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Effects of an Ignition Interlock Device Data-Enhanced Counseling Program on DUI Recidivism

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16. Abstract

Alcohol impairment is a major factor in traffic crashes, contributing to 12,429 fatalities (30% of all crash fatalities) in 2023. Ignition interlock devices (IID) are a common DUI countermeasure and are highly effective while installed on the vehicle. However, recidivism rebounds after removal and recidivism rates become comparable to those of non-IID DUI offenders. One promising approach to increase the effectiveness of IIDs and further reduce recidivism, particularly in the longer-term once IIDs are removed, is to receive IID data-enhanced counseling (IEC) while on the IID. While preliminary evidence has shown promise, research has been scant given the various ways in which IEC can be implemented in the context of IID sanctions. The purpose of this quasi-experimental study was to examine one variation of the IID data-enhanced counseling approach on DUI recidivism by evaluating a unique "parallel" program in Colorado (IEC immediately upon IID installation). Results showed that the IID+IEC group was five times (78%) less likely to recidivate than participants in the IID-only group at any time in the study window (January 2017 to January 2024). This study provides strong support for the inclusion of a parallel IID+IEC program for IID offenders. Given the specialized nature of this program, future research would benefit from further examining the implementation and impact of this effective countermeasure to reducing DUI recidivism among IID offenders.

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Executive Summary

Alcohol impairment is a major factor in traffic crashes, contributing to 12,429 fatalities (30% of all crash fatalities) in 2023 (NCSA, 2025). Ignition interlocks (IIDs) are a common alcohol-impaired driving (DUI) countermeasure and are highly effective when they are installed on vehicles (Voas et al., 1999; Willis et al., 2004). However, recidivism rebounds after removal, becoming comparable to that of non-IID DUI offenders (Elder et al., 2011; Marques et al., 2004; Willis et al., 2004). To enhance the effect of IIDs, particularly once they are removed, IID data-enhanced counseling (IEC) programs—a type of alcohol use disorder counseling informed by offenders' IID performance data—have been developed to supplement the IID sanctions (Voas et al., 2013).

One unique approach to IEC programs is Colorado's "parallel" Ignition Interlock Device Data-Enhanced Counseling program (IID+IEC) program, which involves initiating the IEC as soon as possible after IID installation and using the IID performance data to inform the counseling sessions. By structuring treatment in this way, the IID+IEC program uniquely provides close monitoring and feedback and addresses pre-existing and emerging risk factors—two well-known factors associated with recidivism (Marques et al., 2001, 2003, 2010; Robertson et al., 2019; Zador et al., 2011). To date, there has been little examination of the few IEC programs that exist in the United States (Voas et al., 2016), and no formal examination of Colorado's specific approach to IEC. The purpose of the current study was to examine whether Colorado's IID+IEC program reduces recidivism significantly more than IIDs alone.

To examine this research question, a quasi-experimental study was conducted with 11,205 DUI offenders who each had a DUI conviction and subsequent IID installed from January 2017 to August 2022. Several offender personal variables were also examined as predictors of recidivism (e.g., age at IID install, blood alcohol concentration [BAC] at arrest). Recidivism data included DUI convictions from January 2017 to January 2024. Results showed that the IID+IEC group was five times less likely (78%) to recidivate at any time during the study compared to the IID-only group. Offender age, arrest BAC, breath test refusal, and prior DUIs also predicted recidivism.

Overall, this study showed strong support for the "parallel" IID+IEC program as a supplemental countermeasure for DUI offenders on IIDs. This highlights the importance of IID-data enhanced counseling as a supplementary countermeasure to IIDs and shows the importance of proactively offering the program at the time of IID install rather than waiting for IID violations. Future research could address the non-random assignment in the current study, directly compare variations of IID+IEC programs ("prescriptive" vs. "parallel"), and demonstrate the feasibility of employing this approach in other States with IID programs looking to further reduce their DUI recidivism rates among IID offenders.

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Background

Alcohol impairment is a major factor in traffic crashes, contributing to 12,429 motor vehicle crash fatalities (30% of all crash fatalities) in 2023 (NCSA, 2025). To address this important traffic safety issue, NHTSA engages in various ongoing efforts to reduce impaired driving and related crashes and fatalities including behavioral- and vehicle-based countermeasures, educational and outreach campaigns, and rulemaking (NHTSA, 2026). Among the many countermeasures, ignition interlock devices (IIDs) are a common alcohol-impaired driving (i.e., driving under the influence; DUI) countermeasure and are highly effective when they are installed on the vehicle (Voas et al., 1999; Willis et al., 2004). However, recidivism rebounds after removal, with rates comparable to that of DUI offenders not on IIDs. (Elder et al., 2011; Marques et al., 2004; Willis et al., 2004). Therefore, it is of interest to enhance the effect of IIDs on DUI recidivism reduction in the short- and long-term, particularly after the IID is removed.

In earlier attempts at increasing the effectiveness of IIDs, a simple approach that demonstrated IID effectiveness was providing feedback to offenders about their IID performance. Even in the form of monthly mailed letters, that level of "close-monitoring and feedback" about IID performance and the potential consequences of poor performance demonstrated a reduction in IID recidivism compared to those who did not receive the letters (i.e., feedback; Zador et al., 2011). In an extension of this successful demonstration of feedback on IID performance, a more elaborate approach to enhancing IIDs has been the development of ignition interlock data-enhanced counseling (IEC), a type of alcohol use disorder counseling informed by offenders' IID performance data (Voas et al., 2013). To date, few such programs exist in the United States, and only one program—in Florida—has been rigorously evaluated (Voas et al., 2016). In the Florida program, IID offenders were required to attend "prescriptive" counseling sessions after three IID violations and then simultaneously remained in counseling and on the IID. Since offenders were not randomly assigned to treatment, a quasi-experimental approach was used with an elaborate procedure for creating a risk-matched control group. The results were encouraging, showing a 32% reduction in recidivism for the IID plus counseling group compared to the IID-only group during a four-year period after IID removal. As to future IEC counseling programs, the authors postulated the effects found in their study may be enhanced by using additional recidivism risk factors to identify IEC candidates more accurately and earlier in their time on the interlock; factors such as offender age (C'de Baca, 2001; Lucas et al., 2018; Voas et al., 2016), prior DUI convictions (NCSA, 2008; Rauch et al., 2010), arrest BAC (Marowitz, 1998), breath test refusal (Marowitz, 1998; Rauch et al., 2010), time on the IID (Voas et al., 2016), and IID performance (Marques et al., 2001).

While the Florida approach is promising, research is scant on the various ways in which IEC can be implemented in the context of IID sanctions. Another variation of this promising approach being conducted in Colorado is the Ignition Interlock Data-Enhanced Counseling (IID+IEC) program. In contrast to the "prescriptive" approach taken in Florida, the Colorado program takes a "parallel" approach with individuals starting the IID data-enhanced counseling sessions as soon as possible after IID installation rather than prescriptively based on IID performance (i.e., IID violations). Moreover, consistent with the recommendations by the authors of the Florida study and other existing literature on predictors of DUI recidivism, Colorado DUI offenders with four or more convictions are required to take the program, thereby proactively addressing an important risk factor for DUI recidivism.

Colorado's DUI programs and sanctions

Standard Education and treatment. Colorado has an array of standard programs and sanctions for DUI offenders, including IIDs, education, and treatment. Assignment to these programs and sanctions is complex and can vary by many factors, such as breath test refusal at arrest, BAC at arrest, and number of prior DUI convictions. Moreover, initial IID sanction duration can be modified if IID violations are committed (e.g., recidivism, failed IID starts) or if offenders successfully complete standard DUI education and therapy. Some level of standard education (I, II) and treatment (I, IIA-D, II Four Plus) [1] is mandatory for most DUI offenders, typically ranging from 24 to 86 hours of education (depending on level) and 24 hours of treatment; however, egregious offenders with 4+ DUI convictions complete specialized treatment and education that lasts much longer and is focused on the internalization and demonstration of competencies rather than on time in the program. DUI offenders, regardless of IID status, must successfully complete their assigned education and treatment for license reinstatement.

Ignition interlock-enhanced counseling. In addition to standard education and treatment, Colorado also offers the IID+IEC program (Colorado Behavioral Health Administration, 2024) as a supplemental resource for offenders on IIDs (Timken & Marques, 2001a, 2001b; Timken et al., 2012). This program is used in conjunction with, not as a replacement, for standard education and treatment and it is likely that DUI offenders participate in multiple programs.[2] While offenders are required to complete their assigned standard education and treatment programs, completion of the IID+IEC program may shorten the duration of those programs for offenders. The IID+IEC program is provided on a voluntary basis for those with three or fewer convictions (i.e., those also in Level I or II treatment) and mandated for those with four or more convictions (i.e., those also in level II Four Plus treatment). Thus, offenders may voluntarily complete the IID+IEC program while mandatorily completing the standard education and treatment or, for more egregious offenders, must mandatorily complete the IID+IEC program and the standard education and treatment programs.

Colorado's is one of few IEC programs in the United States and the only one using a "parallel" approach known to exist in the United States. With this approach, counseling begins immediately upon install rather than after a set number of violations. Monthly therapy sessions are then directly informed by offenders' IID performance data to improve performance on the IID (i.e., reduce failed starts) and reduce recidivism after IID removal. By structuring treatment in this way, the IID+IEC program uniquely addresses pre-existing and emerging risk factors and provides close monitoring and feedback—two well-known factors associated with recidivism (Marques et al., 2001, 2003, 2010; Robertson et al., 2019; Zador et al., 2011).

More specifically, the parallel IID+IEC program is unique in that it proactively addresses pre-existing recidivism risk factors prior to the IID sanction. By providing the IID+IEC treatment earlier to all IID offenders, at the outset of the IID sanction rather than after some amount of time, pre-existing risk factors are universally addressed. This includes mandatory participation among the riskiest offenders—those with 4 or more prior DUIs. Moreover, the "parallel" IID+IEC program, by starting immediately upon IID install, provides the benefit of addressing

[1] For more information on Colorado's standard DUI education and treatment programs, see: https://dmv.colorado.gov/alcohol-and-drug-education-treatment; https://bha.colorado.gov/for-individuals-and-families/information-for-people-with-a-dui-or-dwai

[2] Offenders' level and completion status of standard education and therapy were not known for this study.

emerging or "would be" risk factors. More specifically, different aspects of IID performance (i.e., total lockouts, total violations, morning lockouts, and the highest BAC lockout while on the IID) have been shown to be related to post-removal recidivism (Marques et al., 2001) and are often factors in State's compliance-based removal programs to extend or reduce time on the IID based on the offender's performance. Therefore, targeting IID performance from IID install (prior to any violations), as with the current Colorado IID+IEC program, learning how to succeed on the IID and better-understand one's pattern of behavior more quickly, seems to be an effective way at reducing longer-term recidivism for DUI offenders on IIDs.

In order to successfully address emerging risk factors on the IID, the IID+IEC provides close monitoring and frequent feedback by using offenders' IID data to tailor individual and group therapy experiences. This feedback cycle is occurring monthly, with offenders receiving detailed information about their patterns of IID behavior, having the opportunity to discuss risky times, and strategizing for the future. Moreover, the high-quality and personalized feedback is informed by evidence-based approaches shown to support desired behavior change, such as motivational interviewing and cognitive behavioral therapy.

Current Study

The current study examined whether the parallel IID+IEC program reduced DUI recidivism significantly more than IIDs alone. The hypothesis was that participation in the IID+IEC program would significantly reduce DUI recidivism at any point during the data collection window compared to the control group (IIDs only). This was tested as a between-group comparison.

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Method

Design and Procedure

First, IRB approval was obtained, with a special provision for protecting the transfer of data covered by the Health Insurance Portability and Accountability Act (HIPAA). The study used a quasi-experimental approach given the non-randomized nature of Colorado's IID and IID+IEC program participation. The treatment group were DUI offenders on IIDs who either voluntarily entered the IID+IEC program (those with 1-3 DUI convictions) or mandatorily entered the IID+IEC program (those with 4+ DUI convictions). The control group consisted of DUI offenders on IIDs only (those with 1-3 DUI convictions who did not volunteer to complete the IID+IEC program). Retrospective administrative data were gathered from Colorado's Behavioral Health Administration (BHA) and Department of Motor Vehicles (DMV) to examine the effect of treatment on DUI recidivism. BHA data on IEC enrollment range from January 2017 to August 2022 while DMV DUI conviction data (i.e., recidivism) range from January 2017 to January 2024. In this data-collection window the "benchmark" DUI arrest refers to the arrest prompting the sanctions and treatment examined during this period and some variables examined are operationalized "in reference" to this benchmark (e.g., DUIs prior to the "benchmark" DUI arrest versus DUI arrests/recidivism after benchmark). The timeline is shown below in Figure 1. Note that "time to recidivism" may be longer than "time in program" given that DUI recidivism may occur before the end of the data period in January 2024 but after the IID+IEC program end-date.

Of note, given that Colorado DUI offenders on IIDs must complete standard education and treatment program for license reinstatement, offenders in this study—whether in the IID+IEC or IID-only group—were likely participating in several programs.

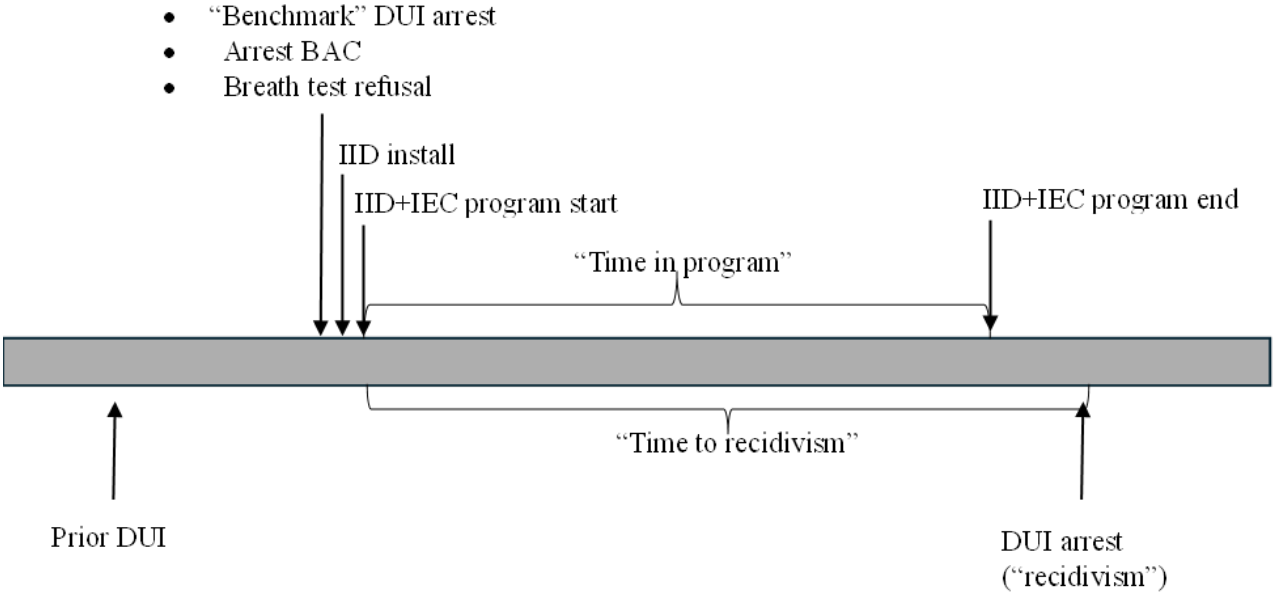


Figure 1. Timeline of events with respect to benchmark DUI

Participants. Participants were 11,205 DUI offenders sanctioned to IIDs in Colorado—10,632 on IIDs only (control group) and 573 in the IID+IEC program (treatment group). Overall, most were male (76%) with an average age of 42 (range=19.50 to 84.30; *SD*=11.85).

Independent variable

Treatment type. Intervention participants included those on ignition interlocks who enrolled in the IID+IEC program while control participants were those on interlocks only. The IID+IEC program involved 10 hours of therapy spread over 5 months, including four 2-hour group sessions and four 30-minute individual sessions. Participants in the IID+IEC began their participation as soon as possible after the IID was installed and attended both individual and group sessions for the first 3 months, only a group session in the fourth month, and only an individual session in the fifth month. Thus, offenders attended two sessions for three months and then one session per month for the final two months. Throughout this program, offenders' IID data was provided to the therapist monthly and was used to inform and guide therapy sessions. The control condition involved DUI offenders on IIDs only (no participation in the IID+IEC program).

Control variables

To address potentially confounding variables in the analysis, several offender personal and situational variables were included as controls. Offender personal variables included sex (0=female, 1=male) and age at IID install (centered at *M*=42 years old). Situational variables, most of which reference the "benchmark" DUI conviction (i.e., the specific DUI conviction which necessitated the current IID sanction), included: number of DUI convictions prior to "benchmark" DUI conviction (0, 1, 2+; centered at .65), test refusal at "benchmark" arrest (0=no refusal, 1=refusal), time (years) in the IID program (program start date to program completion date), and "benchmark" arrest BAC (*M*=.19 g/dL).

Note that the range of values for "number of DUI convictions prior to benchmark DUI conviction" was deliberately restricted to 0 to 2+, with all values 2 or over entered as "2." A count of prior convictions could not be calculated because the list of convictions was not comprehensive (i.e., arrests before the study period were missing). The closest available estimate of prior convictions that was available for all participants was the DMV's "Sanction Action" code, from which offenders' number of prior convictions could be inferred.

Dependent variables

Recidivism (yes/no). To determine recidivism, data was acquired from the DMV about DUI convictions for the 7-year period from January 2017 to January 2024. Recidivism (yes/no) was based on whether the offender had a DUI conviction after the "benchmark" DUI conviction within the data collection window. For participants who did not recidivate within the data collection window, their data was "censored" or coded as 0 (the event did not occur); those that did were coded as 1 (the event did occur before the end of the data collection window).

Time to recidivism. To determine "time to first recidivism" after IID installation, the elapsed time in days was calculated between the start of the IID program (i.e., when the IID is installed: "sanction reinstatement") and the next DUI conviction during the data collection window. For those who did not recidivate after IID install within the data collection window, the time elapsed is the full number of days remaining in the data collection period.

Results

Descriptives

As shown in Table 1, most offenders (55%) agreed to take a breath test at "benchmark" arrest and, of those, had an average BAC of .19 g/dL (*SD*=.06). Prior to the "benchmark" arrest, offenders had an average of .68 (*SD*=.71) DUI arrests and after "benchmark" arrest had an average of .02 (*SD*=.15) DUI arrests. After "benchmark" arrest, the average amount of time on the interlock was 2.38 years (*SD*=.79). Depending on when the "benchmark" arrest occurred, and when the interlock was installed, there may be more or fewer days of follow-up data on potential recidivism available in the data collection window. Recidivism might occur while the interlock is installed, after the interlock was removed, or might not occur at all. The average number of days to first DUI recidivism was 827.80 days (*SD*=553.75; range: 0 to 2,569 days).

Between subjects t-tests revealed significant differences between the groups among six of the eight control variables (Table 1). Compared to the IID-only group (control), the IID+IEC group was significantly younger (IID+IEC, *M*=38.29, *SD*=11.73 versus IID-only, *M*=42.20, *SD*=11.83; $t(636)=-7.77$, $p<.001$), refused an alcohol breath test at "benchmark" arrest less often (*M*=0.31. *SD*=0.46 versus *M*=0.45, *SD*=0.50; $t(645)=-7.23$, $p<.001$), had a higher "benchmark" arrest BAC (of those who took the test; (*M*=.20, *SD*=.05 versus *M*=.19, *SD*=.07; $t(423)=3.38$, $p<.001$), had more DUI arrests prior to the "benchmark" arrest (*M*=0.97, *SD*=0.80 versus *M*=0.66, *SD*=0.70; $t(620)=9.24$, $p<.001$), recidivated less frequently (no/yes) after "benchmark" arrest (*M*=0.01, *SD*=0.08 versus *M*=0.02, *SD*=0.15; $t(790)=-4.33$, $p<.001$), went longer before their first recidivism after "benchmark" arrest (*M*=1,629, *SD*=576 versus *M*=785, *SD*=519; $t(623)=34.36$, $p<.001$). There were no significant group differences regarding sex or offenders' years in the IID program.

Table 1. Demographics of offenders enrolled in the IID-only and IID+IEC programs.

	IID (*n*=10,632)	**IID+IEC (*n*=573)**	**Total (*N*=11,205)**	***p* value**
Age				
Mean (SD)	42.20 (11.83)	38.29 (11.73)	42.00 (11.85)	< .001
Range	19.50 - 84.30	21.46 - 76.27	19.50 - 84.30	
Sex				
N-Missing	1,002	443	1,445	
Male	7,321 (76%)	113 (77%)	7,434 (76%)	.695
Female	2,309 (24%)	33 (23%)	2,342 (24%)	
Breath Test Refusal				
Mean (SD)	0.45 (0.50)	0.31 (0.46)	0.45 (0.50)	< .001
N	4,835	178	5,013	
Arrest BAC (g/dL)				
Mean (SD)	.19 (.07)	.20 (0.05)	.19 (007)	< .001
Range	003 - .46	.08 - 0.39	.03 - .46	
Prior DUI Arrests[3]				
Mean (SD)	0.66 (0.70)	0.97 (0.80)	0.68 (0.71)	< .001
Range	0.00 - 2.00	0.00 - 2.00	0.00 - 2.00	
Years in IID Program				
Mean (SD)	2.38 (0.81)	2.36 (0.32)	2.38 (0.79)	.08
Recidivism after IID				
Mean (SD)	0.02 (0.15)	0.01 (0.08)	0.02 (0.15)	< .001
N	248	4	252	
Time to 1st Recidivism				
Mean (SD; Days)	784.62 (518.55)	1,628.79 (575.65)	827.80 (553.75)	< 0.001
Range (Days)	0.00 – 2,002.00	14.00 – 2,569.00	0.00 – 2,569.00	
Range (Years)	0.00 – 5.48	0.04 – 7.04	0.00 – 7.04	

[3] Prior arrests were inferred from DMV Sanction Action codes; the only possible values were 0, 1, or 2+. We coded 2+ as 2 when computing these statistics (See "Control variables" under "Method" for more details).

Correlation matrix among control variables

To address potential problems with multi-collinearity, control variables were examined in a correlation matrix (Table 2). None of the correlation coefficients showed multi-collinearity, including "Time to First Recidivism" and "Years on IID," which had the strongest relation (r=.62, p<.001) but still did not reach the threshold of r=.80 to show increased risk of multi-collinearity (Vatcheva et al., 2016); therefore, adjustments were not made for multi-collinearity in the model.

Table 2. Demographics of offenders enrolled in the IID-only and IID+IEC programs

	Variable	1	2	3	4	5	6	7	8
1	Recidivism	1.0	-	-	-	-	-	-	-
2	Time to 1st Recidivism (Days)	-0.05***	1.0	-	-	-	-	-	-
3	Age	-0.03***	-0.02*	1.0	-	-	-	-	-
4	Sex (0=female, 1=male)	0.01	0.00	0.00	1.0	-	-	-	-
5	Test Refusal (0=no, 1=yes)	0.03**	-0.11***	-0.04***	0.01	1.0	-	-	-
6	Arrest BAC	.05***	-.06***	.02	-.08***	.03*	1.0	-	-
7	Prior DUIs	0.01	0.00	0.19***	0.05***	-0.28***	0.09***	1.0	-
8	Years on IID	0.04***	0.62***	-0.03***	0.00	-0.05***	0.00	0.00	1.0

Note: * p<.05; ** p<.01; *** p<.001

Cox proportional hazards model

A Cox proportional hazard model, otherwise known as a "time to event" or "survival" analysis, was used in this study to determine the relation between treatment type and the risk of DUI recidivism (i.e., whether DUI recidivism occurred before the end of the data collection window). This model is a form of survival analysis (or time to event) in which the covariates multiplicatively increase or decrease the hazard ratio (i.e., risk of recidivism). In this case, the event is whether recidivism occurred (n=11,205 participants, number of recidivism events=252) and the time to event is the "time to first recidivism" (in days); if recidivism did not occur at any point in the data collection window, the "time to first recidivism" was right censored (i.e., computed based on the end of the data collection period). The model evaluated whether the ratio of the hazard rate in the treatment condition to the hazard rate in the control condition was significantly different from one (0=IID-only control; 1=IED+IEC treatment). The following control variables were included in the model: age, sex, breath test refusal, arrest BAC[4], number of prior DUI arrests, years in the IID program. For each variable, a hazard ratio greater than one shows an increased risk of recidivism while a hazard ratio below one shows a reduced risk of

[4] For the purposes of conducting the Cox proportional hazard model, mean BAC was imputed for the 45% of participants who refused a breath test.

recidivism. Overall model fit was good. The full Cox proportionate hazard model was statistically significant, indicating that the predictors collectively improved model fit over the null model, $\chi^2(7) = 97.04$, $p<.001$.

Table 3. Results of the Cox proportional hazards regression

	Hazard Ratio	95% CI	Significance (*p*)
Age	0.97	0.96 - 0.99	< .001*
Sex			
Female	*Ref.*	*Ref.*	*Ref.*
Male	0.88	0.64 - 1.21	.400
Arrest BAC	1.50	1.28 - 1.76	< .001*
Breath Test Refusal			
No	*Ref.*	*Ref.*	*Ref.*
Yes	2.11	1.60 - 2.77	< .001*
Number of Prior DUI Arrests	1.44	1.19 - 1.75	< .001*
Years on IID	0.93	0.79 - 1.08	.300
Treatment			
IID (control)	*Ref.*	*Ref.*	*Ref.*
IID+IEC (treatment)	0.22	0.08 - 0.60	.003*

Results showed that, controlling for all covariates, the treatment group (IID+IEC) had a significantly lower risk of recidivism compared to the control group (IID-only; HR=0.22, 95% CI: 0.08-0.60, $p<.01$); their risk of recidivism was 78% lower (Table 3). Several control variables were also significant, with a 50% increase in the risk of recidivism for every one standard deviation increase (0.06 g/dL) in offenders' arrest BAC above the breath test mean of 0.19 g/dL (HR = 1.50; 95% CI, 1.28-1.76, $p<.001$); a 111% increase in the risk of recidivism among those who refused to take a breath test compared to those who agreed (HR = 2.11; 1.60-2.77, $p<.001$); and a 44% increase in the risk of recidivism for each prior DUI arrest, up to 2+ prior DUI arrests[5] (HR = 1.44; 95% CI, 1.19-1.75, $p<.001$). There was also a 3% decrease in the risk for recidivism for each one-year increase in age (relative to the mean age of 42 years old) (HR=.97; 95% CI, .96-.99, p<.001). Offender sex and years in the IID program did not predict risk of recidivism.

[5] See "Control variables" under "Method" for more details.

Discussion

The results provide strong support for "parallel" IID+IEC (initiating the IEC as soon as possible after IID installation and using the IID performance data to inform the counseling sessions) as an effective countermeasure for recidivism reduction among DUI offenders on IIDs. In this study, implementing the IEC intervention as soon as possible after IID installation (IID+IEC) resulted in a 78% decrease in DUI recidivism within the data collection window compared to the IID-only (control) group. This relationship was significant while including known predictors of DUI recidivism in the model as control variables, such as offender's arrest BAC and DUI history. Further, these results are particularly promising because the treatment group demonstrated greater recidivism reduction despite having more pre-existing risk factors for recidivism due to the non-random assignment of the groups. This included having a significantly younger average age, more breath test refusals, a higher average arrest BAC, and more prior DUI arrests. Despite these disadvantageous factors working against them, the treatment group recidivated less frequently and went longer before their first recidivism after "benchmark" arrest (i.e., the start of treatment) compared to the control group. Given that the IID+IEC program in Colorado is the only one of its kind in the United States, this first formal evaluation of this approach has important implications for parallel IID+IEC use as a recidivism reduction tool by enhancing the effects of IIDs in the short- and longer-term.

The effectiveness of this unique approach is, at least in part, attributable to two features of the IID+IEC program known to reduce recidivism: the beneficial effect of close monitoring plus feedback and addressing pre-existing and emerging risk factors. More specifically, close monitoring with feedback about IID performance has shown to reduce IID violations and DUI offenses. Even simple monthly mailed letters conveying offenders' recent IID performance, with praise or admonishment, reduces IID violations (Zador et al., 2011). In the current study, IID performance monitoring and feedback were enhanced by having offenders' IID performance data incorporated into monthly in-person treatment sessions. Further, the close monitoring and feedback within these treatment sessions is provided as soon as possible after the start of the IID sanction when offenders may have the most difficult time performing desirably on the IID. Providing feedback in a timely way allows offenders to use the information immediately—prior to IID violations—to identify their patterns of behavior, risky times, and IID success strategies moving forward.

Second, the Colorado IID+IEC program is unique, in that, the nature of the program addresses both pre-existing and emerging risk factors as early as possible in the IID sanction timeline. More specifically, the IID+IEC program is offered to all participating IID offenders (either voluntarily or mandatorily) upon IID installation, thus treating offenders of varying risk for future recidivism earlier in the IID sanction process. In particular, since offense history does necessitate mandatory IID+IEC participation among offenders with four or more prior DUI convictions, higher risk DUI offenders given an IID sanction are automatically enrolled in IEC treatment without having to first commit a set number of IID violations. Beginning IID+IEC treatment as soon as possible after IID installation preemptively addresses IID performance, which is also a risk factor for later recidivism (Marques et al., 2001, 2003, 2010). The Colorado IID+IEC group's 78% reduction in recidivism shows there is a beneficial effect of preemptively offering the IEC program to all IID offenders as soon as possible after IID installation, to address pre-existing risk factors earlier and decrease the likelihood of IID violations occurring in the first place.

Overall, this study further supports the general role of IID data-enhanced counseling among DUI offenders on IIDs; however, this study strongly shows that broad availability and early implementation of this program to all IID offenders has important implications for enhancing the effectiveness of IIDs at reducing DUI recidivism.

Limitations. First, the evaluation of the IEC was not a randomized control trial, with voluntary participation among offenders with fewer than four DUI convictions and mandatory participation among those with four or more DUI convictions. Therefore, post-treatment differences in recidivism between the IID-only and IID+IEC offenders could be explained by factors other than the effect of treatment. For example, most DUI offenders on IIDs in Colorado mandatorily complete 24-86 hours of standard education and 24 hours of standard treatment before license reinstatement; egregious offenders with 4 or more DUI convictions have a specialized treatment and education program that lasts much longer and is focused on the internalization and demonstration of competencies rather than by time. Unfortunately, offenders' education and treatment participation was unknown in this study so, while offenders in both the treatment and control groups would have participated in standard education and treatment, differences in the levels or amount of time in these programs could not be examined or controlled for in the current study. The IID+IEC program was voluntary for offenders with three or fewer DUI convictions. Therefore, it is possible that some personal attribute of those individuals who voluntarily participate also make them less likely to recidivate compared to offenders who have the choice but choose not to participate in IID+IEC. While efforts were made to address potential confounds, such as by including several known predictors of recidivism in the analysis, it is not possible to determine definitively whether the results are due to the treatment or to other unknown confounding factors—such as an effect of standard education and treatment or offenders' personal traits—unless a randomized control trial were conducted. Last, the Cox proportional hazards model suggests that the hazard ratio remains constant across time, something which may not be true. Of note, the data collection window included time which overlapped with the COVID-19 pandemic when driving behavior, especially drinking and driving behavior, was shown in many cases to differ from traffic behavior before the pandemic (NHTSA, 2021).

Future Directions. Future research would benefit from addressing the primary limitation of this study, namely, by conducting a randomized control trial to fully understand the effect of IID+IEC on DUI recidivism without potential confounds (e.g., the beneficial impact of standard education/treatment, offender personal attributes, and abnormal traffic patterns/behavior due to the COVID-19 pandemic). Given the unique nature of this program as the only one of its kind in the United States, future research would benefit from examining the implementation and impact of this effective countermeasure for reducing DUI recidivism in other States.

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