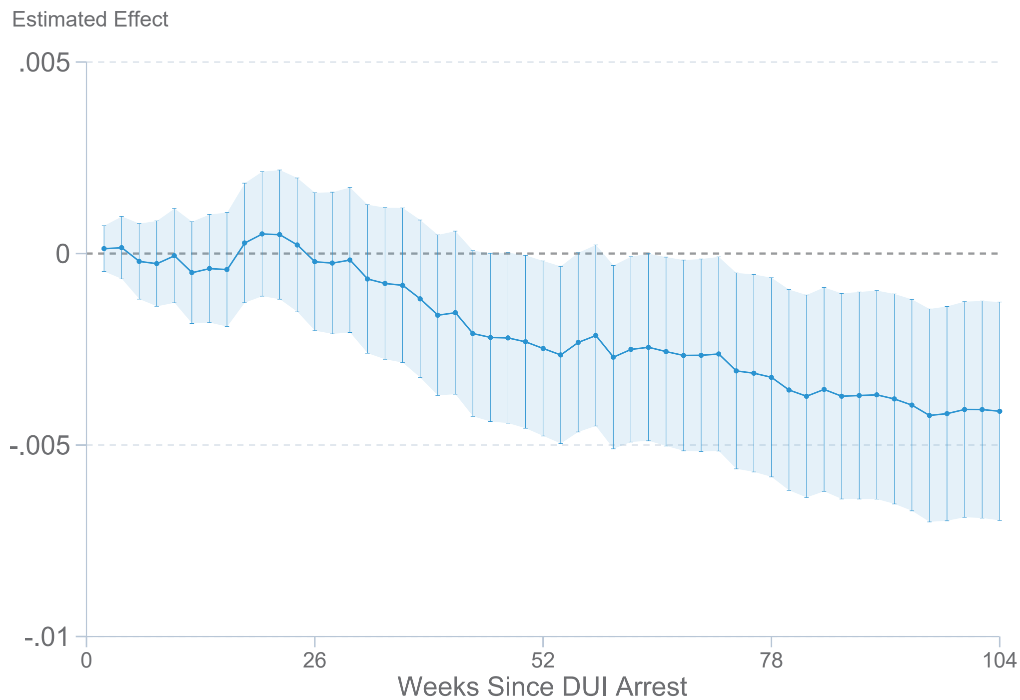


Figure 11: **Difference-in-Differences Estimated Effect on Probability of a Crash Within x Weeks of Arrest**

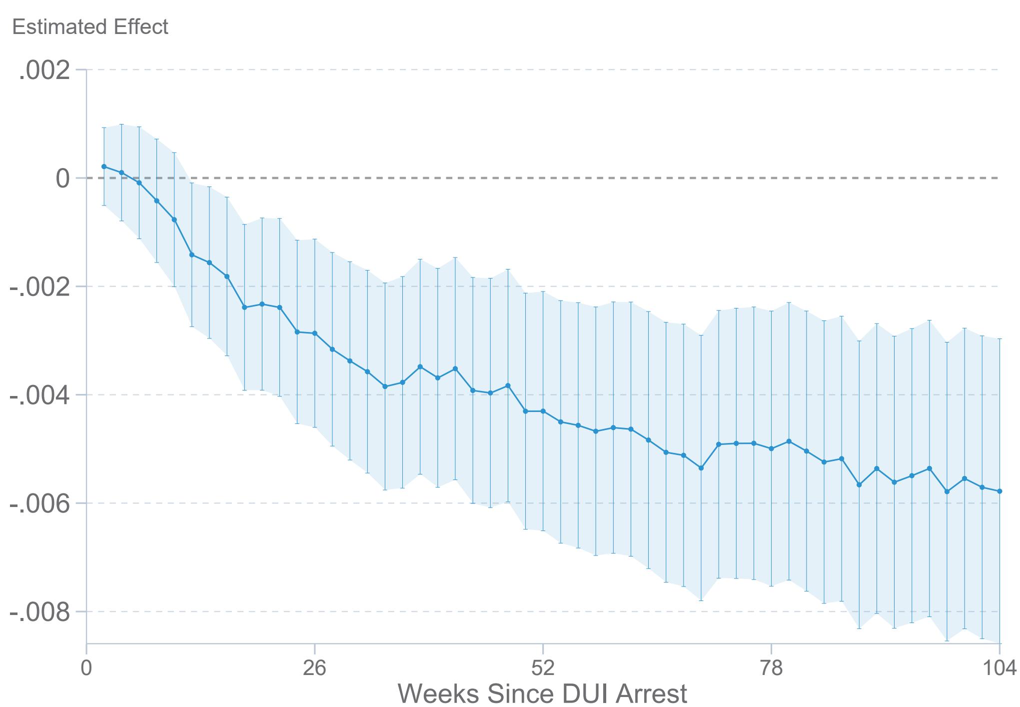
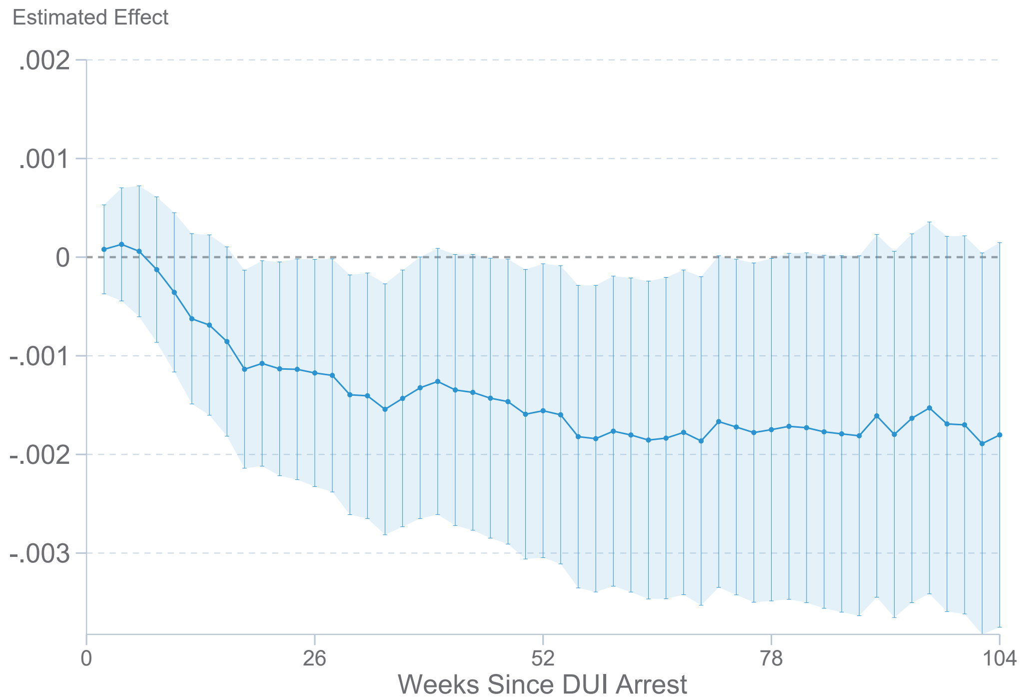


Figure 12: **Difference-in-Differences Estimated Effect on Probability of an Crash With Injury Within x Weeks of Arrest**



5.2 Regression Adjusted Difference-in-Difference Estimates

The results thus far indicate that the relative increase in IID installations in non-AB 91 counties corresponds in time with relative declines in the three recidivism measures under study. One might be concerned that DUI arrests in AB 91 and non-AB 91 counties are somehow fundamentally different from each other or that the composition of DUI arrests in these two county sets differentially change in a manner that may be spuriously creating this pattern. To explore whether this is the case, in this section, we present difference-in-difference estimates that employ multiple regression analysis along with case-level matching to adjust for potential differences in the observable characteristics of DUI arrests that may determine subsequent recidivism outcomes independently of whether an IID is installed.

We estimate regression-adjusted difference-in-difference models for the three recidivism outcomes analyzed in Tables 9 through 11 using the following model and sample specifications:

- **Model 1**: A baseline model including a dummy for non-AB9 91 county, post-SB 1046 and an interaction term between the two variables. The coefficient on the interaction term provides the unadjusted difference-in-difference estimate corresponding to those provided in Tables 9, 10, and 11.

- **Model 2**: Adding to the specification in model 1 controls for the driver being male, dummy variables indicating having one, two, three, four, or five or more prior DUIs, a quadratic in age at the time of arrest, a quadratic in the maximum BAC reading at arrest, a dummy variable indicating BAC missing, and interactions of the male dummy with all of these additional control variables.

- **Model 3**: Adding a complete set of year-month and county-of-residence fixed effects to the specification of model 2.

- **Model 4:** Estimation of Model 3 in a sample where each AB 91 county arrest is matched to a non-AB 91 county arrest using exact matching in age, sex, arrest date, and number of previous alcohol-related convictions and nearest-neighbor matching for the highest BAC reading at arrest.

Table 12 presents these results. Here, we omit the bulk of the model coefficients and present only the difference-in-difference estimates from each model specification for each outcome. Beginning with the DUI recidivism outcome, we observe statistically significant relative declines in recidivism in non-AB 91 counties in all models, with point estimates varying from -0.0032 in model 3 (the full specification but not using the matched sample) to -0.0042 in model 1 (the unadjusted difference-in-difference estimate). The four estimates are within each other's confidence intervals. Interestingly, adding an extensive set of covariates has little impact on the standard errors, although we have less precision in the model based on the sample of AB91 county arrests matched to arrests from other counties.[44]

Turning to the crash recidivism outcome, we find statistically significant relative declines in crash recidivism in non-AB91 counties in all model specifications, with each estimate statistically significant at the one percent level of confidence. The estimates employing the full sample of arrests range from -0.0053 in model (3) to -0.0057 in model (1). We observe the largest point estimate for the model using the full covariate vector and estimated on the matched sample (a relative decline of 0.0074 in the non-AB 91 counties relative to the AB 91 counties). Again, all of the estimates lie within each others' confidence intervals.

Finally, for the crashes with-injury recidivism outcome, we again find relative declines in non-AB 91 counties. These estimates are significant at the ten-percent confidence level in the unadjusted model (model 1), the model using the full sample and the full vector of covariates (model 3), and the model employing the matched sample (model 4). Again we find that the magnitude of the estimates is generally not sensitive to the model specification. For all three outcomes, the general stability of the estimates indicates that the relative change in IID installation is unrelated to observable characteristics of the arrests, and thus bolsters the identification assumption that the relative shift in IID installations provides exogenous variation in our key explanatory variable of interest.

[44]Note, this sample is by construction, smaller than the full sample of arrests and thus we have slightly larger standard errors.

Table 12: **OLS Difference-in-Difference Estimates: Change in Recidivism Outcomes, Non-AB 91 Relative to AB 91 Counties**

Two-year recidivism outcome	Model (1)	Model (2)	Model (3)	Model (4)
DUI arrest	-0.0042^{a}	-0.0045^{a}	-0.0032^{b}	-0.0034^{c}
	(0.0015)	(0.0014)	(0.0014)	(0.0018)
Crash	-0.0057^{a}	-0.0055^{a}	-0.0053^{a}	-0.0074^{a}
	(0.0014)	(0.0014)	(0.0014)	(0.0017)
Crash with injury	-0.0018^{c}	-0.0016	-0.0017^{c}	-0.0020^{c}
	(0.0010)	(0.0010)	(0.0010)	(0.0012)
Controls	No	Yes	Yes	Yes
Year-month effects	No	No	Yes	Yes
County effects	No	No	Yes	Yes
Matched sample	No	No	No	Yes
N	947,765	947,765	947,765	459,198

Robust standard errors are in parentheses. The vector of control variables include a male dummy, dummies for having one, two, three, four, or five or more prior DUIs, a quadratic in age at arrest, a quadratic in the maximum BAC reading at arrest, a dummy variable indicating BAC missing, and interactions of the male dummy with all other control variables. County effects measure county of resident and the year-month effects measure the year/month of arrest.

a. Estimate significant at the one percent level of confidence.
b. Estimate significant at the five percent level of confidence.
c. Estimate significant at the ten percent level of confidence.

These difference-in-difference estimates present tests of the hypothesis that recidivism rates decline in the county group experiencing relative increases in IID installation rates. The findings strongly suggest that this is indeed the case. However, it is difficult to interpret the magnitude of these estimates as they reflect the product of the change in policy in installation rates and the effect of IID installation on recidivism. We now turn to generating structural estimates of the effect of an IID installation on the three recidivism outcomes.

5.2.1 Two stage least squares estimates of the effect of IID installation

The difference-in-difference analysis clearly indicates that the relative increase in IID installation in non-AB 91 counties corresponded in time with a relative decrease in recidivism among people arrested for a DUI. Moreover, this result is robust to controlling for observable arrest characteristics and estimating the model using a matched sample.

For policy evaluation as well as comparison with results from previous studies, it is helpful to have structural estimates of the effects of IID installation on each of these recidivism outcomes.

Here, we employ two-stage least squares to generate such estimates. As discussed in the methods section above, we estimate models where the first stage equation models IID installation and the specification is basically the right-hand side of equation 1 above, and the second stage models a recidivism outcome as a function of installing an IID within two years (with the specification corresponding to 2 above). The interaction term between the post-SB 1046 dummy variable and the non-pilot county dummy variable serves as the instrument in this just-identified model.

We estimate two-stage least squares models for each of the four specifications that we employ in the OLS analysis in Table 12. Table 13 presents the results. The top portion of the table presents the estimates of the effect of installing an IID on each recidivism outcome using the four model specifications discussed above. The bottom panel presents the first stage coefficient on the interaction term between post-SB 1046 and the non-AB 91 county dummy (the difference in difference in IID installation rates), along with the coefficient standard error, an F-test of the significance of the instrument in the first stage, and a corresponding p-value.

Installing an IID within two years reduces DUI recidivism in the next two years by between 1.3 and 2.3 percentage points. The estimate of the model without covariates is 1.68 percentage points. Three of the estimates are statistically significant at the one percent confidence level (models (1), (2), and (4)), while one estimate (model (3)) is statistically significant at the five percent level of confidence.

We see somewhat larger absolute effects on crash recidivism. The estimated effects of installing an IID range from a 2.19 percentage point reduction in crashes (model 3) to a 2.29 percentage point reduction (model 4). All estimates for this outcome are statistically significant at the one-percent confidence level.

Finally, estimates of the effects of installing an IID on subsequent crashes with injury suggest reductions ranging from 0.65 percentage points (model 2) to 1.11 percentage points (model 4). Two of the estimates (Models 1 and 3) are significant at the ten-percent level of significance, while the estimate using the matched sample is significant at the five-percent level of confidence.

To contextualize these estimates, we calculate a counterfactual baseline recidivism rate assuming zero IID installations and then measure the declines implied by the effects in Table 13 relative to this counterfactual. To be specific, in Table 8 we see that in the post-SB 1046 period, 15.16 percent of DUI arrests result in an IID installation within two years, 9.71 percent are re-arrested for a DUI within two years, 8.51 percent are involved in a subsequent crash, and 3.96 percent are involved in a crash that causes an injury. With the effect size estimates in Table 13, we can calculate what recidivism rates would be during these periods if no one installed an IID after arrest.[45]

[45] To do so, we use the estimates from the models with no covariates since the model estimates are generally insensitive to the inclusion of controls. Here we illustrate this tabulation for the DUI recidivism outcome. Using the estimates from model (1) for DUI recidivism, the counterfactual recidivism rate with zero IID installations would be 0.0971 + 0.0168x0.1516, where 0.0971 is the observed recidivism rate in the post SB 1046 period, 0.0168 is the reduction in the likelihood of recidivating for this outcome caused by installing an IID, and 0.1516 is the proportion that installed an IID in the post period. This suggests a counterfactual recidivism rate with zero installations of

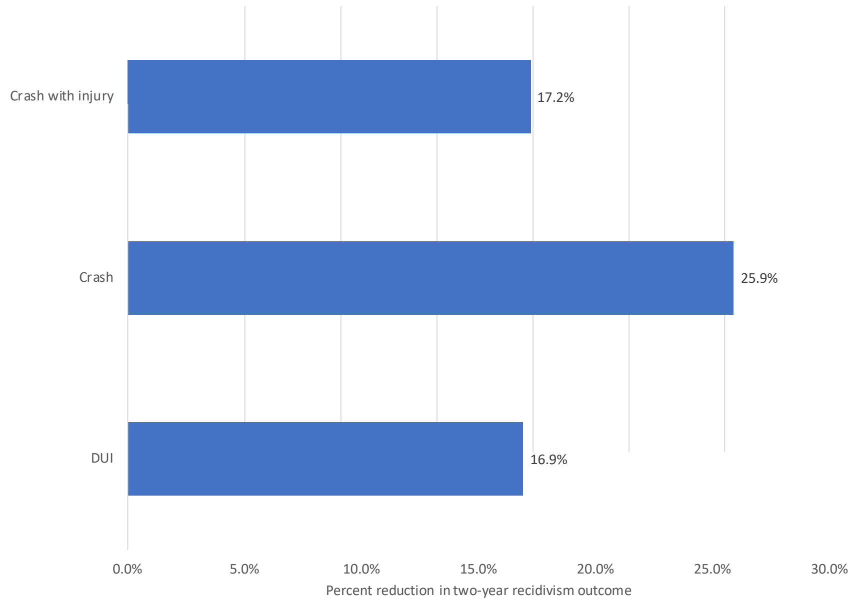
Table 13: **Two Stage Least Squared Estimates of the Effect of Installing an IID on Recidivism Outcomes Two Years Following Arrest**

Two-Year recidivism outcome	Model (1)	Model (2)	Model (3)	Model (4)
DUI arrest	-0.0168^{a}	-0.0179^{a}	-0.0129^{b}	-0.0234^{a}
	(0.0058)	(0.0058)	(0.0059)	(0.0071)
Crash	-0.0229^{a}	-0.0220^{a}	-0.0219^{a}	-0.0214^{a}
	(0.0057)	(0.0057)	(0.0059)	(0.0058)
Crash with injury	-0.0070^{c}	-0.0065	-0.0068^{c}	-0.0111^{b}
	(0.0040)	(0.0040)	(0.0040)	(0.0048)
Controls	No	Yes	Yes	Yes
Year-month effects	No	No	Yes	Yes
County effects	No	No	Yes	Yes
Matched sample	No	No	No	Yes
First-stage coefficient	0.2506^{a}	0.2503^{a}	0.2456^{a}	0.2538^{a}
	(0.0012)	(0.0019)	(0.0019)	(0.0020)
F-statistic	16,884	17,535	16,949	12,477
(p-value)	(< 0.0001)	(< 0.0001)	(< 0.0001)	(< 0.0001)
N	947,765	947,765	947,765	459,198

Robust standard errors are in parentheses. The vector of control variables include a male dummy, dummies for having one, two, three, four, or five or more prior DUIs, a quadratic in age at arrest, a quadratic in the maximum BAC reading at arrest, a dummy variable indicating BAC missing, and interactions of the male dummy with all other control variables. County effects measure county of resident and the year-month effects measure the year/month of arrest. The first-stage coefficient is the coefficient on the interaction term between non-pilot counties and the after dummy variable. Note, this interaction terms is omitted from the second-stage model. The F-statistic rest the significance of the instrument in the first-stage model.

a. Estimate significant at the one percent level of confidence.
b. Estimate significant at the five percent level of confidence.
c. Estimate significant at the ten percent level of confidence.

Figure 13: **Estimated Percent Reduction in Two-Year Recidivism Rate Caused by Installing an IID Within Two Years of Arrest**



Using the estimates from model (1), we estimate counterfactual two-year recidivism rates with zero IID installations of 9.96 percent, 8.86 percent, and 4.07 percent for DUI, crash, and crash-with injury recidivism, respectively.

Dividing the effect sizes presented in Table 13 by these counterfactual recidivism rates provides an estimate of the percentage reduction in two-year recidivism caused by installing an IID within two years of arrest. Figure 13 visualizes these tabulations. The findings suggest that installing an IID within two years reduces two-year recidivism rates by 16.9 percent for new DUIs, by 25.9 percent for new crashes, and by 17.2 percent for crashes with injury.

It is also instructive to characterize the findings in Table 13 with respect to the findings from past research on the effectiveness of IIDs. Regarding DUI recidivism, the results from the Maryland RCT evaluation by Beck et al. (1999) find two-year recidivism rates of 9.1 percent for the experimental control group and 5.9 percent for the treatment group, yielding a two-year effect size of 3.2 percentage points.[46] In Table 13, our effect size estimates range from roughly 1.7 to 2.3 percentage points for this outcome. Although the estimates are a bit smaller than what was

0.0996 for DUI arrest within two years. Performing similar calculations for crashes and crashes with injury yield counterfactual recidivism rates of 0.0886 and 0.0407, respectively.

[46]It is interesting to note that the two-year recidivism rate for the control group in this RCT of 9.1 percent is quite close to our counterfactual calculation of what DUI recidivism would have been in the post SB 1046 period with zero installations (9.96 percent).

observed in the RCT, they are within the range and suggest that our findings on DUI recidivism are in line with the findings from previous research.

Our review of the literature noted the conflicting findings related to the effects of IID installation on crashes. For example, Kaufman and Wiebe (2016) find in an analysis of state panel data that a mandatory IID requirement for all DUI convictions reduces alcohol-related crash fatalities by 15 percent. In a more recent and similar analysis, Teoh et al. (2021) finds that universal IID requirements reduce alcohol-related crash fatalities by 26 percent. In contrast, earlier AB91 evaluations found that while alcohol-related crashes decreased, IIDs increased the overall number of crashes when those who install an IID are compared with people subject to a hard license suspension (Department of Motor Vehicles, 2016). The results here, which essentially contrast people who are arrested for a DUI who install an IID to similar people who do not, find reductions in both overall crashes and crashes involving injury. The magnitudes (25.9 and 17.2 percent reductions, respectively) align with the findings from the state-level panel data studies.

Tables 14 through 16 present two-stage least squares estimates of the effects of IID installations on the three recidivism outcomes where we estimate separate models by the three offense subgroups specified by SB 1046. In Table 14 and 15 we observe statistically significant and sizable negative effects of IID installation on future DUI arrests for persons whose focal arrest was a first offense, as well as for persons whose first focal arrest was a first offense involving an injury, with the largest effects for the latter group. We also find significant preventive effects of IIDs on future crashes for these two groups, again with effect size larger in absolute value for cases where the focal offense involved an injury. Turning to people with priors, in Table 16 we observe negative point estimates for the effects of IIDS on future DUIs, although none of the estimates are statistically significant. However, we observe the largest effects of IID on future crashes for this group as well as future crashes involving injury.

All subgroup estimates are generally less precise than the estimates that pool all DUI arrests, due to the smaller sample sizes used to estimate the two-stage least squares models. Hence, for several of the subgroup estimate where we do not find statistically significant effects, the lower power associated with smaller sample sizes may prevent us from measuring meaningful effects of an IID for the outcome in question. However, we find evidence of the effectiveness of IID installation for each individual group for at least two of the three outcomes that we study.

We also estimated these models for the subgroups defined by the number of prior convictions. These results are presented in appendix tables A6 through A9. The results are quite similar to what we see when we estimate by offense subgroups. We observe the strongest evidence or an effect of IIDs on DUI recidivism among people with no prior convictions (appendix table A6) and effects on crashes and crashes with injury for people with one prior conviction (appendix table A7). We do not find statistically significant effects for any of the outcomes for people with two priors or people with three or more priors. However, the samples used to estimate these models are comparatively small and our estimated effects are imprecise.

Finally, appendix table A10 presents two-stage least squares estimates of the effects of IID installation on four additional outcomes: subsequent alcohol-involved crashes, subsequent alcohol-involved crashes with injury, subsequent fatal crashes, and subsequent fatal crashes involving alcohol. All outcomes are measured over the two-year period after focal arrest. For reasons we discussed above, we know that information pertaining to whether a motorist had been drinking is missing for at least 40 percent of crashes we observe in the data. Moreover, crashes involving fatalities are quite rare, and thus it is difficult to detect an impact for this outcome. With these caveats in mind, we find no evidence of an impact of IIDs on these additional outcomes.

6 Policy Analysis of the Effectiveness of SB1046

The previous section finds sizable effects of IID installation on the various measures of recidivism among people arrested for DUI. Of course, these devices are effective only to the extent that persons who are required to install an IID actually install a device. The net effect of a mandatory IID requirement will be a function of both the effectiveness of the device in preventing future driving under the influence and the extent to which people comply with the requirements or respond to the opportunities to install a device in lieu of some other sanction.

What we observe in the post-SB1046 period is that most DUI arrests do not result in an IID installation (roughly 15 percent install). As we have discussed in detail, this low rate is due to many factors, including conviction rates that are less than 100 percent and lower in recent years, the non-universality of the mandatory IID requirements under SB 1046, and people choosing to not install an IID even when it is a requirement for restoring driving privileges.

What then is the ultimate impact of SB1046 on recidivism rates among persons arrested for a DUI? How does this effect depend on the proportion of people who install an IID? Although we cannot answer these questions with certainty, we can use the calculations from the previous section along with the installed rates observed under SB 1046 to answer these two questions.

Figure 14 presents the projected percent reduction in recidivism as a function of the percent of arrests that result in an IID installation for the three recidivism outcomes that are the focus of this study. Although the line in each figure shows the complete projected relationship between the percentage reduction in recidivism and the IID installation rate, each figure also highlights two specific points: the recidivism reduction associated with a 100 percent installation rate and the recidivism reduction associated with the statewide installation rates observed under SB1046 (roughly 15 percent). The recidivism reductions with 100 percent installation rates correspond to the estimated effects of installing a device presented in Figure 13 (16.9 percent reduction for DUI recidivism, 25.9 percent reduction for crash recidivism, and 17.2 percent reduction for crash-with-injury recidivism).

This exercise suggests that the overall effects of SB 1046 on these recidivism measures are small. The declines among those arrested for a DUI during the post period are on the order of 2.5 percent

Table 14: **Two Stage Least Squared Estimates of the Effect of Installing an IID on Recidivism Outcomes Two Years Following Arrest: First-Time Offenses**

Two-Year recidivism outcome	Model (1)	Model (2)	Model (3)	Model (4)
DUI arrest	-0.0147^{a}	-0.0158^{a}	-0.0134^{b}	-0.0112
	(0.0058)	(0.0058)	(0.0059)	(0.0072)
Crash	-0.0140^{b}	-0.0134^{b}	-0.0132^{b}	-0.0209^{a}
	(0.0061)	(0.0060)	(0.0061)	(0.0073)
Crash with injury	-0.0040	-0.0036	-0.0041	-0.0061
	(0.0042)	(0.0042)	(0.0043)	(0.0092)
Controls	No	Yes	Yes	Yes
Year-month effects	No	No	Yes	Yes
County effects	No	No	Yes	Yes
Matched sample	No	No	No	Yes
First-stage coefficient	0.3003^{a}	0.3000^{a}	0.2954^{a}	0.2981^{a}
	(0.0023)	(0.0023)	(0.0023)	(0.0020)
F-statistic	17,047	17,013	16,495	22,215
(p-value)	(< 0.0001)	(< 0.0001)	(< 0.0001)	(< 0.0001)
N	595,327	595,327	595,327	301,656

Robust standard errors are in parentheses. The vector of control variables include a male dummy, dummies for having one, two, three, four, or five or more prior DUIs, a quadratic in age at arrest, a quadratic in the maximum BAC reading at arrest, a dummy variable indicating BAC missing, and interactions of the male dummy with all other control variables. County effects measure county of resident and the year-month effects measure the year/month of arrest. The first-stage coefficient is the coefficient on the interaction term between non-pilot counties and the after dummy variable. Note, this interaction terms is omitted from the second-stage model. The F-statistic rest the significance of the instrument in the first-stage model.

a. Estimate significant at the one percent level of confidence.
b. Estimate significant at the five percent level of confidence.
c. Estimate significant at the ten percent level of confidence.

Table 15: **Two Stage Least Squared Estimates of the Effect of Installing an IID on Recidivism Outcomes Two Years Following Arrest: First-Time Offenses With Injury**

Two-Year recidivism outcome	Model (1)	Model (2)	Model (3)	Model (4)
DUI arrest	-0.0276^{c}	-0.0296^{c}	-0.0234	-0.0271
	(0.0162)	(0.0162)	(0.0164)	(0.0193)
Crash	-0.0336^{c}	-0.0313^{c}	-0.0308^{c}	-0.0116
	(0.0174)	(0.0175)	(0.0178)	(0.0205)
Crash with injury	-0.0145	-0.0128	-0.0129	-0.0046
	(0.0123)	(0.0124)	(0.0126)	(0.0145)
Controls	No	Yes	Yes	Yes
Year-month effects	No	No	Yes	Yes
County effects	No	No	Yes	Yes
Matched sample	No	No	No	Yes
First-stage coefficient	0.2795^{a}	0.2779^{a}	0.2724^{a}	0.2899^{a}
	(0.0072)	(0.0071)	(0.0071)	(0.0084)
F-statistic	1,507	1,532	1,471	1,191
(p-value)	(< 0.0001)	(< 0.0001)	(< 0.0001)	(< 0.0001)
N	58,785	58,785	58,785	30,934

Robust standard errors are in parentheses. The vector of control variables include a male dummy, dummies for having one, two, three, four, or five or more prior DUIs, a quadratic in age at arrest, a quadratic in the maximum BAC reading at arrest, a dummy variable indicating BAC missing, and interactions of the male dummy with all other control variables. County effects measure county of resident and the year-month effects measure the year/month of arrest. The first-stage coefficient is the coefficient on the interaction term between non-pilot counties and the after dummy variable. Note, this interaction terms is omitted from the second-stage model. The F-statistic rest the significance of the instrument in the first-stage model.

a. Estimate significant at the one percent level of confidence.
b. Estimate significant at the five percent level of confidence.
c. Estimate significant at the ten percent level of confidence.

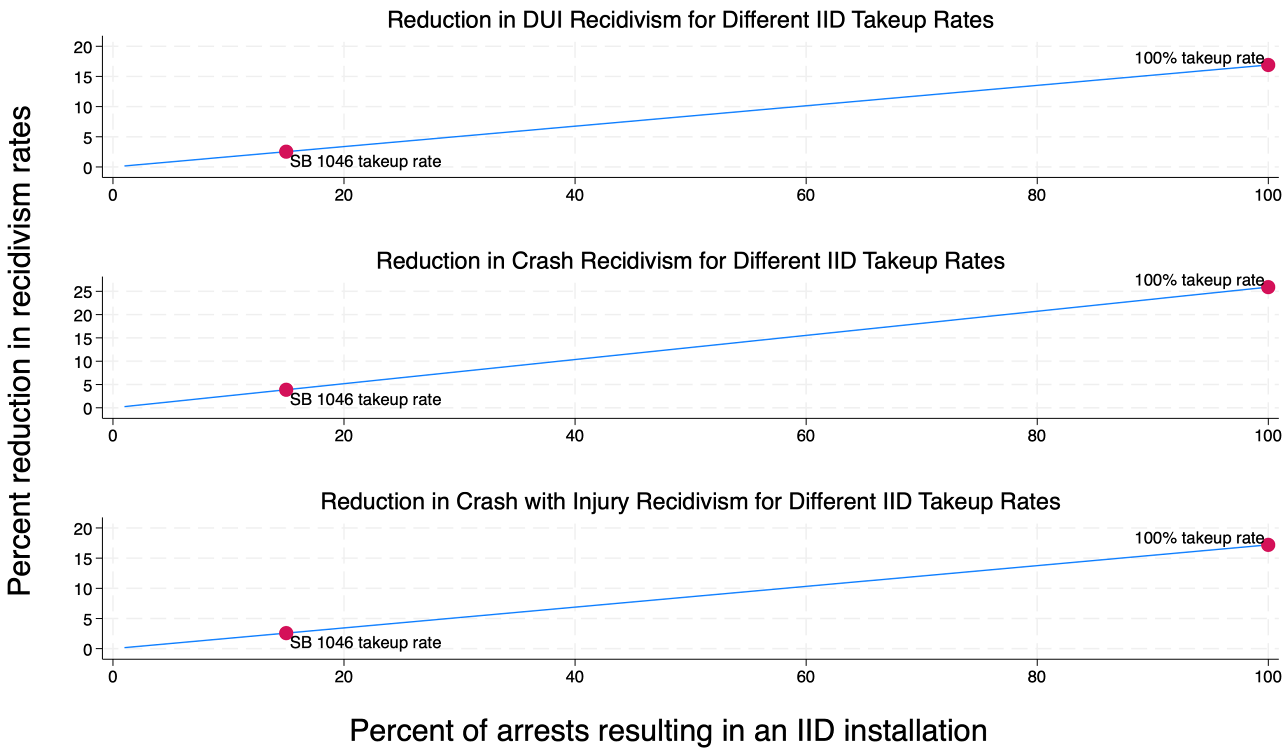
Table 16: **Two Stage Least Squared Estimates of the Effect of Installing an IID on Recidivism Outcomes Two Years Following Arrest: Repeat Offenses**

Two-Year recidivism outcome	Model (1)	Model (2)	Model (3)	Model (4)
DUI arrest	-0.0236	-0.0236	-0.0076	-0.0182
	(0.0225)	(0.0225)	(0.0235)	(0.0274)
Crash	-0.0717^a	-0.0707^a	-0.0692^a	-0.0860^a
	(0.0199)	(0.0120)	(0.0207)	(0.0238)
Crash with injury	-0.0242^c	-0.0235^c	-0.0238^c	-0.0220
	(0.0138)	(0.0138)	(0.0144)	(0.0165)
Controls	No	Yes	Yes	Yes
Year-month effects	No	No	Yes	Yes
County effects	No	No	Yes	Yes
Matched sample	No	No	No	Yes
First-stage coefficient	0.1332^a	0.1327^a	0.1280^a	0.1394^a
	(0.0037)	(0.0036)	(0.0036)	(0.0047)
F-statistic	1,296	1,359	1,264	880
(p-value)	(< 0.0001)	(< 0.0001)	(< 0.0001)	(< 0.0001)
N	293,653	293,653	293,653	126,608

Robust standard errors are in parentheses. The vector of control variables include a male dummy, dummies for having one, two, three, four, or five or more prior DUIs, a quadratic in age at arrest, a quadratic in the maximum BAC reading at arrest, a dummy variable indicating BAC missing, and interactions of the male dummy with all other control variables. County effects measure county of resident and the year-month effects measure the year/month of arrest. The first-stage coefficient is the coefficient on the interaction term between non-pilot counties and the after dummy variable. Note, this interaction terms is omitted from the second-stage model. The F-statistic rest the significance of the instrument in the first-stage model.

a. Estimate significant at the one percent level of confidence.
b. Estimate significant at the five percent level of confidence.
c. Estimate significant at the ten percent level of confidence.

Figure 14: **Reduction in Statewide Two-Year Recidivism Rates Among Those Arrested for a DUI as a Function of the Percent of Arrests where an IID is Installed Within Two Years**



for the likelihood of another DUI within two years, 3.9 percent for the likelihood of a crash within two years, and 2.6 percent for the likelihood of a crash with an injury within two years relative to a counterfactual with zero installations. The figure also illustrates that higher installation rates would correspond with higher recidivism reductions statewide.

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Table A1: **Percent of Arrests where an IID is Installed within Two Years of the Arrest, by Arrest Year and County**

County	2014	2015	2016	2017	2018	2019	2020	2021
Alameda	21.9	20	15.6	15.7	14.6	10.3	7.9	10.1
Alpine	-	-	-	-	-	-	-	-
Amador	6.7	6.8	4.9	3.2	2.8	35.5	29.5	16.8
Butte	3.8	4.6	5.4	3.8	4.4	18	18.3	21.4
Calaveras	5.3	6.9	10.8	4.1	7.8	24.7	24.1	19.8
Colusa	1.9	8.3	4.1	7.1	10.5	24	16.7	9.4
Contra Costa	3.6	3.1	2.1	3.4	3.1	11.9	11.8	10.2
Del Norte	3.6	1	7.8	4.7	3.6	13.7	12.3	12.8
El Dorado	4.9	6.4	7.9	9.5	6.9	27.9	25.8	25.8
Fresno	2.7	3.1	3.9	3.3	2.9	9.8	10.3	11.1
Glenn	5.8	6.7	2.1	2.8	1.5	18	18.1	16.7
Humboldt	3.7	3.3	5.3	4.5	4.3	13.9	11.6	12.4
Imperial	1.8	0.9	1.4	1.8	2.1	11.9	10.5	8.5
Inyo	1.6	4.3	8.4	3.8	3	19.6	9.9	16.7
Kern	3.1	2.5	3.3	2.8	2.6	7.6	6.9	7.2
Kings	1.6	1.8	2.2	3.4	2.9	11.7	12.3	12.5
Lake	4.3	2.7	3.5	4.9	2.8	11.3	8.5	12.8
Lassen	4.3	6	0.6	1	5.1	12.8	10.4	15.4
Los Angeles	34	33.4	33.1	33.4	31.7	17.9	13.8	14.2
Madera	1.2	0.7	1.7	1.8	1.2	8.1	6.9	6.1
Marin	3.9	4.2	4.7	5.2	7.7	21.1	13.2	20.5
Mariposa	1.8	5.1	8	4.2	6.2	29.3	22.6	25.5
Mendocino	5.9	4.5	5.5	3.6	6.1	22.5	18.2	20.7
Merced	1.1	2.7	1.9	2.5	2.6	11.1	9.5	9.1
Modoc	1.9	0	5.3	0	4.8	9.1	20.8	9.7
Mono	5.5	3.1	2.3	3.4	3.8	19.7	14.5	18.1
Monterey	3.9	4.9	5.7	5.4	6.6	22.6	17.8	17.4
Napa	7.2	6.3	8.2	10.2	9.1	27.6	28.9	24.9
Nevada	4.4	6.2	7.5	6.5	7.1	25.4	25.8	26.7
Orange	5.9	5.9	6.1	5.8	4.5	20.1	16.8	17.9
Placer	6.7	9.2	8.8	9.1	9.7	25.7	27.4	27.8
Plumas	5.3	3	7.8	7.9	5.9	23.7	17.8	19.6
Riverside	2.7	3.3	3.1	3.3	4.4	18.4	13.3	13.5
Sacramento	33.7	33.3	32.9	35.5	32.4	23.6	16.6	16.8

Table A1: **Percent of Arrests where an IID is Installed within Two Years of the Arrest, by Arrest Year and County**

County	2014	2015	2016	2017	2018	2019	2020	2021
San Benito	4.6	3.1	4.8	3.8	4.4	17.1	12.8	21.3
San Bernardino	3.1	2.6	3.3	3.1	3.2	12.4	10.2	10
San Diego	4.1	4.3	4.8	4.1	4.7	18.9	12.5	13.8
San Francisco	3.2	2.7	1.9	1.6	3	10.4	7.2	7.8
San Joaquin	6	5.8	5.8	5.7	5.9	16.6	12.9	13.4
San Luis Obispo	4.2	5.4	4.5	5.2	6	21.4	15.8	17.7
San Mateo	3.1	3.3	3.2	5.2	5.3	15.4	12.5	13.6
Santa Barbara	4.2	3.3	3.6	3.7	4.2	13.1	10.4	11.9
Santa Clara	4	4.5	4.4	5.1	4.7	15.1	12.8	16.9
Santa Cruz	3.8	3.6	3.3	5.1	4.8	20.1	16.4	19.3
Shasta	9.1	6.8	8.6	6.9	11.8	25.5	23.5	21.7
Sierra	-	-	-	-	-	-	-	-
Siskiyou	3.5	3	3.9	3.8	2.5	14.7	12.9	10.8
Solano	6.7	4	4.1	3.9	3.7	15.1	12.9	14.5
Sonoma	7.6	6.4	7.7	7.5	6.5	30.8	28.9	33.6
Stanislaus	3.3	2.9	3.5	3.7	4.4	12.8	10.8	10.1
Sutter	4.9	4.7	5	6.3	4	18.8	15.8	16.3
Tehama	3.4	3.2	5.5	3.7	5.4	14.6	9.8	12.6
Total	12.5	11.7	11.4	11.1	10.4	16.9	13.6	14.5
Trinity	2.8	7.1	1.8	1.2	4.7	16.9	15.9	12.4
Tulare	24.7	21.9	26	26	23.4	15.9	14.3	12.3
Tuolumne	7.3	5.5	4.4	3.4	7.9	18.5	14.9	16.5
Ventura	6.6	7	6.6	6.2	6.4	23.5	16.8	19.6
Yolo	4.1	3.2	6	6.1	4.2	19.6	14.8	16.5
Yuba	4.4	5.5	5.3	5.6	2.6	10.7	9.3	13.2

Figures are suppressed for cells with fewer than 30 cases.

Table A2: **Relative Changes in the Proportion of Arrests Where an IID is Installed Within Two Years of Arrest Between Non-AB 91 and AB 91 Counties by the Number of Prior Convictions**

Panel A: No Priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.029	0.134	0.105^{a}
	(0.000)	(0.001)	(0.001)
AB 91 counties	0.329	0.135	-0.193^{a}
	(0.001)	(0.002)	(0.002)
Difference	-0.300^{a}	0.001	0.298^{a}
	(0.001)	(0.002)	(0.002)
Panel B: One prior			
	0.001	0.002	0.002
Non-AB 91 counties	0.143	0.218	0.076^{a}
	(0.001)	(0.002)	(0.002)
AB 91 counties	0.284	0.205	-0.079^{a}
	(0.003)	(0.004)	(0.005)
Difference	-0.141^{a}	0.013^{a}	0.154^{a}
	(0.003)	(0.004)	(0.005)
Panel C: Two prior			
	0.003	0.004	0.005
Non-AB 91 counties	0.126	0.184	0.057^{a}
	(0.002)	(0.003)	(0.003)
AB 91 counties	0.218	0.161	-0.057^{a}
	(0.004)	(0.005)	(0.007)
Difference	-0.091^{a}	0.023^{a}	0.114^{a}
	(0.004)	(0.006)	(0.007)
Panel C: Three or more priors			
	0.004	0.006	0.007
Non-AB 91 counties	0.063	0.097	0.035^{a}
	(0.002)	(0.003)	(0.003)
AB 91 counties	0.117	0.087	-0.029^{a}
	(0.004)	(0.005)	(0.007)
Difference	-0.054^{a}	0.010^{c}	0.064^{a}
	(0.004)	(0.006)	(0.007)

Standard errors in parentheses.
a. Difference statistically significant at the one percent level of confidence.

Table A3: **Relative Changes in the Proportion of Arrests Where a New DUI Arrest Occurs Within Two Years of Arrest Between Non-AB 91 and AB 91 Counties by the Number of Prior Convictions**

Panel A: No Priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.079	0.088	0.009^a
	(0.000)	(0.001)	(0.001)
AB 91 counties	0.065	0.079	0.014^a
	(0.001)	(0.001)	(0.001)
Difference	0.014^a	0.009^a	-0.005^a
	(0.001)	(0.001)	(0.002)
Panel B: One prior			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.101	0.112	0.012^a
	(0.001)	(0.001)	(0.002)
AB 91 counties	0.092	0.107	0.015^a
	(0.002)	(0.003)	(0.003)
Difference	0.009^a	0.006^c	-0.003
	(0.002)	(0.003)	(0.004)
Panel C: Two priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.114	0.128	0.014
	(0.002)	(0.002)	(0.003)
AB 91 counties	0.110	0.128	0.018
	(0.003)	(0.005)	(0.006)
Difference	0.004	0.000	-0.004
	(0.004)	(0.006)	(0.007)
Panel C: Three or more priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.132	0.152	0.020^a
	(0.002)	(0.003)	(0.004)
AB 91 counties	0.138	0.160	0.022^a
	(0.004)	(0.007)	(0.008)
Difference	-0.007	-0.008	-0.001
	(0.005)	(0.007)	(0.009)

Standard errors in parentheses.
a. Difference statistically significant at the one percent level of confidence.

Table A4: **Relative Changes in the Proportion of Arrests Where the Person is in a Crash Within Two Years of Arrest Between Non-AB 91 and AB 91 Counties by the Number of Prior Convictions**

Panel A: No Priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.070	0.082	0.012[a]
	(0.000)	(0.001)	(0.001)
AB 91 counties	0.077	0.093	0.016[a]
	(0.001)	(0.001)	(0.001)
Difference	−0.007[a]	−0.011[a]	−0.005[a]
	(0.001)	(0.001)	(0.002)
Panel B: One prior			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.065	0.083	0.018[a]
	(0.001)	(0.001)	(0.001)
AB 91 counties	0.070	0.098	0.028[a]
	(0.001)	(0.003)	(0.003)
Difference	−0.005[a]	−0.015[a]	−0.010[a]
	(0.002)	(0.003)	(0.003)
Panel C: Two priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.061	0.085	0.024[a]
	(0.001)	(0.002)	(0.002)
AB 91 counties	0.064	0.093	0.030[a]
	(0.002)	(0.004)	(0.005)
Difference	-0.002	−0.009[c]	-0.006
	(0.003)	(0.005)	(0.005)
Panel C: Three or more priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.064	0.087	0.023[a]
	(0.002)	(0.003)	(0.003)
AB 91 counties	0.069	0.103	0.034[a]
	(0.003)	(0.006)	(0.006)
Difference	-0.005	−0.016[a]	−0.011[c]
	(0.004)	(0.006)	(0.007)

Standard errors in parentheses.
a. Difference statistically significant at the one percent level of confidence.

Table A5: **Relative Changes in the Proportion of Arrests Where the Person is in a Crash Involving an Injury Within Two Years of Arrest Between Non-AB 91 and AB 91 Counties by the Number of Prior Convictions**

Panel A: No Priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.032	0.038	0.006[a]
	(0.000)	(0.000)	(0.001)
AB 91 counties	0.036	0.044	0.007[a]
	(0.001)	(0.001)	(0.001)
Difference	−0.004[a]	−0.006[a]	-0.001
	(0.001)	(0.001)	(0.001)
Panel B: One prior			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.030	0.039	0.009[a]
	(0.001)	(0.001)	(0.001)
AB 91 counties	0.032	0.046	0.014[a]
	(0.001)	(0.002)	(0.002)
Difference	-0.002	−0.007[a]	−0.005[a]
	(0.001)	(0.002)	(0.002)
Panel C: Two priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.027	0.040	0.013[a]
	(0.001)	(0.001)	(0.002)
AB 91 counties	0.028	0.041	0.013[a]
	(0.002)	(0.003)	(0.003)
Difference	-0.001	0.000	0.000
	(0.002)	(0.003)	(0.004)
Panel C: Three or more priors			
	Before SB 1046	After SB 1046	After - Before
Non-AB 91 counties	0.029	0.042	0.013[a]
	(0.001)	(0.002)	(0.002)
AB 91 counties	0.029	0.042	0.012[a]
	(0.002)	(0.004)	(0.004)
Difference	-0.001	0.000	0.001
	(0.002)	(0.004)	(0.005)

Standard errors in parentheses.
a. Difference statistically significant at the one percent level of confidence.

Table A6: **Two Stage Least Squared Estimates of the Effect of Installing an IID on Recidivism Outcomes Two Years Following Arrest: No Priors**

Two-Year recidivism outcome	Model (1)	Model (2)	Model (3)	Model (4)
DUI arrest	-0.0161^{a}	-0.0175^{a}	-0.0146^{a}	-0.0302^{a}
	(0.0055)	(0.0055)	(0.0055)	(0.0067)
Crash	-0.0154^{a}	-0.0146^{b}	-0.0144^{b}	-0.0167^{b}
	(0.0057)	(0.0057)	(0.0058)	(0.0069)
Crash with injury	-0.0047	-0.0042	-0.0046	-0.0022
	(0.0040)	(0.0040)	(0.0041)	(0.0048)
Controls	No	Yes	Yes	Yes
Year-month effects	No	No	Yes	Yes
County effects	No	No	Yes	Yes
Matched sample	No	No	No	Yes
First-stage coefficient	0.2985^{a}	0.2980^{a}	0.2936^{a}	0.2996^{a}
	(0.0022)	(0.0022)	(0.0022)	(0.0026)
F-statistic	17,876	18,502	18,038	13,649
(p-value)	(< 0.0001)	(< 0.0001)	(< 0.0001)	(< 0.0001)
N	654,112	654,112	654,112	332,590

Robust standard errors are in parentheses. The vector of control variables include a male dummy, dummies for having one, two, three, four, or five or more prior DUIs, a quadratic in age at arrest, a quadratic in the maximum BAC reading at arrest, a dummy variable indicating BAC missing, and interactions of the male dummy with all other control variables. County effects measure county of resident and the year-month effects measure the year/month of arrest. The first-stage coefficient is the coefficient on the interaction term between non-pilot counties and the after dummy variable. Note, this interaction terms is omitted from the second-stage model. The F-statistic rest the significance of the instrument in the first-stage model.

a. Estimate significant at the one percent level of confidence.
b. Estimate significant at the five percent level of confidence.
c. Estimate significant at the ten percent level of confidence.

Table A7: **Two Stage Least Squared Estimates of the Effect of Installing an IID on Recidivism Outcomes Two Years Following Arrest: One Prior**

Two-Year recidivism outcome	Model (1)	Model (2)	Model (3)	Model (4)
DUI arrest	-0.0205	-0.0198	-0.0063	0.0203
	(0.0234)	(0.0234)	(0.0244)	(0.0308)
Crash	-0.0675^a	-0.0656^a	-0.0641^a	-0.0775^a
	(0.0216)	(0.0217)	(0.0226)	(0.0277)
Crash with injury	-0.0356^b	-0.0347^b	-0.0356^b	-0.0371^c
	(0.0151)	(0.0152)	(0.0158)	(0.0195)
Controls	No	Yes	Yes	Yes
Year-month effects	No	No	Yes	Yes
County effects	No	No	Yes	Yes
Matched sample	No	No	No	Yes
First-stage coefficient	0.1543^a	0.1535^a	0.1477^a	0.1485^a
	(0.0049)	(0.0048)	(0.0048)	(0.0060)
F-statistic	987	1,023	954	603
(p-value)	(< 0.0001)	(< 0.0001)	(< 0.0001)	(< 0.0001)
N	187,339	187,339	187,339	83,956

Robust standard errors are in parentheses. The vector of control variables include a male dummy, dummies for having one, two, three, four, or five or more prior DUIs, a quadratic in age at arrest, a quadratic in the maximum BAC reading at arrest, a dummy variable indicating BAC missing, and interactions of the male dummy with all other control variables. County effects measure county of resident and the year-month effects measure the year/month of arrest. The first-stage coefficient is the coefficient on the interaction term between non-pilot counties and the after dummy variable. Note, this interaction terms is omitted from the second-stage model. The F-statistic rest the significance of the instrument in the first-stage model.

a. Estimate significant at the one percent level of confidence.
b. Estimate significant at the five percent level of confidence.
c. Estimate significant at the ten percent level of confidence.

Table A8: **Two Stage Least Squared Estimates of the Effect of Installing an IID on Recidivism Outcomes Two Years Following Arrest: Two Priors**

Two-Year recidivism outcome	Model (1)	Model (2)	Model (3)	Model (4)
DUI arrest	-0.0343	-0.0336	-0.0100	-0.0168
	(0.0575)	(0.0571)	(0.0597)	(0.0785)
Crash	-0.0547	-0.0542	-0.0520	-0.0621
	(0.0483)	(0.0481)	(0.0502)	(0.0643)
Crash with injury	0.0037	0.0040	0.0071	0.0000
	(0.03300	(0.0329)	(0.0344)	(0.0440)
Controls	No	Yes	Yes	Yes
Year-month effects	No	No	Yes	Yes
County effects	No	No	Yes	Yes
Matched sample	No	No	No	Yes
First-stage coefficient	0.1142[a]	0.1145[a]	0.1102[a]	0.1082[a]
	0.0076	0.0075	0.0075	0.0097
F-statistic	224	232	215	123
(p-value)	(< 0.0001)	(< 0.0001)	(< 0.0001)	(< 0.0001)
N	65,843	65,843	65,843	27,716

Robust standard errors are in parentheses. The vector of control variables include a male dummy, dummies for having one, two, three, four, or five or more prior DUIs, a quadratic in age at arrest, a quadratic in the maximum BAC reading at arrest, a dummy variable indicating BAC missing, and interactions of the male dummy with all other control variables. County effects measure county of resident and the year-month effects measure the year/month of arrest. The first-stage coefficient is the coefficient on the interaction term between non-pilot counties and the after dummy variable. Note, this interaction terms is omitted from the second-stage model. The F-statistic rest the significance of the instrument in the first-stage model.

a. Estimate significant at the one percent level of confidence.
b. Estimate significant at the five percent level of confidence.
c. Estimate significant at the ten percent level of confidence.

Table A9: **Two Stage Least Squared Estimates of the Effect of Installing an IID on Recidivism Outcomes Two Years Following Arrest: Three or More Priors**

Two-Year recidivism outcome	Model (1)	Model (2)	Model (3)	Model (4)
DUI arrest	-0.0180	-0.0156	0.0099	0.0837
	(0.1404)	(0.1417)	(0.1452)	(0.1570)
Crash	-0.1748	-0.1792	-0.1752	-0.0270
	(0.1128)	(0.1140)	(0.1164)	(0.1215)
Crash with injury	0.0134	0.0129	0.0110	0.0343
	(0.0746)	(0.0752)	(0.0767)	(0.0814)
Controls	No	Yes	Yes	Yes
Year-month effects	No	No	Yes	Yes
County effects	No	No	Yes	Yes
Matched sample	No	No	No	Yes
First-stage coefficient	0.0640[a]	0.0633[a]	0.0620[a]	0.0809[a]
	(0.00730	(0.0072)	(0.0072)	(0.0104)
F-statistic	76	76	73	61
(p-value)	(< 0.0001)	(< 0.0001)	(< 0.0001)	(< 0.0001)
N	40,471	40,471	40,471	14,936

Robust standard errors are in parentheses. The vector of control variables include a male dummy, dummies for having one, two, three, four, or five or more prior DUIs, a quadratic in age at arrest, a quadratic in the maximum BAC reading at arrest, a dummy variable indicating BAC missing, and interactions of the male dummy with all other control variables. County effects measure county of resident and the year-month effects measure the year/month of arrest. The first-stage coefficient is the coefficient on the interaction term between non-pilot counties and the after dummy variable. Note, this interaction terms is omitted from the second-stage model. The F-statistic rest the significance of the instrument in the first-stage model.

a. Estimate significant at the one percent level of confidence.
b. Estimate significant at the five percent level of confidence.
c. Estimate significant at the ten percent level of confidence.

Table A10: **Two Stage Least Squared Estimates of the Effect of Installing an IID on Recidivism Outcomes Two Years Following Arrest**

Two-Year recidivism outcome	Model (1)	Model (2)	Model (3)	Model (4)
Alcohol-involved crash	0.0031	0.0027	0.0036	0.0031
	(0.0026)	(0.0026)	(0.0026)	(0.0032)
Alcohol-involved injury crash	0.0002	0.0000	0.0004	0.0007
	(0.0022)	(0.0022)	(0.0022)	(0.0027)
Fatal crash	0.0000	0.0000	-0.0000	0.0003
	(0.0007)	(0.0017	(0.0007)	(0.0009)
Alcohol-involved fatal crash	0.0003	0.0003	0.0004	0.0005
	(0.0004)	(0.0004)	(0.0004)	(0.0005)
Controls	No	Yes	Yes	Yes
Year-month effects	No	No	Yes	Yes
County effects	No	No	Yes	Yes
Matched sample	No	No	No	Yes
First-stage coefficient	0.2506^a	0.2503^a	0.2456^a	0.2538^a
	(0.0012)	(0.0019)	(0.0019)	(0.0020)
F-statistic	16,884	17,535	16,949	12,477
(p-value)	(< 0.0001)	(< 0.0001)	(< 0.0001)	(< 0.0001)
N	947,765	947,765	947,765	459,198

Robust standard errors are in parentheses. The vector of control variables include a male dummy, dummies for having one, two, three, four, or five or more prior DUIs, a quadratic in age at arrest, a quadratic in the maximum BAC reading at arrest, a dummy variable indicating BAC missing, and interactions of the male dummy with all other control variables. County effects measure county of resident and the year-month effects measure the year/month of arrest. The first-stage coefficient is the coefficient on the interaction term between non-pilot counties and the after dummy variable. Note, this interaction terms is omitted from the second-stage model. The F-statistic rest the significance of the instrument in the first-stage model.

a. Estimate significant at the one percent level of confidence.
b. Estimate significant at the five percent level of confidence.
c. Estimate significant at the ten percent level of confidence.