U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**

NHTSA

DOT HS 813 574

April 2024

Drug-Impaired Driving Data Collection

Report to Congress

This page intentionally left blank.

DISCLAIMER

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. If trade or manufacturers' names or products are mentioned, it is because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Suggested APA Format Citation:

National Highway Traffic Safety Administration. (2024, April). *Drug-impaired driving data collection: Report to Congress* (Report No. DOT HS 813 574).

This page intentionally left blank.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT HS 813 574		

4. Title and Subtitle	5. Report Date
Drug-Impaired Driving Data Collection: Report to Congress	April 2024
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Randolph Atkins, Trisann Jodon, Jennifer Davidson Conlon, and Amy Schick	

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
	11. Contract or Grant No.

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Highway Traffic Safety Administration 1200 New Jersey Avenue SE Washington, DC 20590	.
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report was prepared in accordance with Section 25025 (Drug-Impaired Driving Data Collection) of the Infrastructure Investments and Jobs Act (IIJA), Pub. L. 117-58. The report summarizes what is known about the collection of drug-impaired driving data and its reporting to the Fatality Analysis Reporting System (FARS).

The report describes the FARS data collection process and its toxicology reporting framework, the Recommendations for Toxicological Investigations of Drug-Impaired Driving and Motor Vehicle Fatalities – 2021 Update, identifies barriers that States encounter in submitting alcohol and drug toxicology results to FARS, provides recommendations on how to address those barriers, and describes the actions that the U.S. Department of Transportation and the National Highway Traffic Safety Administration are taking to assist States in improving toxicology testing in cases of motor vehicle crashes, and the reporting of alcohol and drug toxicology results in cases of motor vehicle crashes.

17. Key Words	18. Distribution Statement
Drug-impaired driving, drug-impaired driving data collection, Fatality Analysis Reporting System, FARS drug data, toxicological investigations of drug-impaired driving	This document is available to the public from the DOT, BTS, National Transportation Library, Repository & Open Science Access Portal, https://rosap.ntl.bts.gov.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	34	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

This page intentionally left blank.

Table of Contents

List of Figures

This page intentionally left blank.

Introduction

This report has been prepared in response to a requirement in Section 25025 (Drug-Impaired Driving Data Collection) of the Infrastructure Investments and Jobs Act (IIJA), Pub. L. 117-58 (Nov 15, 2021) which states:

SEC. 25025. DRUG-IMPAIRED DRIVING DATA COLLECTION.
Not later than 2 years after the date of enactment of this Act, the Secretary, in consultation with the heads of appropriate Federal agencies, State highway safety offices, State toxicologists, traffic safety advocates, and other interested parties, shall submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Transportation and Infrastructure of the House of Representatives a report that, in accordance with the document entitled ''Recommendations for Toxicological Investigations of Drug-Impaired Driving and Motor Vehicle Fatalities—2017 Update'' (and subsequent updates to that document)—

(1) identifies any barriers that States encounter in submitting alcohol and drug toxicology results to the Fatality Analysis Reporting System;
(2) provides recommendations on how to address the barriers identified pursuant to paragraph (1); and
(3) describes steps that the Secretary, acting through the Administrator of the National Highway Traffic Safety Administration, will take to assist States in improving—
(A) toxicology testing in cases of motor vehicle crashes; and
(B) the reporting of alcohol and drug toxicology results in cases of motor vehicle crashes.

Note: The document referenced in the legislation has since been updated to *Recommendations for Toxicological Investigations of Drug-Impaired Driving and Motor Vehicle Fatalities – 2021 Update*.[i]

Background

Driving under the influence of drugs (DUID) is a growing concern in the United States. While alcohol is the drug most often linked to impaired driving and crashes, there are many other drugs that can impair driving ability and contribute to crashes.[ii] Other potentially impairing drugs include some over-the-counter (OTC) drugs, some prescription drugs, and most illegal drugs. The use of drugs other than alcohol and in combination with alcohol is also widespread. The 2022 National Survey on Drug Use and Health (NSDUH) estimated that 70.3 million people in the United States aged 12 or older (24.9 % of the population) reported use of illicit drugs in the past year, [iii] a statistically significant increase of approximately 8.3 million people since the 2021 NSDUH survey. The 2022 NSDUH survey found that 101.6 million people (36%) reported using prescription psychotherapeutics with 14.2 million people (14%) reporting misusing prescription psychotherapeutics in the past year. The 2022 NSDUH survey also found that 13.6 million people (5.2%) reported driving under the influence of illicit drugs[1] in the past year, a statistically significant increase from 11.9 million people (4.6%) in the 2021 survey, and 15.6 million people

[1] Includes marijuana, cocaine, heroin, hallucinogens, inhalants, or methamphetamine.

(5.9%) reported driving under the influence of alcohol, a statistically significant increase from 13.4 million people (5.1%) in 2021.

NHTSA's *2013-2014 National Roadside Survey of Alcohol and Drug Use by Drivers*[2] reported that 20.1% of all drivers surveyed on weekend nights tested positive for the presence of some drug, legal and/or illegal, other than alcohol, a statistically significant increase from the 16.3% of drug-positive drivers found in the 2007 survey.[iv] More recently, NHTSA's 2019-2021 study of drug prevalence in road users with serious or fatal injuries admitted to one of seven Level-1 trauma centers or to one of four of the corresponding Medical Examiner's offices found that 55.8% of these road users tested positive for one or more drugs. Overall, cannabinoids (active THC)[3] were the most prevalent drug category (25.1%) present in road user toxicology, followed by alcohol (23.1%), stimulants (10.8%), and opioids (9.3%); with 19.9% positive for two or more drugs.[v] In data available at five of these sites in the months just prior to the COVID-19 pandemic,[4] 50.8% of the drivers in the study had at least one drug present (including alcohol) in their system with 17.6% having multiple drugs in their systems. This increased to 64.7% and 25.3%, respectively, during the pandemic in the second quarter of 2020. During this time cannabis presence increased from 20.8% to 32.7% and opioid presence increased from 7.5% to 13.9% in this sample of drivers.[vi]

Prescription and OTC drug use is quite common in America. The National Center for Health Statistics estimated that, from 2015-2018, 48.6% of Americans used at least one prescription medication in the past 30 days, with 24% using three or more prescription medications in the last 30 days and 12.8% using five or more prescription medications in the last 30 days. The most frequently prescribed drugs were analgesics for pain relief.[vii] While not all prescription and OTC drugs are impairing, drivers may increase their risk of drug-impaired driving as they may be unaware of the potentially impairing effects of many prescription drugs - especially for medications that require time adjustment.[viii] Furthermore, the simultaneous use of multiple therapeutic drugs or combining therapeutics with alcohol increases the risk of motor vehicle crashes because of the potential for interaction effects between the medications and alcohol that increase the effect of the alcohol on the driver.[ix]

The shift in use, social acceptance, and policies regarding the use of cannabis is also fueling concerns about drug-impaired driving. From the 2001 - 2002 survey to the 2012 – 2013 survey, the use of cannabis doubled from 4.1% to 9.5% of the U.S. adult population, with 30% of these users meeting the criteria for cannabis use disorder.[x] By 2020, 17.9% of Americans 12 years or older reported using cannabis in the past year (approximately 49.6 million people), and an estimated 5.1% of people 12 and older (approximately 14.2 million people) had a cannabis use disorder.[xi] Though cannabis is still illegal under Federal law, 24 States and the District of Columbia have legalized both recreational and medical use of cannabis and 15 other States have legalized cannabis for medical use. Another 10 States have legalized cannabis for specific medical conditions.[xii]

---

[2] The next National Roadside Survey of Alcohol and Drug Use by Drivers is planned for 2025. It will also pilot data collection for other road users, including pedestrians and bicycle riders.

[3] THC or delta-9-tetrahydrocannbinol is the primary psychoactive substance in cannabis.

[4] Two trauma centers joined the study after the pandemic began, so they were not included in NHTSA's COVID-19 reports because the original five trauma center sites were the only cites collecting data pre-pandemic.

This increase in legalization has been accompanied by an increase in the presence of delta-9-tetrahydrocannabinol (THC) found in drivers, indicating use of cannabis. NHTSA's 2013-2014 National Roadside Survey found THC presence in 12.7% of surveyed drivers in 2013-2014, up from 8.7% in the 2007 survey. In a 2018 study by Washington State, 39.1% of drivers admitted to driving within 3 hours of using cannabis at least once in the previous year, and the biological results from the survey indicated that the presence of cannabis in surveyed drivers had doubled, from approximately 10%, to 20% of all drivers after the State's implementation of retail cannabis sales.[xiii] A roadside survey conducted in Washington State with NHTSA's assistance found similar results, with 7.8% of drivers testing positive for presence of THC prior to the implementation of legal cannabis in the State. NHTSA found significant increases in the percentage of drivers with THC presence six months (18.4%), and one year (18.9%) after legalization.[xiv]

While linking the level of cannabis present in biological samples with level of impairment remains challenging, well-established evidence shows that cannabis use can detrimentally affect driving-related skills. Cannabis use slows driver reaction time, creates decrements with road tracking and maintaining lane position, and decreases cognitive performance and driver attention maintenance. Cannabis use in conjunction with other drugs, such as alcohol, can also have a compounding effect on impairment.[xv] The current shifts in policy and cannabis use increase the public health concerns regarding possible increases in drug-impaired driving.

There is a need for more national-level data addressing the issue of drug-impaired driving.[xi,xvi] Estimates show that comprehensive societal costs for alcohol-impaired driving were approximately $1.37 trillion in 2019;[xvii] however, the data required for conducting similar analyses for the comprehensive societal costs of drug-impaired driving are lacking as the data have too many limitations, precluding their use.[xviii] The improvement of FARS DUID data, as discussed in this report, would help address this problem.

The Fatality Analysis Reporting System

NHTSA's Fatality Analysis Reporting System (FARS) is a national census of fatal traffic crashes on public roadways in the United States. The FARS contains data starting from 1975 on every fatal traffic crash within the 50 States, the District of Columbia, and Puerto Rico. To be included in FARS, a traffic crash must involve a motor vehicle traveling on a trafficway customarily open to the public that results in the death of a vehicle occupant or a nonoccupant within 720 hours of the crash. FARS includes data on the traffic crash environment, the involved vehicles, the involved persons and their roles, the events of the crash itself, and the circumstances leading up to those crash events. NHTSA publishes two data files per calendar data collection cycle: The Annual Report File (ARF) is the FARS data file associated with the most recent available year which is subject to change when it is finalized the following year to the FARS Final File version.

FARS Case Compilation

NHTSA works closely with the 50 States, the District of Columbia, and Puerto Rico to coordinate the collection of the data included in FARS. The cornerstone document for FARS data is the Police Crash Report (PCR) and any amended versions of the PCR. The State FARS analysts collect source documents from ancillary State agencies, such as data from State Highway Departments, State Vehicle Registration and Driver Licensing data, Vital Records Department data, death certificates, Coroner/Medical Examiner data, and Emergency Medical Services reports, in addition to the PCR, to address the various data collection aspects of each case – including alcohol and drug testing dispositions and findings from State toxicology laboratories.

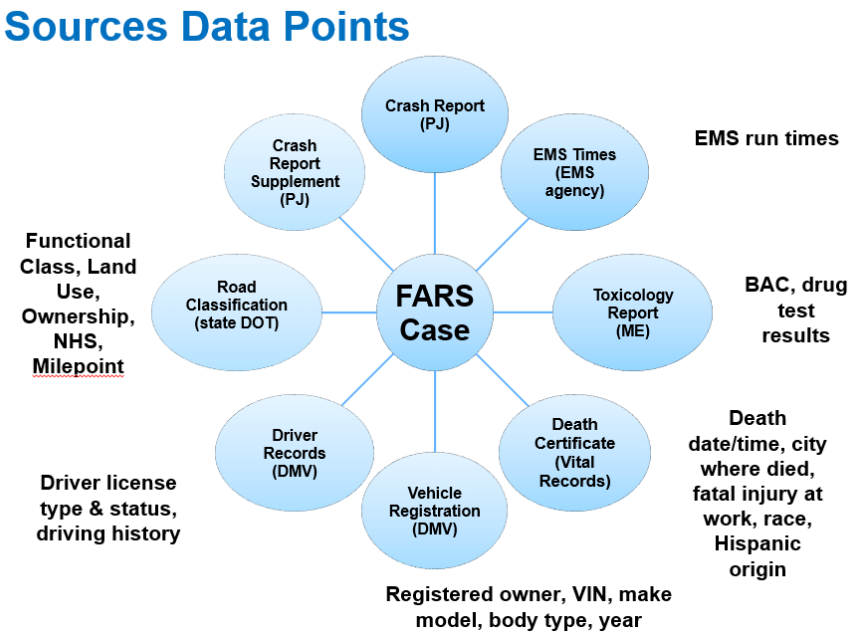

Figure 1. Source data points for each FARS case

FARS Toxicology Reporting Framework

Historical emphasis by FARS on alcohol use and testing has made way for growing interest in drug use and testing among drivers and non-motorists as the prevalence of prescription and illicit drug use competes with the prevalence of alcohol use. FARS has focused on reporting quantified blood alcohol concentration (BAC) levels while only reporting positive (and name of detected drug) or negative test results for drugs when persons were known to be tested. FARS drug reporting has differed significantly from its alcohol reporting due to the complexity of drug toxicology and the limitation of the FARS framework to accommodate more precise drug reporting. Starting with the FARS 2022 data collection timeframe, NHTSA has added new data fields that identified the DRUG TEST STATUS, the DRUG SPECIMEN and listed DRUG TEST RESULTS for all substances. Negative drug test results are reported for each unique specimen type in which no drugs in the drug test panel were detected.[xix]

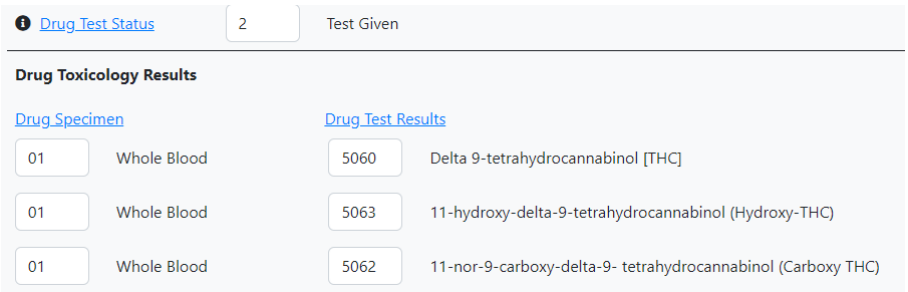

Figure 2. The FARS 2022 data file drug reporting example using expanded DRUG TEST RESULTS list

Beginning in the FARS 2023 data collection cycle, NHTSA expanded the framework of the drug reporting to allow more specific reporting regarding the DRUG TESTING METHOD (i.e., screening vs confirmatory) and the ability to record the actual quantities of drugs reported for detected substances.[xx] These changes will allow FARS to report drugs more consistently with the manner the forensic laboratories report their toxicology results. A continued issue is that FARS analysts across States[5] receive the toxicology reports from sources other than the laboratory itself. For example, a laboratory may transmit its findings to a police agency and the agency may then (often in another format) forward the results to the State FARS analysts in each State. Having the same FARS data elements reported by different sources in different formats complicates data collection for those elements and increases the time and effort required to code and validate those elements and add them to the FARS database.

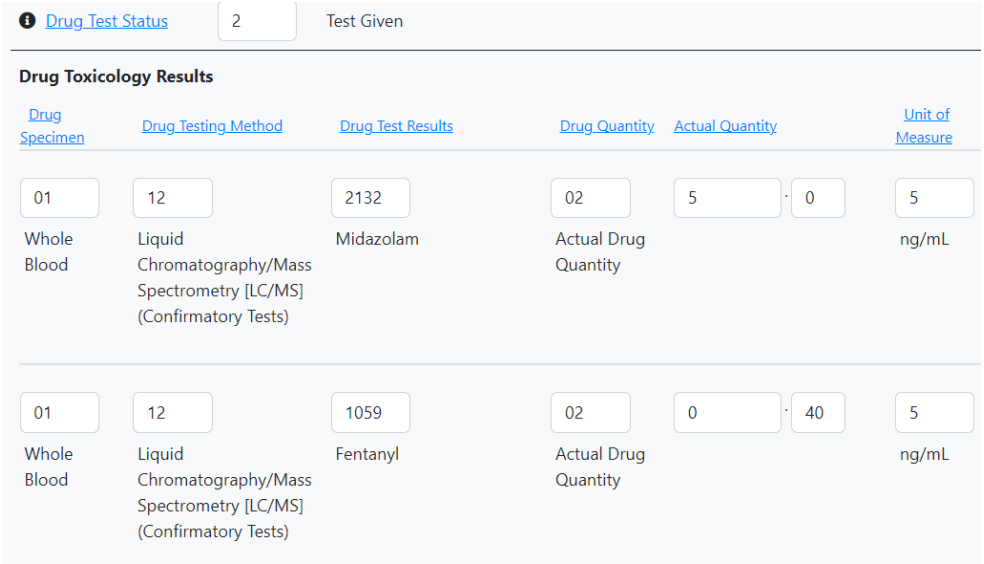

Figure 3. The FARS 2023 data file reporting example using a new framework to capture the DRUG TESTING METHOD and QUANTITIES of drugs reported, when availlable

[5] Each State, Washington, DC, and the territories employ their own analysts who are trained by NHTSA to perform the FARS work for the State.

Document Sourcing

While the framework for capturing drug testing dispositions and findings has improved in the 2023 FARS data collection cycle, the varying degree of detail in the source documents remains an issue. The manner, type, amount and reporting of DUID data vary by State. Several factors determine the availability of drug testing documentation such as:

- State laws that specify the circumstances under which a person may, may not or must be tested if involved in a fatal crash
- Local policies
- The role of the person involved in the crash (e.g., all drivers, only persons suspected of being under the influence)
- The extent of injury suffered by the person

Testing practices vary by State depending on whether the person themselves survived the crash (but there was at least one fatality in the crash), or if the person was a non-motorist.

Testing of surviving drivers and non-motorists

- Testing of surviving drivers and non-motorists rely on a law enforcement officer to provide the drug testing disposition
- Police crash reports (PCRs) vary as to how this information might be captured:
  - Some PCRs only allow an officer to report alcohol testing and BAC results – there is no space for recording of drug test information.
  - Drug testing disposition (i.e., tested or not tested) is reported, but no fields are available to report drug testing results.
  - Drug testing disposition is reported, and fields are available to report positive or negative findings but with no place for drug category or specific drug name of any drug is listed.
  - Drug testing disposition is reported, and names of drugs are listed.
  - Some crash narratives provide detailed, verbatim findings transcribed from the PCR.
  - PCRs amended by law enforcement officers to include drug testing results may or may not be submitted to the State FARS unit for inclusion in the FARS data.

Testing fatally injured drivers and non-motorists

- Fatally injured drivers and non-motorists who die at the scene of the crash or prior to arrival at a trauma center would rely on the coroner or medical examiner (ME) as the primary source to provide the drug testing disposition.
  - Drug testing dispositions for deceased persons who were not tested may be more difficult to ascertain as some coroners or MEs only report known positive or negative findings; coroners and MEs seldom state a “not tested” disposition unless intended testing failed for some reason (e.g., insufficient or contaminated specimen).
  - Drug testing results may be issued to the FARS units in various formats: the original, full laboratory report; a text summary of findings; an Excel spreadsheet with an extract of findings, etc.

Communicating Drug Testing Outcomes to FARS

States specify the content and format of drug data included in a PCR or on a coroner or medical examiner (ME) report. FARS relies on the reported data in these reports. Drug testing outcomes can lose specificity as they pass through various agencies en route to the State FARS unit or through transcription of original results into subsequent documents (e.g., the law enforcement officer receives toxicology report and enters results into the PCR in a shortened form).

NHTSA provides the State FARS analysts with comprehensive training on the data reporting framework to interpret raw data and record the findings in the FARS database. NHTSA also provides customized training sessions with individual State FARS analysts to review specific source documents having drug testing results to ensure that information from specific laboratories or police jurisdictions is accurately and consistently interpreted. NHTSA's efforts support States to perform reliable analysis and report drug testing results to the FARS national database using a standard taxonomy.

The primary obstacle to more robust drug testing reporting is an inability to acquire source documents on toxicology from law enforcement and/or coroners or MEs. Amended PCRs containing alcohol/drug updates are not always forwarded to FARS. Accident reconstruction reports that typically have more robust toxicology data are seldom submitted to the State FARS units and are not typically included in the State crash data repository. Drug testing requires more time to complete than alcohol testing and may require additional follow up by the State FARS units to acquire the information. Additionally, drug testing incurs higher expenses compared to alcohol testing and may be subject to a "stop" order if preliminary alcohol testing satisfies evidential requirements for impairment judicial proceedings.

FARS supports NHTSA's mission to improve traffic safety and makes traffic safety data available to the public, including State and local governments and other traffic safety-related organizations and researchers. However, it is dependent on the source documents from States and the data available to it. The barriers to advancing the quality of FARS drugged-driving data are many and the solutions challenging, as described above and in subsequent sections of this report below.[xx] NHTSA has been working diligently to address this issue and continues to take steps to improve the toxicology testing and reporting of drug- and alcohol-impaired driving data to the FARS as discussed further below.

Recommendations for Toxicological Investigations of Drug-Impaired Driving and Motor Vehicle Traffic Fatalities

The National Safety Council's Alcohol, Drugs and Impairment Division (NSC-ADID) initiated an effort to "standardize toxicology laboratory testing practices for cases involving driving under the influence of drug (DUID) and traffic fatalities" in 2004.[i] After surveying laboratories across the country on the scope and the analytical blood and urine cutoffs these laboratories used for their DUID testing, the first recommendations were published in 2007 based on the survey results and the consensus of a panel of leading forensic toxicologists. These recommendations for standardization included drugs and drug categories known to have adverse

pharmacological effects on driving performance based on the peer reviewed literature, the experiences of survey respondents, and data from DUID crashes and arrests. Using the same methodology, the NSC-ADID updated the recommendations in 2013, adding oral fluid testing and establishing a two-tier approach, with Tier I drugs the most prevalent drugs found for laboratories across the country and Tier II drugs with regional or limited prevalence. To be compliant with the 2013 standards, laboratories were required to test for all Tier I drugs at or below the recommended cutoffs. In 2016, with NHTSA's support, the NSC-ADID reviewed the recommendations and based on changes in technology and growing use of new substances, such as fentanyl analogs and synthetic cannabinoids, published updated recommendations in 2018. The NSC-ADID published their most recent update of the recommendation in 2021, based on current trends in drug prevalence and evolving laboratory technology.[i]

Barriers to Submitting Drug and Alcohol Toxicology Results to FARS

The barriers to submitting drug and alcohol data results from fatal traffic crashes to FARS involve three general areas of the data collection and reporting process: 1) The alcohol and drug testing must be conducted in a consistent and comprehensive manner; 2) The test results must also be reported in a consistent and comprehensive manner; and 3) The FARS data system must be able to receive and process all the data and provide it to end users in a comprehensive manner that accurately represents drug and alcohol involvement in all fatal traffic crashes in the country. All three aspects of the data collection and reporting are critically important to accurate reporting to FARS.

The reporting of comprehensive toxicology data for DUID cases involving fatal traffic crashes is a process, with the forensic toxicology testing one step in that process. For FARS alcohol and drug driving data to meet the NSC-ADID *Recommendations for Toxicological Investigations of Drug-Impaired Driving and Motor Vehicle Fatalities – 2021 Update*, all forensic toxicology laboratories across the country handling fatal motor vehicle crash cases would have to make changes in many steps in the process to meet those recommendations for all fatal crashes. There are many barriers to this occurring at many stages in the process as NHTSA's previous research has discussed. NHTSA's Research Note, *Understanding the Limitations of Drug Test Information, Reporting, and Testing Practices in Fatal Crashes* began documenting these issues in 2014.[xxi] NHTSA's 2022 report, *Drug testing and traffic safety: What you need to know* [xxi] further describes the many challenges to improving the FARS DUID data. These issues are described below.

To understand the barriers to obtaining quality drugged-driving data through FARS, it is important to examine the entire process that a State takes prior to reporting data to FARS (See Figure 4). Each step in the process has its challenges and the potential for the loss of data and the creation of inconsistencies in the data, which impacts later analyses of the data.

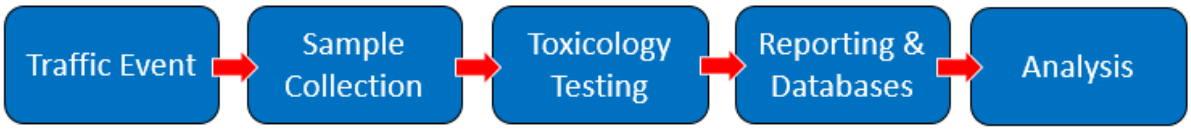

Figure 4. FARS DUID data and toxicological process

Traffic Event

The first step in a State's DUID data and toxicology process is the occurrence of a traffic event – a traffic crash. Drivers and others involved in a traffic crash can be tested for alcohol and/or other drugs; however, State law or policy and/or local laws designating who should be tested and the circumstances and location under which testing occurs vary. For example, some States do not test for other drugs if the alcohol test is positive and over the illegal BAC level. Jurisdiction resources and other unique local factors may also influence decisions on drug testing those involved in traffic crashes. Additionally, police officers may not have sufficient probable cause to test an individual for drugs. It should also be noted that someone fatally injured in a crash may test positive for presence of drugs but may not be a driver of a vehicle in the crash and/or may not be drug impaired. Figure 5, below, shows the percentage of fatally injured drivers drug tested by State.

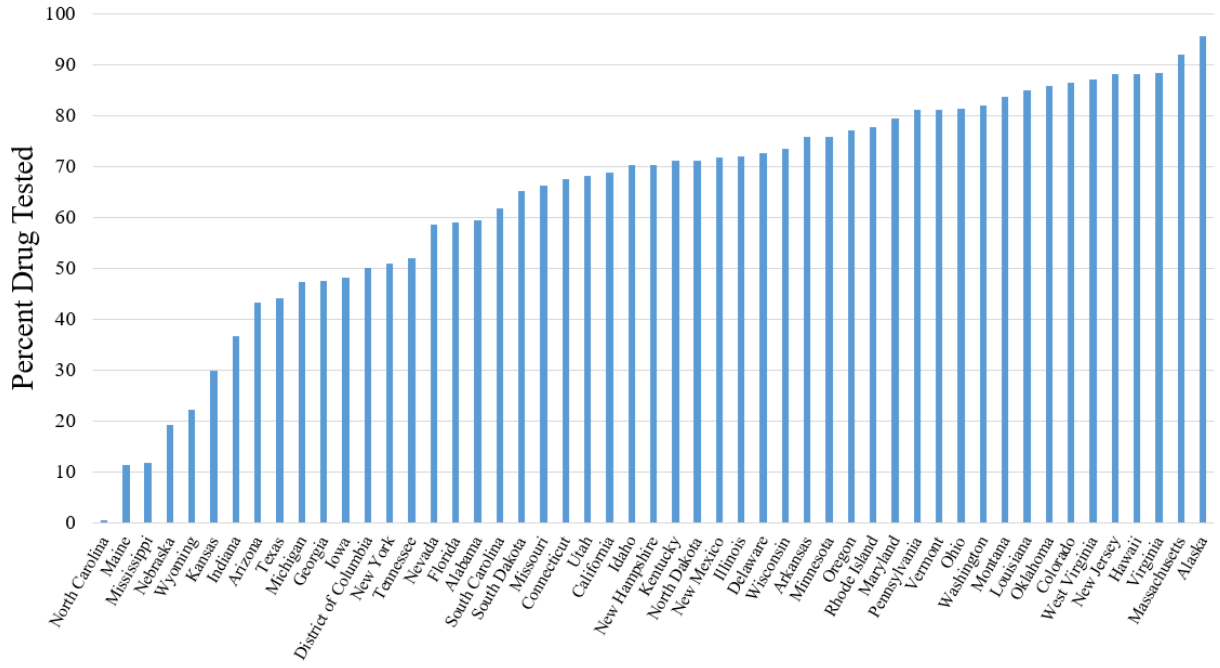

Figure 5. Percent of fatally injured drivers drug tested by State, 2019

Sample Collection

Once the decision is made to collect a sample for drug testing, other factors begin to come into play such as *time of the collection* and the *matrix collected*. Long delays in sample collection after the traffic event can impact drug test results. Some drugs metabolize relatively quickly; they have a short *window of detection* and may no longer show up in drug tests if there are long delays. For example, the level of the active substance in cannabis, delta-9-tetrahydrocannibnol (THC), drops by over 80% within 90 minutes of smoking marijuana,[xxi] and levels of active THC may become too low to measure if the delay from traffic event to sample collection is too great. Cannabis is fat soluble and, when metabolized in the body, a non-psychoactive metabolite may be stored in the fatty tissues of a user for days or sometimes even

weeks after the last use of cannabis. Thus, presence of a THC metabolite in a drug test may not indicate use during or in the hours just before a traffic event.

The matrix or type of specimen collected (blood, urine, oral fluid, etc.) may also vary and impact drug testing data. For example, urine matrices are designed to detect THC metabolites that are not psychoactive. It is a good matrix to test for use in workplace drug-testing. But urine is not ideal for possible THC influence during a traffic event as THC metabolites can remain in the body for days after last use and urine tests typically do not test for active THC. Most States authorize use of a urine drug test as a matrix option for drugged driving cases.

Toxicology Testing

Many of the challenges to the nationwide adoption of the NSC-ADID drug testing guidelines are found in the toxicology testing stage of the process starting with which drugs are included in the *drug test panels*. There are many drug test panels commercially available for laboratories. Drug test panels use immunoassay techniques and include tests targeting different combinations of drugs or drug classes. If someone is drug tested, it is only possible to detect the drugs/drug classes included in the drug panel used for testing that person. Drugs that may have been used by the person being tested but not included in the test panel used by the laboratory would be missed.

The drug test panels used in the initial laboratory testing are drug screeners. Positive tests for drug presence in the *screening* phase must then be confirmed using more advanced *confirmation testing* methods. Typically, in DUID cases involving Tier I drugs, a sample is first screened using an immunoassay test panel and any drug positives found with the screener are then confirmed using gas chromatography-mass spectrometry (GC-MS) instrumentation. Less common drugs, such as those in Tier II, may require more advanced instrumentation "such as liquid chromatography tandem mass spectrometry (LC-MS-MS) or liquid spectrometry-high resolution mass spectrometry (LC-HRMS)."[i] Screening tests may have false positives or false negatives, so confirmation testing is crucial. State-reported test results to FARS often do not indicate if the test result is a screener or a confirmation test.[6] This introduces possible error in the data if the tests reported were screener results and include false positive or false negative results.

Cut-off levels or *levels of detection* are the lowest amounts of a drug that can be detected for a given drug test such that the test would be considered positive for a given drug. Cut-off levels can vary across drug panels. For example, a laboratory screening at a 10 ng/dL[7] for a given drug would find a specimen with 15 ng/dL of the drug to be positive for that drug. A different laboratory screening the same sample but at 20 ng/dL would find the specimen to be negative for the drug even though it used the same specimen. The cut-off levels used for laboratory instrumentation may also vary across laboratories doing DUID testing. These variations are not uncommon and can introduce inconsistencies in the FARS drug data. Since cut-off levels are rarely reported to FARS, there is no way to control for this variation in cut-off levels.

---

[6] Drug screens only indicate positive or negative for a given drug class. Confirmation tests are more accurate, can detect specific drugs and metabolite, and can quantify the amount of a drug

[7] Drug levels are typically measured as nanograms per deciliter or ng/dL.

Drug testing *instrumentation* varies across laboratories as do related laboratory capabilities. While GC-MS instrumentation is found in most if not all laboratories doing DUID testing, few laboratories have more advanced instrumentation such as LC-MS-MS or LC-HRMS. There can also be differences in instrumentation across manufacturers that impact instrument procedures as well as the ability to quantify test results at specific levels of detection compared to similar devices. Standard *procedures* for validating instrumentation can also vary across laboratories. These differences can lead to inconsistencies in drug data that States report to FARS that cannot be accounted for in analyses.

Reporting and Databases

As with forensic drug testing, there are also issues with State data reporting and data inclusion in FARS that create challenges for the adoption of the NSC-ADID drug testing guidelines. As discussed earlier in this report, the PCR is the starting point for each FARS case, and case data is also collected from several ancillary State agencies, including data from State Highway Departments, State Vehicle Registration and Driver Licensing data, Vital Records Department data, death certificates, Coroner / Medical Examiner data, Emergency Medical Services reports, and State toxicology laboratories. The type of information collected and the terminology in PCRs vary from State to State and there can be differences in other agency databases from State to State, as well. This variation can create issues with data consistency between States in what data is collected, how data is formatted, and what data is generated and available to report to FARS.

There are also limits regarding what data can be included in FARS. There must be fields in the data system to enter State data items into FARS. There must be appropriate coding in place to code data as it is entered into the database. Adding fields for data entry and codes for data entered in the FARS database is an ongoing process. FARS includes data on many types of crashes – speeding, seat belt use, distraction, etc. – so while the inclusion of new data fields is an ongoing process, there are considerations to weigh whether additional data fields should be included for any one crash type such as drug impaired driving before data collection becomes too unwieldly to collect, code, verify and report cases in a timely manner.

Analysis

There are significant limitations to analyses using the current FARS drug-impaired driving data. Cases in the database currently don't include what drugs were tested for so analysts cannot reliably state rates of use of any given drug in fatal crashes. Many cases are not tested for any drugs other than alcohol. For those cases where a specific drug or drug panel was done, there is no information on possible presence of other drugs that were not tested for. Additionally, there is no information in the database on which drugs were tested for nor information on whether the drug test conducted was a drug screen or a confirmation test. One limitation presents in the misinterpretation of the labels drug negative and drug positive in FARS. If a FARS drugged-driving case is positive for a drug, it means the drug was present in the body of the crash victim. It is not an indication that the person was impaired by the drug. Analysts often misinterpret this label to mean impairment resulting in many misleading published articles, despite NHTSA disclaimers.

As reported above, every step in the FARS DUID data and toxicology process has the potential for data loss and the creation of inconsistencies in the data that eventually is provided for use in FARS (see Figure 6) below.

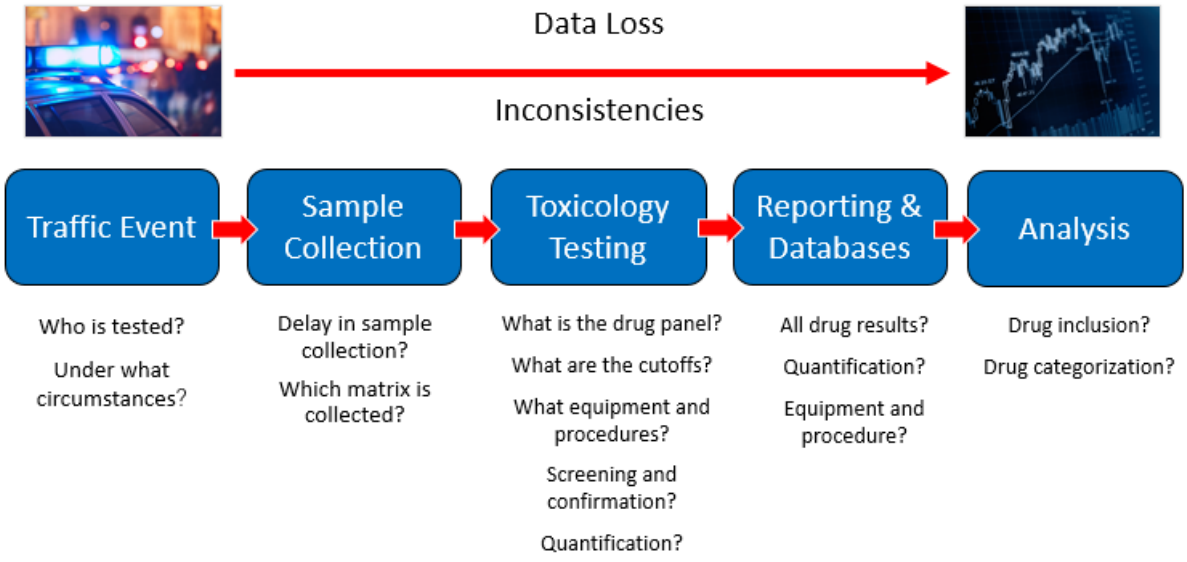

Figure 6. Possible introductions of data loss and inconsistencies in the FARS DUID data and toxicology process

NHTSA's Past Efforts on Reporting Systems for Impaired Driving Data

NHTSA has been working to improve the reporting of test results for alcohol- and drug-impaired driving cases for decades. In 1997, NHTSA published a three-volume report on reporting and sharing impaired driving data. The first volume, *Driving While Intoxicated Tracking Systems, Volume I: Design & Operation*[xxii] included a qualitative analysis of State-level tracking system designs and operations, extensive recommendations for system development, emphasized need for quality, scope, and completeness of data, and included illustrations of specific State systems. The second volume, *Driving While Intoxicated Tracking Systems, Volume 2: State Tracking System Descriptions*[xxiii] included a compilation of descriptions of seven State DWI tracking systems reviewed for the report. The seven States were California, Louisiana, Mississippi, New Jersey, New Mexico, New York, and Utah. Volume 3 added Virginia. The third volume, *Driving While Intoxicated Tracking Systems, Volume 3: DWI Estimated for the United States*[xxiv] included a quantitative presentation of DWI estimates based on data from the eight State tracking systems and provided more detailed examples from many systems mentioned in Volume I.

In 2001, NHTSA initiated a demonstration project, *Model Impaired Driving Records Information System* (MIDRIS) based on the earlier three-volume report. The project, which included Alabama, Iowa, Nebraska, Wisconsin, and Connecticut, documented how States could further improve and expand existing systems. Drawing from the findings in this demonstration project, in 2006, NHTSA published "Guidelines for Impaired Driving Information Systems" in

the *Federal Register*.[xxv] This model system requires timely, accurate, complete, consistent, integrated, accessible, and secure information. The guidelines noted that a successful impaired-driving records information system requires significant efforts by a State to generate, transmit, store, update, link, manage, analyze, and report information on impaired driving offenders and citations. Key system stakeholders in such a system must include law enforcement agencies, the Department of Motor Vehicles (DMV), and the judicial system, as well as forensic toxicology laboratories.

In 2011, NHTSA published *Model Impaired Driving Records Information Systems Tying Together Data Systems to Manage Impaired Drivers*.[xxvi] This followup study documented improvements made by four States in the 2001 demonstration project and provided examples on how the States made their improvements. However, a review by NHTSA[8] indicates that States did not sustain the improvements they made. NHTSA plans to undertake a new study to examine what happened and how such a reporting system can be sustained in the long term.

This model impaired-driving records information system is intended to be comprehensive and include all impaired driving cases and not just fatal traffic crashes. The requirements for the FARS impaired driving fatal cases data are similar. Both require significant efforts and resources by a State to establish and maintain.

Challenges for Laboratories

NHTSA has gathered information from the DUID forensic toxicology community's surveys as well as NHTSA's toxicology liaisons in the NHTSA regions, State impaired driving stakeholder meetings, and a *Federal Register* notice[9] requesting input regarding implementation of the NSC-ADID DUID Toxicology recommendations. The forensic toxicology community has provided a great deal of input on the challenges they currently face through use of regional toxicology liaisons. These issues are critical barriers to forensic toxicologists' ability to address the testing issues described earlier and meet the recommendations for drug-impaired driving forensic toxicology testing for fatal traffic crashes. And, as the regional toxicology liaisons have pointed out, all laboratories are not the same. This section summarizes the issues reported to NHTSA.

Staffing

A common concern reported by the DUID forensic toxicology community is the ***shortage of full-time employees*** (FTEs) needed to handle the laboratory workload. A 2020 NSC sponsored survey of U.S. laboratories conducting DUID forensic testing found that 45% of responding laboratories stated that additional staffing was their first priority for additional resources with another 37% of laboratories listing staffing as a second or third priority behind additional instrumentation for testing (see Figure 7).[xxvii] ***Heavy workloads*** in many laboratories often result in delayed ability to conduct drug tests which delays the availability of drug test

[8] NHTSA is undertaking a literature review related to the improvements of the States' impaired driving records information systems. NHTSA expects to make the results available in 2024.
[9] https://www.federalregister.gov/documents/2022/04/25/2022-08776/request-for-comments-on-barriers-and-solutions-for-submitting-toxicology-data-to-the-fatality

results. The laboratories responding to the 2020 NSC survey reported an average of 2,220 impaired driving cases tested for drugs per year with a median of 820 and a high of 19,000 cases tested for drugs.

Laboratory workloads involve more than just conducting the drug testing. Laboratory toxicologists are often called on to testify in court as to the toxicological findings, which takes time for staff to prepare, time to travel to and from the court, and time in court to testify. Whenever tests for new substances are added or new equipment introduced in forensic toxicology laboratories, the staff must take time (several days or weeks) for method[10] development and validation, usually requiring the most experienced senior staff toxicologists. There is also the time required for administrative matters, record keeping and training to ensure staff are current on instrumentation and address other toxicological matters. When laboratories are short-staffed, handling all the laboratory's activities in a timely manner is a challenge.

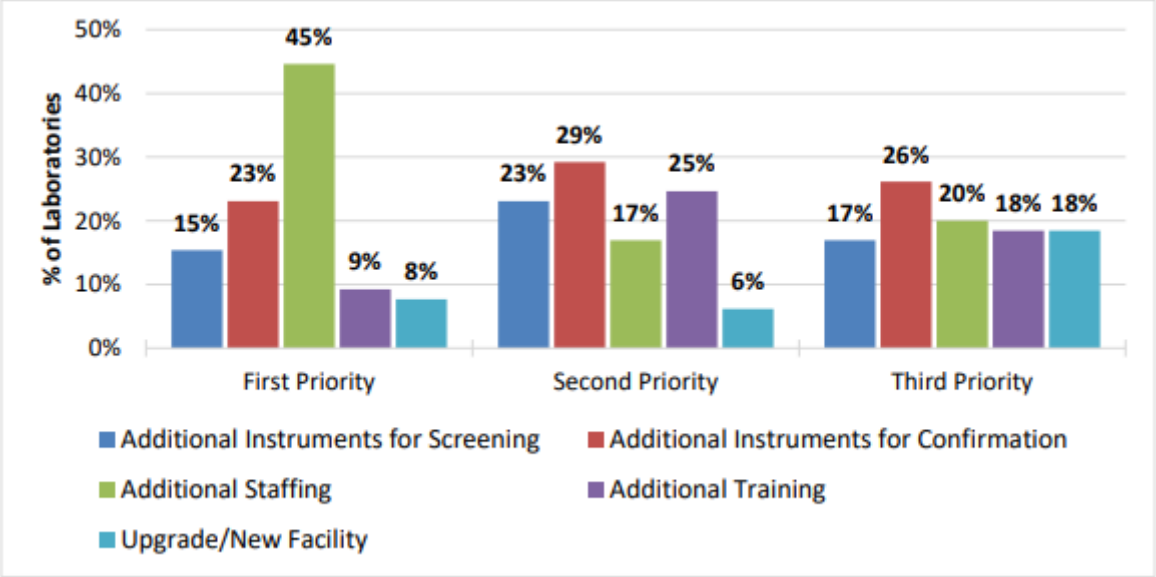

Figure 7. Top three priorities for additional resources for laboratories performing DUI and DUID resting (n=65) - figure from NSC survey of laboratories report

Infrastructure

Another issue for DUID forensic toxicology laboratories is **laboratory working space**. The NSC laboratory survey showed 32% of laboratories responding said laboratory upgrades or new facilities were one of their top three priorities for additional resources (Figure 7).

[10] There are many forensic methods for toxicological drug testing such as Enzyme Linked Immunosorbent Assay (ELISA), GC-MS, LC-MS, etc. all of which must be developed and validated in the lab for each target drug tested.

Technology Needs

Many laboratories responding to the NSC laboratory survey reported a need for **additional instrumentation** to conduct drug screening (a top three priority for 55%) and/or drug confirmation testing a (top three priority for 78%). Some laboratories are using older and slower technology with limited testing capacity rather than more efficient state-of-the-art technology that can run many drug tests concurrently and more quickly. Some laboratories are not able to conduct drug quantification testing. Matrices used in laboratories for DUID cases also may vary. Some laboratories only test blood specimens, some only test urine specimens, some a combination of blood and urine, and some test other matrices such as gastric fluid, vitreous fluid, or other tissue types for deceased drivers.

Aging instruments may lose sensitivity and spend more time down for repairs and maintenance and need to be replaced. There is also the issue of supplies, accessories, and consumables required for testing which must also be compatible with laboratory instrumentation, and according to the NSC survey, 35% of the responding laboratories said they reported unconfirmed screening results and 37% of the laboratories had to outsource drug confirmation tests. Finally, laboratories have also experienced supply chain problems regarding instrumentation, consumables and other supplies.

Data Systems

Each toxicology laboratory uses **Laboratory Information Management System (LIMS)** software. LIMS typically handle several laboratory functions, including sample management, the integration of laboratory instruments and applications, and electronic data exchange. LIMS may also help with the management of a variety of other things, such as instrument calibration and maintenance schedules, workload management, quality assurance and report creation. There are several manufactures of LIMS software, and the software is customizable. There is much variation in LIMS data systems across laboratories, there are system capacity differences, and also significant compatibility issues between laboratory systems. This has an impact on the data that can be and is reported to FARS.

Drug Testing Costs

The cost of conducting DUID forensic toxicology testing can be prohibitive for jurisdictions. A single drug screening test can cost[11] anywhere between $200 to $500 depending on the technology and method used for the test. The cost of a single confirmation test is around $500, but could cost more depending on the number of drugs to be confirmed and if quantification for each drug is done.

Training

Forensic toxicology laboratories have many training needs. As with most technical professions, toxicologists and laboratory technicians must keep up with the state of technology and maintain professional certifications. Whenever new instrumentation and test methods are

[11] Drug test cost estimates based on conversation with Amy Miles, President, Society of Forensic Toxicologists.

introduced in a laboratory, staff must be trained accordingly. Toxicologists have also expressed the need for more training on providing expert testimony in court, including toxicology testimony on oral fluid specimens. And with staffing shortages, taking staff away from laboratory production to train is a challenge that affects drug test turnaround time.

Recommendations for Addressing Barriers Pursuant to Improving Submission of Drug and Alcohol Toxicology Results to FARS

1. Support Statewide comprehensive and compatible impaired driving data systems that facilitate the collection and sharing of data within each State and that can better provide DUID data and support the FARS data system.

Developing and maintaining a statewide comprehensive impaired driving system is a great challenge for States both financially and logistically. NHTSA has provided guidelines for the data elements required, but few States have managed to build systems such as MIDRIS. Programs to assist States with building data systems that capture the entire census of traffic offense cases from stop through adjudication and sentencing are needed. Such a system would include the drug toxicology data, including drug quantification, for all fatal traffic crashes which, in turn, could be collected into FARS. To support improvements to their information systems, States may apply for a NHTSA State traffic safety information system improvement grants, see 23 U.S.C. § 402(a)(2)(D) and 23 U.S.C. § 405(c).

2. Encourage standardized variables in Laboratory Information Management Systems that can be easily compiled for submission to the FARS and Statewide data systems.

Standardized variables (name, format, definitions) used across laboratory information management systems (LIMS) would greatly improve the compatibility of key DUID data elements across laboratories. These systems could be designed to easily provide comprehensive DUID data output that could be more easily incorporated into FARS. Government incentives could support such efforts by the laboratories.

3. Encourage policies to improve national DUID data collection for FARS.

Encourage State policies to improve DUID data collection that remove barriers to and improve data collection for FARS.

- Stop-test practices / statutes – While stop-test practices for cases where the offender is not tested for drugs if they test over the illegal limit for alcohol is understandable from a fiscal perspective to reduce costs, it results in important DUID data not being collected for many cases. This limits the data available to FARS on DUID. Comprehensive drug testing of all fatal crash cases could ensure that this needed DUID data would be available for inclusion in FARS.
- Single offense impaired driving statutes - Many States have a single impaired driving law that includes both alcohol- and drug-impaired driving offenses. This may encourage stop-test practices since it reduces the incentive to test for drugs when alcohol is present. Separate chargeable offenses for alcohol- and drug-impaired

driving violations should provide more jurisdictional incentive to test for drugs and also provide another deterrent for drug-impaired driving. Given the high percentage of drivers on the roadways with multiple drugs in their systems, this should help get more impaired drivers off the road and into treatment.

- Matrices tested – Some States require urine testing, which does not help ascertain what drugs may be in the system of a driver at the time of a traffic stop. Requiring blood or oral fluid matrices for DUID testing would help make the DUID data more uniform, which would improve the FARS DUID data. Making oral fluid an option would provide a matrix that is non-invasive to collect and easier to collect close to the time of the traffic stop.
- Remote testimony – Forensic toxicologists are in short supply today. The time for laboratory test results turnaround is delayed when toxicologists are away from the laboratory testifying in court. Legislation making remote testimony an option would greatly reduce the time away from the laboratory for court appearances and could help address staffing shortages to some degree.

4. **Make the necessary funding available to address forensic toxicology laboratories staffing and training, and equipment and technology needs and facilitate comprehensive DUID data collection that can be easily provided to the FARS data system.**

The *2023 GAO report*[xxviii] *on Impaired Driving: Information on Data Used to Identify Repeat Offenders* found that the biggest challenges to toxicology laboratories' ability to collect repeat offender data were insufficient staff and training and lack of equipment and technology. The GAO report also pointed out the importance of grant programs at the Department of Justice and Department of Transportation (including the NHTSA State traffic safety information system improvement grants) as well as other Federal resources to help forensic toxicologists address their laboratory needs. The availability of more resources for these laboratories is critical for their ability to meet the NSC-ADID recommendations and collect the toxicological data needed for improving the FARS DUID data.

Steps the U.S. Department of Transportation and NHTSA Are Taking to Improve Toxicology Testing and Reporting of DUID Results to FARS

The U.S. Department of Transportation and NHTSA have been working to improve toxicology testing and the reporting of DUID results to FARS for many years. NHTSA's current efforts to support the improvement of FARS DUID data are discussed below.

Traffic Safety Grants[xxix]

Annually, NHTSA provides nearly $880 million in 23 U.S.C. § 402 and § 405 National Priority Safety Program behavioral highway safety formula grants to the State and territorial highway safety offices (HSOs) to support a broad array of proven effective and innovative countermeasures to address highway safety challenges. A key tenet of the highway safety grant

program is data. All States conduct a problem identification, which is defined as the data collection and analysis process for identifying areas of the State, types of crashes, types of populations (e.g., high-risk populations), related data systems, or other conditions that present specific highway safety challenges within a specific program area.

- HSOs, under the auspices of the Governor, are expected to coordinate highway safety data collection and information systems activities with other federally and non-federally supported programs in the State relating to or affecting highway safety.
- States may use § 402 and select § 405 grants to support data collection efforts regarding driving under the influence of drugs. For example, under § 402 each State must include in its plan the development of statewide data systems to provide timely and effective data analysis to support allocation of highway safety resources. States may use § 405 State Traffic Records System Improvement grant funds to make data program improvements to core highway safety databases, including DUID elements such as supporting reporting criteria relating to impaired driving due to drug, alcohol, or polysubstance consumption. States may use § 405d Impaired Driving Countermeasure grant funds to improve drug concentration screening and testing, detection of potentially impairing drugs, and reporting relating to testing and detection.

Model Minimum Uniform Crash Criteria (MMUCC)[xxx]

In 1998, NHTSA and the Governor's Highway Safety Association (GHSA) worked together to develop the MMUCC voluntary guidelines to address the lack of uniformity across State and local traffic crash databases. The MMUCC, currently in its 6th Edition, states :

> "Lack of uniformity can significantly hinder the timely analysis of critical crash data. Every State has its own police crash report, developed for that State's individual needs. Sharing and comparing data between localities, States, and the Federal Government can be very difficult when the data elements to describe similar crash characteristics have different definitions or collect different information. In addition, without standardized guidance or training, interpretations can vary greatly across the country."
>
> "MMUCC identifies a minimum set of motor vehicle traffic crash data elements that States should consider collecting and including in their crash data systems. The MMUCC was first published in 1998 and updated in 2003, 2008, 2012, and 2017." (MMUCC, 6th Edition, page x)

NHTSA, the Federal Highway Administration (FHWA) and Federal Motor Carrier Safety Administration (FMCSA) at the U.S. DOT, along with the National Transportation Safety Board (NTSB), the GHSA, and subject matter experts from State Departments of Transportation and other stakeholders convene periodically to review and update the MMUCC. NHTSA staff also meet regularly internally to examine and discuss data elements and changes in the MMUCC that may be needed to improve data quality and consistency. Updates to the MMUCC guidelines are published approximately every 5 years to allow time to examine and monitor data elements to determine their reliability and usefulness in traffic crash analyses. This also allows States time to adopt new elements as they see fit. This process is central to efforts to improve the FARS DUID data. NHTSA also recently published a *Guide to Updating State Crash Data Systems* to assist end users in their efforts to improve State crash data.[xxxi]

Internal Identification of Issues With the FARS Drug-Impaired Driving Data

Internal improvements of FARS drug data have been underway for over a decade. This effort has resulted in two important publications on the limitations of the FARS data. First, in 2014, NHTSA published the Traffic Safety Facts Research Note, *Understanding the Limitations of Drug Test Information, Reporting, and Testing Practices in Fatal Crashes*. In 2022, NHTSA published a comprehensive report on the issue, *Drug testing and traffic safety: What you need to know*. This internal effort by NHTSA is ongoing and has led to improvements in the FARS drug data. For example, NHTSA has increased the FARS ability to accept all drugs identified in case toxicology from just three drugs and added fields for screening test/conformation test, test matrix, and the inclusion of negative results for all drugs not found to be positive.

Guidelines for Impaired Driving Information Systems

As mentioned earlier, NHTSA published the Guidelines for Impaired Driving Information Systems in 2006 and conducted demonstration programs to examine the impaired driving data systems for several States. Recently, NHTSA found that the data systems in the States in the earlier MIDRIS study were unable to maintain the improvements they accomplished at the time of that study. In 2023, NHTSA launched a study to follow up with these States and a few others to determine what happened with the data systems over time.

Drug-Impaired Driving Criminal Justice Evaluation Tool

NHTSA supported the development of an evaluation tool that assists jurisdictions to assess their drug-impaired driving criminal justice system. The tool assesses 10 different aspects of the DUID criminal justice system, including sections on law enforcement, prosecution, judiciary, community supervision, toxicology, treatment, emergency medical service, data, legislation, and program and communications. Each section asks a series of key questions per topic. Jurisdictions can score themselves in the ten areas to identify their strengths and needs regarding DUID and utilize as a benchmark with future use. The tool can be found at: https://www.nhtsa.gov/drug-impaired-driving-criminal-justice-evaluation-tool.

Regional Toxicology Liaison Program

NHTSA established the Regional Toxicology Liaison Program to improve the overall understanding of the scope and prevalence of drug-impaired driving. This demonstration project supports liaisons in three NHTSA regions to encourage data collection, toxicology testing, and communication among State and local toxicology laboratories and partners.

State Stakeholders Meetings

NHTSA convened State Toxicology Stakeholder Meetings in five States to increase coordination, communication, drug testing, and reporting of drug-impaired driving cases. Through these venues, NHTSA's ongoing work with State Highway Safety Offices, and oversight activities, NHTSA shares best practices and distributes important toxicology information to States.

Prosecutor Support for Impaired Driving

NHTSA supports the education of State prosecutors to become Traffic Safety Resource Prosecutors, who are subject matter experts specially trained for handling impaired-driving offenses. They provide critically important training and education for other prosecutors, law enforcement officers, and even judges.

Additional Considerations

Oral Fluid Drug Testing

Oral fluid specimens are noninvasive and easy to collect at the time of an impaired driving incident. They also provide a sample close to the time of a traffic stop. While only a few laboratories handle oral fluid for DUID cases at this time, the anticipated new influx of oral fluid testing in the workplace means most forensic toxicology laboratories are expected to add this new matrix into their toxicological methods.[12] This trend will necessarily increase laboratory staffing, training, and equipment needs. It may also impact the ability of some laboratories to adopt the NSC-ADID recommendations. The increase in laboratory DUID oral fluid testing will impact data collection for the FARS.

Roadside oral fluid drug screening devices are also being developed and marketed for DUID enforcement. These devices may impact FARS in the future by identifying more DUID cases for laboratory confirmations if they become more widespread in use. They are not evidential devices. NHTSA has evaluated some of these screening devices and found variability across devices and across different drugs within devices with regard to identification of drug presence.[xxxii]

[12] The U.S. Department of Transportation's Office of Drug & Alcohol Policy & Compliance (ODAPC) and the Department of Health and Human Service's (HHS) Substance Abuse and Mental Health Services Administration Office of Division of Workplace Programs (DWP) recently authorized the use of oral fluid testing as an alternate drug testing methodology to urine testing for employers in the private sector covered under DOT's workplace drug testing regulations and Federal agencies covered under federal agency workplace drug testing programs, respectively. Oral fluid specimens collected under these programs are collected as split specimens and are not point-of-collection tests. Specimens must be sent to a HHS-certified laboratory for screening and confirmation testing. However, oral fluid drug testing has not been implemented in these programs as of the date of this Report. Furthermore, there must be at least two HHS-certified laboratories for oral fluid drug testing. One laboratory to conduct the screening and confirmation testing of the primary specimen and a different HHS-certified laboratory to conduct testing of the split specimen (when requested by the employee because their primary specimen tested positive).

Drug-Impaired Driving Prevalence Research

While not directly linked to FARS DUID data, NHTSA regularly conducts research on drugged driving prevalence. NHTSA's National Roadside survey collects information to provide nationally representative data on alcohol and other drug use and driving, testing for a similar list of drugs to that of the NSC-ADID Recommendations. This provides an important measure of driver alcohol and drug use on America's roadways and supports the importance of establishing more comprehensive DUID forensic toxicology testing. NHTSA also recently published a report to facilitate best practices for State-level roadside survey data collections.[xxxiii]

Drug Prevalence Versus Drug Impairment

As we have noted in previous Reports to Congress on drug-impaired driving[xxxiv] and marijuana-impaired driving,[xxxv] the science, to date, has not been able to establish specific drug levels that correspond to impairment as has been done with the BAC for alcohol. Current DUID cases in the FARS drug data show a presence of drugs in the system of the person who died, but it does not necessarily indicate drug impairment. That said, it is very important that the data on the drugs detected also include drug levels so that when and if science can establish levels comparable to the BAC for alcohol, cases in FARS can be coded accordingly.

References

[i] D'Orazio, A., Mohr, A., Chan-Hosokawa, A., Harper, C., Huestis, M., Limoges, J., Miles, A., Scarno, C., Kerrigan, S., Liddicoat, L., Scott, K., & Logan, B. (2021, July). Recommendations for Toxicological Investigation of Drug-Impaired Driving and Motor Vehicle Fatalities – 2021 Update. *Journal of Analytical Toxicology, 45*(6):529-536. https://pubmed.ncbi.nlm.nih.gov/34086916/

[ii] Couper, F. & Logan, B. (2004, April). *Drugs and Human Performance*. (Report No. DOT HS 809 725). National Highway Traffic Safety Administration. https://www.wsp.wa.gov/breathtest/docs/webdms/DRE_Forms/Publications/drug/Human_Performance_Drug_Fact_Sheets-NHTSA.pdf

[iii] Center for Behavioral Health Statistics and Quality. (2023, November). *The 2022 National Survey on Drug Use and Health*. SAMHSA. https://www.samhsa.gov/data/sites/default/files/reports/rpt42731/2022-nsduh-nnr.pdf

[iv] Kelley-Baker, T., Berning, A., Ramirez, A., Lacey, J., Carr, K., Waeher, G., Moore, C. Pell, K., Yao, J., & Compton, R. (2017, May). *2013-2014 National Roadside Survey of Alcohol and Drug Use by Drivers: Drug Results* (Report No. DOT HS 812 411). National Highway Traffic Safety Administration. https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13013-nrs_drug_092917_v6_tag.pdf

[v] Thomas, F. D., Darrah, J., Graham, L., Berning, A., Blomberg, R., Finstad, K., Griggs, C., Crandall, M., Schulman, C. Kozar, R., Lai, J., Mohr, N., Chenoweth, J., Cunningham, K., Babu, K., Dorfman, J., Van Heukelom, J., Ehsani, J., Fell, J., … & Moore, C. (2022, December). *Drug prevalence among seriously or fatally injured road users* (Report No. DOT HS 813 399). National Highway Traffic Safety Administration.

[vi] Thomas, F. D., Berning, A., Darrah, J., Graham, L., Blomberg, R., Griggs, C., Crandall, M., Schulman, C., Kozar, R., Neavyn, M., Cunningham, K., Ehsani, J., Fell, J., Whitehill, J., Babu, K., Lai, J., & Rayner, M. (2020, October). *Drug and alcohol prevalence in seriously and fatally injured road users before and during the COVID-19 public health emergency* (Report No. DOT HS 813 018). National Highway Traffic Safety Administration.

[vii] Centers for Disease Control and Prevention. (2019). National Center for Health Statistics: Therapeutic Drug Use. https://www.cdc.gov/nchs/fastats/drug-use-therapeutic.htm

[viii] Smith, R., Turturici, M. & Camden, M. (2018, October). *Countermeasures against prescription and over-the-counter-impaired driving.* AAA Foundation for Traffic Safety. http://aaafoundation.org/wp-content/uploads/2018/10/VTTI_Rx_OTC_FinalReport_VTTI-FINAL-complete-9.20.pdf
[ix] Alda, A., Pharm, D., & Morse, M. (2008, May). *Multiple medications and vehicle crashes: Analysis of Databases* (Report No. DOT HS 810 858). National Highway Traffic Safety Administration.
[x] National Institutes of Health. (2015, October 21). Prevalence of Marijuana Use Among U.S. Adults Doubles Over Past Decade. https://www.nih.gov/news-events/news-releases/prevalence-marijuana-use-among-us-adults-doubles-over-past-decade.
[xi] National Institute on Drug Abuse. (2023, December). *What is the scope of cannabis (marijuana) use in the United States?* National Institutes of Health. https://www.drugabuse.gov/publications/research-reports/marijuana/what-scope-marijuana-use-in-united-states
[xii] Insurance Institute for Highway Safety. Alcohol and drugs: Marijuana laws. https://www.iihs.org/topics/alcohol-and-drugs
[xiii] Grondel, D., Hoff, S., & Doane, D. (2018, April). *Marijuana use, Alcohol use and driving in Washington state.* Washington Traffic Safety Commission. http://wtsc.wa.gov/wp-content/uploads/dlm_uploads/2018/05/Marijuana-and-Alcohol-Involvement-in-Fatal-Crashes-in-WA_FINAL.pdf
[xiv] Ramirez, A., Berning, A., Carr, K., Schere, M., Lacey, J., Kelley-Baker, T., & Fisher, D. (2016, July). *Marijuana, other drugs, and alcohol use by drivers in Washington state* (Report No. DOT HS 812 299). National Highway Traffic Safety Administration. https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/812299-washingtonstatedrugstudy.pdf
[xv] Compton, R. (2017, July). *Marijuana-impaired driving: A report to Congress* (Report No. DOT HS 812 440). National Highway Traffic Safety Administration. https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/812440-marijuana-impaired-driving-report-to-congress.pdf
[xvi] Compton, R., Vegega, M., & Smither, D. (2009, December). *Drug-impaired driving: Understanding the problem and ways to reduce it; A report to Congress* (Report No. DOT HS 811 268). National Highway Traffic Safety Administration. https://rosap.ntl.bts.gov/view/dot/1949
[xvii] Blincoe, L., Miller, T.., Wang, J.-S., Swedler, D., Coughlin, T., Lawrence, B., Guo., F., Klauer, S., & Dingus, T. (2023, February). *The economic and societal impact of motor vehicle crashes, 2019 (Revised)* (Report No. DOT HS 813 403). National Highway Traffic Safety Administration.
[xviii] Berning, A. & Smither, D. (2014, November). Understanding the limitations of drug test information, reporting, and testing practices in fatal crashes (Traffic Safety Facts Research Note. Report No, DOT HS 812 072). National Highway Traffic Safety Administration. https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/812072-understandlimitsdrugtest-researchnote.pdf
[xix] National Highway Traffic Safety Administration. (2023, April). *2021 FARS/CRSS coding and validation manual* (Report No. DOT HS 813 426). National Highway Traffic Safety Administration.
[xx] Berning, A., Smith, R. C., Drexler, M., & Wochinger, K. (2022, March). *Drug testing and traffic safety: What you need to know* (Report No. DOT HS 813 264). National Highway Traffic Safety Administration.
[xxi] Compton, R. (2017, July). *Marijuana-impaired driving: A report to Congress* (Report No. DOT HS 812 440). National Highway Traffic Safety Administration. https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/812440-marijuana-impaired-driving-report-to-congress.pdf
[xxii] National Highway Traffic Safety Administration. (1997, January). *Driving while intoxicated tracking systems, Volume 1: Design & operation* (Report No. DOT HS 808 520). https://rosap.ntl.bts.gov/view/dot/1621
[xxiii] National Highway Traffic Safety Administration. (1997, January). *Driving while intoxicated tracking systems, Volume 2: State tracking system descriptions* (Report No. DOT HS 808 521). https://rosap.ntl.bts.gov/view/dot/1042
[xxiv] National Highway Traffic Safety Administration. (1997, January). *Driving while intoxicated tracking systems, Volume 3: DWI estimates for the United States* (Report No. DOT HS 808 522). https://rosap.ntl.bts.gov/view/dot/1618
[xxv] National Highway Traffic Safety Administration. (2006, August). Guidelines for Impaired Driving Records Information Systems. Federal Register. Vol. 71, No. 168. Pp 51665-51672. https://www.gpo.gov/fdsys/pkg/FR-2006-08-30/pdf/E6-14463.pdf
[xxvi] National Highway Traffic Safety Administration. (2011, July). *Model Impaired Driving Records Information Systems - Tying together data systems to manage impaired drivers* (Report No. DOT HS 811 489). https://www.nhtsa.gov/sites/nhtsa.gov/files/811489.pdf

[xxvii] D'Orazio, A., Mohr, A., & Logan, B. (2020, June). *Updates for recommendations for drug testing in DUID and traffic fatality cases: Toxicology laboratory survey.* The Center for Forensic Science Research & Education at the Fredric Rieders Family Foundation. https://www.cfsre.org/images/content/research/toxicology/Survey_Report_Final.pdf

[xxviii] United States Government Accountability Office. (2023, June). *Report to congressional committees: Impaired driving – Information on data used to identify repeat offenders* (GAO 23-105859).

[xxix] National Highway Traffic Safety Administration. (2023, February). Uniform Procedures for State Highway Safety Grant Programs. https://www.federalregister.gov/documents/2023/02/06/2023-01819/uniform-procedures-for-state-highway-safety-grant-programs

[xxx] National Highway Traffic Safety Administration (2024, January). *MMUCC guideline: Model minimum uniform crash criteria, 6th edition* (Report No. DOT HS 813 525a). https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813525

[xxxi] Brown, R., Haney, K., DeFisher, J., Zhou, Y., Benac, J., Cross, A., Chestnutt, C., & Scopatz, B. (2021, December). *Guide to updating state crash data systems* (Report No. DOT HS 813 217). National Highway Traffic Safety Administration.

[xxxii]Buzby, D., Mohr, A. L. A., Logan, B. K., & Lothridge, K. L. (2021, April). *Evaluation of on-site oral fluid drug screening technology* (Report No. DOT HS 812 854). National Highway Traffic Safety Administration. https://rosap.ntl.bts.gov/view/dot/54911

[xxxiii] Thomas, F. D., Berning, A., Blomberg, R. D., Graham, L. A., Darrah, J. R., & Tippetts, A. S. (2021, November). *A how-to guide for conducting a statewide roadside survey of alcohol and other drugs* (Report No. DOT HS 813 198). National Highway Traffic Safety Administration. https://rosap.ntl.bts.gov/view/dot/60880

[xxxiv]Compton, R., Vegega, M., & Smither, D. (2009, December). *Drug-impaired driving: Understanding the problem and ways to reduce it – A report to Congress* (Report No. DOT HS 811 268). National Highway Traffic Safety Administration. https://rosap.ntl.bts.gov/view/dot/1949

[xxxv]Compton, R. (2017, July). Marijuana-impaired driving: A report to Congress (Report No. DOT HS 812 440). National Highway Traffic Safety Administration. https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/812440-marijuana-impaired-driving-report-to-congress.pdf

DOT HS 813 574
April 2024

U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

16257-041824-v1a