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Recommendations for Toxicological Investigation of Drug-Impaired Driving and Motor Vehicle Fatalities—2021 Update

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Abstract

This report describes updates to the National Safety Council's Alcohol, Drugs and Impairment Division's recommendations for drug testing in driving under the influence of drug (DUID) cases and motor vehicle fatalities. The updates are based on a survey of drug testing practices in laboratories in the USA and Canada, a comprehensive review of the prior recommendations and data and research on drugs most frequently detected in DUID cases. A consensus meeting was held with representative forensic science practitioners and the authors of this report to update recommendations. No changes were made to the Tier I scope; however, there were changes to cutoffs of some analytes for blood, urine and oral fluid. Due to increased prevalence in DUID cases, trazodone and difluoroethane were added to the Tier II scope. For clarification, Tier I cutoffs reflect free concentrations, and hydrolysis is recommended but not required. The consensus panel concluded that urine is an inferior matrix to blood and oral fluid as it may represent historical use or exposure unrelated to observed impairment; therefore, future iterations of these recommendations will not include urine as a recommended matrix. Laboratories currently testing urine should work with traffic safety partners to encourage the use of blood and oral fluid as more appropriate specimens and adjust their capabilities to provide that testing.

Introduction

Drug and alcohol testing in suspected impaired driving cases and motor vehicle fatalities serves several critical functions. Evidence is collected for criminal investigations and potential prosecutions, and sometimes civil litigation, and treatment, intervention and rehabilitation of convicted impaired drivers. In addition, biological testing provides insight into the extent and etiology of an important public health and safety issue. This in turn allows the allocation

of resources for public education and other programs to mitigate drug-impaired driving's effects on traffic safety, including the adoption or amendment of laws and detection and law enforcement practices. To be most effective in supporting these outcomes, the toxicological testing of potentially impaired and deceased drivers needs to be forensically defensible, uniform, relevant and up-to-date. Furthermore, every tested drug needs to be detected at an applicable and relevant minimum concentration.

In 2004, the National Safety Council's Alcohol, Drugs and Impairment Division (NSC-ADID) (previously the Committee of Alcohol and Other drugs) started an initiative to standardize toxicology laboratory testing practices for cases involving driving under the influence of drug (DUID) and traffic fatalities. Laboratories performing blood and urine drug testing in these cases were asked to complete a survey about their scope of testing and analytical cutoffs used. Based on survey results and consensus input from a panel of forensic toxicologists, the first recommendations document was published in 2007 and represented a list of drugs considered essential for scope of testing in these investigations (1). Drugs and drug classes were included based on their known potential to cause impairment, as described in peer-reviewed traffic safety and human performance literature, the experience of laboratories participating in the survey and the data gathered from DUID arrests and fatal motor vehicle crashes. Drugs of concern generally have pharmacological effects (central nervous system (CNS) depression, sedation, drowsiness, hyperstimulation, hallucinations, drug withdrawal, risk taking, mood alteration, etc.) that produce adverse driving effects. Following the publication of the 2007 recommendations, the 2009 National Academy of Sciences Report on Strengthening Forensic Science in the United States was published (2). This report called for among other things better standardization of approaches to forensic analysis and consensus-based standards—a goal consistent with the 2007 recommendations.

In 2013, the NSC-ADID updated the 2007 recommendations using the same approach of a survey of laboratory practices, resources and drug prevalence, followed by a face-to-face consensus meeting of stakeholders from laboratories performing this forensic casework (3). In addition to updating the scope for blood and urine testing, reporting thresholds for oral fluid drug testing in DUID cases were established. Further, drugs of concern were divided into two groups: Tier I and Tier II. While both groups are equally capable of causing impairment, Tier I drugs encompassed the most frequently encountered drugs in DUID casework and those detected and confirmed with commonly available immunoassay and gas chromatography–mass spectrometry (GC–MS) instrumentation. Tier I drugs were considered essential for inclusion in routine testing workflows. Tier II analytes had limited or regional prevalence, were encountered less frequently or required more advanced instrumentation such as liquid chromatography–tandem mass spectrometry (LC–MS-MS) or liquid chromatography–high-resolution mass spectrometry (LC–HRMS), not widely available in most laboratories at that time.

The 2013 report required that laboratories must test for Tier I compounds at or below the recommended cutoffs to be compliant with the NSC-ADID recommendations. Laboratories may or may not elect to include Tier II compounds depending on regional trends in their DUID casework, as well as laboratory resources, staffing, availability of instrumentation/technology, and resources for method development and validation.

In 2016, the NSC-ADID, with the support of the National Highway Traffic Safety Administration (NHTSA), requested another review of the recommendations in light of changes in available technology and the increased popularity and rapidly changing landscape of new psychoactive substances (NPSs). NPSs include synthetic cannabinoids, cathinones and "bath salts", and novel opioids, especially fentanyl analogs (4, 5). The updated recommendations were published in 2018 (6).

The updated recommendations served as the basis for a proposed standard drafted by the Toxicology Subcommittee of the National Institute for Standards and Technology's (NIST's) Organization of Scientific Area Committees (OSAC) and developed into an American National Standard by the American Academy of Forensic Sciences Standards Board (ASB), an accredited standards development organization. ASB Standard 120 "Standard for the Analytical Scope and Sensitivity of Forensic Toxicology Blood Testing in Impaired Driving Investigations" is expected to be published in 2021.

In the meantime, trends in drugs involved in impaired driving cases continue to evolve, and the technology available to testing laboratories including greater access to more sensitive screening techniques, such as LC–MS-MS and HRMS, increased. This publication is an update to the 2017 recommendations and reflects a new survey, review and consensus meeting by members of the NSC-ADID conducted in 2020, to ensure that the recommendations reflect best analytical practices. We describe in detail the process used to make changes and update the recommendations for drug testing in DUID and motor vehicle fatality cases.

Methods

Toxicology survey

The 2020 toxicology laboratory survey was created on SurveyMonkey® (San Mateo, CA). Questions related to agency type, staffing, laboratory management and resources, caseload, availability and use of various technologies for screening and confirmation, matrices accepted by the laboratory (i.e., blood, urine and/or oral fluid), scope of testing, screening and confirmation cutoffs currently in use, prevalence of drugs encountered in DUID and motor vehicle fatality cases (aggregated), and compliance with the previously published NSC-ADID recommendations were unchanged from the 2016 questionnaire. New questions related to reporting limits, restricting drug testing based on ethanol testing results, hydrolysis and quantification of drugs in urine were also incorporated into the 2020 survey to better understand the scope of testing practices across laboratories.

Forensic toxicology laboratories were identified from databases of professional organizations, specifically the American Board of Forensic Toxicology, the Society of Forensic Toxicologists, the International Association for Chemical Testing and the American Academy of Forensic Sciences, as well as those laboratories providing support for the Fatality Analysis Reporting System through NHTSA.

A screening invitation email was sent to 325 directors of US and Canadian forensic toxicology laboratories to confirm their involvement in DUID or motor vehicle fatality toxicology testing and their willingness to participate in the survey. Eighty-four laboratories responded, and the designated contact person was sent a link to the survey. Laboratories were given 2 weeks to respond and received a follow-up email to encourage completion of the survey. A total of 65 toxicology laboratories throughout the USA and Canada eventually completed the survey and were included in the survey data compilation and analysis. Survey data were analyzed using Survey Monkey and Microsoft Excel (Redmond, WA).

Consensus meeting

A subset of survey respondents ($n = 10$) and authors met in July and August 2020 during the coronavirus-19 pandemic for a virtual consensus meeting. Participants provided varied laboratory perspectives based on agency type, geographic location, workload and matrices tested. States represented were AL, AZ, CA, CO, FL, IN, MD, MI, NC, NH, NY, OR, PA, TX, and WI. The results of the 2020 survey were reviewed, followed by a comprehensive review of the 2017 recommendations using a modified Delphi method, re-evaluating scope and cutoffs for screening and confirmation, and designation of compounds as Tier I or Tier II.

Results

Toxicology survey

A total of 65 laboratories completed the survey. Full results of the survey are available on the Center for Forensic Science Research and Education website (https://www.cfsre.org/wp-content/uploads/2021/04/2020-DUID-Survey-Report-Final.pdf). Survey participants represented state (46%), county (26%), municipal (9%), regional (8%), private (4%), university (3%), federal (2%) and hospital (2%) laboratories. Of the 65 laboratories, 89% reported testing blood, 63% urine and 3% oral fluid. For those testing urine, only 21% quantified drugs, and 60% hydrolyzed urine samples prior to confirmation.

Enzyme-Linked Immunosorbent Assay (ELISA) was the most frequently reported method for screening for drugs in blood in DUID cases (51% of laboratories), followed by GC–MS (35%), LC–MS-MS (31%), LC–HRMS (23%), gas chromatography–flame ionization detection (GC–FID) (11%), Enzyme Multiplied Immunoassay Technique (EMIT) (9%), Biochip Immunoassay (9%) and gas chromatography–nitrogen phosphorus detection (GC–NPD) (3%). The methods for urine screening were GC–MS (34%), ELISA (28%), LC–MS-MS (23%), EMIT (23%), LC–HRMS (15%), Biochip Immunoassay (5%), GC–FID (5%) and GC–NPD (3%). Thirty-five percent of laboratories report unconfirmed screening results. Under some circumstances, this is limited to reporting the detection of non-psychoactive or incidental substances (e.g., caffeine, acetaminophen and lidocaine). However, other laboratories indicated they report unconfirmed screening results for relevant substances with a comment that further confirmation testing may be requested. Reporting of unconfirmed screen positive toxicology results is a controversial practice, and the NSC published a position/policy statement in 2008 recommending that reporting presumptive positive results in transportation accidents should be abolished (7).

For confirmation and quantification of drugs in blood, 88% of laboratories use LC–MS-MS followed by GC–MS (71%), LC–HRMS (12%), GC–FID (9%), GC–NPD (8%) and ELISA (3%). For confirmation of drugs in urine, GC–MS was used by 62% of laboratories, followed by LC–MS-MS (51%), LC–HRMS (11%), GC–NPD (3%), GC–FID (3%), ELISA (2%) and EMIT (2%). Between the 2016 and 2020 surveys, the results demonstrated a shift by laboratories from GC to LC technology.

The two most common reporting limits for ethanol among laboratories were 0.010 g/dL (73%) and 0.020 g/dL (17%). The practice of laboratories only performing drug testing if the alcohol concentration is below a certain threshold is known as "stop-testing". Forty-five percent of laboratories indicated they have a stop-testing policy, with 34% of those laboratories stopping at 0.08 g/dL and 41% at 0.10 g/dL., while 29% of laboratories have a specific scope for drug testing if alcohol is below a certain limit. Reasons for stop-testing and the specific scope for drug testing varied based on laboratory policy, availability of laboratory resources or staffing, client request, jurisdictional laws and severity of charges in the case.

Compliance with scope of confirmatory testing and cutoff limits in blood from the 2017 recommendations showed that 12% of laboratories met or exceeded all recommendations, while 40% reported partial compliance and active method development or validation to meet the remaining recommendations. Nineteen percent of laboratories reported they do not agree with some aspect of the recommendations. Reasons given were that some compounds are not relevant in their jurisdiction due to low local rates of prevalence, and/or their existing methods were designed for both DUID and post-mortem cases, with the latter not requiring lower levels of analytical sensitivity included in the recommendations. Forty-four percent of laboratories were close to meeting the recommendations; however, developing or validating new methods was not a high management priority.

For confirmation in blood, 51–95% of laboratories (mean 85%) confirmed for Tier I compounds, while 49–98% (mean 80%) met the recommended confirmation cutoffs. Benzoylecgonine, carboxy-tetrahydrocannabinol (THC), tramadol and CNS depressants had the highest rates of compliance, while buprenorphine had the lowest. Rates of compliance remained the same or increased for cutoffs that had not changed between the 2013 and 2017 recommendations. Lower rates of compliance were seen with cutoffs that were lowered between 2013 and 2017, suggesting revalidation of methods had not yet occurred to meet the new recommended sensitivity. Compounds newly promoted to Tier I from the 2017 recommendations (fentanyl, tramadol, O-desmethyltramadol, buprenorphine and norbuprenorphine) demonstrated compliance of at least 48%. Laboratories reported reasons for lack of compliance as due to staffing, analyst time, budget, instrument technology, instrument capacity, confirmation method or that the cutoff limits were not relevant for the laboratory.

The 15 most frequently encountered drugs reported by the participating laboratories are shown in Table I. Citalopram was the only compound appearing in the top 15 drugs not listed in Tier I or II, as it was previously removed from the 2017 recommendations due to a lack of evidence of its ability to cause impairment.

Laboratories were asked about their testing practices for Tier II compounds, or compounds that may be emerging, or have regional but not national prevalence in DUID populations (3). The 2017 recommendations listed 32 Tier II compounds or classes of compounds. Of the 65 responding laboratories, 91% test for some Tier II compounds, an increase from the number of laboratories reporting Tier II testing in the 2016 survey (81%).

At the conclusion of the survey, participants provided a list of drugs for inclusion in the updated recommendations. The top three suggestions were novel benzodiazepines, specifically etizolam and flualprazolam, and gabapentin.

Recommendations

Based on the review of the survey results and discussions from the consensus meeting, Table II includes updated scope and cutoff recommendations for screening and confirmation in blood, urine and oral fluid for Tier I drugs. The Tier I cutoffs listed in Table II reflect free rather than total concentrations. The consensus panel discussed hydrolysis of phase II metabolites in urine to their non-conjugated forms and recognized that it will improve detectability especially for opioids, THC metabolite and benzodiazepines. At the present time,

Table I. Number of Laboratories Reporting This Drug/Drug Class in Their 15 Most Frequently Detected Drugs ($n = 64$)

Compound	Frequency
Δ^9-THC and metabolites[a]	62
Alprazolam/alpha-hydroxyalprazolam[a]	57
Cocaine and metabolites[a]	57
Methamphetamine[a]	56
Diazepam/nordiazepam[a]	48
Clonazepam/7-aminoclonazepam[a]	45
Fentanyl[a]	45
Amphetamine[a]	43
Hydrocodone[a]	34
Morphine[a]	34
Oxycodone[a]	34
Diphenhydramine[b]	30
Lorazepam[a]	26
Zolpidem[a]	23
Methadone[a]	22
Gabapentin[b]	21
Codeine[a]	18
Buprenorphine/norbuprenorphine[a]	15
Tramadol/O-desmethyltramadol[a]	14
Phencyclidine (PCP)[b]	12
6-Acetylmorphine[a]	11
Fentanyl analogs[b]	11
Oxazepam[a]	11
Temazepam[a]	10
Citalopram	9
3,4-MDMA[a]	8
Carisoprodol/meprobamate[a]	8
Cyclobenzaprine[b]	8
Dextromethorphan[b]	8
Hydromorphone[a]	6
Novel benzodiazepines[b]	6
Trazodone	6
Mitragynine[b]	4
Doxylamine[b]	3
Novel opioids[b]	3
Oxymorphone[a]	3
Tricyclic antidepressants[b]	3
Etizolam	2
Heroin	2
Inhalants[b]	2
Ketamine[b]	2
Midazolam	2
Phenylpropanolamine	2
Pseudoephedrine	2
Sertraline	2
Barbiturates[b]	1
Cathinones[b]	1
Chlorpheniramine[b]	1
Ethanol	1
Flualprazolam	1
Guaifenesin	1
Hydroxyzine[b]	1
Lamotrigine[b]	1
Methylphenidate[b]	1
Olanzapine	1
Phentermine	1
Synthetic cannabinoids[b]	1
Valproic acid[b]	1
Venlafaxine	1

[a] Tier I compounds.
[b] Tier II compounds.

however, urine hydrolysis is not a specific recommendation of the consensus panel and is left to the discretion of the laboratory.

For the 2021 recommendations: no changes to Tier I compound scope; no changes to cutoff or scope requirements for screening assays in blood and urine; screening and confirmation cutoffs for carisoprodol were raised to 1,000 ng/mL; screening cutoff for meprobamate in urine and oral fluid were removed; confirmation cutoff for norbuprenorphine in blood was raised to 1 ng/mL and confirmation cutoff for fentanyl in urine was raised to 1 ng/mL.

The screening cutoffs listed were selected with laboratories screening only with immunoassay technology in mind, rather than setting requirements that would require sensitivity achieved using LC–MS-MS or LC–HRMS. When a laboratory is limited to screening by immunoassay, care is needed to ensure adequate cross-reactivity for all drugs within Tier I. When using ELISA as a primary screening method in DUID investigation casework, the consensus panel concluded that in general, compounds in Tier I should have cross-reactivity at or above 80% of the target ELISA compound. If a recommended minimum of 80% cross-reactivity cannot be achieved using general drug-class assays, laboratories should evaluate the need to implement compound-specific assays. An exception was made for cocaine, for which many commercially available cocaine metabolite (benzoylecgonine) immunoassay kits do not have 80% cross-reactivity to cocaine. Some examples of compounds with poor cross-reactivity to a drug-class assay include lorazepam and clonazepam against oxazepam or diazepam calibrated kits; oxycodone, oxymorphone and hydromorphone against morphine calibrated kits; methamphetamine and 3,4-methylenedioxymethamphetamine (MDMA) against amphetamine calibrated kits and amphetamine and MDA against methamphetamine calibrated kits.

As in the 2013 and 2017 recommendations, the authors further reinforced the limitations of urine as a specimen for impaired driving investigations, as drug presence in urine demonstrates only historical drug use or exposure, potentially outside the window of relevance to an individual's alleged intoxication or impairment. The presence of drugs in an individual's urine does not equate to impairment at the time of collection or proximate to the time of driving. Even though some states still allow (or may even require) urine as a specimen for DUID or motor fatality investigations, the consensus panel strongly encourages the use of blood or oral fluid as a more appropriate sample to indicate recent, relevant drug use. Future iterations of the guidelines will not provide recommendations related to urine screening and confirmatory cutoffs for DUID investigations. Jurisdictions that mandate the use of urine in DUID investigations should consider the adoption of more suitable matrices.

Recent developments within the field of forensic toxicology include increased interest in the use of oral fluid as a specimen for drug detection in impaired driving cases (8). Drug deposition into oral fluid is via passive diffusion of un-ionized free drug from the blood through the salivary glands and ion trapping of basic drugs in the oral cavity. The rate of diffusion is affected by several factors including lipophilicity of the drug, salivary pH, pKa, molecular size, un-ionized free drug blood concentration and membrane characteristics (8–11). With respect to drug chemistry, weak bases are generally found in higher concentrations and persist longer in oral fluid due to ion trapping. Ion trapping occurs after the un-ionized free drug crosses the membrane and the drug becomes ionized due to the lower salivary pH increasing drug concentrations in this matrix. Conversely, for acidic drugs or drugs that are tightly protein-bound, the equilibrium favors the blood resulting in decreased drug concentrations in oral fluid compared to blood. Within the frequently

Table II. 2021 Recommended Scope and Cutoffs for Tier I Drugs/Drug Classes (ng/mL) for Screening and Confirmation in Blood, Urine and Oral Fluid

Drug	Blood		Urine		Oral fluid	
	Screen	Confirm	Screen	Confirm	Screen	Confirm
DRE category; cannabinoids						
Δ⁹-THC	–	1	–	–	4	1
Carboxy-THC	10	5	20	5	–	–
11-hydroxy-THC	–	1	–	–	–	–
DRE category; CNS stimulants						
Methamphetamine	20	20	200	50	20	20
Amphetamine	20	20	200	50	20	20
MDMA[a]	–	20	–	50	20	20
MDA[a]	–	20	–	50	20	20
Cocaine	–	10	–	20	15[b]	8
Benzoylecgonine	50	50	150	50	15[b]	8
Cocaethylene	–	10	–	20	–	8
DRE category; CNS depressants						
Carisoprodol	1,000	1,000	1,000	1,000	500	500
Meprobamate[a]	–	500	–	500	–	500
Zolpidem	10	10	20	20	10	10
Low-dose benzodiazepines	10	–	50	–	5	–
Alprazolam	–	10	–	50	–	1
Alpha-hydroxyalprazolam	–	–	–	50	–	–
Clonazepam	–	10	–	50	–	1
7-Aminoclonazepam	–	10	–	50	–	1
Lorazepam	–	10	–	50	–	1
High-dose benzodiazepines	50	–	100	–	5	–
Diazepam	–	20	–	50	–	1
Nordiazepam	–	20	–	50	–	1
Oxazepam	–	20	–	50	–	1
Temazepam	–	20	–	50	–	1
DRE category; narcotic analgesics						
Codeine[a]	–	10	–	50	30	5
6-Acetylmorphine	–	5	–	10	–	1
Buprenorphine	1	0.5	5	1	1	2
Norbuprenorphine	–	1	–	1	–	–
Fentanyl	1	0.5	1	1	1	0.5
Hydrocodone[a]	–	10	–	50	30	5
Hydromorphone[a]	–	5	–	50	30	5
Methadone	50	20	300	50	20	10
Morphine	10	10	200	50	30	5
Oxycodone[a]	10	10	100	50	30	5
Oxymorphone[a]	–	5	–	50	30	5
Tramadol	100	50	100	50	50	10
O-Desmethyltramadol	–	50	–	50	–	–

[a] Must have ≥80% cross-reactivity if using immunoassay for blood and urine.
[b] Screening for either benzoylecgonine or cocaine in oral fluid is acceptable.

encountered drug classes in impaired driving cases, benzodiazepines are likely to have decreased concentrations in oral fluid due to high protein binding in blood and require lower levels of analytical sensitivity for detection.

Oral fluid drug testing for DUID investigation is widely used in Australia, Europe and the UK (12–14). In Canada, field oral fluid drug screening equipment was recently approved for law enforcement use (15, 16). In the USA, oral fluid is an authorized specimen to detect drug use in 22 states under either the implied consent law or the impaired driving statue; however, few jurisdictions have implemented oral fluid testing due to the lack of availability of laboratory-based confirmation (17). The advantages of oral fluid

Table III. Recommended Tier II Drugs/Drug Classes

DRE category; cannabis
  Synthetic cannabinoids
DRE category; CNS stimulants
  Cathinones
  Methylphenidate
  Mitragynine
DRE category; CNS depressants
  Atypical antipsychotics
  Barbiturates
  Carbamazepine
  Chlordiazepoxide
  Chlorpheniramine
  Cyclobenzaprine
  Diphenhydramine
  Doxylamine
  Gabapentin
  Gamma-hydroxybutyrate
  Hydroxyzine
  Lamotrigine
  Mirtazapine
  Novel benzodiazepines
  Phenytoin
  Pregabalin
  Secobarbital
  Topiramate
  Trazodone
  Tricyclic antidepressants
  Valproic acid
  Zopiclone
DRE category; narcotic analgesics
  Fentanyl analogs
  Novel opioids
  Tapentadol
DRE category; dissociative drugs
  Dextromethorphan
  Ketamine
  PCP
DRE category; inhalants
  Difluoroethane
  Inhalant class
DRE category; hallucinogens
  Hallucinogens

within the context of impaired driving include non-invasive sample collection proximate to the time of the traffic stop and no requirement for medically trained personnel to collect the sample. Roadside collection of an oral fluid sample can eliminate a 1- to 3-hour delay commonly associated with blood draws. Other advantages include the identification primarily of the active (parent) drug, which is suggestive of recent use. Research shows a good correlation between drug detection in oral fluid and other matrices; however, oral fluid concentrations cannot predict blood concentrations or vice versa (10, 18, 19). Drugs that are insufflated, smoked or taken orally may coat the oral mucosa and elevate the oral fluid drug concentration if the sample is collected close to the time of ingestion.

The oral fluid scope and cutoffs were updated significantly from the 2017 recommendations based on increased data available from laboratories using this matrix for DUID investigations or studies and increasing interest in this matrix from law enforcement and workplace drug testing programs (Table II). These oral fluid recommendations were based in part on a review of existing recommendations including the Substance Abuse and Mental Health Administration's recently approved oral fluid drug testing recommendations, the European Guidelines for Workplace in Oral Fluid, Toronto Transit Commission's guidelines, Australian Standards for drug quantification in oral fluid (AS 4760), Construction Owners Association of Alberta, Construction Opportunities Development Council and SYNLAB Laboratory Technical Specification Manual and authentic data from laboratories performing oral fluid drug testing in the USA, including the Alabama Department of Forensic Sciences and Forensic Fluids Laboratories (14, 20–23). The intended detection time of federal workplace oral fluid drug testing or other applications may be substantially longer than DUID oral fluid testing, requiring lower cutoff concentrations to be employed. In such cases, the desired window of detection may be 24–72 (or more) hours since last use. With the ever-increasing sensitivity of mass spectrometers, cutoffs may need to be administratively set above the instrumental limit of detection to meet recommended cutoffs and ensure an appropriate window of detection.

Table III shows the revised recommended list of compounds for Tier II. Trazodone was added after being removed from the 2013 recommendations due to its increased prevalence, and difluoroethane was also added due to increased prevalence. In the 2017 recommendations, the consensus panel decided to list classes of drugs rather than individual compounds due to the rapid changes in NPS drug prevalence. These classes specifically include synthetic cannabinoids, cathinones, new benzodiazepines, fentanyl analogs and new opioids. The consensus panel determined the best practice for laboratories currently is to test for compounds in these classes based on local rates of prevalence and the ability of the laboratory to provide testing.

The consensus panel discussed other additions to Tier I and Tier II scopes; however, there was insufficient justification for such changes. While there is an increase in the prevalence of gabapentin, it is typically present in high concentrations in polydrug cases with opioids and antidepressants, making it difficult to discern its impairment contribution. MDMA, MDA, hydromorphone, oxymorphone, oxazepam and temazepam remain in Tier I, despite their low prevalence, due to their relevance in determining drug abuse patterns and assessing the metabolic pathway for parent compounds.

Conclusions

Throughout the years, efforts to promote standardization of scope and cutoffs for drug testing in DUID and motor vehicle fatality cases demonstrate progress by laboratories willing to implement these recommendations. However, challenges faced by laboratories in meeting the recommendations have not changed year to year, where lack of budget, time, staffing and instrumentation continue to hinder laboratories from full implementation. To further promote these standardization efforts, the NIST OSAC Toxicology Subcommittee adopted the 2017 recommendations as the basis for the proposed draft standard they submitted to the ASB for development. ASB Standard 120: Standard for the Analytical Scope and Sensitivity of Forensic Toxicology Blood Testing in Impaired Driving Investigations is expected to be published as an American National Standard in 2021. The NSC-ADID will continue to survey laboratories and publish recommendations to assist laboratories in making improvements, while the published standard will define

the minimum expectation of laboratory services for impaired driving investigations.

Although there was a spirited discussion about the scope and thresholds of the recommendations for this iteration among the members of the consensus panel, changes were only recommended when there was a compelling and substantive case, as unwarranted minor changes in the specification place an unreasonable burden on laboratories already making progress toward compliance. With no changes required to the Tier I scope and minimal changes to the Tier II scope, the authors were satisfied that the identification of the most frequently encountered analytes among laboratories throughout the USA and Canada is accomplished. Due to the fast-paced changes in drug trends for emerging recreational drugs, Tier II compounds such as novel opioids, novel benzodiazepines, fentanyl analogs, cathinones and synthetic cannabinoids should be monitored, and testing should be provided by laboratories where there is regional prevalence and instrument capacity and in cases where these compounds are specifically indicated from investigative information.

Both the 2016 and 2020 consensus panels reached the conclusion that urine best speaks to historical drug use or exposure and is therefore acknowledged to provide less information as it relates to assessing potential drug impairment in the context of an impaired driving or motor vehicle fatality investigation. Therefore, the 2021 recommendations will be the last iteration to include urine as a matrix for testing Tier I and Tier II compounds.

The goal of these recommendations is to achieve standardization of drug testing practices to detect drugs commonly encountered in DUID cases and improve data quality. Therefore, laboratories are encouraged to meet the recommended cutoffs in Table II. While this may not be possible for laboratories directed to follow local regulations or or that are in the process of an existing validation, those laboratories that meet or exceed the cutoffs in Table II are considered to be in compliance with the recommendations.

The NSC-ADID plans to repeat the survey and review the recommendations in 2025.

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