Executive Summary

Article Title: Oral Fluid and Drug Impairment: Pairing Toxicology with Drug Recognition Expert Observations

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Study Purpose or Objective(s):

- To analyze paired oral fluid and urine with drug recognition expert (DRE) observation to determine if oral fluid may be a viable source for confirming driving under the influence of drugs (DUID)

Key Findings:

- The DRE drug class identification was confirmed by oral fluids 90% of the time and by urine 85% of the time.
    - DRE identification was confirmed by oral fluids 18/20 occurrences
    - DRE identification was confirmed by urine 28/33 occurrences
- Results for individual compounds:
    - Cannabis: 9 subjects admitted to using marijuana; 14 tested positive using urinalysis; 7 posted by DRE
    - CNS Stimulants: 15 subjects positive for at least one or more CNS stimulant in urine and 16 were positive in oral fluid; DRE only identified CNS stimulants for 8 subjects
        - 9 subjects admitted to using <u>methamphetamine</u>; 5 positive identifications in urine; 16 positive in oral fluid;
        - <u>amphetamine</u> was detected in 13 urine samples and 14 oral samples (two subjects who refused DRE examinations tested positive for methamphetamine and amphetamine);
        - <u>cocaine</u> was self-identified by two subjects; 11 positive urine samples and 6 positive oral fluid samples
    - Narcotics: A total of 10 narcotic analgesics (opiates and methadone) were identified in urine and oral fluids; 1 DRE indicated narcotics but was unconfirmed
        - <u>Heroin</u>: 7 subjects admitted use; 9 positive opiate identifications in urine; 8 positive morphine in oral fluids
        - 3 subjects admitted methadone use; 2 positive in urine and oral fluids
    - CNS Depressants:
        - Xanax: 3 subjects admitted use; 9 subjects positive for benzodiazepines in urine (oral fluids test not optimized for identifying benzos)
        - DRE identifications made in 6 subjects, confirmed in 4 subjects
    - Hallucinogens, Inhalants, Dissociative Anesthetics: 1 subject admitted to taking LSD (unconfirmed in both urine and oral fluids)
        - 1 subject was identified by the DRE, but this subject was positive for every panel except oxycodone, making DRE identification very difficult

- 1 subject had a positive urine sample for PCP, but was not identified by DRE

Study Considerations:

- Low limits of detection (LODs) were not achieved for all compounds due to optimization of the method to different target analytes. However, the cut-offs presented are comparable to or lower than the urine screening system.
- Detection windows differ depending on the drug.
- Polydrug use could mask the use of some drugs, making some drugs more easily identifiable than others.

Study Strengths:

- 3 methods of identification (urine, oral, DRE)
- "Real world" samples (subjects from detainee centers)

Study Weaknesses/Limitations:

- Subjects were those in detainee centers in San Antonio and Dallas. Subjects were incentivized with food, drink, or a phone call to participate in the study.
- DRE were undergoing training for their certification – lack of experience.
- Unable to detect cannabinoids in oral fluids.
- Oral fluids method not optimized for benzodiazepines
- Small sample size.

Future Considerations:

- Adds to the growing literature on oral fluids being a valuable tool; future research is needed to develop methods for synthetic fluids using a larger sample size.

Subcommittee Commentary

Prosecutorial Perspective:

- Oral fluid testing is not being used in TX courts (and this study will not make that change). This study is good for informational purposes, but there is not much that prosecutors need to know about it currently, other than its existence and potential.
- The study also clearly points out the merit of the DRE process. There are several limitations shown by oral fluid testing. But this study and others finding those limitations will help develop better oral fluid testing.

Enforcement Perspective:

- In Texas, oral fluid is not currently an accepted specimen; only breath, blood, or urine. Should the use of oral fluids become an acceptable tool for drug identification, it would provide a less invasive and easier method for obtaining a sample. It can be difficult to obtain a urine sample from some drug abusers, and others are resistant to providing a blood sample. Oral fluid has the potential to be a good presumptive roadside test (because a portable breathalyzer [PBT] only measures alcohol).
- The lack of experience of officers used in the research may have been a factor in the accuracy of their determination. The more experienced a DRE becomes, the more accurate their determinations. Using experienced DREs during testing might bring the results of the oral fluid tests and DRE determinations more in line.
- Due to the prevalence of cannabis and benzodiazepine use in impaired driving cases, future research is needed to determine whether oral fluid testing is a viable method for accurately confirming the presence of these drugs in driving while impaired cases.

Toxicology Perspective:

- The study was limited in scope and number of samples, but it provided valuable information regarding the comparisons between opinions by DRE officers, oral fluid results, and urine screening results.
- Academically, oral fluid shows great promise for the future as a non-invasive option for roadside testing. Practically, the resources and methodology required for this testing may not be available to all publicly funded laboratories within the state of Texas.
- Additional research is needed moving forward to correlate impairment with oral fluid results. This research may be available in other articles.

Research and Evaluation Perspective:

- Because drugs have different windows of detection, caution should be taken when considering interpreting these results. Specifically, if a subject self-identifies as taking a substance, but it is not confirmed, it should be outside the window of detection.

- Polydrug use is common. It is quite possible that DREs may misinterpret or mistakenly identify a particular drug as a result of polyuse. However, one may consider whether it is most important to identify whether *any* drug use is present or *what* drug is present.
- For any research study, the impact of coercion should be considered. The subjects in this study were in detention centers -- and food, drink, or a phone call was used to incentivize them. Though this likely did not have a major impact on the biological results of this study, such a method could perhaps impact the DRE examination.
- Oral fluid is likely a valuable biological tool for drug use identification.

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Oral Fluid and Drug Impairment: Pairing Toxicology with Drug Recognition Expert Observations

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Abstract

According to the Governors Highway Safety Association, drugs are detected more frequently in fatally injured drivers than alcohol. Due to the variety of drugs (prescribed and/or illicit) and their various physiological effects on the body, it is difficult for law enforcement to detect/prosecute drug impairment. While blood and urine are typical biological specimens used to test for drugs, oral fluid is an attractive alternative matrix. Drugs are incorporated into oral fluid by oral contamination (chewing or smoking) or from the bloodstream. Oral fluid is non-invasive and easy to collect without the need for a trained professional to obtain the sample, unlike urine or blood. This study analyzes paired oral fluid and urine with drug recognition expert (DRE) observations. Authentic oral fluid samples ($n = 20$) were collected via Quantisal™ devices from arrestees under an institutional review board-approved protocol. Urine samples ($n = 18$) were collected with EZ-SCREEN® cups that presumptively screened for Δ^9-tetrahydrocannabinol (cannabinoids), opiates, methamphetamine, cocaine, methadone, phencyclidine, amphetamine, benzodiazepines and oxycodone. Impairment observations ($n = 18$) were recorded from officers undergoing DRE certification. Oral fluid samples were screened using an Agilent Technologies 1290 Infinity liquid chromatograph (LC) coupled to an Agilent Technologies 6530 Accurate Mass Time-of-Flight mass spectrometer (MS). Personal compound and database libraries were produced in-house containing 64 drugs of abuse. An Agilent 1290 Infinity LC system equipped with an Agilent 6470 Triple Quadrupole MS was used for quantification of buprenorphine, heroin markers (6-acetylmorphine, morphine) and synthetic opioids. Subjects were 23–54 years old; 11 (55%) were male and 9 (45%) were female. Evaluator opinion of drug class was confirmed in oral fluid 90% of time and in urine 85% of the time in reference to scope of testing by the LC–MS methods employed (excludes cannabis and central nervous system depressants). Data indicate that oral fluid may be a viable source for confirming driving under the influence of drugs.

Introduction

According to the Governors Highway Safety Association, 44% of fatally injured drivers tested positive for drugs in 2016, which was higher than alcohol with 38% of fatally injured drivers tested positive for alcohol. Due to the variety of drugs (prescribed and/or illicit) and their various physiological effects on the body, it is difficult for law enforcement to detect/prosecute drug impairment. According to the International Association of Chiefs of Police, there were over 30,000 drug recognition expert (DRE) evaluations performed in 2017 in the USA. The most abundant evaluator opinion was cannabis, then central nervous system (CNS) stimulants, followed by CNS depressants and narcotic analgesics (1). Depending on state laws, proof of impairment could be needed in order to prosecute someone suspected of driving under the influence of drugs (DUID). Previous

studies indicate that the tests performed during DRE examinations are beneficial impairment indicators (2–4).

In 2017, there were over 8,000 certified DRE in the USA (1). While training more DRE officers may help reduce DUID-related fatalities, improving drug detection and identification may also aid in this public safety issue. A potential tool for improvement in drug testing is consideration of alternative matrices, such as oral fluid. Oral fluid may be collected roadside as it is non-evasive, easy to transport and does not need a trained professional to collect. As of April 2018, states that allow oral fluid collection are Arizona, Arkansas, Colorado, Georgia, Illinois, Indiana, Kansas, Louisiana, Missouri, Nevada, New York, Oklahoma, South Dakota, Utah and Wyoming (5). These participating states only make up 30% of the USA and while it is legal for oral fluid to be collected, few states are currently collecting due to lack of capabilities. Police officers in European countries prefer oral fluid opposed to blood, urine or sweat due to its ease of use, non-invasive nature and lowered risk of infection transmission (6). Oral fluid collection with a roadside portable device has the benefit of screening the suspect's specimen within minutes (7–9). Krotulski *et al*. (10) demonstrated that the Alere DDS® 2 was reliable and suitably robust in the field by comparing results from the device to confirmation results and assessing true positives, true negatives, false positives and false negatives. Roadside screening devices are limited in scope and sensitivity. For evidentiary testing, oral fluid can be collected with various devices, such as the Quantisal™ collection device, for comprehensive laboratory analyses such as liquid chromatography–mass spectrometry (LC–MS). With the emergence of novel psychoactive substances (NPSs), analyzing oral fluid on a sensitive instrument such as a liquid chromatograph accurate mass time-of-flight mass spectrometer (LC–QTOF–MS), can allow for retrospective analysis of the accumulated data. Some NPS such as U-47700 have been detected in oral fluid samples (11).

Countries outside the USA, such as Australia, Belgium and France, have implemented either screening and/or confirmation in roadside oral fluid collection (12). Established cut-off concentrations for Δ^9-tetrahydrocannabinol (THC), CNS stimulants and narcotic analgesics ranging from 5 to 25 ng/mL are implemented for confirmatory analysis in Belgium (12). This range is similar to the confirmatory analysis cut-off range (2–15 ng/mL) proposed for workplace drug testing by the Substance Abuse and Mental Health Services Administration for the same drug classes (13). Michigan recently completed a pilot study to evaluate oral fluid roadside analysis where oral fluid samples were screened with the Alere DDS® 2, collected with Quantisal™ collection device (if subject consented) and compared to blood draws. Of the 92 roadside oral fluid tests, 88 were confirmed in blood or oral fluid collected by the Quantisal™ device. Although further evaluation will be performed, this study demonstrates the viability of oral fluid used for suspected DUID investigations in the USA (14).

Our study aimed to compare presumptive urine test results and confirmatory oral fluid test results with DRE evaluations performed by officers in training in an effort to assess use of alternative matrices for toxicology during DRE examinations.

Methods

Subjects

Participants ($n = 20$) in this study were recruited from detainee centers in Texas (Dallas and San Antonio). Demographic information can be seen in Table I.

Table I. Subject Demographics

Sample	Age	Sex	Race	Location
01	37	M	Hispanic	San Antonio
02	32	F	Hispanic	San Antonio
03	27	F	Hispanic	San Antonio
04	36	F	White	San Antonio
05	23	F	Hispanic	San Antonio
06	27	M	Hispanic	San Antonio
07	34	M	Black	San Antonio
08	27	M	Black	San Antonio
09	25	F	White	San Antonio
10	36	F	Hispanic	San Antonio
11	32	F	Hispanic	San Antonio
12	47	F	Hispanic	San Antonio
13	29	M	White	San Antonio
14	24	M	Hispanic	San Antonio
15	35	M	Hispanic	San Antonio
16	42	M	White	San Antonio
17	31	F	Black	San Antonio
18	35	M	White	San Antonio
19	54	M	Black	Dallas
20	46	M	White	Dallas

DRE examinations

DRE examinations were performed by officers undergoing Drug Evaluation and Classification Program (DEC/DRE) certification. Part of the curriculum includes drug recognition field certification with persons under the influence of drugs. Law enforcement recruited subjects within the detention centers based on clues of impairment. Subjects were incentivized by food, water or a phone call to participate in the training. Participation was optional and completely anonymous. Officers used the 12-step DRE protocol to perform their examinations: (i) breath alcohol test, (ii) interview of the arresting officer, (iii) preliminary examination and first pulse, (iv) eye examination, (v) divided attention psychophysical tests, (vi) vital signs and second pulse, (vii) dark room examinations, (viii) examination of muscle tone, (ix) check for injection sites and third pulse, (x) subject's statements and other observations, (xi) analysis and opinions of the evaluator and (xii) toxicological examination (15).

Urine samples

Urine was collected during the DRE examination from subjects using a MEDTOX® EZ-SCREEN® (Burlington, NC) cup, which presumptively screened for amphetamines (300 ng/mL), benzodiazepines (200 ng/mL), cocaine (100 ng/mL), methadone (200 ng/mL), methamphetamine (1,000 ng/mL), opiates (100 ng/mL), oxycodone (100 ng/mL), phencyclidine (PCP) (25 ng/mL) and cannabinoids (40 ng/mL). Adequate volume was verified for each specimen. Cups were read within 15 min by field instructor while DRE examinations were continued by trainees. Urine results were blinded to trainees until DRE opinions were rendered to instructor.

Oral fluid specimens

Quantisal devices were used to obtain oral fluid from subjects in accordance with a Sam Houston State University Institutional Review Board-approved protocol (# 2017-11-37550). All subjects gave informed consent prior to collection. Oral fluid was collected

Table II. Analytes Included in Personal Compound Database and Library Categorized by DRE Classification ($n = 64$)

DRE classification	Compounds
CNS depressant	Alprazolam, Amytriptyline, Carisoprodol, Cyclobenzaprine, Diphenhydramine, Etizolam, Lorazepam, Zolpidem
CNS stimulant	Amphetamine, Caffeine, Cotinine, Cocaine, Methamphetamine, Nicotine, Pseudoephedrine
Hallucinogens	25B-NBOMe, 25C-NBOMe, 25D-NBOMe, 25E-NBOMe, 25H-NBOMe, 25I-NBOMe, 25 N-NBOMe, LSD, MDMA, Mesc-NBOMe
Narcotic analgesics	4-ANPP, 6-AM, 7-hydroxymitragynine, Acetaminophen, Acetyl fentanyl, AH-7921, Alfentanil, Buprenorphine, Butyryl fentanyl, Carfentanil, Cis-methyl fentanyl, Codeine, Fentanyl, Furanyl fentanyl, Furanyl norfentanyl, Hydrocodone, Hydromorphone, Isobutyryl fentanyl, Meperidine, Mephedrone, Methadone, Mitragynine, Morphine, MT-45, N,N-didesmethyl-U-47700, N-desmethyl-U-47700, Norcarfentanil, Norfentanyl, Oxycodone, Oxymorphone, Remifentanil, Sufentanil, U-47700, U-49900, U-50488, Valeryl fentanyl
Dissociative anesthetics	Dextromethorphan, Ketamine, PCP

during DRE examinations within 30 min of urine specimen collection. Samples were extracted and analyzed using validated methods (16, 17). Oral fluid samples (1 mL) were fortified with internal standard and extracted using SPEware PolyChrom ClinII 3 cc (35 mg; Baldwin Park, CA) solid phase extraction cartridges. Briefly, samples were buffered (100 mM), loaded onto cartridges, then washed and dried. For screening, basic drugs were eluted with 5% ammonium hydroxide in ethyl acetate. For confirmation, acidic and basic drugs were eluted with ethyl acetate and dichloromethane:isopropyl alcohol with 5% ammonium hydroxide, respectively. An Agilent 1290 Infinity liquid chromatograph coupled to an Agilent 6530 Accurate Mass Time-of-Flight mass spectrometer (LC–QTOF–MS) was used to screen samples for common drugs of abuse shown in Table II. An Agilent 1290 Infinity II liquid chromatograph coupled to an Agilent 6470 triple quadruple mass spectrometer was used to confirm and quantify heroin markers and buprenorphine. Oral fluid samples were fortified with a drug mixture at 0.1, 0.25, 0.5, 1.0, 2.5, 10 and 100 ng/mL in three pooled sources assessed in duplicate over 3 days. The cut-off concentrations were determined to be amphetamine (2.5 ng/mL), methamphetamine (2.5 ng/mL), cocaine (0.25 ng/mL), morphine (1.0 ng/mL), 6-AM (1.0 ng/mL), codeine (100 ng/mL) and methadone (0.25 ng/mL).

Limitations

Methods used in this study were optimized for the detection and quantification of synthetic opioids in order to monitor prevalence in populations (16, 17). After sample collection and analysis, the authors felt that although no synthetics were detected, data aggregated from DRE examinations paired with oral fluid and presumptive urine results were important to disseminate to the forensic community. Cannabinoid use is prevalent as demonstrated by the presumptive urine cups. Although confirmatory testing would be preferred to further correlate matrices for the cannabis category, urine samples collected by the DRE training officers were promptly destroyed in line with their privacy protocol and oral fluid samples were consumed during analytical testing and therefore could not be analyzed externally. Further, THC was outside the analytical scope of the LC–MS method at the time of analysis.

Results and Discussion

The subjects were 23–54 years old and consisted of 11 males and 9 females. There were a total of 18 urine samples and 20 oral fluid samples collected and analyzed, as two subjects (08 and 16) withdrew from the DRE examinations and therefore urine specimens were not collected. Table III summarizes the drug classes detected in urine and oral fluid, alongside the DRE opinion and self-reported drug use for each subject. The evaluator opinion was confirmed in oral fluid 90% of the time, while confirmed in urine 85% of the time (within the scope of each test). In Figure 1, the pairing of oral fluid and urine positive identifications is depicted.

Low limits of detection (LODs) were not achieved for all compounds due to optimization of the method to different target analytes. However, the cut-offs presented are comparable to or lower than the urine screening system. Logan *et al.* (18) report several recommended screening method cut-off values for various drugs in blood, urine and oral fluid. The recommended cut-off values range from 10 to 20 ng/mL in oral fluid for compounds investigated in the present study. While not all compounds have a recommended screening cut-off value, the LODs presented here are comparable to or lower than those recommended are. These achieved lower limits of detection ensure that proper identifications can be made in oral fluid.

Cannabis

Of the 20 subjects, 9 admitted to using marijuana. With the presumptive urinalysis, 14 were positive for THC and the DRE identified cannabis intoxication for 7 subjects. Positive urine results for THC do not necessarily indicate that the subject was under the influence at the time of the evaluation, since the detection window for urine is wide. The LC–MS methods used in this study were not optimized for the detection of cannabinoids, so THC was not detected in oral fluid. Although this study was not able to detect cannabinoids in oral fluid, previous studies have detected THC in screening device and confirmatory tests (19, 20).

CNS stimulants

Methamphetamine use was self-identified by 9 of the 20 subjects, with 5 positive identifications of methamphetamine in urine and 16 positive identifications in oral fluid as seen in Figure 1. Amphetamine was detected in 13 of the urine samples and in 14 of the oral fluid samples. Differences in detection rates can be attributed to differences in detection windows between the two matrices. The two subjects that did not complete DRE examinations tested positive for methamphetamine and amphetamine, which also contributes to the differences in detection rates as there were no paired urine specimens. There were two subjects that admitted to using cocaine, while 11 were positive in urine samples and 6 positives in oral fluid. The discrepancy between the oral fluid and urine results could be attributed to the target analyte of the urine cup (benzoylecgonine), which has a longer detection window in urine.

Table III. Toxicological Findings Paired with DRE Opinion

Sample	Drugs admitted to using	Urine	Oral fluid	Evaluator opinion
01	Methamphetamine, Heroin, K2	Amphetamine, Benzodiazepine, Cocaine, Methamphetamine, Opiate, THC	Amphetamine, Cocaine, Methamphetamine, Morphine (145 ng/mL), 6-AM (109 ng/mL)	Narcotic analgesics
02	Speedballs and Ice	Amphetamine, Benzodiazepine, Cocaine, Opiate	Amphetamine, Cocaine, Codeine, Methamphetamine, Morphine (32.2 ng/mL), 6-AM (15.2 ng/mL)	Narcotic analgesics
03	Heroin	Opiate	Morphine	Narcotic analgesics
04	Heroin	Amphetamine, Cocaine, Opiate, THC	Amphetamine, Codeine, Methamphetamine, Morphine (103 ng/mL), 6-AM (6.8 ng/mL)	Narcotic analgesics
05	Heroin and Meth	Amphetamine, Cocaine, Opiate, THC	Methamphetamine, Morphine (<LOQ), 6-AM	CNS stimulant, CNS depressant, cannabis
06	Xanax, Ice and Marijuana	Amphetamine, Methamphetamine, THC	Amphetamine, Methamphetamine	CNS stimulant, cannabis
07	Max (Synthetic Cannabis)	Negative	Negative	Cannabis
08[a]	-	-	Amphetamine, Methamphetamine	-
09	Methamphetamine, Marijuana, EtOH	Amphetamine, Cocaine, THC	Amphetamine, Methamphetamine	Alcohol, CNS stimulant, cannabis
10	LSD, Pot and Meth	Amphetamine, THC	Amphetamine, Cocaine, Methamphetamine	Cannabis
11	Methadone, Heroin, Methamphetamine	Amphetamine, Benzodiazepine, Opiate	Amphetamine, Methamphetamine, Morphine	CNS depressant, narcotic analgesics
12	Xanax	Amphetamine, Benzodiazepine, Cocaine, Methadone, Methamphetamine, THC	Amphetamine, Cocaine, Methadone, Methamphetamine	CNS depressant, narcotic analgesics
13	Marijuana, Methamphetamine, Xanax	Amphetamine, Benzodiazepine, Cocaine, Methamphetamine, THC	Amphetamine, Methamphetamine	CNS stimulant, CNS depressant, cannabis
14	Cocaine, Marijuana, Xanax	Benzodiazepine, Cocaine, THC	Cocaine	CNS stimulant, cannabis
15	Weed and K2	Amphetamine, Cocaine, THC	Amphetamine, Methamphetamine	CNS stimulant, CNS depressant, cannabis
16[a]	-	-	Amphetamine, Methamphetamine	-
17	Klonopin, Methadone, Marijuana	Amphetamine, Benzodiazepine, Cocaine, Opiate, Methadone Methamphetamine, PCP, THC	Methadone, Methamphetamine	CNS depressant, hallucinogen, narcotic analgesics
18	Meth	Amphetamine, Benzodiazepine, THC	Amphetamine, Methamphetamine	CNS stimulant, narcotic analgesics
19	Marijuana	Benzodiazepine, Opiate, THC	Cocaine, Morphine	Alcohol, CNS depressant, narcotic analgesics
20	Heroin	Cocaine, Opiate, THC	Amphetamine, Methamphetamine, Morphine, 6-AM	Narcotic analgesics

[a]The participant only provided oral fluid sample.

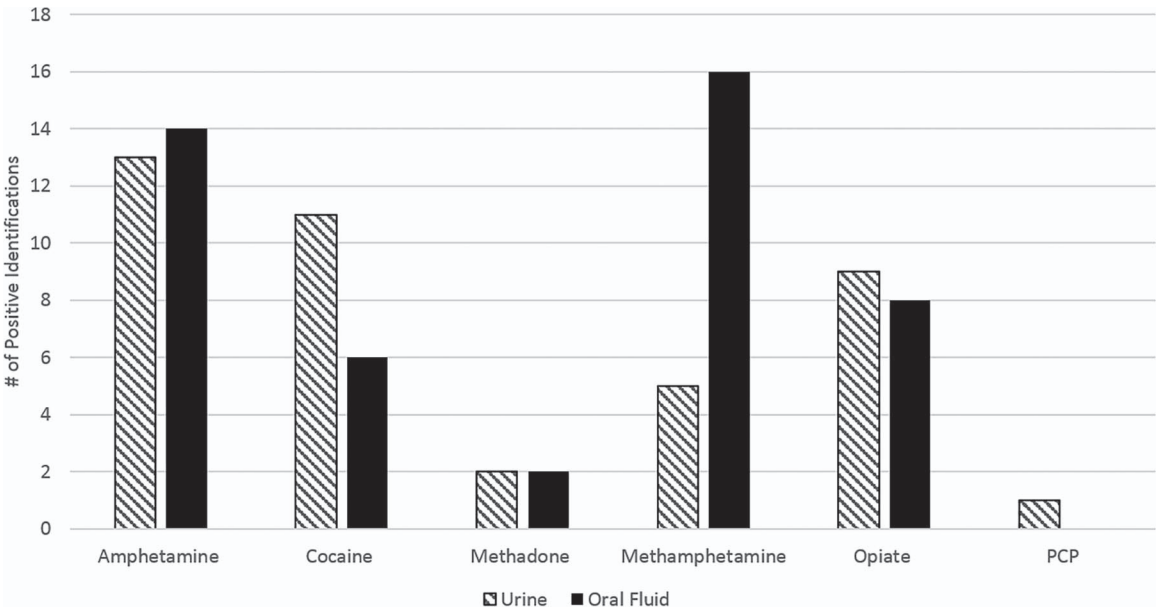

Figure 1. Positive identifications of analytes for urine ($n = 18$) and oral fluid ($n = 20$).

A total of 15 subjects were positive for at least one or more CNS stimulant in urine and 16 were positive in oral fluid, but evaluators only identified CNS stimulant intoxication for 8 subjects. Poly-drug use could cause some impairment clues to mask others (21). In Table IV, a summary of DRE examinations is shown, which includes subject's vitals, psychophysical tests, nystagmus and physical response. An example of poly-drug use with masking clues is Subject 01. He demonstrated low average heart rate (45 beats per minute, BPM), slowed estimation of time (72 s to estimate the passage of 30 s), pupils with slow reaction to light and flaccid muscle tone. All of these clues are indicative of being under the influence of narcotic analgesics, but in both urine and oral fluid, cocaine and methamphetamine were present along with narcotic analgesics. Depending on time administered, one drug may have greater effect on subject's behavior during the time of evaluation. Subject 09 presented multiple clues of being under the influence of a CNS stimulant: elevated blood pressure (150/92) and heart rate (127 BPM), fast estimation of 30 s (25 s) and dilated pupils.

Narcotic analgesics

The use of heroin or 'speedballs' was admitted by seven of the subjects, while there were nine positive identifications of opiates in urine and eight positive results of morphine or 6-acetylmorphine (6-AM) in oral fluid. Quantitative concentrations of morphine and 6-AM for Subjects 01, 02 and 04 were assessed. Morphine concentrations were 145 ng/mL, 32.2 ng/mL and 103 ng/mL, respectively. Corresponding 6-AM concentrations were 109 ng/mL, 15.2 ng/mL and 6.8 ng/mL, respectively. There were three subjects that admitted to using methadone, while two were positive in both urine and oral fluid. A total of 10 narcotic analgesics (opiates and methadone) were identified in both urine and oral fluid. In one case, the DRE indicated narcotic analgesics but was not confirmed by either urine or oral fluid. For Subject 18, signs of stimulant use were present such as high blood pressure (150/110), but the only sign of narcotic analgesic was flaccid muscle tone and a 'little' reaction to light. Due to this being a training/certification setting, a miscall would not be uncommon.

CNS depressants

Self-reported use of Xanax was indicated by three subjects, and nine subjects were positive for benzodiazepines in urine. The LC–MS screening method was not optimized for benzodiazepines, so these cases were not confirmed in oral fluid. The evaluators called CNS depressant for six of the subjects and were confirmed in urine in four subjects. Subject 15 presented with clues of CNS stimulant impairment, but also had flaccid muscle tone and slow reaction to light. However, oral fluid and urine results were positive for CNS stimulants and cannabis. Subject 05 also showed clues of CNS stimulant impairment accompanied with flaccid muscle tone and slow reaction to light. Oral fluid and urine were positive for CNS stimulants, narcotic analgesics and cannabis. It is possible that the evaluator misinterpreted the presence of a narcotic analgesic as a CNS depressant.

Hallucinogens, inhalants and dissociative anesthetics

Only one subject admitted to taking a hallucinogen lysergic acid diethylamide, (LSD) but could not be confirmed in oral fluid or urine as it was outside the scope of both methods. A hallucinogen was only identified by the evaluator for Subject 17, along with CNS depressants and narcotic analgesics. This subject demonstrated signs of poly-drug intoxication and fell asleep while providing the oral fluid sample. This subject was positive for every panel except oxycodone on the EZ-Screen urine cup. The interaction of multiple drugs may have been incorrectly interpreted as hallucinogen intoxication or perhaps a drug was missed by the toxicological testing due to limitations of both analytical tests. No inhalants were detected in either matrix and inhalant impairment was not determined in any of the examinations. As previously mentioned, the dissociative anesthetic PCP was identified in Subject 17's urine sample but signs of impairment from that drug were not observed by the DRE.

Conclusion

Given the analytical scope of the LC–MS methods (excluding CNS depressants and cannabis), there were 20 identifications of drug class

Table IV. Vitals, Nystagmus, Psychophysical Tests and Physical Response for Subjects

Sample	Vitals					Walk and turn	One-leg stand		Modified Romberg balance		Muscle tone	Pupil size	Reaction to light
	Temp (°F)	BP (mmHg)	Mean HR (BPM)	Vertical nystagmus	HGN	Clues	Clues (left)	Clues (right)	Estimation of 30 s	Body sway (in)			
01	95.9	110/58	45	No	None	4	2	2	72	3	Flaccid	Normal	Slow
02	96.9	130/72	81	No	None	2	3	4	39	2	Flaccid	Normal	Slow
03	97.7	118/70	79	No	None	2	2	1	58	2	Normal	Normal	Normal
04	98.7	124/78	73	No	None	2	2	0	28	2	Flaccid	Normal	Normal
05	99.4	108/70	93	Yes	Present	3	2	2	18	2	-	Dilated	Slow
06	98.2	138/100	76	No	None	3	2	1	25	2	Rigid	Dilated	Normal
07	97.8	138/74	73	No	None	3	0	2	47	2	Normal	Normal	Slow
09	99.8	150/92	127	No	Present	1	1	3	25	2	Flaccid	Dilated	Normal
10	98.6	118/72	82	No	None	2	0	3	44	-	Flaccid	Normal	Normal
11	98.5	118/76	69	Yes	Present	2	2	2	22	1	Rigid	Normal	Normal
12	96.0	122/80	63	No	Present	3	3	2	25	3	Flaccid	Constricted	Little
13	97.3	144/92	103	Yes	Present	4	1	1	14	2	Flaccid	Dilated	Slow
14	97.0	142/78	65	No	None	6	2	4	30	-	Rigid	Dilated	Normal
15	97.0	152/104	94	Yes	Present	3	3	4	51	2	Flaccid	Dilated	Slow
17	97.6	112/72	60	Yes	Present	3	2	3	19	2	Flaccid	Normal	Normal
18	98.0	150/110	81	No	None	4	2	1	33	3	Flaccid	Normal	Little
19	96	98/66	76	Yes	Present	5	3	3	90	3	Flaccid	-	-
20	93.3	138/78	60	No	None	2	2	2	26	2	Flaccid	Normal	Slow

BP, blood pressure; HR, heart rate; BPM, beats per minute; HGN, horizontal gaze nystagmus

impairment in 18 subjects. The evaluator opinion was confirmed with oral fluid results in 18/20 occurrences (90%). In urine, there were 33 separate identifications of drug class impairment that were confirmed in 28 instances of DRE opinion for 18 subjects (85%). Differences in confirmation rates can be attributed to extended detection window of urine and the lack of experience by the officers due to training environment. As is the difficulty with NPS, synthetic drug use may be missed or misinterpreted by DRE examination. As such, Subject 07 admitted to using 'Max' (a synthetic cannabinoid) but cannabis impairment was indicated by the officer. Synthetic cannabinoids may present as a variety of drug impairment types but were outside the scope of both the urine and oral fluid tests. Overall, toxicological results between urine and oral fluid paired with DRE evaluations were comparable. Data, while limited, add to the growing amount of literature that oral fluid may be a valuable biological specimen for identifying drugs in cases of DUID.

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