DRUG EVALUATION AND CLASSIFICATION PROGRAM: AN EVALUATION AND VALIDATION STUDY IN THE STATE OF FLORIDA

by

Micah Moore

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree of

Doctor of Philosophy

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APPROVED BY:

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ABSTRACT

Over the past several decades, the fatality rates in traffic crashes related to drug-impaired driving have increased significantly. Specialized law enforcement officers are currently being deployed to help reduce the number of drug-related traffic crash fatalities and identify drugged impaired drivers. The National Highway Traffic Safety Administration (NHTSA) and the International Association of Chiefs of Police (IACP) developed the drug evaluation and classification program (DECP) to certify law enforcement officers as drug recognition experts (DREs). An evaluation and validation study was conducted on the DECP in Florida. The purpose of the study was to evaluate the DECP in Florida to determine the accuracy rates of DREs and determine which core set of measurements (signs and symptoms) from the drug influence evaluation (DIE) face sheets correspond to each of the seven drug categories, and to determine if any core set of measurements from the DIEs are identified with the inaccuracies of DRE opinions. This study is a quantitative cross-sectional descriptive and predictive examination of Florida's DECP. The population for this study comprised the enforcement DIEs and toxicological results for 2019 in the state of Florida with a target sample size being calculated for a logistic regression analysis. This study analyzed the DECP accuracy rates in Florida during 2019. The study also completed a binary logistic regression analysis to determine the core set of measurements (signs and symptoms) to predict the drug categories determined by toxicology results and the core set of measurements (signs and symptoms) to predict the drug categories inaccurately determined by the DREs.

Keywords: drug evaluation and classification program, drug recognition experts, drug influence evaluation.

Dedication

First, I thank my Lord and Savior Jesus for guiding me onto the path of becoming a better man, husband, and father. To my mother, Raynita, and father, Richard, who saw the potential in a child and gave me the freedom to find my own way while still being present when I needed you most. To my wife, Rebecca, who supported me and pushed me through this journey to completion, and to my son, Xavier, who gave me the opportunity to complete my goals with understanding and encouragement.

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VITA

Micah Moore is a doctoral candidate with the Helms School of Government, pursuing a Ph.D. in Criminal Justice – Leadership. He received a bachelor's degree in Criminal Justice from Saint Leo University and a master's degree in Justice Studies – Homeland Security/Terrorism from Southern New Hampshire University. Micah has served as a Law Enforcement Officer with the Marion County Sheriff Office for 17 years.

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List of Abbreviations

American Automobile Association (AAA)

Blood Alcohol Concentration (BAC)

Blood Pressure (BP)

Breath Alcohol Concentration (BrAC)

Delta-9-Tetrahydrocannabinol (THC)

Driving Under the Influence (DUI)

Drug Evaluation and Classification Program (DECP)

Drug Influence Evaluation (DIE)

Drug Recognition Expert (DRE)

Finger to Nose (FTN)

Florida Department of Law Enforcement (FDLE)

Horizontal Gaze Nystagmus (HGN)

International Association Chiefs of Police (IACP)

Lack of Convergence (LOC)

Los Angeles Police Department (LAPD)

Modified Romberg Balance (MRB)

National Highway Traffic Safety Administration (NHTSA)

One Leg Stand (OLS)

Standardized Field Sobriety Test (SFST)

State Attorney Office (SAO)

Vertical Gaze Nystagmus (VGN)

Walk and Turn (WAT)

CHAPTER ONE: INTRODUCTION

Overview

According to the 2019 National Survey of Drug Use and Health, an estimated 57.2 million people aged twelve or older used illicit drugs, and 16.3 million people misused prescription psychotherapeutic drugs (Substance Abuse and Mental Health Services Administration, 2020). In 2019, the Florida Department of Highway Safety and Motor Vehicles recorded a total of 1,150 crashes in which the drivers had both alcohol and drugs in their system. Of these 1,150 crashes, there were a combined total of 969 injuries and 723 fatalities (Florida Department of Highway Safety and Motor Vehicles, 2021). The elevated level of drug users combined with the number of drug-related driving fatalities requires a specialized law enforcement officer to detect and remove drug-impaired drivers from the roadways to save lives. These specialized law enforcement officers are classified as Drug Recognition Experts (DREs) (International Association of Chiefs of Police [IACP], 2018c). The Drug Evaluation and Classification Program (DECP) was established in Florida in 1993. In 2019, 405 certified DREs removed an estimated 2,100 drug-impaired drivers from the roads and completed 986 drug influence evaluations (Florida Department of Transportation, 2020).

Background

Alcohol-impaired driving has been well documented and researched, while drug-impaired driving has been far less researched. Increased interest over the past decade is attributed to the decriminalization and legalization of marijuana in many States (National Highway Traffic Safety Administration [NHTSA], 2018). NHTSA developed the Drug-Impaired Driving Initiative in 2018 for engaging stakeholders in addressing the problem of drug-impaired driving (NHTSA, 2018). In 2017, a survey found that 91% of individuals considered driving after using illegal drugs a personal safety issue (American Automobile Association [AAA], 2018). A roadside

study conducted by NHTSA in 2013 gathered oral fluid samples from 7,881 drivers and blood samples from an additional 4,686 drivers in the United States (Berning et al., 2015). The survey results revealed that 15.2% tested positive for illegal drugs, 7.3% for over the counter and prescription medications that cause impairment. In addition, 12.6% tested positive for delta-9-Tetrahydrocannabinol (THC), which is an increase of 48% from a similar study conducted in 2007 (Berning et al., 2015). Additional studies were completed that showed similar results to the increase of drug-impaired driving over the past ten years (Banta-Green et al., 2016; Compton & Berning, 2015; Ramirez et al., 2016; Tefft et al., 2016). Each of these studies focused on the increased numbers of individuals driving with drugs in their systems.

Alcohol-impaired driving has dominated the field of impaired driving research, enforcement, deterrence, and education. The result of alcohol dominance in the subject of impaired driving has created a lack of research literature on drug-impaired driving (Porath-Waller & Beirness, 2009; Porath-Waller et al., 2010; Porath-Waller et al., 2021). Research in alcohol impairment set the standard and strategies for law enforcement officers when attempting to detect drug-impaired drivers. During the 1970s, the National Highway Traffic and Safety Administration (NHTSA) developed a standardized battery of tests to assist law enforcement officers in identifying alcohol impaired drivers validly and reliably (Porath-Waller & Beirness, 2013). In addition, all fifty states in the United States require subjects arrested for driving under the influence to provide a breath sample to determine the level of alcohol concentration in their blood (Venkatraman et al., 2021).

At the end of the 1970s, the Los Angeles Police Department (LAPD) officers were noticing that some subjects who provided a zero-alcohol concentration level were impaired by drugs and not alcohol. This became problematic for officers, and prosecutors because a

toxicological analysis of bodily fluids, such as blood or urine was the only way to determine if the subjects had ingested drugs (Porath-Waller et al., 2021). The second issue with drug-impaired driving cases at the time was that even if the toxicological analysis revealed the ingestion of drugs, an officer and prosecutor still needed to prove in the court system that the driver was under the influence at the time of the traffic stop. Bodily fluid toxicological analysis reveals the presence of a drug but does not show impairment from the drug (International Association of Chiefs of Police [IACP], 2018c).

LAPD collaborated with research psychologist, toxicologists, medical professionals, and medical doctors to develop a 12-step systematic and standardized process to identify drug-influenced drivers (Beirness & Porath, 2019; Porath-Waller et al., 2008; Porath-Waller & Beirness, 2010; Talpins et al., 2018). The 12-step process consisted of officers examining individuals through interviews, behavioral tests, physical assessments, and measuring vital signs and clinical indicators consistent with the effects of psychoactive substances (Beirness & Porath, 2019; Porath-Waller & Beirness, 2010; Talpins et al., 2018).

The 12-step process became known as the Drug Recognition Expert (DRE) protocol (Beirness & Porath, 2019; Porath-Waller & Beirness, 2010; Talpins et al., 2018). DREs are trained in recognizing the signs and symptoms associated with seven drug categories of central nervous system depressants, central nervous system stimulants, hallucinogens, dissociative anesthetics, narcotic analgesics, inhalants, and cannabis (International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021). In the 1980s, LAPD and the National Highway Traffic Safety Association (NHTSA) conducted several research projects to develop a standardized methodology. The results of the studies created the Drug Evaluation and

Classification Program (DECP) (International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021).

The DECP process is a systematic and standardized method for DREs to determine and verify that a subject's impairment is inconsistent with a measured alcohol level. The inconsistency between observable impairment and alcohol levels suggests the presence of some other drug(s) or some other complicating factors. DECP process then determines if the visible impairment is due to illness or injury requiring medical attention or drug-related. Once a DRE determines the subject's impairment is not consistent with alcohol levels in the blood, and medical issues are not related, then a Drug Influence Evaluation (DIE) is completed to determine which categories of drugs are primarily causing the impairment (Heishman et al., 1996; International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021). "The process is systematic in that it is based on a careful assessment of a variety of observable signs and symptoms known to be reliable indicators of drug impairment" (International Association of Chiefs of Police [IACP], 2018c, p. 86).

The DRE protocol consists of a 12-step standardized and systematic process documented in the drug influence evaluation (International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021; Scherer et al., 2020; Talpins et al., 2018; Vaillancourt et al., 2021). The twelve steps of the DRE protocol are as follows:

1. Breath alcohol test.
2. Interview of the arresting officer.
3. Preliminary examination.
4. Examinations of the eyes.
5. Divided attention tests.

6. Examination of vital signs.
7. Darkroom examinations.
8. Examination of muscle tone.
9. Examination for injection sites.
10. Suspect's statements and other observations.
11. Opinion of the evaluator.
12. Toxicological examination.

DREs document the 12-step protocol on a DIE face sheet (Appendix A). After the evaluation is completed, DREs develop an opinion based on the signs and symptoms exhibited by participants. DREs will then classify which of the seven-drug category or categories is currently psychoactive during the evaluation (International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021). The seven drug categories are central nervous system depressants, central nervous system stimulants, hallucinogens, dissociative anesthetics, narcotic analgesic, inhalants, and cannabis (International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021).

Law enforcement officers seeking the certification of becoming a DRE will participate in a three-phase training program governed by the IACP, which consist of a sixteen-hour DRE pre-school, fifty-six-hour DRE school, and a hands-on evaluation phase including a final knowledge exam. The details of the DECP certification process are addressed in chapter two of this dissertation in the literature review (International Association of Chiefs of Police [IACP], 2018c).

The DECP was validated by NHTSA when a controlled laboratory and field study was conducted in the early 1980s designed in the same manner as previous alcohol validation studies

of psychomotor tasks (Bigelow et al., 1985; Compton, 1986; International Association of Chiefs of Police [IACP], 2018c). The two-phase validation study was then followed by a third validation study conducted in Arizona with the Phoenix Police Department resulting in DREs having an accuracy rate of 85%, agreeing with Compton's previous field validation study in 1986 (Adler & Burns, 1994). The research studies concluded that the DRE process is a validated method for officers to identify drug-impaired drivers. DREs can identify and classify which drug categories are causing impairment to the individuals participating in a drug influence evaluation (Alders & Burns, 1994; International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021).

Research conducted on the DECP has been limited. The three primary validation studies were conducted in 1984, 1985, and 1994 (Alder & Burns, 1994; Bigelow et al., 1985; Compton, 1986). Between 2000 and 2015, researchers focused on individual drugs and their respective signs and symptomology. Researchers examined how drugs affected the human body and compared these results with the DECP curriculum for validation (Bramness et al., 2003; Bramness et al., 2009; Declues et al., 2018; Downey et al., 2015; Hartman et al., 2016; Heishman et al., 1998; Khiabani et al., 2007; Perry et al., 2015; Silber et al., 2005). Research has been completed on the DECP in Canada examining the accuracy rates of DRE opinions, but data is lacking for the United States. Porath-Waller et al. (2021) conducted a study in the United States focusing on "which combinations of drug-related signs and symptoms from the DECP protocol can most efficiently and effectively predict the drug category or combination used by the subject" (p. v). No empirical studies have been conducted regarding the DECP in Florida concerning the effectiveness of DRE's ability to identify persons impaired by drugs other than

alcohol. As a result, there is currently a gap in the research and additional studies need to be conducted in this particular area.

Problem Statement

Although research has increased on the potential impairing effects of drugs in drivers in the United States, the research remains primary focused on driving under the influence of alcohol. Alcohol-impaired driving is a singular item issue that researchers can focus on with the results of breath samples and alcohol blood concentration levels. Drugs are more challenging to address in drug impairment due to several factors, which include: a wide range of drugs from licit to illicit, drugs are constantly changing, the relationship of drug levels and impairment has not been established for DUI related crimes, and blood levels of drugs can disappear after sample collection (Arnold & Scopatz, 2016; Berning & Smither, 2014; Compton, 2017; Logan et al., 2016; Smith et al., 2018). Delta-9-tetrahydrocannabinol (THC) concentrations decrease rapidly after smoking cannabis, from high peak concentrations of 100 to 400 ng/ml to levels of 1 to 10 ng/ml in a few hours (Brubacher et al., 2019; Karschner et al., 2009; Peng et al., 2020). As a result, researchers in the field of drug-impaired driving have begun to focus on singular drugs and their effects on the human body, causing impairment (Strand et al., 2016). The DECP was developed to assist law enforcement officers with detecting and gathering evidence of drug-impaired drivers. As more research is conducted on individual drugs effects, the DECP advances the program to increase the accuracy rates of DREs when predicting drug categories causing impairment (Porath-Waller et al., 2021).

Under Florida law (F.S. 316.193), an individual arrested for Driving Under the Influence (DUI) who gives a breath sample of .000 breath alcohol content and then refuses to provide a urine sample cannot be prosecuted for DUI. The State Attorney Office (SAO) in Florida must articulate what specific drug is believed to be impairing the driver. DREs are only allowed to

make an opinion of a broad drug category, which is then confirmed by the toxicology of the specific drug. So, if a driver refuses to provide a toxicology sample for testing, the SAO will never be able to identify a specific drug. The exception to this rule is if a driver confesses to a specific drug or is found to be in possession of a specific drug. In addition, drivers must be under the influence of a listed controlled substance in Florida. Also, Florida DUI law requires law enforcement officers and prosecutors to prove an individual was under the influence of alcohol or a controlled substance at the time of operating a motor vehicle. A roadblock for law enforcement officers in Florida is that the definition of 'controlled substance' does not include many prescriptions, over-the-counter drugs, and designer drugs known to impair drivers.

The Florida impaired driving coalition is currently attempting to have the language of the DUI statute changed so that the opinions of a certified DRE can bear enough weight as to the intoxication of a driver arrested for DUI. A DRE conducts an evaluation after an individual has been arrested for a DUI. The evaluation and opinion formed by the DRE is an evidence collection tool for law enforcement officers that State prosecutors can utilize in the prosecution of DUI cases if the language in the statute is changed as it pertains to the definition of ‘controlled substance’. The proposal of the new DUI law changes the language of a specific drug to a drug category. Florida's 2021 Senate Bill 436 and House Bill 271 request the DUI law be updated to a more rational definition of drug-impaired driving by upgrading the current law to include "or any other impairing substance, or combination thereof." The legislation enables prosecutors to address impaired driving no matter what drug is causing the driver to be impaired. To assist the coalition, a research study is needed to provide the accuracy rates of DRE opinions compared to toxicology results of suspected DUI offenders. If the requested legislative changes are made, the DECP will be critical to proving impairment in DUI cases.

The existing empirical research on the DECP focuses on the program's curriculum. DECP was developed to train law enforcement officers in the DRE 12-step protocol (Porath-Waller et al., 2021). Empirical research has focused on individual components that make up the process, and little research has examined the accuracy rates of the DREs compared to toxicological results. Most of the empirical research was conducted prior to 2007, and over the past twenty years, researchers have ignored the program in the United States (Alder & Burns, 1994; Bigelow et al., 1985; Bramness et al., 2003; Compton, 1986; Heishman et al., 1998; Preusser et al., 1992; Shinar & Schechtman, 2004; Smith et al., 2006). The most recent empirical research on the program has been conducted with the DECP in Canada (Porath-Waller & Beirness, 2010; Porath-Waller & Beirness, 2013; Porath-Waller et al., 2009; Porath & Beirness, 2019). The lack of empirical research in the United States is collecting data for the DECP. Prior to 2020, all DREs entered their opinions and toxicology results in a national database. The individual DREs kept the DIE face sheets and narratives completed by DREs in their respective law enforcement organizations. The United States lacked a centralized repository of drug influence evaluations prior to 2020.

Since the inception of the DECP in Florida, no research studies have been completed on the effectiveness of Florida's DREs abilities to accurately predict which drug category or categories are impairing the driver's ability to operate a motor vehicle. There have been very few studies across the United States addressing the accuracy rate of DRE opinions, and the studies that have been conducted were in the 1980s and early 1990s. Although three primary studies have been conducted on the proper administration and validation of the DECP 12-step protocol in identifying drug categories impairing individuals, no empirical data has been collected and analyzed for the drug evaluation and classification program in Florida (Alder & Burns, 1994;

Bigelow et al., 1985; Compton, 1986; Preusser et al., 1992). As a result, tens of thousands of drivers have been arrested and convicted in Florida for driving under the influence of a chemical or controlled substance with the assistance of a DRE's testimony without the results of an analytical study of the DREs accuracy rates in Florida. Continued research is also needed to determine the DREs missed or inaccuracy in predicting the drug category or categories impairing an individual's ability to operate a motor vehicle safely. An analysis of DRE opinions' misses or inaccuracy could identify common themes or traits to assist the DECP training. The problem is a lack of research on the accuracy rates of DREs in Florida and a lack of research on the inaccuracy of DRE opinions related to the drug categories correlations to the signs and symptoms of subjects.

Purpose Statement

The purpose of this study was to evaluate the DECP in Florida to determine the accuracy rates of DREs and determine which core set of measurements (signs and symptoms) from the Drug Influence Evaluation (DIE) face sheets correspond to each of the seven drug categories. In addition, a statistical analysis was conducted to determine which core set of measurements from the DIEs are identified with the inaccuracies of DRE opinions. The DIE face sheet contains over one hundred data points that can be coded and entered into a statistical software program for analysis. There is a clear gap in the literature focusing on DRE opinions inconsistencies with toxicological results in the DECP. There is also a gap in the literature related to DECP in Florida. To date, there has never been a validation study performed to determine the accuracy rates of DRE opinions compared to toxicological results in Florida. To ascertain which core set of measurements from the DIEs in missed opinions of DRE’s and corresponding toxicological results, a statistical analysis of the DIE face sheets were conducted. An analysis of the DIE face sheets collected in Florida during 2019 were coded using Porath-Waller’s (2021) data coding

instrument as a foundation coding instrument. The resulting coding instrument for this study expanded on Porath-Waller's (2021) coding instrument to include additional variables obtained from the DIE face sheets.

This study was a quantitative cross-sectional descriptive and predictive examination of Florida's DECP study using existing data. The dependent (criterion) variable was the DRE opinion of which drug category was psychoactive during the evaluation causing impairment. According to the DRE 12-step protocol, an opinion was formulated by the DRE administering the DIE. The DRE opinion was influenced by the independent (predictor) variables of the signs and symptoms observed during the evaluation and recorded on the DIE face sheet.

The toxicology results of the subject's bodily fluid sample of blood or urine was another dependent (criterion) variable. The toxicology results indicate which impairing substances belonging to the seven drug categories were ingested by the subject. The impairing substances ingested by the subject are independent variables due to influencing the toxicology results. Accuracy rates were computed from the DRE opinions and toxicology results. A binary logistic regression analysis was performed to use measures from the DIE face sheets to predict the drug categories determined by the toxicology results. Another binary logistic regression analysis was performed to use measures from the DIE face sheets to predict the drug categories inaccurately determined by the DREs. The binary logistic regression analyses are discussed in Chapter 3.

The DIE face sheets were collected from around Florida through the coordination of the NHTSA DECP State Coordinator. The DIE face sheets utilized for this study consisted of enforcement evaluations in 2019. Each subject evaluated by a DRE was placed under arrest for DUI and agreed to submit to a breath test. The breath test results were not consistent with the impairment level of the subject, and a DRE completed a drug influence evaluation.

Significance of Study

Previous literature has focused on validating the DECP, DRE accuracy rates, signs and symptoms associated with individual drugs, and statistical analysis of signs and symptoms predictability. Bigelow et al. (1985), Compton (1986), Preusser et al. (1992), Alder & Burns (1994) focused research on the validation of the DECP and DRE accuracy rates to assist law enforcement and prosecutors in meeting standards for the criminal justice court system. This study continued the research of determining the accuracy rates of DREs by evaluating Florida's DECP in 2019.

Multiple research studies focused on the signs and symptoms produced by individual types of drugs have been conducted (Bramness et al., 2003; Downey et al., 2012; Hartman et al., 2016; Heishman et al., 1998; Perry et al., 2014; Shinar & Schechtman, 2005; Silber et al., 2005; Vaillancourt et al., 2021). Additional researchers focused their studies on performing statistical analysis of the drug influence evaluations to determine which signs and symptoms help with the predictability of the DREs opinions for drug classification causing impairment (Beirness et al., 2009; Beirness et al., 2013; Porath-Waller et al., 2009; Porath-Waller et al., 2010: 2013: 2019; Porath-Waller et al., 2021). This study added to the existing body of knowledge on the DECP by adding current and updated findings on the program. The study also contributed to the body of knowledge by analyzing the inaccuracy of DRE opinions related to the drug categories' correlations to the signs and symptoms of subjects.

Florida is currently in the process of trying to amend the driving under the influence law to include language identifying "any substance that causes impairment," which will need a DRE to conduct a DIE to show impairment. This study will assist Florida legislators in the confidence of the DECP accuracy rates. Researchers for NHTSA will also be able to use the data contained in this study to produce further research studies on the DECP. Another advantage of conducting

this study was identifying common themes or traits related to DRE missed opinions and the signs and symptoms associated with the evaluations.

Research Questions

RQ1: What is the accuracy rate of DRE opinions compared to the toxicology results for drug influence evaluations completed by DREs in Florida during 2019?

RQ2: What set of measures (signs and symptoms) from the drug influence evaluations completed by DREs in Florida during 2019 significantly predict the drug categories determined by toxicology results?

RQ3: Among the inaccurate drug influence evaluations (missed opinions) completed by DREs in Florida during 2019, what set of measures (signs and symptoms) significantly predict the drug categories inaccurately determined by the DREs?

Definitions

1. *Analgesic* – A medication or drug that relieves pain (International Association of Chiefs of Police [IACP], 2018c).
2. *Bivariate Analysis* – Analysis used to determine the relationship between two variables (Maxfield & Babbie, 2017; Meier et al., 2014; Porath-Waller et al., 2021).
3. *Blood Alcohol Concentration (BAC)* – Percentage of alcohol in a subject's blood expressed in number of grams of alcohol per one hundred milliliters of blood (International Association of Chiefs of Police [IACP], 2018c).
4. *Breath Alcohol Concentration (BrAC)* – Percentage of alcohol in subject's blood measured by a breath testing device expressed in number of grams of alcohol per 210 liters of breath (Fiorentino et al., 2020; International Association of Chiefs of Police [IACP], 2018c).
5. *Central Nervous System (CNS)* – System within the human body consisting of spinal cord, brain, and brain stem (International Association of Chiefs of Police [IACP], 2018c).
6. *Corroboration Rate* – is the proportion of all persons identified by the DRE procedure as being under the influence of a given substance that are subsequently confirmed by toxicology as being correctly identified (Beirness et al., 2007).
7. *Divided Attention Tests* – Four psychophysical tests used in drug influence evaluations, accessing the subject's ability to concentrate on more than one thing at a time dividing their attention on both simple mental and simple physical tasks at the same time (International Association of Chiefs of Police [IACP], 2018c).
8. *Drug* – Any substance that, when taken into the human body, can impair the ability of the person to operate a vehicle safely (International Association of Chiefs of Police [IACP], 2018c).

9. *Drug Evaluation & Classification Program (DECP)* – Trains certified law enforcement officers in the detection and identification of drug impaired drivers. DECP was developed and maintained by IACP and NHTSA (Fiorentino et al., 2020; International Association of Chiefs of Police [IACP], 2018c; Porath-Waller & Beirness, 2019; Porath-Waller et al., 2021).
10. *Drug Influence Evaluation (DIE)* – A standard and systematic process of examining a suspected subject of being under the influence of a drug, for the purpose of determining what category of drug or categories of drugs causing the impairment (International Association of Chiefs of Police [IACP], 2018c).
11. *Drug Recognition Expert (DRE)* – Law enforcement officer who successfully completes all phases of the DRE training requirements for certification established in the DECP by IACP and NHTSA (Fiorentino et al., 2020; International Association of Chiefs of Police [IACP], 2018c; Solensten & Willits, 2021).
12. *False Alarm Rate* – is the proportion of all drug negative cases in which a DRE indicates the subject is under the influence of a drug (Beirness et al., 2007).
13. *Hallucinogen* – Drugs that affect a person's perceptions, sensations, thinking, self-awareness and emotions (International Association of Chiefs of Police [IACP], 2018c).
14. *Homeostasis* – Dynamic balance involving levels of salts, water, sugars, and other material in the human body's fluids *(*International Association of Chiefs of Police [IACP], 2018c).
15. *Horizontal Gaze Nystagmus (HGN)* – Involuntary jerking of the eyes occurring as the eyes gaze to the side (Bertolli et al., 2007; International Association of Chiefs of Police [IACP], 2018c).

16. *Impairment* – One of the several items used to describe the degradation of mental and/or physical abilities necessary for safely operating a vehicle (International Association of Chiefs of Police [IACP], 2018c).
17. *Intoxication* – The degradation of mental and/or physical abilities due to the ingestion of an impairing substance (International Association of Chiefs of Police [IACP], 2018c).
18. *Lack of Convergence (LOC)* – Inability of a subject's eyes to converge, or cross, as the subject attempts to focus on a stimulus moving slowly towards their nose (International Association of Chiefs of Police [IACP], 2018c).
19. *Major Indicators* – Physiological signs that are specifically assessed and are involuntary reflecting the status of the CNS homeostasis (International Association of Chiefs of Police [IACP], 2018c).
20. *Medical Rule Out* – DRE opinion based on the DIE that a subject's impairment is more likely associated with a medical issue then an impairing drug substance (International Association of Chiefs of Police [IACP], 2018c).
21. *Miosis* – Abnormally small (constricted) pupils (International Association of Chiefs of Police [IACP], 2018c).
22. *Miss Rate* – is the proportion of all drug positive cases that are judged by DREs to be drug free (Beirness et al., 2007).
23. *Multivariate Analysis* – Analysis used to determine if there is a relationship between two or more variables (Maxfield & Babbie, 2017; Meier et al., 2014; Porath-Waller & Beirness, 2019; Porath-Waller et al., 2021).
24. *Mydriasis* – Abnormally large (dilated) pupils (International Association of Chiefs of Police [IACP], 2018c).

25. *Narcotic* – A drug derived from Opium, or produced synthetically, that relieves pain but also induces euphoria, alters mood, and produces sedation (International Association of Chiefs of Police [IACP], 2018c).
26. *On the Nod* – A semi-conscious state of deep relaxation. Subject appears to be asleep but can easily respond to questions (International Association of Chiefs of Police [IACP], 2018c).
27. *Ptosis* – Droopy eyelids (International Association of Chiefs of Police [IACP], 2018c).
28. *Rebound Dilation* – A period of pupillary constriction followed by a period of pupillary dilation where the pupil steadily increases in size and does not return to its original constricted size (International Association of Chiefs of Police [IACP], 2018c).
29. *Resting Nystagmus* – Involuntary jerking of the eyes as they look straight ahead (International Association of Chiefs of Police [IACP], 2018c).
30. *Sensitivity* – is the number of drug-positive cases identified by DREs, also known as the hit rate or true positive rate (Beirness et al., 2007).
31. *Sign* – An observable or detectable indicator of drug influence (International Association of Chiefs of Police (IACP), 2018a, session 7, p. 6).
32. *Specificity* – refers to the number of drug-negative cases identified by DREs, also known as the correct rejection rate (Beirness et al., 2007).
33. *Standardized* – Conforming to a model in comparative applications (International Association of Chiefs of Police [IACP], 2018c).
34. *Standardized Field Sobriety Tests (SFSTs)* – Standardized divided attention (mental and physical) tests validated by NHTSA. The three tests consist of HGN, walk and turn, and

one leg stand (Jones et al., 2019; International Association of Chiefs of Police [IACP], 2018c).

35. *Symptom* – A subjective indicator of drug influence reported by the drug-impaired subject (International Association of Chiefs of Police (IACP), 2018a, session 7, p. 6).
36. *Systematic* – Done or acting according to a fixed plan or system; methodical (International Association of Chiefs of Police [IACP], 2018c).
37. *Tolerance* – An adjustment of the drug user's body and brain to the repeated presence of a drug (International Association of Chiefs of Police [IACP], 2018c).
38. *Type I Error* – Error occurs when one rejects a true null hypothesis (Maxfield & Babbie, 2017; Meier et al., 2014; Porath-Waller et al., 2021).
39. *Vertical Gaze Nystagmus (VGN)* – Involuntary jerking of the eyes, up-and-down, which occurs as the eyes are held at maximum elevation (International Association of Chiefs of Police [IACP], 2018c).

CHAPTER 2: LITERATURE REVIEW

Overview

Empirical research of the drug evaluation and classification program (DECP) contains three time periods, each with its particular study area. First, the primary source foundational studies of the program are from the mid-1980s to the early 1990s. The primary studies focused on the 12-steps of the DRE process, and researchers examined the validation requirements needed for court purposes. The early studies in the program assisted law enforcement officers and prosecutors in entering the judicial system as a valid process to detect drug-impaired drivers. The second period of empirical studies was conducted from 2000 to 2015 and focused on individual drugs and their signs and symptomology. Researchers examined how drugs affected the human body and compared these results with the DECP curriculum for validation (Bramness et al., 2003; Bramness et al., 2009; Declues et al., 2018; Downey et al., 2015; Hartman et al., 2016; Heishman et al., 1998; Khiabani et al., 2007; Perry et al., 2015; Silber et al., 2005). The final period of empirical research in the DECP overlapped the second period from 2013 to the present, focusing on the accuracy rates of the DRE opinions conducted in Canada (Porath-Waller & Beirness, 2013; Porath-Waller et al., 2009; Porath & Beirness, 2019). This literature review examined previous peer-reviewed journal articles and government-sponsored research, which focused on creating the drug evaluation and classification program, drug recognition expert 12-step protocol, seven drug categories identified in the DECP, and the validation studies conducted on the DRE accuracy rates.

Theoretical Framework

Program evaluation theory's function is to ascertain the theoretical sensibility of the program being evaluated (Sharpe, 2011). A program evaluation theory consists of a set of statements that describe a particular program, explain why, how, and under what conditions the

program effects occur, predict the outcomes of the program, and specify the requirements necessary to bring about the desired program effects (Sedani & Sechrest, 1999; Sharpe, 2011). Programs implemented in criminal justice need to have evaluations completed throughout the program's life span to ensure the goals identified by policymakers and designers are being met (Braga & Weisburd, 2013; Janeksela, 1977; Reichert & Gatens, 2019). According to Reichert & Gatens (2019), an "evaluation in criminal justice is vital to improving program effectiveness, increasing efficiency, and improving public safety" (p. 1).

Criminal Justice programs are primarily funded through local, state, or federal government assistance. Government-funded criminal justice programs must provide proof of their legitimacy, efficiency, and effectiveness to justify the program's existence (Braga & Weisburd, 2013; Janeksela, 1977; Reichert & Gatens, 2019). Program evaluation theory answers the dilemma of ascertaining if a particular program effectively achieves the goals of a particular criminal justice program. Program evaluations are a systematic assessment of a program's outcomes compared to the implicit or explicit standards to improve a program (Vito & Higgins, 2014). Chen (2005) stated, "an evaluation that examines how a program's structure, implementation procedures, and causal mechanisms actually work in the field will provide information that can be very useful in program improvement" (p. 37).

Criminal justice programs are implemented and sustained through limited resources. Program evaluation theory assists policymakers in determining if the limited resources being utilized by a program are justified. Evaluations of a criminal justice program assist policymakers in making informed decisions on program improvement and contain accountability to the utilization of the limited resources of the program (Chen, 2005). The Office of Justice Programs (OJP) has devoted an entire division to the research of criminal justice programs to ensure grant

programs are spending taxpayer dollars wisely (Office of Justice Programs, 2022). "OJP's Evidence Integration Initiative is focused on improving the synthesis and translation of social science research findings to inform practice and policy in criminal justice" (Office of Justice Programs, 2022, para. 6).

The overall goal of the DECP is to help prevent crashes, deaths, and injuries by improving enforcement of drug-impaired driving offenses (International Association of Chiefs of Police [IACP], 2018c). International Association of Chiefs of Police, *Drug recognition expert course - instructor guide* (2018) identifies three additional goals of the DECP training program, which include:

1. Determine if the subject is impaired.
2. Determine if the impairment is resulting from an injury, illness, or drugs.
3. Determine, if drug-related, what category (or categories) of drugs is (or are) the likely cause of the subject's impairment (p. 5).

Utilizing program evaluation theory of the DECP, this dissertation explained how the program enabled a certified DRE to determine whether a suspect is under the influence of alcohol and or drugs and, if so, by what category of drugs to achieve the program's overall goals. Program evaluation theory of the DECP also assists the research in identifying the detailed process the DECP uses to achieve the three secondary goals of the program. A detailed description of the process and mechanisms of the DECP was examined in the literature review of this dissertation. Program evaluation theory of the DECP assist in defining the critical inputs of the program's components and how these components are delivered. Program evaluation theory of the DECP assist in defining the amount of treatment required to induce the outcome and outline the required aspects vital in producing the expected outcomes (Sharpe, 2011).

In order to achieve the goals of the DECP, a DRE conducts the 12-step DRE protocol DIE of individuals suspected of impairment after being arrested for Driving Under the Influence (DUI). The DIE contains over one-hundred data points documented on a DIE face sheet and narrative report. These data points are the critical inputs needed to influence the opinion made by the DRE to achieve the three secondary goals of the DECP. This literature review examined previous peer-reviewed journal articles and government-sponsored research, which focused on creating the DECP, the DRE 12-step protocol, seven drug categories identified in the DECP, and the validation studies conducted on the DRE accuracy rates.

Related Literature

Drugs in Society

The use of psychoactive drugs can be traced back several centuries to the beginning of recorded history (Mann, 2017). Psychoactive substances have been used for religious ceremonies, medicinal reasons, and recreational use (Crocq, 2007; Mann, 2017). For example, priests and shamans have induced dissociative trances for religious purposes by ingesting psychoactive plants. The use of amanita muscaria, a psychedelic mushroom, can be traced back 4,000 years in Central Asia which was used in religious rituals. In present times individuals use the psilocybe mushrooms, which contain a psychoactive compound of psilocin and psilocybin, to induce the same effects used over 4,000 years ago (Crocq, 2007).

Healers throughout history have used psychoactive substances for medicinal use, which is evident in the 9th century BC Homer's *Odyssey*, where opium use is described as a potion to lull all pain and anger (Crocq, 2007). In current society, cannabis has evolved into the largest medicinal used plant, which contains the psychoactive substance delta-9-tetrahydrocannabinol (THC) and can produce a variety of physical and mental effects, including euphoria, change in perception, changes in appetite, and changes in memory (Behere et al., 2017). Cocaine for

medicinal use appeared in 1860 when German chemist Albert Nieman isolated cocaine from coca leaves (Goldstein et al., 2009). Doctors and healers used cocaine for its analgesic effect on blocking nerves numbing effect for various medical procedures. Cocaine was sold over the counter to the public in the United States until 1916 (Goldstein et al., 2019). Sigmund Freud was known to use cocaine for depression and indigestion issues which assisted the drug to become more commonplace in society (Goldstein et al., 2009).

As new drugs are developed or discovered from natural plants, individuals have utilized them for their psychoactive effects on the human body for no other reason than personal satisfaction (Behere et al., 2017; Crocq, 2007; Goldstein et al., 2007). Some of the most widely abused drugs throughout history are alcohol, nicotine, and caffeine (Khan & Aslam, 2020). As these drugs evolved, they became socially acceptable in most societies. For example, according to the Bible, one of Noah's first actions after coming out of the Ark was to plant a vineyard; he drank some of its wine and became drunk (*New King James Version*, 1997, Genesis 9:20-21).

Drug use has become the social norm either for religious ceremonies, medicinal, or recreational uses. Although most drugs begin their journey into our society for legitimate purposes, individuals have taken advantage of the drug's psychoactive properties for personal pleasures or addiction. Furthermore, as pharmaceutical companies develop more drugs, the psychoactive properties become more potent, increasing consumers' likelihood of abuse (Valeriy & Tregubenko, 2019). Substance Abuse and Mental Health Services Administration (SAMHSA) published the *Key substance use and mental health indicators in the United States: Results from the 2020 National Survey on Drug Use and Health* (2021) which indicated “58.7 percent or 162.5 million people aged twelve or older self-reported the use of tobacco, alcohol, or illicit drug in the past month” (p. 1).

Drug-Related Legislation in the United States

The Hague Convention of 1912 required countries to regulate opium traffic into their respective borders. During the same period as the Hague Convention, there was also an increase in drug abuse levels. The federal government held hearings to determine the best course of the regulation (Sacco, 2014). As a result, United States Congress passed the Harrison Narcotic Act in 1914, establishing prescriptions for products exceeding the allowable limit of narcotics and mandated an increase of physicians and pharmacists to maintain dispensing records (Olsen, 2022; Sacco, 2014). The Harrison Narcotic Act sought to regulate and control drugs through taxation. The Narcotic Division of the Internal Revenue Bureau sent thousands of physicians and pharmacists to federal penitentiaries for violations under the Harrison Narcotic Act (Olsen, 2022; Sacco, 2014). As the United States moved into the prohibition era of the 1920s, several other congressional acts were passed to enforce and regulate the sell, transportation, and use of drugs. One of these acts was the Marihuana Tax Act of 1937, requiring a high-cost transfer tax stamp for every sale of marijuana. The federal government issued the marijuana tax stamps, and the issuance was rare. In response to the Act of 1937, all of the states made the possession of marijuana illegal. Over the next several decades, Congress implemented several Drug Acts to increase penalties and provide stricter criminalization laws for drug-related offenses (Sacco, 2014).

In 1970, Congress passed the Comprehensive Drug Abuse Prevention and Control Act (CDAPCA), including the Controlled Substance Act (CSA). CDAPCA moved the drug laws from a taxation enforcement concept to a regulation and law enforcement function. The Act was designed to place the various drug laws under a single comprehensive statute (Redford, 2017; Sacco, 2014). CSA helped establish a framework for the federal government to regulate the

lawful production, possession, and distribution of controlled substances (Redford, 2017; Sacco, 2014). In addition, CSA enacted the scheduling of controlled substances in the United States. In 1973, the Drug Enforcement Administration (DEA) was created to enforce the CSA (Redford, 2017; Sacco, 2014). CDAPCA and CSA was the first step in the "War on Drugs" that would last to present-day enforcement and legislation (Redford, 2017).

In the 1980s, other anti-drug abuse Acts were passed through congress, including the Comprehensive Crime Control Act of 1984, the Anti-Drug Abuse Act of 1986 and 1988, and the Chemical Diversion and Trafficking Act of 1988. These different Acts were developed to combat the growing number of drug-related criminal offenses occurring in the United States by increasing the mandatory sentencing guidelines and expanding the number of illegal substances (Sacco, 2014). Throughout the 1990s and 2000s, the United States government expanded the various drug Acts to include synthetic compounds and prescription drug abuse control.

Drugs and Impairment

As illustrated above, drug use in society has a long history dating back several centuries. Natural plants with psychoactive properties were initially used for religious and medicinal purposes, which have become an addiction and dependency for individuals in society. The advancement of the pharmaceutical field has only increased the addictive and dependence cycle plaquing or society. "Addiction is a chronic disease characterized by drug seeking and use that is compulsive, or difficult to control, despite harmful consequences" (National Institute on Drug Abuse, 2018, p. 1). Repeated and chronic use of drugs can lead to changes in the human brain, making it more difficult to stop using drugs (Herman & Roberto, 2015; National Institute on Drug Abuse, 2018). Drugs affect various critical neurotransmitters, for example, gamma-aminobutyric acid, glutamate, dopamine, opioid peptides, serotonin (Herman & Roberto, 2015;

International Association of Chiefs of Police [IACP], 2018c). One of the most common neurotransmitters linked to illegal drugs is dopamine (Solinas et al., 2019). Dopamine is a chemical messenger, a neurotransmitter, associated with the brain's reward and pleasure circuits, causing a sense of euphoria, which increases an individual's motivation to repeat the behaviors associated with drug use (National Institute on Drug Abuse, 2018).

Some drugs mimic the action of neurotransmitters associated with sympathetic and parasympathetic nerves causing messages to be transmitted in the autonomic nervous system. Sympathomimetic drugs can cause the elevation of blood pressure, pupils dilate, sweat glands activate, and blood vessels of the skin constrict. Parasympathomimetic drugs can cause the pupils to constrict, heartbeat to slow, peripheral blood vessels to dilate, and blood pressure to decrease (International Association of Chiefs of Police [IACP], 2018c). When drugs are ingested into the human body, the body reacts to the presence of these drugs by producing more chemicals to bring the body back to a homeostasis level. The artificial creation of the body's reaction to these messages is generally associated with neurotransmitters and hormones. When an individual is ingesting a more significant than the average therapeutic dose of a drug, the body "may produce greatly exaggerated simulations of the natural action of the hormones and neurotransmitters" (International Association of Chiefs of Police [IACP], 2018c, p. 254).

American Psychological Association (APA) (2022) defines a *psychoactive drug* as "any drug that has significant effects on psychological process, such as thinking, perception, and emotion" (para. 1). Psychoactive drugs include the classification of drugs that produce an altered state of consciousness affecting an individual's mental abilities and psychomotor skills (International Association of Chiefs of Police [IACP], 2018c).

Drugs and Driving

In 2020, there were 228 million licensed drivers in the United States (Carlier, 2022). With the increase of licensed drivers and the corresponding self-reported surveys of drugged impaired driving, law enforcement organizations needed to adapt to alcohol-only impaired driving to include the identification of drugged impaired drivers. According to the *2018 National Survey on Drug Use and Health*, 20.5 million people aged sixteen or older drove under the influence of alcohol in the past year of 2018, and 12.6 million drove under the influence of an illicit drug (National Institute on Drug Abuse, 2019).

The legalization of cannabis has only increased the number of drivers under the influence of drugs. It has become more common in some cases than driving under the influence of alcohol (Cordelier et al., 2021). The legalization of cannabis capitulated literature on the relationship and comparison of drugged driving versus alcohol driving (Yockey et al., 2020). Drugged-related surveys and research indicate a problem occurring in the United States related to the significant increase in drug driving traffic crashes (Thomas et al., 2020). According to the Office of Behavioral Safety Research (2021), based on a 2020 study conducted at trauma centers in the United States, during the last quarter of 2020, fifty-six percent of drivers involved in a serious injury crash tested positive for at least one drug. (Thomas et al., 2020). In 2015, more people lost their lives in drugged driving crashes than alcohol driving crashes (Governors Highway Safety Association [GHSA], 2017). GHSA (2018) estimated that forty-three percent of drivers in 2016 who tested positive for illegal drugs in their system were involved in fatal related crashes.

The DECP was developed to assist law enforcement officers with detecting and gathering evidence of drug-impaired drivers. With the increase in drug-related traffic crashes, specialized law enforcement officers are needed to assist in detecting and identifying individuals who may

be under the influence of drugs while operating a motor vehicle. The DECP was created to assist with the specialized training needed to increase the level of knowledge of law enforcement in detecting drugged driving (International Association of Chiefs of Police [IACP], 2018c).

Drug Evaluation and Classification Program

LAPD was the first organization to examine the problem of drugged-impaired drivers on the roadways. During the 1970s, LAPD officers noticed that individuals arrested for driving under the influence had low breath alcohol concentration readings. As a result, the officers suspected the individuals were under the influence of drugs but lacked the training and knowledge to support their suspicions in court. As a result, LAPD assigned two sergeants, Richard Studdard and Len Leeds, to collaborate with medical professionals, toxicologist, research psychologist, and medical doctors to develop a program to identify drug-influenced drivers (Beirness & Porath, 2019; Porath-Waller et al., 2008; Porath-Waller & Beirness, 2010; Talpins et al., 2018). The result of the collaboration was the 12-step systematic and standardized process which later became the DRE protocol (Beirness & Porath, 2019; Porath-Waller & Beirness, 2010; Talpins et al., 2018). The DRE protocol consisted of officers examining individuals through interviews, behavioral tests, physical assessments, and measuring vital signs and clinical indicators consistent with the effects of psychoactive substances (Beirness & Porath, 2019; Porath-Waller & Beirness, 2010; Talpins et al., 2018). "The LAPD formally recognized the Program in 1979" (Talpins et al., 2018, p. 11).

Physicians, behavioral researchers, and other scientists held the first DRE school in Los Angeles in 1980 (Beirness & Porath, 2019). The school gained the attention of NHTSA in the 1980s, and NHTSA, in collaboration with LAPD, conducted several research projects to develop a standardized methodology. The focus of the research was to create a standardized and

systematic process that could be taught to law enforcement officers to assist with the recognition, arrest, and prosecution of suspected drivers under the influence of drugs (International Association of Chiefs of Police [IACP], 2018c; Talpins et al., 2018). The results of the studies created the DECP in 1987 with pilot programs in Arizona, Colorado, New York, and Virginia. Currently all fifty states and several countries participate in the DECP (Beirness & Porath, 2019; Talpins et al., 2018).

LAPD and NTHSA developed the DIE process into a 12-Step protocol for DREs to follow in creating, analyzing, and developing opinions of which drug categories are psychoactive during the evaluation. The DRE protocol addresses three required questions for law enforcement officers: "Whether the suspect is impaired; and if so, whether the impairment relates to drugs or a medical condition; and if drugs, the category or combination of categories of drugs that is the likely cause of the impairment" (International Association of Chiefs of Police [IACP], 2018c, p. 133). The DRE protocol is a standardized and systematic approach to determine the complex observable signs and symptoms known to be reliable indicators of drug impairment (International Association of Chiefs of Police [IACP], 2018c; Newmeyer et al., 2017; Papfotiou et al., 2004; Papfotiou et al., 2005; Schmitt et al., 2003; Scherer et al., 2020; Smith et al., 2002; Stuster et al., 2006; Talpins et al., 2018; Vaillancourt et al., 2021).

DREs are law enforcement officers who have completed all three phases of the DECP training requirements for certification established by IACP and NHTSA. Law enforcement officers are first required to have prerequisites before being accepted into the DECP training. Officers must have completed the NHTSA twenty-four-hour DUI standardized field sobriety testing course and the sixteen-hour NHTSA Advanced Roadside Impaired Driving Enforcement (ARIDE) course. ARIDE was developed to bridge the gap between the DUI alcohol training

program and the DECP by providing officers with general knowledge related to drug impairment (International Association of Chiefs of Police, 2022). The next step in the application process is for officers to receive the recommendation of their organizational leader, the state prosecutor, and a certified DRE. Applications are then sent to the DECP State Coordinator for approval and verification of all prerequisite requirements.

Once accepted into the DECP, officers begin phase one training in the sixteen-hour DRE preliminary school. The goal of the DRE preliminary school is to prepare officers to successfully complete the second phase of training consisting of the seven-day DRE school. Students are introduced to the seven drug categories used in the DECP, identify the twelve major components of the DRE 12-step protocol, administer and interpret the psychophysical tests, conduct eye examinations used in DIEs, check vital signs, describe the history and physiology of alcohol as a drug, and list the major signs and symptoms associated with each drug category (International Association of Chiefs of Police [IACP], 2018a).

Phase two of DECP is the seven-day DRE school which consists of an intensive learning environment to comprehend and understand the 981-page student manual. Students learn each component of the DRE 12-step protocol, including the examination procedures, observations, measurements, the effects of drugs on the body, signs, and symptoms of each drug category. The training is presented with classroom instruction followed by hands-on training. For example, students learn how to take blood pressure, pulse rates, and body temperature. Students are also taught how to estimate pupil sizes in three different lighting conditions. Students are also given an overview of physiology and drugs, eye examinations (HGN, VGN, LOC), and in-depth education on how drugs chemically affect the human body. After completing the seven-day

school training, students must take a final examination with an acceptable passing score of 80% (International Association of Chiefs of Police [IACP], 2018c).

The third phase of the DECP training consists of field evaluation certifications. Students are observed and supervised by certified DRE instructors during the certification phase. Students perform the DRE 12-step protocol on individuals under the influence of drugs. In Florida, the DECP conducts the certification phase at an outreach clinic in Jacksonville. Volunteers give a toxicology specimen and are screened by a DRE instructor before being presented to the DRE student. Students then conduct the DRE 12-step protocol documenting their findings on the DIE face sheets. Students must complete 12 drug evaluations and identify a minimum of three of the seven drug categories. DREs then complete the written narrative portion of the DIE and submit it to a minimum of two DRE instructors for review. Toxicological specimen results are compared to the DRE opinion, and a passing rate of 75% is required to complete the certification phase. After the certification phase, students complete a five-part final knowledge examination (International Association of Chiefs of Police [IACP], 2018c).

DREs are highly trained and experienced officers skilled in detecting and identifying subjects under the influence of drugs and identifying the categories of drugs causing the impairment (International Association of Chiefs of Police, 2022). In 2020, the United States had an estimated 696,644 law enforcement officers providing services to their communities (Statista, 2021). According to IACP, there are an estimated 8,000 certified DREs in the United States, equating to certified DREs being only 1.1% of the law enforcement officer community. Florida had an estimated 38,580 active certified law enforcement officers in 2020 (U.S. Bureau of Labor Statistics, 2022). According to IACP, in 2019, Florida employed 405 DREs, equating to only 1% of employed law enforcement officers.

DRE 12-Step Protocol

The DRE 12-step evaluation protocol consists of a breath test, interview of arresting officer by the DRE, preliminary examination, pulse rates, eye examination, divided attention psychophysical tests, vital signs, dark room examinations, examination of muscle tone, check for injection sites, subject's statements and other observations, opinion of the evaluator, and toxicological examination (International Association of Chiefs of Police [IACP], 2018c; Scherer et al., 2020; Talpins et al., 2018; Vaillancourt et al., 2021). Several of the steps contained in the DRE evaluation protocol are not new concepts, and creators of the DECP utilized trusted and proven methods of assessment in the medical community (International Association of Chiefs of Police [IACP], 2018c). Therefore, the individual tests performed during the evaluation have a strong foundation in the medical community as reliable and validated (Talpins et al., 2018). DREs document the 12-step protocol on a DIE face sheet that contains over one hundred different elements in numerical, narrative, and pictorial forms (Porath-Waller et al., 2021). DREs then create a written narrative that can range from one to ten pages in length, submitted to the State Attorney's Office as evidence for prosecution.

Breath Alcohol Test. The first step in the DRE protocol consists of obtaining a breath test from the subject. Florida Administrative Code (FAC) 11D-8 outlines the requirements of the Florida Department of Law Enforcement (FDLE) alcohol testing program. FAC 11D-8 requires subjects to provide two valid breath samples, within fifteen minutes of each other, utilizing CMI, Inc. Intoxilyzer 8000 to complete the breath test (Florida Department of State, 2015). A breath alcohol test gives an accurate concentration level of the subject's alcohol content contained in the breath sample (Porath-Waller et al., 2021; Talpins et al., 2018). In addition, the breath test assists the DRE in determining if the impairment level observed in the subject is consistent with the

measured alcohol level (Porath-Waller et al., 2021). The inconsistency of the impairment level and breath alcohol levels identified in the sample is required to determine if a medical condition mimicking impairment is the cause of the observed impairment or if drugs are possibly causing the observed impairment (International Association of Chiefs of Police [IACP], 2018c; Talpins et al., 2018).

Interview Arresting Officer. The second step in the DRE protocol is interviewing the arresting officer. The DREs inquire about the behaviors, impairment, appearance, driving pattern, smells, and any other identifiers that could indicate the subject being under the influence of drugs (International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021; Talpins et al., 2018). The interviewing process is critical because DRE evaluations are, on average, 54 minutes after the subject's arrest (Porath-Waller et al., 2021). For example, due to psychoactive drug periods, an officer on the traffic stop scene might observe indicators of drug categories. However, when the subject is presented to the DRE for an evaluation, the drug could no longer be psychoactive. The subject would then display different outward indicators than they did on the traffic stop scene.

Preliminary Examination. The third step in the DRE protocol is known as the "fork in the road" (International Association of Chiefs of Police [IACP], 2018c). This step is critical in determining the first question for the DRE of whether the subject is impaired or having a medical emergency (Porath-Waller et al., 2021; Talpins, 2018). A preliminary examination and first pulse reading are conducted in the third step. Next, the DRE will ask the subject a series of questions relating to the subject's health, medical history, drug use, and ingestion of food. DREs observe the subject's appearance, attitude, speech, smells, coordination, breath, and face color. DREs will also estimate if the subject's pupils are within a .05-millimeter difference. Finally, the DRE will

determine if the subject's eyes can track and obtain an estimation of the angle of onset for Horizontal Gaze Nystagmus (HGN) if present. The preliminary eye examination aims to determine if the subject is possibly suffering from a neurological disorder, disease, or brain injury (International Association of Chiefs of Police [IACP], 2018c; Talpins et al., 2018).

Eye Examination. The fourth step in the DRE protocol is the eye examination. The DRE will conduct the Horizontal Gaze Nystagmus (HGN), Vertical Gaze Nystagmus (VGN), and Lack of Convergence (LOC) test during this step (Porath-Waller et al., 2021; Talpins et al., 2018). Central nervous system depressants, inhalants, and dissociative anesthetics may cause horizontal gaze nystagmus and lack of convergence. Cannabis alone may also cause a lack of convergence for the eyes. *Nystagmus* is the involuntary jerking of the eyes. *Horizontal Gaze Nystagmus (HGN)* is the involuntary jerking of the eyes occurring as the eyes gaze to the side (Bertolli et al., 2007; International Association of Chiefs of Police [IACP], 2018c; Talpins et al., 2018).

HGN has been established and validated through multiple studies as a strong indicator of a subject's breath alcohol content level (Burns & Anderson, 1995; Burns & Dioquino, 1997; Stuster, 1998; Stuster, 2006). Nystagmus causes an individual's inability to track a moving object. This impairing condition restricts an individual's ability to operate a motor vehicle due to the restriction of tracking moving objects (Talpins et al., 2018). The phenomena caused by nystagmus indicate that HGN is not only an indicator of impairment; HGN is impairment (Talpins et al., 2018). Several medical validation studies have shown alcohol impairment is not the only impairing substance causing HGN, but other known drug categories can also induce HGN (Dhingra et al., 2019; Kosnoski et al., 1998). For this reason, DECP included the eye

examinations as step four of the DRE evaluation protocol to help DREs identify and conclude which drug categories could be causing impairment in individuals.

Vertical Gaze Nystagmus (VGN) is also administered during the eye examination. VGN will be present if the drug is a high dose for that particular individual's tolerance levels (International Association of Chiefs of Police [IACP], 2018c; Talpins et al., 2018). *VGN* is the involuntary jerking of the eyes, up-and-down, which occurs as the eyes are held at maximum elevation (International Association of Chiefs of Police [IACP], 2018c).

Finally, the last eye examination test performed to assist DREs in determining which drug categories are causing impairment is Lack of Convergence (LOC). *LOC* is the inability of a subject's eyes to converge, or cross, as the subject attempts to focus on a stimulus moving slowly towards their nose (International Association of Chiefs of Police [IACP], 2018c).

Divided Attention Psychophysical Tests. The fifth step of the DRE protocol is the divided attention psychophysical tests, which consist of the Modified Romberg Balance (MRB), Walk and Turn (WAT), One-Leg Stand (OLS), and Finger to Nose (FTN) (Porath-Waller et al., 2021; Talpins, 2018). The psychophysical tests aim to determine the subject's impairment indicators (International Association of Chiefs of Police [IACP], 2018c; Talpins et al., 2018). In addition, the psychophysical test are modifications of neurologists' performance test in diagnosing illness and are used by pharmacologists in assessing the psychomotor effects of drugs (Cowan & Jaffee, 1989; Talpins et al., 2018).

The Standardized Field Sobriety Tests (SFST) were initially developed to assist law enforcement officers in determining the degree of impairment among alcohol-affected individuals (Anderson et al., 1983; Burns & Anderson, 1995; Burns & Moskowitz, 1977; Burns & Dioquino, 1997; Downey et al., 2016; Fiorentino et al., 2020; Porath-Waller & Beirness, 2013;

Stuster & Burns, 1998; Tharp et al., 1981). Subsequent validation studies were conducted and suggested the usefulness of identifying drug impairment in individuals (Alder & Burns, 1994; Downey et al., 2012; Downey et al., 2016; Fiorentino et al., 2020; Ip et al., 2013; Papafotiou et al., 2005; Perry et al., 2015; Porath-Waller & Beirness, 2013). SFSTs are a series of tasks to assess an individual's ability levels of divided attention, cognitive functioning, and psychomotor performance (Downey et al., 2016).

Modified Romberg Balance. The Modified Romberg Balance (MRB) is a modified version of Moritz Heinrich Romberg, a German neurologist, balance test which evaluates neurological function detecting the individual's inability to maintain a steady standing posture with eyes closed, divided attention and time sense impairment (Hartman et al., 2016). The participants are asked to estimate the passing of thirty seconds with their eyes closed, standing with their feet together and head tilted back. An individual's internal timing estimates can slow down or speed up depending on a particular drug category that may be psychoactive at the time of the evaluation (International Association of Chiefs of Police [IACP], 2018c).

MRB is divided into the instructional and balance stages. DREs evaluate the subject for several indicators of impairment in the two stages (International Association of Chiefs of Police [IACP], 2018c). First, subjects are instructed to stand straight with their feet together and arms down by their side. The subject is to remain in this position while the DRE continues with the instructions for the test. Next, evaluated subjects are instructed not to begin the test until told by the DRE. The DRE instructs the subject that once they are told to begin the test, they are to tilt their head back, close their eyes, and estimate the passage of thirty seconds. When the subject believes the passage of thirty seconds occurs, they are to tilt their head forward, open their eyes, and say stop (International Association of Chiefs of Police [IACP], 2018c).

DREs document on the DIE face sheet if they observe body or eyelid tremors, swaying of the subject, and the time it took for the subject to conduct the test. Each clue exhibited by the subject correlates to one or more of the drug categories symptomologies on the drug-matrix, assisting DREs in determining which drug category is causing impairment in the subject (International Association of Chiefs of Police [IACP], 2018c).

Walk and Turn. The second divided attention test in the 12-Step DRE protocol is the Walk and Turn (WAT) test (International Association of Chiefs of Police [IACP], 2018c). The WAT divides a subject's mental ability such as short-term memory, judgment, and decision making with physical activity such as balance, muscle control, and coordination (International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018b). The WAT test was one of the first validated tests used to assess a subject's alcohol impairment (Anderson et al., 1983; Burns & Anderson, 1995; Burns & Moskowitz, 1977; Burns & Dioquino, 1997; Stuster & Burns, 1998; Tharp et al., 1981).

WAT is divided into the instructional and walking stages. DREs evaluate the subject for eight indicators of impairment in the two stages (International Association of Chiefs of Police [IACP], 2018c). According to the DRE instructor manual (International Association of Chiefs of Police [IACP], 2018a), the test begins with the DRE instructing the subject to place their right foot on a line, the left foot directly in front of the right foot with their left heel touching their right toes on the line. The subject is then instructed to place their arms down by their side and stay in this position while the DRE finishes giving all the instructions. This first set of instructions is called the instructional stage, and DREs are looking to see if the subject can maintain their balance in this position as the first clue of impairment. The second indicator of impairment is to see if the subject begins the test prior to being told to start. The DREs then

complete the rest of the instructions telling the subjects to walk nine heel-to-toe steps down the line, turn in a prescribed manner and return nine heel-to-toe steps down the line. DREs evaluate the subject for six additional indicators of impairment, including does not touch heel-to-toe, steps off the line, using arms for balance, improper turn, incorrect number of steps, and stops walking to steady themselves.

While performing the WAT test, DREs evaluate the subject's ability to divide their attention between physical actions such as walking on the line and mental actions such as short-term memory of the instructions for the required number of steps and turning instructions. DREs document each clue of impairment on the DIE face sheet, including a pictogram of the subject's performance (International Association of Chiefs of Police [IACP], 2018c).

One Leg Stand. The third divided attention test in the 12-Step DRE protocol is the One Leg Stand (OLS) test (International Association of Chiefs of Police [IACP], 2018c). The OLS divides a subject's mental ability, such as short-term memory and information processing, with physical activity such as balance, muscle control, and coordination (International Association of Chiefs of Police [IACP], 2018b). The OLS test is also one of the original validated tests used to assess a subject's alcohol impairment (Anderson et al., 1983; Burns & Anderson, 1995; Burns & Moskowitz, 1977; Burns & Dioquino, 1997; Stuster & Burns, 1998; Tharp et al., 1981).

One Leg Stand (OLS) is divided into the instructional stage and balance and counting stage. DREs evaluate the subject for four indicators of impairment in the two stages (International Association of Chiefs of Police [IACP], 2018c). According to the DRE instructor manual (International Association of Chiefs of Police [IACP], 2018a), the test begins with the DRE instructing the subject to stand with their feet together and arms by their sides. Next, the DRE instructs the subject to raise their left foot six inches off the ground, keeping their foot

parallel to the ground and counting aloud by one thousand while keeping their arms down by their side. Finally, the DRE times the test for thirty seconds before instructing the subject to place their foot down. The exact timing of the test is essential for the DRE during the evaluation due to the original research showed subjects were able to stand on one leg for up to twenty-five seconds, but most were not able to keep their foot raised for a full thirty seconds (Burns & Moskowitz, 1977; International Association of Chiefs of Police [IACP], 2018b).

The DRE then instructs the subject to perform the same test using the right foot raised off the ground. The DRE evaluation of the OLS differs from alcohol-related OLS test on the roadside due to having the subject perform the test twice, once with each raised foot. The purpose of administering the test twice for both the left and right legs is to assist the DRE in making comparisons and identifying potential medical conditions that may be present (International Association of Chiefs of Police [IACP], 2018a). DREs are evaluating the subject for four clues of impairment which include the subject swaying while balancing, using their arms to balance, hopping, and placing their foot down (Anderson et al., 1983; Burns & Anderson, 1995; Burns & Moskowitz, 1977; Burns & Dioquino, 1997; International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018b; International Association of Chiefs of Police [IACP], 2018c, Stuster & Burns, 1998; Tharp et al., 1981).

While performing the OLS test, DREs evaluate the subject's ability to divide their attention between physical actions such as the balancing task and mental actions such as the information processing needed to conduct the test. DREs document each clue of impairment on the DIE face sheet, including a pictogram of the subject's performance (International Association of Chiefs of Police [IACP], 2018c).

Finger-to-Nose. The fourth divided attention test in the 12-Step DRE protocol is the Finger-to-nose (FTN) test (International Association of Chiefs of Police [IACP], 2018c). The FTN divides a subject's mental ability, such as information processing, with physical activity such as muscle control and coordination (International Association of Chiefs of Police [IACP], 2018b). The subject is instructed to touch their nose six times in a systematic sequence. Their eyes are closed, and the two hands are outstretched to the sides (International Association of Chiefs of Police [IACP], 2018a; Shinar & Schechtman, 2005). DREs document each placement of the subject's index finger to the nose on the DIE face sheet, which includes a pictogram of the subject's performance (International Association of Chiefs of Police [IACP], 2018c). DREs also observe the subject for any indication of swaying during the test, body tremors, and eyelid tremors (International Association of Chiefs of Police [IACP], 2018a).

Vital Signs. The sixth step in the DRE protocol is the vital signs. DREs obtain a subject's blood pressure, pulse rate, and body temperature (Porath-Waller et al., 2021; Talpins et al., 2018). Subjects under the influence of specific drug categories can raise or lower vital signs. The results of the vital signs assist DREs in identifying which drug category is currently psychoactive at the time of the evaluation (International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018c). DREs document the results of the vital signs on the DIE face sheets to determine the possible drug category associated with the results of the subject's blood pressure, pulse rate, and body temperature.

DREs use a standard manual sphygmomanometer with a stethoscope to record the systolic and diastolic pressures to obtain the subject's blood pressure. The subject's blood pressure is obtained at the brachial artery pulse point on the left arm. The DRE average range is 120-140 systolic and 70-90 diastolic. A subject's blood pressure above the average range is

considered raised, and if below the average range, it is considered lowered (International Association of Chiefs of Police [IACP], 2018c).

DREs obtain a subject's pulse measurement manually at the radial artery pulse point. The average DRE pulse rate is sixty to ninety beats per minute. The pulse is measured with a mechanical timepiece for thirty seconds and then times by two. If the pulse rate is above ninety beats per minute, it is considered raised. If the pulse is below sixty beats per minute, it is considered lowered (International Association of Chiefs of Police [IACP], 2018c). DREs obtain a subject's body temperature using an oral thermometer. The average DRE range for body temperature is 98.6 degrees Fahrenheit plus or minus one-degree Fahrenheit (International Association of Chiefs of Police [IACP], 2018c).

Drugs affect human physiology and indicators of possible impairment may be present and assessed in this evaluation stage. For example, central nervous system stimulants, hallucinogens, and dissociative anesthetics can increase a subject's blood pressure, pulse rate, and body temperature. Conversely, central nervous system depressant and narcotic analgesic drugs can lower a subject's blood pressure and pulse rate (International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018c). Depending on what type of drug a subject ingests prior to driving a vehicle and that drug being psychoactive in the body determines the different physiological responses observed. The sixth step of taking vital signs is a critical component of the DRE protocol (International Association of Chiefs of Police [IACP], 2018c).

Dark Room Examination. The seventh step of the 12-step DRE protocol is the darkroom examinations. The subject's pupil sizes are estimated with a pupilometer in three different lighting conditions room light, near-total darkness, and direct light (Porath-Waller et al.,

2021; Talpins et al., 2018). Specific drug categories cause an individual's pupils to be constricted or dilated (International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018c; Shinar & Schechtman, 2005;). DREs also assess how the subject's pupils react to light's introduction under near-total darkness conditions (Porath-Waller et al., 2021; Talpins et al., 2018).

DREs utilize a room for this step that can be turned into a near-total darkness environment to estimate the subject's pupil size. DREs use a pupilometer containing a series of circles or semi-circles with diameters ranging from 1.0mm to 10.0mm in half-millimeter increments (International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018c). According to the DRE Instructor Manual (International Association of Chiefs of Police [IACP], 2018a), the first estimation of the subject's pupils occurs in the room with normal lighting conditions with an average DRE range of 2.5mm to 5.0mm. Once the room light estimate has been obtained, the room is placed into a near-total darkness environment for ninety seconds before the second estimation of the pupil sizes. The DRE average range of near-total darkness is 5.0mm to 8.5mm. An estimate of direct light pupil size then occurs with the DRE turning on a penlight directly into the eyes of the subject, one eye at a time. The average DRE range for direct light is 2.0mm to 4.5mm. The DRE is also estimating the reaction of the subject's pupils to the direct light to determine if the reaction is slow, normal, or none (International Association of Chiefs of Police [IACP], 2018c).

Specific drug categories can dilate a subject's pupils when they are psychoactive at the evaluation time. For example, central nervous system stimulants and hallucinogens can dilate the pupils. In contrast, a narcotic analgesic can constrict a subject's pupils (International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018c).

Therefore, examining the pupils under controlled lighting conditions provides essential evidence of possible drug influence due to the various manifestations of the drug's psychoactive properties. After the estimations are gathered, the DRE then checks the nose and mouth of the subject for other signs of drug use (International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021; Talpins et al., 2018).

Muscle Tone and Injection Sites. The eighth step of the DRE process is the examination of muscle tone. DREs examine the subject's skeletal muscle tone to assess whether the muscles are rigid, flaccid, or normal (International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021; Talpins et al., 2018). The ninth step is conducted simultaneously as the muscle tone examination. DREs observed the subject body for injection sites to indicate drug use. The third pulse rate is also taking in the nineth step (International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021; Talpins et al., 2018).

Interrogation, Statements, and Observations. The tenth step in the DRE process is to interview the subject and record any statements. Observations of the subject's behavior and mannerisms are also documented during this step (Porath-Waller et al., 2021; Talpins et al., 2018). DREs ask a series of questions about the subject's history of drug use and attempt to determine if they confirm the use of drugs prior to operating a vehicle. The statements and observations are documented on the DIE face sheets (Talpins et al., 2018).

Opinion of Evaluator. Step eleven is for the DRE to formulate their opinion of which drug category or categories they believe the subject is currently under the influence (International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs

of Police [IACP], 2018c; Porath-Waller et al., 2021; Talpins et al., 2018). The opinion made by the DRE is based on the totality of the evidence and observations noted during the evaluation. The DRE opinion is to determine if the subject is impaired, and if so, then by which drug category or combination of drug categories is causing the impairment (Porath-Waller et al., 2021). The subsequent opinion by the DRE is to determine if the subject's impairment is affecting the subject's ability to operate a vehicle safely (International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018c).

Toxicology Examination. The final step in the DRE process is the toxicology examination. It is dependent on the DREs jurisdiction as to whether urine, blood, or both are collected and sent for examination (International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021; Talpins et al., 2018). The toxicology examination can occur months after the DRE completes the evaluation and is used as a toxicological confirmation of the DRE's opinion.

DRE 12-Step Protocol Validation Studies

NHTSA and LAPD focused on developing a standardized and systematic process for a law enforcement officer to determine if drugs impair suspected individuals under arrest for driving under the influence. Accordingly, NHTSA and LAPD conducted a two-phase validation study in 1984 and 1985 (International Association of Chiefs of Police [IACP], 2018c). The first phase was a laboratory validation research study where individuals ingested selected drugs and then performed field sobriety tests. The laboratory evaluation study was conducted at Johns Hopkins University in Maryland in 1984 (Bigelow et al., 1985; International Association of Chiefs of Police [IACP], 2018c). After the laboratory study was completed, NHTSA and LAPD officers moved into the second phase by conducting a field validation study commonly referred

to as the 173 study (International Association of Chiefs of Police [IACP], 2018c). These two primary studies set the foundation for the DECP and admissibility in the criminal justice system.

John Hopkins Study. Bigelow et al. (1985) enlisted the assistance of four DREs from LAPD: Richard Studdard, Jerry Powell, Pat Russell, and Doug Laird. Volunteers were given a "pill" and smoked a "cigarette" in a controlled laboratory. The pill contained either a placebo, secobarbital, diazepam, or d-amphetamine. The cigarette contained either a placebo or delta-9-tetrahydrocannabinol (THC). The laboratory study was a double-blind experiment where neither the DREs nor the volunteers knew which pill or cigarette they received contained any drugs or was a placebo. The dosage units were increased from the normal therapeutic doses for this study due to researchers trying to identify individuals who were impaired by the drugs. The normal daily dose is "secobarbital- 100mg, diazepam- 4-40mg, and d-amphetamine-15mg for therapeutic purposes. The doses administered for this study are secobarbital- 300mg, diazepam-weak-15mg and strong- 30mg, d-amphetamine- weak-15mg and strong-30mg, marijuana- weak 1.3% THC and strong-2.8% THC" (International Association of Chiefs of Police [IACP], 2018c, p. 115).

The four DREs were presented with 80 volunteers, and each DRE evaluated all the volunteers. The evaluations were conducted independently by a single DRE, and the other three DREs were unaware of the conclusions from their partners who also examined the same volunteers. Each DRE was allotted 20 minutes to evaluate to determine if the volunteer was impaired and if impaired by which drug category was causing the impairment. DREs had no contact with the volunteers prior to the evaluation and did not contact other DREs until the evaluations were completed (Bigelow et al., 1985). Due to the allotted time only being 20 minutes, DREs used a modified evaluation compared to a field evaluation which usually lasts

approximately one hour. The core procedures did not change, and only those items which seemed irrelevant to the experimental context were removed. The modified evaluation procedures consisted of three components.

First, the DREs conducted a brief interview to determine the volunteer's medical history, drug history, eating and sleeping habits, and alcohol use. The second component was the clinical evaluation which consisted of pulse rate, blood pressure, body temperature, pupil size, pupil reaction to light, nystagmus, perspiration, and salivation observations. The third component was the field sobriety testing (psychomotor tests) which consisted of standing steadiness and time perception, line test, one-foot balance, and hand-to-nose test (Bigelow et al., 1985). These four psychomotor tests would later be the modified Romberg balance, walk and turn, one-leg stand, and finger to nose tests. (International Association of Chiefs of Police [IACP], 2018c).

DREs correctly identify 95% of the subjects who received placeboes as not impaired. In addition, the DREs correctly identified 98.7% of subjects who received secobarbital or substantial doses of marijuana, diazepam, or d-amphetamine. The DREs also identified the correct category of drugs causing the impairment in 90% of the subjects (Bigelow et al., 1985; International Association of Chiefs of Police [IACP], 2018c).

"173 Study". The second phase of the validation process was to conduct a field validation study in Los Angeles. The study was based on 173 individuals arrested on suspicion of driving under the influence of drugs in Los Angeles (International Association of Chiefs of Police [IACP], 2018c). The study consisted of twenty-five different DREs trained in the LAPD DRE program. Researchers narrowed the field down to 173 participants by excluding any suspects who refused to provide a toxicological sample, were involved in a traffic crash, or were

found in possession of drugs (Compton, 1986; International Association of Chiefs of Police [IACP], 2018c).

Compton (1986) conducted the field validation study over three months in 1985. Individuals arrested for suspicion of driving under the influence were brought to the jail facility, where a DRE evaluated those whose alcohol breath samples were not consistent with their level of impairment. The DREs used the 12-step protocol to conduct the evaluations, which consisted of an interview, physiological symptoms, and behavioral tests (Compton, 1986). Once the evaluation was completed, each DRE gave their opinion on whether or not the individual was impaired and if impaired by which drug category was causing the impairment. The subjects were then asked to provide a toxicological blood sample sent to a private laboratory for analysis. Two hundred one subjects were evaluated, and only one-hundred and seventy-three subjects agreed to provide a blood sample (Compton, 1986).

"Thirty-seven (21%) of the subjects were found to have only one drug other than alcohol, eighty-two (47%) had two drugs and forty-three (25%) had three or more drugs including alcohol" (International Association of Chiefs of Police [IACP], 2018c, Session 3 p. 15). Thus, a total of 125 subjects had ingested two or more drugs. The DREs were able to identify 94% of subjects being impaired by at least one drug, which was confirmed through blood toxicological analysis. DREs then gave an opinion on which drug category they believed was causing the subject's impairment. The DREs were able to identify one or more drugs correctly in 87% of the subjects (Compton, 1986).

Arizona Study. The two-phase validation studies conducted at Johns Hopkins University and the Los Angeles Police Department set the standard for future researchers to examine the DRE protocol and its effectiveness in identifying individuals under the influence of specific drug

categories. The last primary source and foundational study performed was conducted in Arizona, *Drug recognition expert (DRE) validation study: Final report to Governor's office of highway safety state of Arizona*, in 1994 by Eugene Adler and Marcelline Burns.

Adler & Burns (1994) reviewed over five-hundred drug influence evaluations over fifty-three months and the corresponding toxicological analyses of the suspect's specimens. This was the first validation study of the DECP since the 1985 John Hopkins and 173 studies were conducted. Ten years have passed since the original research, and Adler & Burns wanted to examine if the prediction rates of DREs have changed with the increase of experience of officers in the program. The objective of the study was to "evaluate the validity of the DRE methodology with records from an established program, to examine relationships between drug signs and symptoms and drug presence in specimens, and to study arrestee characteristics and drug choices" (Alder & Burns, 1994, p. viii). Five hundred drug influence evaluations were collected from Phoenix Police Department and Arizona Department of Public Safety Laboratory from January 1989 to May 1993. Researchers utilized the Foxplus software to conduct a descriptive statistics analysis of data extracted from the five hundred drug influence evaluations and toxicological results (Alder & Burns, 1994). The study results indicated DREs with the Phoenix Police Department had an accuracy rate of 85%, agreeing with Compton's previous field validation study in 1986 (Alder & Burns, 1994).

DRE Seven Drug Categories

DREs refer to a symptomology drug matrix (Appendix B) to assist with determining an opinion of drug classification. The symptomology drug matrix directly correlates to the DIE face sheet used to document the evaluation results in the 12-step DRE protocol. The symptomology drug matrix contains signs and symptoms observed in the DIE and places these observations into

one of the respective drug categories. DREs define a *sign* as "an observable or detectable indicator of drug influence" (International Association of Chiefs of Police [IACP], 2018a, session 7, p. 6). For example, dilated pupils, high blood pressure, and raised body temperature are considered a sign for DRE evaluations. DREs define a *symptom* as "a subjective indicator of drug influence reported by the drug-impaired subject" (International Association of Chiefs of Police [IACP], 2018a, session 7, p. 6). For example, "I feel nauseous" is considered a symptom by DREs.

Drugs are categorized based on their symptomatology or effects on the human body associated with each category's long-standing, medically accepted facts (Talpins et al., 2018). Each category contains drugs that affect a person's body, impairing their normal faculties and ability to operate a vehicle safely (International Association of Chiefs of Police [IACP], 2018a; Talpins et al., 2018). The 12-step DRE protocol evaluation is designed to assist DREs in identifying which possible drug category is causing impairment in the evaluated subjects who have been placed under arrest for driving under the influence (International Association of Chiefs of Police [IACP], 2018c). The seven drug categories of the DECP are central nervous system (CNS) depressants, central nervous system (CNS) stimulants, hallucinogens, dissociative anesthetics, narcotic analgesics, inhalants, and cannabis **(**International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018c; Porath & Beirness, 2019; Porath-Waller et al., 2021; Talpins et al., 2018**).**

CNS Depressants. Central Nervous System (CNS) Depressants are the first category on the DRE symptomology drug matrix (Porath & Beirness, 2019; Talpins et al., 2018). CNS Depressants contain a classification of drugs that affect the human body by slowing down a person's brain and central nervous system (Logan et al., 2017; Talpins et al., 2018). The six

major subcategories of CNS Depressants other than alcohol are barbiturates, non-barbiturates, anti-anxiety tranquilizers, antidepressants, anti-psychotic tranquilizers, and combinations (International Association of Chiefs of Police [IACP], 2018c).

HGN and LOC are usually present in subjects who have ingested a CNS Depressant drug, while VGN may be present if it is a high dose for that particular subject (Logan et al., 2017). A subject's pupil size will be normal. However, Soma, Quaaludes, and some antidepressants will dilate the pupils (International Association of Chiefs of Police [IACP], 2018c)**.** A subject's reaction to light will usually be slowed when estimated in the darkroom evaluation (Dargan et al., 2013; Stephenson et al., 2013)**.** Pulse rate and blood pressure tend to be lower in subjects under the influence of a CNS Depressant (Dargan et al., 2013; Snozek, 2020; Stephenson et al., 2013**)**. Quaaludes, alcohol, and some antidepressants could elevate a subject's pulse rate (International Association of Chiefs of Police [IACP], 2018c)**.** The subject's body temperature is usually normal, and their muscle tone will be flaccid (Snozek, 2020; Stephenson et al., 2013)**.**

Subjects that ingested above a standard therapeutic dose of CNS Depressants can show signs and symptoms of having a drunk like behavior, drowsiness, ptosis, disoriented, unsteady walking, slow or sluggish reactions, thick or slurred speech, and be uncoordinated (Dargan et al., 2013; Logan et al., 2017; International Association of Chiefs of Police [IACP], 2018c; Snozek, 2020; Stephenson et al., 2013).

CNS Stimulants. Central Nervous System (CNS) Stimulants are the second category on the DRE symptomology drug matrix (Porath & Beirness, 2019; Talpins et al., 2018). CNS Stimulants contain a classification of drugs that affect the human body by speeding up a person's brain and central nervous system (Talpins et al., 2018). The three major subcategories of CNS Stimulants are cocaine, amphetamines, and others (International Association of Chiefs of Police

[IACP], 2018c). All three subcategories exhibit the same signs and symptoms associated with the CNS Stimulant drug category for the DRE evaluation.

HGN, VGN, and LOC will not be present in the DRE evaluation for the subjects who only have ingested a CNS Stimulant drug (International Association of Chiefs of Police [IACP], 2018c). The subject's pupils will be dilated above the average DRE range, and the pupil's reaction to light will be slow (Dhingra et al., 2019; Porath & Beirness, 2019). CNS Stimulants will raise a subject's pulse rate, blood pressure, and body temperature when the drug is consumed over the standard therapeutic dose prescribed for the subject (Caplan et al., 2007; Porath & Beirness, 2019). Subjects can also show signs and symptoms of having body tremors, anxiety, dry mouth, euphoria, exaggerated reflexes, exited, eyelid tremors, bruxism, increased alertness, insomnia, irritability, restlessness, and talkative (Caplan et al., 2007; Chang et al., 2019; International Association of Chiefs of Police [IACP], 2018c; Porath & Beirness, 2019).

Hallucinogens. The third drug category on the DRE symptomology drug matrix is Hallucinogens (Porath & Beirness, 2019; Talpins et al., 2018). *Hallucinogens* "are drugs that affect a person's perceptions, sensations, thinking, self-awareness, and emotions" (International Association of Chiefs of Police [IACP], 2018c, p. 458). DECP divides hallucinogen drugs into two subcategories of natural and synthetic hallucinogens (International Association of Chiefs of Police [IACP], 2018c). Natural hallucinogens consist of drugs that occur in nature such as peyote, psilocybin, salvia divinorum, nutmeg, jimson weed, morning glory seeds, and bufotenine (Barrett et al., 2018; Garcia-Romeu & Richards, 2018; Nitescu & Alexandrescu, 2019). Synthetic hallucinogens are made in a laboratory and consist of lysergic acid diethylamide (LSD), N,N-dimethyltryptamine (DMT), and 3,4-methylenedioxymethamphetamine (MDMA) (Barrett et al., 2018; De Gregorio, 2021; Garcia-Romeu & Richards, 2018; Waters, 2021).

Hallucinogens are known for their psychedelic and psychomimetic properties causing mind-revealing or psychosis-mimicking (Waters, 2021).

HGN, VGN, and LOC will not be present in the DRE evaluation for the subjects who only have ingested a hallucinogen drug (International Association of Chiefs of Police [IACP], 2018c). The subject's pupils will be dilated above the average DRE range, and the pupil's reaction to light will be normal (Dhingra et al., 2019). Hallucinogen's will raise a subject's pulse rate, blood pressure, and body temperature when the drug is consumed over the standard therapeutic dose prescribed for the subject (Vizeli & Liechti, 2017). Subjects can also show signs and symptoms of having body tremors, dazed appearance, difficulty in speech, disorientation, flashbacks, hallucinations, memory loss, paranoia, perception of time and distance distortion, synesthesia, and uncoordinated (Ellenhorn et al., 1999; International Association of Chiefs of Police [IACP], 2018c; Porath & Beirness, 2019).

Dissociative Anesthetic. Dissociative Anesthetics are the fourth category on the DRE symptomology drug matrix (Porath & Beirness, 2019; Talpins et al., 2018). Dissociative anesthetic drugs give a subject a state where they feel detached from their environment and contains a stimulant, depressant, hallucinogenic, and analgesic property (Lee & Stout, 2020). Drugs identified as dissociative anesthetics are Phenyl Cyclohexyl Piperidine (PCP), ketamine, methoxetamine, and dextromethorphan (DXM) (Lee & Stout, 2020; International Association of Chiefs of Police [IACP], 2018c).

HGN, VGN, and LOC will be present in the DRE evaluation for the subjects who only have ingested a dissociative anesthetic drug with a possible early onset of HGN (International Association of Chiefs of Police [IACP], 2018c). The subject's pupils' size and reaction to light will be normal (Lee & Stout, 2020). Dissociative anesthetics will raise a subject's pulse rate,

blood pressure, and body temperature when the drug is consumed over the standard therapeutic dose prescribed for the subject (Lee & Stout, 2020; Morris & Wallach, 2014; Riva-Posse et al., 2018). Subjects can also show signs and symptoms of having blank stare, confused, cyclic behavior disoriented, hallucinations, increased pain threshold, non-communicative, perspiring, possibly violent, sensory distortions, and slurred speech (Lee & Stout, 2020; Morris & Wallach, 2014; International Association of Chiefs of Police [IACP], 2018c).

Narcotic Analgesics. The fifth drug category on the DRE symptomology drug matrix is a narcotic analgesic (Porath & Beirness, 2019; Talpins et al., 2018). A *Narcotic* "is a drug derived from Opium, or produced synthetically, that relieves pain but also induces euphoria, alters mood, and produces sedation" (International Association of Chiefs of Police [IACP], 2018c, p. 577). An *Analgesic* "is a medication or drug that relieves pain" (International Association of Chiefs of Police [IACP], 2018c, p. 577). Narcotic analgesics are divided into two subcategories of opiates and synthetics (International Association of Chiefs of Police [IACP], 2018c). Commonly used drugs in the narcotic analgesic category are heroin, morphine, codeine, dilaudid, hydrocodone, thebaine, oxycodone, oxymorphone, demerol, methadone, fentanyl, and buprenorphine (Talpins et al., 2018).

HGN, VGN, and LOC will not be present in the DRE evaluation for the subjects who only have ingested a narcotic analgesic drug (International Association of Chiefs of Police [IACP], 2018c). The narcotic analgesic drug category is unique because it is the only DRE drug category that causes miosis (Armenian et al., 2018; Edwards, 2019; Finegan, 2021). *Miosis* is abnormally small (constricted) pupils (International Association of Chiefs of Police [IACP], 2018c). A subject's pupillary reaction to light under the influence of a narcotic analgesic will be little to none visible during a DRE evaluation (Dhingra et al., 2019). Narcotic analgesics will

lower a subject's pulse rate, blood pressure, and body temperature when the drug is consumed over the standard therapeutic prescribed dose for the subject (Finegan, 2021; Gupta & Edwards, 2018; Patel et al., 2021).

A common side effect of narcotic analgesics is sedation, which may impact cognition, psychomotor performance, and driving ability (Ferreira et al., 2018). Subjects can also show signs and symptoms of having depressed reflexes, ptosis, drowsiness, dry mouth, euphoria, itching, low, raspy speech, and slowed breathing (Armenian et al., 2018; Finegan, 2021)**.** A common sign DREs observe during an evaluation of a subject under the influence of a narcotic analgesic is called "on-the-nod." *On-the-nod* is a semi-conscious state of deep relaxation. The subject appears to be asleep but can efficiently respond to questions (International Association of Chiefs of Police [IACP], 2018c).

Inhalants. Inhalants are the sixth drug category on the DRE symptomology drug matrix (Porath & Beirness, 2019; Talpins et al., 2018). Inhalants drug category is named after the primary method of ingestion for breathable chemicals (Talpins et al., 2018). Inhalants are divided into three subcategories of volatile solvents, aerosols, and anesthetic gases (International Association of Chiefs of Police [IACP], 2018c). Volatile solvents are toluene, acetone, benzene, spray paint, paint thinners, lighter fluid, model airplane glue, gasoline, and kerosene (Braunscheidel et al., 2019; Crossin et al., 2018; Cruz & Bowen, 2021; Howard et al., 2011). Aerosols include hair sprays, insecticides, and freeze sprays (Cruz & Bowen, 2021; Howard et al., 2011). Anesthetic gases include ether, nitrous oxide, amyl nitrite, and butyl nitrite (Cruz & Bowen, 2021; Howard et al., 2011; Shelton, 2016).

HGN and LOC are usually present in subjects who have ingested an Inhalant, while VGN may be present if it is a high dose for that particular subject (International Association of Chiefs

of Police [IACP], 2018c). Pupillary reaction to light is slow, and pupil size is normal but may be dilated in some subjects. Inhalants will increase pulse rates in subjects (Taylor et al., 2021). Subjects' blood pressure will be down for anesthetic gases and up with volatile solvents and aerosols (International Association of Chiefs of Police [IACP], 2018c). Inhalant impairment is similar to alcohol intoxication signs and symptoms of slurred speech, euphoria, incoordination, lethargy, slowed reflexes, blurred vision, bloodshot watery eyes, confusion, disoriented, and lack of muscle control (Cruz & Bowen, 2021; Howard et al., 2011; International Association of Chiefs of Police [IACP], 2018c). Additional effects of the inhalant drug category include intense headaches, slow, thick speech, and a flushed face (Bowen et al., 2016).

Cannabis. The last category on the DRE symptomology drug matrix is Cannabis (Porath & Beirness, 2019; Talpins et al., 2018). The psychoactive ingredient in Cannabis is delta-9 tetrahydrocannabinol (THC) (Subramaniam et al., 2019; Talpins et al., 2018). Cannabis is also known more commonly as marijuana. The drug category of Cannabis also includes the various forms of marijuana, cannabinoids, and synthetic drugs like Marinol (International Association of Chiefs of Police [IACP], 2018c). Cannabis is becoming the most socially acceptable drug after alcohol in the United States. It is currently legalized in more than thirty-seven states, four territories, and the District of Columbia (Garcia & Hanson, 2022).

HGN and VGN are not present in subjects under the influence of Cannabis. Cannabis is the only drug category in the DEC program that LOC will be present in the absence of HGN and VGN (International Association of Chiefs of Police [IACP], 2018c). Pupils will be dilated for most subjects, but at times they can be normal in size (Dhingra et al., 2019). Pupillary reaction to light will be normal, but subjects may have rebound dilation in the darkroom examination (Dhingra et al., 2019; International Association of Chiefs of Police [IACP], 2018c). Cannabis

causes an increase in blood pressure and pulse rate (Subramaniam et al., 2019). Subjects can also show signs and symptoms of altered time and distance perception, eyelid tremors, body tremors, drowsiness, disorientation, impaired memory function, increased appetite, lack of concentration, possible paranoia, and lack of concentration (Curran et al., 2016; International Association of Chiefs of Police [IACP], 2018c; Prini et al., 2020).

Signs and Symptoms of Drugs

The primary source studies of Bigelow et al. (1985), Compton (1986), and Alder & Burns (1994) set the foundation of research validation for the DECP in the United States. The literature addressing the validation of the DECP has been lacking since the publication of the Arizona study in 1994. Researchers examining the DECP turned their attention to the effects of individual drugs signs and symptoms related to the DRE protocol over the next twenty years. Several studies have been conducted on drug identification performance's observable signs and symptoms.

Heishman et al. (1998) conducted a research study of DECP related to the use of alprazolam, d-amphetamine, codeine, and marijuana. The purpose of the study was to determine if there is a need to refine the DECP evaluations by determining which variables are the best predictors of drug intake across a range of drug classes in order to aid the DREs in the detection process (Heishman et al., 1998; Shinar & Schechtman, 2005; Porath-Waller et al., 2021). Forty-eight volunteers participated in the study and were dosed with either a placebo, alprazolam, d-amphetamine, codeine, or delta-9-tetrahydrocannabinol (THC). The study was conducted under double-blinded conditions according to a randomized, Latin-square design (Heishman et al., 1998). Thirty DREs from eight states participated in the study as evaluators. DREs were instructed only to ask two questions related to physical defects and vision problems. DREs

completed the 12-step protocol except for the interview step on all forty-eight volunteers and then rendered their opinion on impairment and the drug category causing the impairment if present (Heishman et al., 1998).

Heishman et al. (1998) concluded that the DREs in this study could firmly predict the volunteers were impaired and under the influence of a drug but struggled to classify the same drug category causing the impairment. The purpose of the study was to identify select variables to assist DREs in their prediction of drug category classifications. To this objective, researchers were able to identify two to seven variables of the DECP evaluation that predicted the presence or absence of alprazolam, d-amphetamine, and marijuana with moderate sensitivity. Codeine revealed a sensitivity as low, and false-negative rates were extremely high (Heishman et al., 1998).

Shinar & Schechtman (2005) conducted a research study solely based on a subject's performance on the psychophysical tests and a limited number of clinical indicators. The study reanalyzed the data previously collected in the Heishman et al. (1998) study. Shinar & Schechtman (2005) utilized the results of the Heishman et al. (1998) study to determine if DRE predictability could be achieved through the use of only the psychophysical test, blood pressures, pulse rates, nystagmus, pupil estimations, and body temperature for the four categories of central nervous system depressants, central nervous system stimulants, narcotic analgesics, and cannabis. "The results suggested that DREs formed their opinion about the category of drug consumed based on only one or two pivotal signs and symptoms while ignoring others, even if contradictory to their judgment" (Porath-Waller et al., 2021, p. 4).

Other literature during this period focused on individual drugs and their association with the psychophysical test performed during an everyday driving under the influence investigation

and not associated with the DRE protocol. For example, Bramness et al. (2003) completed a study on the performance of individuals dosed with benzodiazepine when administered the field sobriety test of the modified Romberg balance, walk and turn, one-leg stand, and the finger to nose test. In 2005, Silber et al. completed another psychophysical study after dosing subjects with d-amphetamines. Downey et al. (2012) completed their study of psychophysical indicators of impairment on the field sobriety tests after dosing volunteers with dl-3,4-methylenedioxymethamphetamine (MDMA). Ip et al. (2013) published their findings of individuals' results of meeting field sobriety test indicators after being dosed with levels of trazodone. Finally, in 2014, Perry et al. conducted a double-blinded study of the subject's performance on field sobriety tests after being dosed with various levels of dextromethorphan. All of the studies contributed to the curriculum of the DRE school as it was revised over the years to assist students with obtaining additional knowledge of how individuals' performance on field sobriety tests related to certain drugs (International Association of Chiefs of Police [IACP], 2018c). The issue with all the research studies being devoted to the psychophysical test is that it is only one step in the 12-step DRE protocol.

A group of researchers in Canada picked up where Alder & Burns left off in 1994 and began to publish DECP validation studies in 2009. These studies concentrated on drug influence evaluations obtained in Canada from 2009 to 2019. The research literature and studies were spearheaded by Amy J. Porath-Waller and Douglas J. Beirness. One of the first studies completed by Beirness et al. (2009) examined 1,349 cases in which 92.1% of DRE opinions were confirmed through toxicological analysis. Thirty-six cases returned no psychoactive drugs present and were correctly opinioned by the DREs as having no impairment. The overall

accuracy of the DRE opinions with drugs presents and no drugs present was 94.8% as being correctly identified (Beirness et al., 2009).

Porath-Waller et al. (2009) examined 1576 Canadian DEC evaluations from 1995 to 2008. The study aimed to enhance officers' training in the DECP by focusing on a smaller set of critical signs and symptoms when developing an opinion as to which drug category is causing impairment. Statistical analysis was performed to simplify the process used by DREs to predict the best four classes of drugs, including central nervous system stimulants, central nervous system depressants, narcotic analgesics, and cannabis (Porath-Waller et al., 2009). This was one of the first studies to use statistical analysis of univariate relationships and a multinomial logistic regression model to identify signs and symptoms in the DECP to assist the DREs in forming opinions of drug categories. The results of the study indicated a statistical model that includes nine clinical indicators of pulse rate, condition of eyes, eyelids, lack of convergence, hippus, rebound dilation, reaction to light, injection sites, and systolic blood pressure significantly predicted the correct drug category (Porath-Waller et al., 2009).

Porath-Waller et al.'s (2009) study focused on distinct drug categories and their relationship with signs and symptoms. Porath-Waller et al. (2010) study continued by examining 3,489 additional evaluations to determine the signs and symptoms that best predict three common drug combinations. As a result, Porath-Waller et al. (2010) identified eleven clinical indicators that significantly predicted the correct drug combinations. These indicators were the condition of eyes, lack of convergence, rebound dilation, reaction to light, mean pulse rate, injection sites, horizontal gaze nystagmus, pupil size in near-total darkness, one-leg stand test, walk and turn test, and muscle tone.

Amy J. Porath-Waller and Douglas J. Beirness's research studies over the past two decades have been the only studies to use statistical analysis that coded the DIE face sheet and narratives in order to extract data for analysis. They performed several statistical studies that identified which signs and symptoms from the DRE protocol have strong predictability in determining which drug category or drug categories cause impairment (Beirness et al., 2009; Beirness et al., 2013; Porath-Waller et al., 2009; Porath-Waller et al., 2010; Porath-Waller et al., 2013; Porath-Waller et al., 2019; Porath-Waller et al., 2021). Their research indicated that DREs in Canada reported an overall accuracy rate of ninety-five percent (Beirness et al., 2009). The research examined over one hundred quantified indicators from DIE face sheets and narratives.

Until recently, all of Dr. Porath-Waller and Dr. Beirness collaborative research focused on Canada's DECP. In May of 2021, Porath-Waller & Beirness published a research project funded through the National Highway Traffic Safety Administration, *Exploring the predictive validity of drug evaluation and classification program evaluations*, which focused on drug influence evaluations in the United States collected from April 2000 to December 2012. The study's primary objective was to "determine which combinations of drug-related signs and symptoms from the DEC protocol can most efficiently and effectively predict the drug category or combination used by the subject" (Porath-Waller & Beirness, 2021, p. v). "Research built on previous work conducted by Porath-Waller and colleagues by examining all of the information recorded during the DEC evaluations and assessing additional drug categories and combinations" (Porath-Waller & Beirness, 2021, p. 6).

The majority of the research conducted on the DECP is focused first on the development of the program, second on the validation of the DRE opinions, third on the individual drug effects on the body, and finally on the identifying predictors in the DECP evaluations. There is a

significant gap in the literature identifying common themes or predictors that indicate missed or incorrect opinions of DRE evaluations. The majority of the literature identified is over fifteen years old. New literature does not address the incorrect opinions of DREs or the validation of DREs in the State of Florida. The predictability study conducted in 2021 by Porath-Waller et al. utilized ten- to twenty-year-old data.

Summary

Program evaluation theory's function is to ascertain the theoretical sensibility of the program being evaluated (Sharpe, 2011). The Drug Evaluation and Classification Program was developed to assist with training law enforcement officers in identifying and detecting arrested subjects who operated a motor vehicle under the influence of drugs. Drug-related DUIs have increased significantly over the past several decades due to increased recreational use of licit and illicit drugs (Cordelier et al., 2021). Drug use in society is not a new phenomenon and has been used for religious ceremonies, medical reasons, and recreational purposes for several centuries (Crocq, 2007; Mann, 2017). In order to combat the rising levels of drug abuse, the United States has enacted multiple drug-related legislation over the past one hundred years (Olsen, 2022; Sacco, 2014).

The ingestion of drugs causes several impairing effects on the human body when taken in excess of the recommended therapeutic dose; most notably, drugs affect the central nervous system and brain functions (American Psychological Association, 2022). In order to identify and detect drivers under the influence of drugs, law enforcement officers use the 12-step DRE protocol (International Association of Chiefs of Police [IACP], 2018c). The 12-step drug influence evaluation process became known as the Drug Recognition Expert (DRE) protocol (Beirness & Porath, 2019; Porath-Waller & Beirness, 2010; Talpins et al., 2018). DREs are trained in recognizing the signs and symptoms associated with seven drug categories of central

nervous system depressants, central nervous system stimulants, hallucinogens, dissociative anesthetics, narcotic analgesics, inhalants, and cannabis (International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021). After the evaluation is completed, DREs develop an opinion based on the signs and symptoms exhibited by participants. DREs will then classify which of the seven-drug category or categories is currently psychoactive during the evaluation (International Association of Chiefs of Police [IACP], 2018c; Porath-Waller et al., 2021).

Several validation studies were conducted in the 1980s and early 1990s to give creditability to the DECP (Bigelow et al., 1985; Compton, 1986; Alder & Burns, 1994). From 2000 to 2015, researchers examined how drugs affected the human body and compared these results with the DECP curriculum for validation (Bramness et al., 2003; Bramness et al., 2009; Declues et al., 2018; Downey et al., 2015; Hartman et al., 2016; Heishman et al., 1998; Khiabani et al., 2007; Perry et al., 2015; Silber et al., 2005). In addition, research has been completed on the DECP in Canada, examining the accuracy rates of DRE opinions, but data is lacking for the United States. This literature review provided an overview of drug use in society and the history of the DECP. It also identified the DECP systematic and standardized evaluation process and the seven drug categories that are known to impair individuals. This literature review served as a foundation for this study's design, data collection, and analysis portions.

CHAPTER THREE: METHODS

Overview

The purpose of this study was to evaluate the drug evaluation and classification program (DECP) in Florida to determine the accuracy rates of drug recognition experts (DREs) and determine which core set of measurements (signs and symptoms) from the Drug Influence Evaluation (DIE) face sheets correspond to each of the seven drug categories, and to determine if any common themes or indicators from the DIEs are identified with the inaccuracies of DRE opinions. This chapter presents the methodological issues and procedures of the study. First, the research design, research questions, and hypotheses are presented. Next, the study setting, instrumentation, and procedures are described. Finally, the data analysis approach is outlined.

Design

This study was a quantitative cross-sectional descriptive and predictive examination of Florida's DECP. The purpose of a cross-sectional design is to perform a descriptive or inferential analysis of observations from a single period of time (Rezigalla, 2020). This type of design is the most appropriate choice for this study because the purpose of the study was to examine drug influence evaluations performed in Florida in a single year (2019). Cross-sectional research can be further classified as descriptive when the study involves determining the rate or prevalence of an outcome (Rezigalla, 2020). A portion of this study was considered descriptive because one goal of the study was to determine the accuracy rate of DRE opinions in Florida. This study also was considered predictive because the study was to determine which measures from the drug influence evaluations are related to (i.e., predictive of) toxicology results and DRE opinions. Predictive designs are appropriate to use when a goal of the study is to examine if an outcome can be determined by a set of variables or measures (Howell, 2013).

Research Questions

RQ1: *What is the accuracy rate of DRE opinions compared to the toxicology results for drug influence evaluations completed by DREs in Florida during 2019?*

RQ2: *What set of measures (signs and symptoms) from the drug influence evaluations that completed by DREs in Florida during 2019 significantly predict the drug categories?*

RQ3: *Among the inaccurate drug influence evaluations (missed opinions) completed by DREs in Florida during 2019, what set of measures (signs and symptoms) significantly predict the drug categories inaccurately determined by the DREs?*

Hypotheses

$H_0$1: The accuracy rate of DRE opinions for drug influence evaluations completed by DREs in Florida during 2019 will not be significantly different from accuracy rates found in previous studies.

H_a1: The accuracy rate of DRE opinions for drug influence evaluations completed by DREs in Florida during 2019 will be significantly different from accuracy rates found in previous studies.

$H_0$2: No set of measures (signs and symptoms) from the drug influence evaluations completed by DREs in Florida during 2019 significantly predict the drug categories determined by toxicology results.

H_a2: A set of measures (signs and symptoms) from the drug influence evaluations completed by DREs in Florida during 2019 significantly predict the drug categories determined by toxicology results.

$H_0$3: No set of measures (signs and symptoms) significantly predict the drug categories inaccurately determined by the DREs in Florida during 2019.

H_a3: No set of measures (signs and symptoms) significantly predict the drug categories inaccurately determined by the DREs in Florida during 2019.

Participants and Setting

The population for this study was comprised of the enforcement drug influence evaluation and toxicological results for 2019 in the state of Florida. The DECP comprises of DREs who conduct a standardized and systematic 12-step protocol evaluation of subjects suspected to be under the influence of drugs. The DIEs are documented on a DIE face sheet and transferred to a national database maintained by the International Association Chiefs of Police (IACP) and the National Highway Traffic and Safety Administration (NHTSA). The DIEs and toxicological results are maintained in the IACP-NHTSA DRE database and are available due to Florida's public information requirements. Therefore, DRE enforcement DIEs with corresponding toxicological results were obtained for the purpose of this study.

According to the IACP-NHTSA database (2021), a total of 1,480 DIEs were completed in 2019. Of the 1,480 DIEs completed, 986 are considered to be enforcement evaluations. Enforcement evaluations are conducted in the field when an officer has arrested a subject for DUI, and the alcohol breath test does not correspond to the subject's level of impairment. The remaining DIEs are considered to be training evaluations and were excluded from this study.

A target sample size calculation was conducted using G*Power 3.1.9.6 (Faul et al., 2020). The calculation was conducted for a logistic regression analysis assuming a medium effect size, a power level of .80, and an alpha level of .05 based on the recommendations of Cohen (1988). Lipsy & Hurley (1998) recommended an odds ratio of 1.72 as an appropriate medium effect size in a logistic regression. The results of the sample size calculation using these parameters was that 177 cases were needed for analysis.

Instrumentation

Two primary sources of research documents were used in this study: the DIE face sheets and corresponding toxicological results. The first research source used for this study was the DECP drug influence evaluation form. The drug influence evaluation was documented on a DIE face sheet which consists of the possibility for over one-hundred data points. The evaluation included basic information about the incident and person who was examined (i.e., age, gender, race, type of crash, date, and time of the evaluation), breath test results, health and physiological information (i.e., whether the person has eaten or drank that day, the last time the person has slept, whether the person is sick or injured, whether the person is diabetic or epileptic, has physical disabilities, is under the care of a doctor, or is taking medications), and attitude. The evaluation also included several observations and tests such as eye examinations, divided attention tests (modified Romberg balance, walk and turn, one leg stand, and finger to nose), vital signs, pupil size, muscle tone, injection sites, and other notes and observations. At the end of the evaluation, the DRE provided an opinion about what drug category or categories the subject was under the influence of at the time of the evaluation. The DRE opinion options are rule out (no impairment), medical rule out, alcohol, CNS depressant, CNS stimulant, hallucinogen, dissociative anesthetic, narcotic analgesic, inhalant, and cannabis. The DIE face sheet is used by all certified DREs across the nation and is a standardized form for the documentation of the DRE 12-step protocol (International Association of Chiefs of Police [IACP], 2018c).

The second research source used for this study was the toxicological results self-reported to the IACP-NHTSA DRE database for the corresponding DIE face sheets. A toxicological examination is the last step in the 12-step DRE protocol. Either the arresting officer or the DRE supervises the collection of the biological sample to ensure collection procedures follow Florida

Department of Law Enforcement (FDLE) *Crime Laboratory Evidence Submission Manual* (2021). Blood sample collections follow Florida Administrative Code 11D-8, which defines which professionals are qualified to collect a blood sample for analysis. Whole blood samples can be collected up to twenty-four hours after an incident utilizing an FDLE-approved evidence collection kit (Florida Department of Law Enforcement [FDLE], 2021). Urine samples can be collected up to 72 hours after the incident because detecting drugs in urine is longer than in blood (Florida Department of Law Enforcement [FDLE], 2021). Biological samples collected from subjects are then transported to an FDLE laboratory for testing. Toxicologists will only analyze the biological samples for drugs controlled under Florida Statute 893. The commonly abused drugs FDLE laboratories analyze for are amphetamines, methamphetamine, ecstasy, barbiturates, benzodiazepines, carisoprodol, cocaine, methadone, heroin, oxycodone, codeine, morphine, hydrocodone, and Tetrahydrocannabinols. Over-the-counter medications and many prescription medications are not routinely included in drug analysis (Florida Department of Law Enforcement [FDLE], 2021).

Procedures

A sample of DRE DIE face sheets were collected on suspected drug-impaired drivers in the state of Florida during 2019. The DIEs contained over one-hundred data points documented by DREs while performing evaluations. DREs documented the evaluations on DIE face sheets and are entered into a national database with corresponding toxicology results. IACP is the custodian agency for the DRE national database. In addition, every state is assigned a DECP State Coordinator as a point of contact and administrator of the DECP. Employed by the University of North Florida, Tim Cornelius is the State of Florida DECP State Coordinator for IACP and NHTSA.

Florida law requires any documents produced by a law enforcement agency to be available to the public upon request. Florida State Statutes define *public records* as

> all documents, papers, letters, maps, books, tapes, photographs, films, sound recordings, data processing software, or other material, regardless of the physical form, characteristics, or means of transmission, made or received pursuant to law or ordinance or in connection with the transaction of official business by any agency (Section 119.011-12, F.S.).

The DIE face sheets and the information contained in the IACP database are subject to Florida's public record laws. The data for this study was collected by making a public records request to the custodian of the IACP database. The request was for all enforcement DIE face sheets and corresponding toxicological results. The DIE face sheets were redacted to eliminate any identifying data of subjects being evaluated except for the age and gender.

DREs enter into the database enforcement evaluations conducted in the field by trained DREs on individuals who have been arrested for suspected drug-impaired driving offenses. DREs also enter into the database training evaluations that occur across the state at various times in order for DREs to stay current with the standardized and systematic 12-step DRE protocol for evaluations. Training evaluations were excluded from this study due to the evaluations not occurring in the field and are under strict supervision by a DRE instructor.

IACP DRE database was changed in 2020, and evaluations after 2020 are being entered into the program with the one-hundred data points documented on the DIE face sheets and DRE narratives. The database currently only contains information on the DRE opinions and toxicology results for cases prior to 2020. Mr. Cornelius recommended that an email be sent to all active certified DREs that conducted evaluations in 2019 and request the DIE face sheets for

enforcement evaluations. DREs also maintain an active "rolling log," which contains information on drug influence evaluations conducted by each DRE. The rolling log contains the case number, DRE evaluation log number, enforcement or training type, DRE opinion, and toxicological results. An email was sent to the DREs requesting a copy of the rolling log in order to identify the toxicological results.

After receiving the requested DIE face sheets and toxicological results, an exclusion sorting of the information was conducted to determine which evaluations were excluded from the study. Exclusion for evaluations included cases with no corresponding toxicological results, cases where the subject refused to continue participation in the evaluation, medical rule-out cases, and alcohol-only cases. The DIE face sheets (Appendix A) were then coded using the drug influence evaluation coding instrument (Appendix C). Dr. Porath-Waller developed and used the coding instrument in several research studies on the DECP over the past ten years (Porath-Waller et al., 2009; Porath-Waller & Beirness, 2010; Porath & Beirness, 2019; Porath-Waller et al., 2021). The foundational coding instrument provided by Dr. Porath-Waller was adjusted to include additional variables documented on the DIE face sheets to provide an accurate coding instrument for the study.

Data Analysis

Research Question 1

Research Question 1 asks: What is the accuracy rate of DRE opinions compared to the toxicology results for drug influence evaluations completed by DREs in Florida during 2019? To answer this research question, accuracy rates were computed from the DRE opinions and toxicology results, and the rates were reported.

Beirness et al. (2007) conducted a critical review of primary source laboratory and field validation studies of Bigelow et al. (1985), Compton (1986), Preusser et al. (1992), Hardin et al.

(1993), Adler & Burns (1994), Heishman et al. (1998), Smith et al. (2002), and Shinar & Schechtman (2005). Beirness et al. (2007) identified that the previous studies all attempted to determine the degree of correspondence between the opinion of the DRE and the actual use of drugs. Each study examined by Beirness et al. (2007) used different measurements to indicate the criteria for matches or confirmations of DRE opinions and toxicological results. Beirness et al. (2007) developed a standard set of measures based on comparing DRE opinions and toxicology results. This study utilized Beirness et al. (2007) model of standard psychometric measures to analyze the accuracy rates of DRE opinions compared to toxicology results for the drug influence evaluations obtained from Florida for 2019.

Beirness et al. (2007; 2009) model of standard psychometric measures contains six measures: sensitivity, specificity, false alarm rate, miss rate, corroboration rate, and overall accuracy. Beirness et al. (2007) added additional measures (corroboration rate and overall accuracy) to the standard psychometric measures used by previous researchers and the medical environment. Beirness et al. (2007) identify four types of measurement units: true-positive, true-negative, false-positive, and false-negative. True positives (T.P.) are the number of drug-positive cases correctly identified by DREs. True negatives (T.N.) are the number of drug-negative cases correctly identified by DREs. A false positive (F.P.) and false-negative (F.N.) are the numbers of drug positive or negative cases not correctly identified by DREs.

Sensitivity is also known as the hit rate or true positive and refers to a number of drug-positive cases identified by DREs. "This measure is defined as the number of drug-positive cases correctly identified by the DRE (T.P.) divided by the total number of drug-positive cases identified by the toxicology (TP+FN)" (Beirness et al., 2007, p. 369). The next measure is specificity, also known as the correct rejection rate, refers to the number of drug-negative cases

identified by DREs. "The number of cases the DRE specifies as being drug negative (T.N.) divided by the total number of drug negative cases identified by toxicology (TN+FP)" (Beirness et al., 2007, p. 369). False alarm rate is the next measure in Beirness et al. (2007; 2009) model and is the proportion of all true drug-negative cases where the DRE opinioned the subject was impaired (FP+TN).

The miss rate "is the proportion of all drug positive cases that are judged by the DRE to be drug free and is represented by (FN/TP+FN)" (Beirness et al., 2007, p. 369). The fifth measure identified by Beirness et al. (2007) is corroboration rate or positive detection rate and is defined as "the proportion of all persons identified by DRE procedure as being under the influence of a given substance that are subsequently confirmed by the toxicology as being correctly identified" (p. 370). The corroboration rate is T.P./(TP+FP). The corroboration rate is what most legal representatives in the criminal justice court system reference when examining validation studies. The last measure is overall accuracy and is "the proportion of all cases that are either correct or correct rejections (TP+TN)/(TP+FP+TN+FN)" (Beirness et al., 2007, p. 370).

The conclusion of Beirness et al. (2007) study of previous research studies indicated the DECP reported the overall accuracy of DRE evaluations was appropriately 80%. Beirness et al. (2009) conducted an additional study in Canada, examining 1,349 drug influence evaluations and determining the overall accuracy rates of Canadian DRE evaluations was appropriately 95% (Beirness et al.., 2009). Beirness et al. (2007) standard psychometric measure model has been used by various researchers when analyzing the DECP (Porath-Waller et al., 2021). This study examined the sensitivity, specificity, false alarm rate, miss rate, corroboration rate and overall accuracy of the drug influence evaluations completed in Florida for 2019. Each accuracy measure was reported, and *z*-tests of proportions were performed to test the null hypothesis ($H_0 1$)

and determine if the overall accuracy in Florida for 2019 is similar to the overall accuracy found in previous studies.

Research Question 2

Research Question 2 asks: What set of measures (signs and symptoms) from the drug influence evaluations completed by DREs in Florida during 2019 significantly predict the drug categories determined by toxicology results? To answer this research question, a binary logistic regression analysis was performed. Binary logistic regression is appropriate to perform when the aim of the analysis is to determine if a set of variables significantly predict membership in a category (Field, 2017). In this analysis, the goal was to use measures from the DIE face sheets to predict the drug category determined by the toxicology results. Therefore, the dependent (criterion) variable in the analysis was the drug category determined by the toxicology results. The independent (predictor) variables were the signs and symptoms documented on the DIE face sheets.

Due to the large number of variables available from the DIE face sheets, a stepwise method was used to select the variables to include in the final regression model. In a stepwise selection method, variables are entered (or removed) from the model based on their level of statistical significance (e.g., significant predictors are added or non-significant predictors are removed). For this analysis, the forward entry method was used, meaning that at each step, the most significant predictor from the list of possible predictors were added to the model. Predictors continued to be added until there were no predictors remaining that contribute significantly to the model. The level of significance (alpha) used for this procedure was .05. If the forward entry procedure selected one or more measures as contributing significantly to the prediction of drug

category, then the null hypothesis ($H_0$2) may be rejected. The odds ratio was reported as a measure of effect size for each significant predictor in the model.

Research Question 3

Research Question 3 asks: Among the inaccurate drug influence evaluations (missed opinions) completed by DREs in Florida during 2019, what set of measures (signs and symptoms) significantly predict the drug categories inaccurately determined by the DREs? To answer this research question, another binary logistic regression analysis was performed. In this analysis, the goal was to use the measures from the DIE face sheets to predict the drug category opinion of the DREs among cases in which the DRE opinion was inaccurate based on the toxicology results. Therefore, only cases with missed DRE opinions were included in this analysis. The dependent (criterion) variable in the analysis was the drug category opinion of the DRE. The independent (predictor) variables were the signs and symptoms documented on the DIE face sheets. As with the previous analysis, the forward entry method was used to select the predictor variables, meaning that at each step, the most significant predictor from the list of possible predictors were added to the model. Predictors continued to be added until there were no predictors remaining that contributed significantly to the model. The level of significance (alpha) used for this procedure was .05. If the forward entry procedure selected one or more measures as contributing significantly to the prediction of drug category opinion, then the null hypothesis ($H_0$3) may be rejected. The odds ratio was reported as a measure of effect size for each significant predictor in the model.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this study was to evaluate the drug evaluation and classification program (DECP) in Florida to determine the accuracy rates of drug recognition experts (DREs) and determine which core set of measurements (signs and symptoms) from the Drug Influence Evaluation (DIE) face sheets correspond to each of the seven drug categories, and to determine if any common themes or indicators from the DIEs are identified with the inaccuracies of DRE opinions. This chapter presents a description of the collected data and the analyses performed on the data to answer the research questions. The research questions and hypotheses are as follows:

RQ1: *What is the accuracy rate of DRE opinions compared to the toxicology results for drug influence evaluations completed by DREs in Florida during 2019?*

$H_0$1: The accuracy rate of DRE opinions for drug influence evaluations completed by DREs in Florida during 2019 will not be significantly different from accuracy rates found in previous studies.

H_a1: The accuracy rate of DRE opinions for drug influence evaluations completed by DREs in Florida during 2019 will be significantly different from accuracy rates found in previous studies.

RQ2: *What set of measures (signs and symptoms) from the drug influence evaluations that completed by DREs in Florida during 2019 significantly predict the drug categories?*

$H_0$2: No set of measures (signs and symptoms) from the drug influence evaluations completed by DREs in Florida during 2019 significantly predict the drug categories determined by toxicology results.

H_a2: A set of measures (signs and symptoms) from the drug influence evaluations completed by DREs in Florida during 2019 significantly predict the drug categories determined by toxicology results.

RQ3: *Among the inaccurate drug influence evaluations (missed opinions) completed by DREs in Florida during 2019, what set of measures (signs and symptoms) significantly predict the drug categories inaccurately determined by the DREs?*

H_03: No set of measures (signs and symptoms) significantly predict the drug categories inaccurately determined by the DREs in Florida during 2019.

H_a3: No set of measures (signs and symptoms) significantly predict the drug categories inaccurately determined by the DREs in Florida during 2019.

Descriptive Statistics

A total of 236 DRE face sheets were collected for this study. Twenty-two face sheets were excluded because the subjects refused to provide a toxicological sample. An additional nine face sheets were excluded because the DRE called a medical impairment. Finally, 10 additional face sheets were excluded because they were incomplete. A final total of 195 face sheets were entered into an SPSS data file and included in the analysis.

Table 1 displays frequencies and percentages for the active drug categories identified based on the DRE opinion and toxicology results across the 195 cases. In 59% of the cases, a single active drug category was identified, with the most prevalent category being cannabis (n = 51, 26%). In approximately 29% of the cases, more than one active drug category was identified, with the most prevalent combination being CNS depressant and cannabis (n = 20, 10%). No active drug was identified in approximately 12% of the cases (n = 23).

Table 1

Active Drug Categories Identified Based on DRE Opinion and Toxicology Results

Drug Category	Frequency	Percent
No Drug Found	23	11.8
CNS Depressant	22	11.3
CNS Stimulant	20	10.3
Narcotic Analgesic	23	11.8
Cannabis	51	26.2
CNS Stimulant/Narcotic Analgesic	5	2.6
CNS Depressant/Narcotic Analgesic	9	4.6
CNS Depressant/CNS Stimulant	8	4.1
Narcotic Analgesic/Cannabis	6	3.1
CNS Stimulant/Cannabis	3	1.5
CNS Depressant/Cannabis	20	10.3
CNS Depressant/CNS Stimulant/Cannabis	4	2.1
CNS Depressant/CNS Stimulant/Narcotic Analgesic/Cannabis	1	0.5

Characteristics

Table 2 displays characteristics of the study data. The ages of the subjects ranged from 18 to 86 years (M = 36.06, SD = 14.07). Most subjects were men (n = 133, 68.2%), and 79% of the subjects (n = 154) were identified as White. Approximately 80.5% of the cases involved no crash, but the most common type of crash was property (n = 32, 16.4%). A large majority of the chemical tests were urine tests (n = 185, 94.9%).

Table 2

Data Characteristics

Characteristic	Frequency	Percent
Gender		
Male	133	68.2
Female	62	31.8
Race		
White	154	79.0
Black	33	16.9
Hispanic	7	3.6

Other	1	0.5
Type of Crash		
None	157	80.5
Fatal	2	1.0
Injury	4	2.1
Property	32	16.4
Chemical Test		
Urine	185	94.9
Blood	10	5.1

Results

Hypothesis 1

The focus of Hypothesis 1 was the accuracy rate of DRE opinions compared to the toxicology results. To answer the research question and test the hypothesis, measures of accuracy were computed. In order to compute the accuracy measures, each case was classified as either a true positive, true negative, false positive, or false negative. The DRE opinion was considered correct (true positive) if the DRE called one or two drug categories and the toxicology result contained at least one of the called categories. If the DRE called three or more drug categories, the opinion was considered correct if the toxicology result contained at least two of the called categories. The DRE opinion was also considered correct if the DRE called no drug categories and no drugs were found in the toxicology result (i.e., true negative) (International Association of Chiefs of Police [IACP], 2018c; Smith et al., 2002). Table 3 presents the number of true positives, true negatives, false positives, and false negatives observed in the data.

Table 3

Count of True Positives, True Negatives, False Positives, and False Negatives

Result	Count
True positive	167
True negative	5

False positive	17
False negative	6

There were 172 correct opinions and 23 missed opinions, resulting in an overall accuracy rate of approximately 88%. The overall accuracy in this study is higher than the 80% reported by Beirness et al. (2007) but lower than the 95% found in 1,349 Canadian DRE evaluations (Beirness et al., 2009). A *z*-test of proportions shows that the accuracy rate in this study was significantly lower than the Canadian study ($z = -3.80$, $p < .001$); therefore, the null hypothesis that the accuracy rate would be similar to previous studies may be rejected.

In addition to overall accuracy, other measures of accuracy were computed. The sensitivity was approximately 97%. The specificity was approximately 23%. The false alarm rate was approximately 77%. The miss rate was approximately 3%. Finally, the corroboration rate was approximately 91%.

Hypothesis 2

The focus of Hypothesis 2 was determining what set of measures (signs and symptoms) from the face sheet significantly predict the active drug categories. To answer the research question and test the hypothesis, logistic regression models were performed. Due to the low frequencies of specific combinations of active drug categories, binary logistic regressions were performed to predict each active drug category observed in the data (CNS depressant, CNS stimulant, narcotic analgesic, and cannabis). A logistic regression was performed for each drug category with the outcome being coded as 1 if the drug category was active and 0 if the drug category was not active. Before conducting each regression, bivariate tests (i.e., chi-square tests) were performed to determine which factors from the face sheets were significantly associated with the drug category and to test the assumption of adequate expected frequencies. Factors

significantly associated with the drug category at alpha = .05 in the bivariate tests were considered for inclusion in the regression model. Factors with more than 20% of cells with expected frequencies less than five were excluded from the regression model (Porath-Waller & Beirness, 2010; Porath-Waller et al., 2021). Included factors were entered into the regression using a forward (conditional) stepwise procedure to select the factors that contribute most significantly to the prediction of the drug category.

CNS Depressants

Table 4 displays crosstabulations of each factor with the identification of CNS depressant as an active drug category. Factors significantly associated with CNS depressants were abnormal speech, bloodshot eye appearance, lack of smooth pursuit and maximum deviation (both eyes), 30 to 45 degree angle of onset (both eyes), vertical gaze nystagmus, putting foot down on right OLS, starting WAT before instructions are finished, stepping off line in WAT1, both pupil size in near total darkness (NTD) was within normal ranges, abnormal reaction to light, below range blood pressure, and flaccid muscle tone.

Table 4

Crosstabulation of Face Sheet Measures with Active CNS Depressant

		CNS Depressant		
Variable	Value	Not Active *n* (%)	Active *n* (%)	Bivariate Test Result
Have you eaten today	Not available	5 (3.8)	0 (0)	χ^2 (2) = 4.19, p = 0.123
	No	25 (19.1)	18 (28.1)	
	Yes	101 (77.1)	46 (71.9)	
Have you drank today	Not available	4 (3.1)	0 (0)	χ^2 (2) = 3.93, p = 0.140
	No	28 (21.4)	20 (31.3)	
	Yes	99 (75.6)	44 (68.8)	
Est. time vs. actual time	Not available	7 (5.3)	5 (7.8)	χ^2 (4) = 1.38, p = 0.847
	10 minutes or less difference	31 (23.7)	11 (17.2)	
	11 to 30 minutes difference	28 (21.4)	14 (21.9)	

	31 to 90 minutes difference	37 (28.2)	19 (29.7)	
	More than 90 minutes difference	28 (21.4)	15 (23.4)	
Duration of last sleep	Not available	10 (7.6)	9 (14.1)	χ^2 (3) = 4.62, p = 0.202
	Less than 4 hours	20 (15.3)	9 (14.1)	
	4 to 8 hours	86 (65.6)	34 (53.1)	
	More than 8 hours	15 (11.5)	12 (18.8)	
Sick or injured	No	97 (74)	47 (73.4)	χ^2 (1) = 0.01, p = 0.928
	Yes	34 (26)	17 (26.6)	
Diabetic or epileptic	Not available	1 (0.8)	0 (0)	χ^2 (2) = 0.56, p = 0.758
	No	125 (95.4)	62 (96.9)	
	Yes	5 (3.8)	2 (3.1)	
Physical disabilities	No	100 (76.3)	43 (67.2)	χ^2 (1) = 1.84, p = 0.175
	Yes	31 (23.7)	21 (32.8)	
Under care of doctor or dentist	Not available	1 (0.8)	0 (0)	χ^2 (2) = 4.74, p = 0.093
	No	85 (64.9)	32 (50)	
	Yes	45 (34.4)	32 (50)	
Taking medications or drugs	Not available	2 (1.5)	0 (0)	χ^2 (2) = 2.01, p = 0.366
	No	37 (28.2)	14 (21.9)	
	Yes	92 (70.2)	50 (78.1)	
Coordination	Fair/good	33 (25.2)	10 (15.6)	χ^2 (1) = 2.29, p = 0.130
	Other	98 (74.8)	54 (84.4)	
Breath	Normal	68 (51.9)	42 (65.6)	χ^2 (1) = 3.29, p = 0.070
	Other	63 (48.1)	22 (34.4)	
Face	Not available	0 (0)	1 (1.6)	χ^2 (2) = 2.07, p = 0.355
	Normal	55 (42)	27 (42.2)	
	Other	76 (58)	36 (56.3)	
Speech	Normal	38 (29)	8 (12.5)	χ^2 (1) = 6.50, p = 0.011
	Other	93 (71)	56 (87.5)	
Eyes appearance	Not available	2 (1.5)	0 (0)	χ^2 (4) = 13.84, p = 0.008
	Normal	22 (16.8)	6 (9.4)	
	Bloodshot	21 (16)	25 (39.1)	
	Watery	24 (18.3)	8 (12.5)	
	Bloodshot and watery	62 (47.3)	25 (39.1)	
Blindness	None	130 (99.2)	64 (100)	χ^2 (1) = 0.49, p = 0.483
	Right eye	1 (0.8)	0 (0)	
Eye tracking stimulus	Equal	130 (99.2)	64 (100)	χ^2 (1) = 0.49, p = 0.483
	Unequal	1 (0.8)	0 (0)	
Ability to follow stimulus	No	7 (5.3)	4 (6.3)	χ^2 (1) = 0.07, p = 0.797
	Yes	124 (94.7)	60 (93.8)	
Eyelids	Not available	1 (0.8)	1 (1.6)	χ^2 (2) = 1.81, p = 0.406
	Normal	40 (30.5)	14 (21.9)	
	Droopy	90 (68.7)	49 (76.6)	

Pulse	Below range	11 (8.4)	11 (17.2)	χ^2 (2) = 5.19, p = 0.075
	Within range	61 (46.6)	33 (51.6)	
	Above range	59 (45)	20 (31.3)	
Left eye lack of smooth pursuit	Unable to perform	1 (0.8)	1 (1.6)	χ^2 (2) = 45.36, p <.001
	No	79 (60.3)	6 (9.4)	
	Yes or present	51 (38.9)	57 (89.1)	
Left eye maximum deviation	Unable to perform	1 (0.8)	1 (1.6)	χ^2 (2) = 54.98, p <.001
	No	84 (64.1)	5 (7.8)	
	Yes or present	46 (35.1)	58 (90.6)	
Eye angle of onset	Unable to Perform	1 (0.8)	1 (1.6)	χ^2 (3) = 50.24, p <.001
	Not present	90 (68.7)	10 (15.6)	
	30 to 45 Degrees	40 (30.5)	51 (79.7)	
	Immediate on-set	0 (0)	2 (3.1)	
Right eye lack of smooth pursuit	Unable to perform	1 (0.8)	1 (1.6)	χ^2(2) = 45.36, p <.001
	No	79 (60.3)	6 (9.4)	
	Yes or present	51 (38.9)	57 (89.1)	
Right eye maximum deviation	Unable to perform	1 (0.8)	1 (1.6)	χ^2(2) = 54.98, p <.001
	No	84 (64.1)	5 (7.8)	
	Yes or present	46 (35.1)	58 (90.6)	
Vertical gaze nystagmus	No	121 (92.4)	42 (65.6)	χ^2(1) = 22.41, p <.001
	Yes	10 (7.6)	22 (34.4)	
Lack of convergence	Unable to perform	1 (0.8)	0 (0)	χ^2 (2) = 4.77, p = 0.092
	Absent	38 (29)	10 (15.6)	
	Present	92 (70.2)	54 (84.4)	
Completion of one leg stand (left)	Not attempted	6 (4.6)	3 (4.7)	χ^2 (2) = 2.00, p = 0.369
	Attempted but stopped	4 (3.1)	0 (0)	
	Attempted and completed	121 (92.4)	61 (95.3)	
Completion of one leg stand (right)	Not attempted	8 (6.1)	6 (9.4)	χ^2 (2) = 0.99, p = 0.611
	Attempted but stopped	1 (0.8)	1 (1.6)	
	Attempted and completed	122 (93.1)	57 (89.1)	
Left OLS sways while balancing	Not attempted/completed	8 (6.1)	3 (4.7)	χ^2 (2) = 1.72, p = 0.424
	Not present	18 (13.7)	5 (7.8)	
	Present	105 (80.2)	56 (87.5)	
Left OLS uses arms to balance	Not attempted/completed	8 (6.1)	3 (4.7)	χ^2 (2) = 2.10, p = 0.351
	Not present	47 (35.9)	17 (26.6)	
	Present	76 (58)	44 (68.8)	
Left OLS hopping	Not attempted/completed	8 (6.1)	3 (4.7)	χ^2 (2) = 0.16, p = 0.922
	Not present	101 (77.1)	50 (78.1)	
	Present	22 (16.8)	11 (17.2)	
Left OLS puts foot down	Not attempted/completed	8 (6.1)	3 (4.7)	χ^2 (3) = 4.74, p = 0.192

	0	52 (39.7)	16 (25)	
	1	38 (29)	25 (39.1)	
	More than 2	33 (25.2)	20 (31.3)	
Left OLS time	Not attempted/completed	18 (13.7)	8 (12.5)	χ^2 (3) = 1.08, p = 0.781
	0-14	27 (20.6)	16 (25)	
	15-29	79 (60.3)	35 (54.7)	
	30 or more	7 (5.3)	5 (7.8)	
Right OLS sways while balancing	Not attempted/completed	9 (6.9)	6 (9.4)	
	Not present	25 (19.1)	6 (9.4)	χ^2 (2) = 3.19, p = 0.203
	Present	97 (74)	52 (81.3)	
Right OLS uses arms to balance	Not attempted/completed	9 (6.9)	6 (9.4)	
	Not present	42 (32.1)	18 (28.1)	χ^2 (2) = 0.58, p = 0.748
	Present	80 (61.1)	40 (62.5)	
Right OLS hopping	Not attempted/completed	9 (6.9)	7 (10.9)	
	Not present	100 (76.3)	44 (68.8)	χ^2 (2) = 1.50, p = 0.473
	Present	22 (16.8)	13 (20.3)	
Right OLS puts foot down	Not attempted/completed	9 (6.9)	6 (9.4)	
	0	54 (41.2)	11 (17.2)	χ^2 (3) = 13.62, p = 0.003
	1	28 (21.4)	26 (40.6)	
	More than 2	40 (30.5)	21 (32.8)	
Right OLS time	Not attempted/completed	18 (13.7)	12 (18.8)	
	0-14	23 (17.6)	15 (23.4)	
	15-29	79 (60.3)	33 (51.6)	χ^2 (3) = 2.29, p = 0.514
	30 or more	11 (8.4)	4 (6.3)	
MRB swaying front to back	0	27 (20.6)	14 (21.9)	
	Less than 2 inches	32 (24.4)	17 (26.6)	
	2 inches or more	72 (55.0)	33 (51.6.1)	χ^2 (2) = 2.03, p = 0.904
MRB swaying left to back	0	33 (25.2)	21 (32.8)	
	Less than 2 inches	30 (22.9)	10 (15.6)	
	2 inches or more	68 (51.9)	33 (51.6)	χ^2 (2) = 2.01, p = 3.66
MRB internal clock	Not attempted/completed	3 (2.3)	0 (0)	
	0-24	40 (30.5)	12 (18.8)	
	25-35	53 (40.5)	26 (40.6)	χ^2 (3) = 6.36, p = 0.095
	36 or higher	35 (26.7)	26 (40.6)	
MRB presence eyelid tremors	No	80 (61.1)	48 (75)	
	Yes	51 (38.9)	16 (25)	χ^2 (1) = 3.70, p = 0.054
MRB presence body or leg tremors	No	102 (77.9)	55 (85.9)	
	Yes	29 (22.1)	9 (14.1)	χ^2 (1) = 1.79, p = 0.181
WAT completion	Not attempted	4 (3.1)	4 (6.3)	

	Attempted but stopped	4 (3.1)	1 (1.6)	χ^2 (2) = 1.46, p = 0.483
	Attempted and completed	123 (93.9)	59 (92.2)	
WAT balance	Not attempted/completed	6 (4.6)	4 (6.3)	
	0	48 (36.6)	14 (21.9)	χ^2 (3) = 6.16, p = 0.104
	1	63 (48.1)	33 (51.6)	
	2 or higher	14 (10.7)	13 (20.3)	
WAT starts early	Not attempted/completed	6 (4.6)	4 (6.3)	
	0	104 (79.4)	38 (59.4)	χ^2 (3) = 9.16, p = 0.027
	1	20 (15.3)	21 (32.8)	
	2 or higher	1 (0.8)	1 (1.6)	
WAT1 stops walking	Not attempted/completed	6 (4.6)	4 (6.3)	
	0	75 (57.3)	30 (46.9)	$X^2(3)$ = 3.32, p = 0.345
	1	30 (22.9)	14 (21.9)	
	2 or higher	20 (15.3)	16 (25)	
WAT1 missed heel to toe	Not attempted/completed	6 (4.6)	4 (6.3)	
	0	58 (44.3)	17 (26.6)	χ^2 (3) = 6.03, p = 0.110
	1	20 (15.3)	15 (23.4)	
	2 or higher	47 (35.9)	28 (43.8)	
WAT1 steps off line	Not attempted/completed	6 (4.6)	4 (6.3)	
	0	73 (55.7)	22 (34.4)	χ^2 (3) = 8.91, p = 0.031
	1	30 (22.9)	18 (28.1)	
	2 or higher	22 (16.8)	20 (31.3)	
WAT1 raised arms	Not attempted/completed	6 (4.6)	4 (6.3)	
	0	53 (40.5)	19 (29.7)	χ^2 (3) = 2.81, p = 0.421
	1	37 (28.2)	18 (28.1)	
	2 or higher	35 (26.7)	23 (35.9)	
WAT1 steps	Not attempted/completed	6 (4.6)	4 (6.3)	
	Less than 9	19 (14.5)	7 (10.9)	χ^2 (3) = 3.13, p = 0.372
	9	84 (64.1)	36 (56.3)	
	More than 9	22 (16.8)	17 (26.6)	
WAT turn	Not attempted/completed	13 (9.9)	7 (11.1)	
	Proper turn	36 (27.5)	14 (22.2)	χ^2 (2) = 0.63, p = 0.732
	Improper turn	82 (62.6)	42 (66.7)	
WAT2 stops walking	Not attempted/completed	9 (6.9)	5 (7.8)	
	0	80 (61.1)	34 (53.1)	χ^2 (3) = 1.26, p = 0.738
	1	27 (20.6)	15 (23.4)	
	2 or higher	15 (11.5)	10 (15.6)	
WAT2 missed heel to toe	Not attempted/completed	9 (6.9)	5 (7.8)	
	0	48 (36.6)	18 (28.1)	χ^2 (3) = 1.45, p = 0.695
	1	25 (19.1)	13 (20.3)	
	2 or higher	49 (37.4)	28 (43.8)	
WAT2 steps off line	Not attempted/completed	9 (6.9)	5 (7.8)	
	0	76 (58.0)	29 (45.3)	χ^2 (3) = 5.30, p = 0.151
	1	28 (21.4)	13 (20.3)	

	2 or higher	18 (13.7)	17 (26.6)	
WAT2 raised arms	Not attempted/completed	9 (6.9)	5 (7.8)	
	0	52 (39.7)	23 (35.9)	χ^2 (3) = 4.53, p = 0.209
	1	38 (29)	12 (18.8)	
	2 or higher	32 (24.4)	24 (37.5)	
WAT2 steps	Not attempted/completed	9 (6.9)	5 (7.8)	
	Less than 9	10 (7.6)	3 (4.7)	χ^2 (3) = 3.87, p = 0.275
	9	90 (68.7)	38 (59.4)	
	More than 9	22 (16.8)	18 (28.1)	
FTN hit count	Not attempted	6 (4.6)	3 (4.7)	
	0	51 (38.9)	27 (42.2)	χ^2 (7) = 7.76, p = 0.355
	1	12 (9.2)	11 (17.2)	
	2	16 (12.2)	9 (14.1)	
	3	15 (11.5)	5 (7.8)	
	4	8 (6.1)	3 (4.7)	
	5	9 (6.9)	0 (0)	
	6	14 (10.7)	6 (9.4)	
FTN used pad	Not available	5 (3.8)	3 (4.7)	
	No	62 (47.3)	31 (48.4)	χ^2 (2) = 0.13, p = 0.939
	Yes	64 (48.9)	30 (46.9)	
FTN used wrong hand	Not available	5 (3.8)	3 (4.7)	
	No	115 (87.8)	53 (82.8)	χ^2 (2) = 0.95, p = 0.623
	Yes	11 (8.4)	8 (12.5)	
FTN does not return arm to side	Not available	5 (3.8)	3 (4.7)	
	No	97 (74)	50 (78.1)	χ^2 (2) = 0.69, p = 0.709
	Yes	29 (22.1)	11 (17.2)	
FTN swaying	Not available	5 (3.8)	2 (3.1)	
	No	106 (80.9)	51 (79.7)	χ^2 (2) = 0.17, p = 0.921
	Yes	20 (15.3)	11 (17.2)	
FTN eyelid tremors	Not available	5 (3.8)	3 (4.7)	
	No	96 (73.3)	49 (76.6)	χ^2 (2) = 0.49, p = 0.784
	Yes	30 (22.9)	12 (18.8)	
FTN body tremors	Not available	5 (3.8)	3 (4.7)	
	No	111 (84.7)	57 (89.1)	χ^2 (2) = 1.37, p = 0.505
	Yes	15 (11.5)	4 (6.3)	
FTN does not keep eyes closed	Not available	5 (3.8)	3 (4.7)	
	No	122 (93.1)	59 (92.2)	χ^2 (2) = 0.08, p = 0.959
	Yes	4 (3.1)	2 (3.1)	
Left pupil size RL	Not available	1 (0.8)	0 (0)	
	Below range	16 (12.2)	3 (4.7)	χ^2 (3) = 3.36, p = 0.340
	Within range	94 (71.8)	51 (79.7)	
	Above range	20 (15.3)	10 (15.6)	
Left pupil size NTD	Not available	2 (1.5)	0 (0)	

	Below range	40 (30.5)	9 (14.1)	χ^2 (3) = 8.33, p = 0.040
	Within range	83 (63.4)	49 (76.6)	
	Above range	6 (4.6)	6 (9.4)	
Left pupil size DL1	Not available	1 (0.8)	0 (0)	
	Below range	13 (9.9)	1 (1.6)	χ^2 (3) = 6.18, p = 0.103
	Within range	104 (79.4)	59 (92.2)	
	Above range	13 (9.9)	4 (6.3)	
Left pupil size DL2	Not available	94 (71.8)	55 (85.9)	
	Within range	30 (22.9)	7 (10.9)	χ^2 (2) = 4.83, p = 0.089
	Above range	7 (5.3)	2 (3.1)	
Right pupil size RL	Not available	2 (1.5)	0 (0)	
	Below range	16 (12.2)	3 (4.7)	χ^2 (3) = 4.01, p = 0.261
	Within range	92 (70.2)	51 (79.7)	
	Above range	21 (16)	10 (15.6)	
Right pupil size NTD	Not available	3 (2.3)	0 (0)	
	Below range	40 (30.5)	9 (14.1)	χ^2 (3) = 8.19, p = 0.042
	Within range	79 (60.3)	49 (76.6)	
	Above range	9 (6.9)	6 (9.4)	
Right pupil size DL1	Not available	2 (1.5)	0 (0)	
	Below range	13 (9.9)	1 (1.6)	χ^2 (3) = 6.78, p = 0.079
	Within range	103 (78.6)	59 (92.2)	
	Above range	13 (9.9)	4 (6.3)	
Right pupil size DL2	Not available	94 (71.8)	55 (85.9)	
	Within range	30 (22.9)	7 (10.9)	χ^2 (2) = 4.83, p = 0.089
	Above range	7 (5.3)	2 (3.1)	
Rebound dilation	No	89 (67.9)	50 (78.1)	
	Yes	42 (32.1)	14 (21.9)	χ^2 (1) = 2.18, p = 0.140
Reaction to light	Not available	3 (2.3)	0 (0)	
	Normal	54 (41.2)	21 (32.8)	χ^2 (3) = 10.00, p = 0.019
	Slow	52 (39.7)	39 (60.9)	
	Little to none	22 (16.8)	4 (6.3)	
Nasal area	Not available	1 (0.8)	0 (0)	
	Clear/normal	90 (68.7)	46 (71.9)	χ^2 (2) = 0.64, p = 0.728
	Other	40 (30.5)	18 (28.1)	
Oral cavity	Clear/normal	47 (35.9)	31 (48.4)	
	Other	84 (64.1)	33 (51.6)	χ^2 (1) = 2.83, p = 0.093
Left arm injection sites	None	108 (82.4)	51 (79.7)	
	Old	11 (8.4)	4 (6.3)	χ^2 (3) = 2.13, p = 0.546
	Fresh	11 (8.4)	9 (14.1)	
	Both	1 (0.8)	0 (0)	
Right arm injection sites	None	111 (84.7)	58 (90.6)	
	Old	10 (7.6)	3 (4.7)	χ^2 (3) = 1.55, p = 0.670
	Fresh	9 (6.9)	3 (4.7)	
	Both	1 (0.8)	0 (0)	

BP systolic	Not available	1 (0.8)	0 (0)	
	Below range	24 (18.3)	22 (34.4)	χ^2 (3) = 9.39, p = 0.025
	Within range	59 (45)	30 (46.9)	
	Above range	47 (35.9)	12 (18.8)	
BP diastolic	Not available	1 (0.8)	0 (0)	
	Below range	11 (8.4)	16 (25)	χ^2 (3) = 13.00, p = 0.005
	Within range	87 (66.4)	41 (64.1)	
	Above range	32 (24.4)	7 (10.9)	
Body temperature	Not available	0 (0)	3 (4.7)	
	Below range	57 (43.5)	31 (48.4)	χ^2 (3) = 7.15, p = 0.067
	Within range	71 (54.2)	29 (45.3)	
	Above range	3 (2.3)	1 (1.6)	
Muscle tone	Not available	1 (0.8)	0 (0)	
	Normal	65 (49.6)	22 (34.4)	χ^2 (3) = 8.87, p = 0.031
	Flaccid	49 (37.4)	38 (59.4)	
	Rigid	16 (12.2)	4 (6.3)	

The forward stepwise regression procedure selected three predictors, and the model was significant, $\chi^2(8) = 42.02$, $p < .001$, indicating that a set of face sheet measures significantly predicted CNS depressants. Table 5 displays a classification table for the model's predictive effectiveness. The overall prediction accuracy was approximately 74%.

Table 5

Classification Table for Regression Predicting CNS Depressant

	Predicted		
Observed	CNS depressant not active	CNS depressant active	% Correct
CNS depressant not active	117	14	89.3
CNS depressant active	37	27	42.2
Overall % Correct			73.8

Table 6 displays the regression coefficient results for the model predicting CNS depressants. Bloodshot eye appearance (OR = 5.49, $p = .005$), vertical gaze nystagmus (OR = 5.89, $p < .001$), and WAT1 steps off line of 2 or higher (OR = 3.83, $p = .003$) were associated with higher odds of CNS depressant being an active drug category.

Table 6

Coefficients for Regression Predicting CNS Depressant

Variable	*B*	*SE*	Wald	Sig.	OR	95% CI OR Lower	Upper
Eyes appearance [ref: Normal]							
Not available	-19.28	28142.11	0.00	.999	0.00	0.00	.
Bloodshot	1.70	0.60	7.97	.005	5.49	1.68	17.90
Watery	0.27	0.67	0.17	.683	1.31	0.36	4.83
Bloodshot and watery	0.55	0.56	0.96	.326	1.73	0.58	5.18
Vertical gaze nystagmus	1.77	0.46	15.06	< .001	5.89	2.40	14.44
WAT1 steps off line [ref: 0]							
Not attempted/completed	0.93	0.80	1.35	.246	2.54	0.53	12.24
1	0.69	0.44	2.61	.106	2.00	0.86	4.64
2 or higher	1.33	0.56	9.09	.003	3.83	1.59	8.99

Note. The upper bound of the 95% CI for eye appearance not available approaches infinity and is not reported.

CNS Stimulants

Table 7 displays crosstabulations of each factor with the identification of CNS stimulant as an active drug category. Factors significantly associated with CNS stimulants were less ability to follow stimulus, above range pulse, faster MRB internal clock, no MRB eyelid tremors, stopping walking on WAT2, left and right pupil size NTD, no rebound dilation, slow reaction to light, abnormal nasal area, and rigid muscle tone.

Table 7

Crosstabulation of Face Sheet Measures with Active CNS Stimulant

Variable	Value	CNS Stimulant Not Active *n* (%)	CNS Stimulant Active *n* (%)	Bivariate Test Result
Have you eaten today	Not available	5 (3.2)	0 (0)	χ^2 (2) = 1.66, p = 0.436
	No	35 (22.7)	8 (19.5)	
	Yes	114 (74)	33 (80.5)	
Have you drank today	Not available	4 (2.6)	0 (0)	χ^2 (2) = 1.98, p = 0.372
	No	40 (26)	8 (19.5)	
	Yes	110 (71.4)	33 (80.5)	
Est. time vs. actual time	Not available	9 (5.8)	3 (7.3)	χ^2 (4) = 6.29, p = 0.179

	10 minutes or less difference	38 (24.7)	4 (9.8)	
	11 to 30 minutes difference	35 (22.7)	7 (17.1)	
	31 to 90 minutes difference	41 (26.6)	15 (36.6)	
	More than 90 minutes difference	31 (20.1)	12 (29.3)	
Duration of last sleep	Not available	15 (9.7)	4 (9.8)	χ^2 (3) = 3.45, p = 0.327
	Less than 4 hours	25 (16.2)	4 (9.8)	
	4 to 8 hours	96 (62.3)	24 (58.5)	
	More than 8 hours	18 (11.7)	9 (22)	
Sick or injured	No	118 (76.6)	26 (63.4)	χ^2 (1) = 2.93, p = 0.087
	Yes	36 (23.4)	15 (36.6)	
Diabetic or epileptic	Not available	1 (0.6)	0 (0)	χ^2 (2) = 0.47, p = 0.789
	No	147 (95.5)	40 (97.6)	
	Yes	6 (3.9)	1 (2.4)	
Physical disabilities	No	111 (72.1)	32 (78)	χ^2 (1) = 0.59, p = 0.442
	Yes	43 (27.9)	9 (22)	
Under care of doctor or dentist	Not available	1 (0.6)	0 (0)	χ^2 (2) = 0.65, p = 0.721
	No	94 (61)	23 (56.1)	
	Yes	59 (38.3)	18 (43.9)	
Taking medications or drugs	Not available	2 (1.3)	0 (0)	χ^2 (2) = 1.08, p = 0.583
	No	42 (27.3)	9 (22)	
	Yes	110 (71.4)	32 (78)	
Coordination	Fair/good	34 (22.1)	9 (22)	χ^2 (1) = 0.00, p = 0.986
	Other	120 (77.9)	32 (78)	
Breath	Normal	84 (54.5)	26 (63.4)	χ^2 (1) = 1.04, p = 0.309
	Other	70 (45.5)	15 (36.6)	
Face	Not available	1 (0.6)	0 (0)	χ^2 (2) = 1.18, p = 0.556
	Normal	62 (40.3)	20 (48.8)	
	Other	91 (59.1)	21 (51.2)	
Speech	Normal	38 (24.7)	8 (19.5)	χ^2 (1) = 0.48, p = 0.489
	Other	116 (75.3)	33 (80.5)	
Eyes appearance	Not available	2 (1.3)	0 (0)	χ^2 (4) = 0.99, p = 0.911
	Normal	21 (13.6)	7 (17.1)	
	Bloodshot	37 (24)	9 (22)	
	Watery	26 (16.9)	6 (14.6)	
	Bloodshot and watery	68 (44.2)	19 (46.3)	
Blindness	None	154 (100)	40 (97.6)	χ^2 (1) = 3.78, p = 0.052
	Right eye	0 (0)	1 (2.4)	
Eye tracking stimulus	Equal	154 (100)	40 (97.6)	χ^2 (1) = 3.78, p = 0.052
	Unequal	0 (0)	1 (2.4)	
Ability to follow stimulus	No	6 (3.9)	5 (12.2)	χ^2 (1) = 4.19, p = 0.041
	Yes	148 (96.1)	36 (87.8)	

Eyelids	Not available	1 (0.6)	1 (2.4)	χ^2 (2) = 4.60, p = 0.100
	Normal	38 (24.7)	16 (39)	
	Droopy	115 (74.7)	24 (58.5)	
Pulse	Below range	21 (13.6)	1 (2.4)	χ^2 (2) = 6.01, p = 0.049
	Within range	76 (49.4)	18 (43.9)	
	Above range	57 (37)	22 (53.7)	
Left eye lack of smooth pursuit	Unable to perform	2 (1.3)	0 (0)	χ^2 (2) = 1.72, p = 0.423
	No	70 (45.5)	15 (36.6)	
	Yes or present	82 (53.2)	26 (63.4)	
Left eye maximum deviation	Unable to perform	2 (1.3)	0 (0)	χ^2 (2) = 0.64, p = 0.726
	No	71 (46.1)	18 (43.9)	
	Yes or present	81 (52.6)	23 (56.1)	
Eye angle of onset	Unable to Perform	2 (1.3)	0 (0)	χ^2 (3) = 1.36, p = 0.715
	Not present	80 (51.9)	20 (48.8)	
	30 to 45 Degrees	70 (45.5)	21 (51.2)	
	Immediate on-set	2 (1.3)	0 (0)	
Right eye lack of smooth pursuit	Unable to perform	2 (1.3)	0 (0)	χ^2 (2) = 1.72, p = 0.423
	No	70 (45.5)	15 (36.6)	
	Yes or present	82 (53.2)	26 (63.4)	
Right eye maximum deviation	Unable to perform	2 (1.3)	0 (0)	χ^2 (2) = 0.64, p = 0.726
	No	71 (46.1)	18 (43.9)	
	Yes or present	81 (52.6)	23 (56.1)	
Vertical gaze nystagmus	No	130 (84.4)	33 (80.5)	χ^2 (1) = 0.36, p = 0.546
	Yes	24 (15.6)	8 (19.5)	
Lack of convergence	Unable to perform	1 (0.6)	0 (0)	χ^2 (2) = 4.20, p = 0.123
	Absent	33 (21.4)	15 (36.6)	
	Present	120 (77.9)	26 (63.4)	
Completion of one leg stand (left)	Not attempted	6 (3.9)	3 (7.3)	χ^2 (2) = 1.89, p = 0.389
	Attempted but stopped	4 (2.6)	0 (0)	
	Attempted and completed	144 (93.5)	38 (92.7)	
Completion of one leg stand (right)	Not attempted	10 (6.5)	4 (9.8)	χ^2 (2) = 1.58, p = 0.454
	Attempted but stopped	1 (0.6)	1 (2.4)	
	Attempted and completed	143 (92.9)	36 (87.8)	
Left OLS sways while balancing	Not attempted/completed	8 (5.2)	3 (7.3)	χ^2 (2) = 1.19, p = 0.551
	Not present	20 (13)	3 (7.3)	
	Present	126 (81.8)	35 (85.4)	
Left OLS uses arms to balance	Not attempted/completed	8 (5.2)	3 (7.3)	χ^2 (2) = 0.49, p = 0.784
	Not present	52 (33.8)	12 (29.3)	
	Present	94 (61)	26 (63.4)	
Left OLS hopping	Not attempted/completed	8 (5.2)	3 (7.3)	χ^2 (2) = 0.28, p = 0.869

	Not present	120 (77.9)	31 (75.6)	
	Present	26 (16.9)	7 (17.1)	
Left OLS puts foot down	Not attempted/completed	8 (5.2)	3 (7.3)	χ^2 (3) = 1.67, p = 0.644
	0	57 (37)	11 (26.8)	
	1	49 (31.8)	14 (34.1)	
	2 or more	40 (26)	13 (31.7)	
Left OLS time	Not attempted/completed	20 (13)	6 (14.6)	χ^2 (3) = 2.24, p = 0.524
	0-14	31 (20.1)	12 (29.3)	
	15-29	94 (61)	20 (48.8)	
	30 or more	9 (5.8)	3 (7.3)	
Right OLS sways while balancing	Not attempted/completed	11 (7.1)	4 (9.8)	χ^2 (2) = 1.63, p = 0.442
	Not present	27 (17.5)	4 (9.8)	
	Present	116 (75.3)	33 (80.5)	
Right OLS uses arms to balance	Not attempted/completed	11 (7.1)	4 (9.8)	χ^2 (2) = 0.58, p = 0.749
	Not present	49 (31.8)	11 (26.8)	
	Present	94 (61)	26 (63.4)	
Right OLS hopping	Not attempted/completed	12 (7.8)	4 (9.8)	χ^2 (2) = 0.29, p = 0.865
	Not present	115 (74.7)	29 (70.7)	
	Present	27 (17.5)	8 (19.5)	
Right OLS puts foot down	Not attempted/completed	11 (7.1)	4 (9.8)	χ^2 (3) = 1.07, p = 0.784
	0	50 (32.5)	15 (36.6)	
	1	45 (29.2)	9 (22)	
	2 or more	48 (31.2)	13 (31.7)	
Right OLS time	Not attempted/completed	24 (15.6)	6 (14.6)	χ^2 (3) =1.21, p = 0.751
	0-14	28 (18.2)	10 (24.4)	
	15-29	89 (57.8)	23 (56.1)	
	30 or more	13 (8.4)	2 (4.9)	
MRB swaying front to back	None	33 (21.4)	8 (19.5)	χ^2 (2) = .477, p = 0.788
	< 2 inches	37 (24)	12 (29.3)	
	2 inches or more	84 (54.5)	21 (51.2)	
MRB swaying left to right	None	44 (28.6)	10 (24.4)	χ^2 (2) = 1.31, p = 0.521
	< 2 inches	29 (18.8)	11 (26.8)	
	2 inches or more	81 (52.6)	20 (48.8)	
MRB internal clock	Not attempted/completed	2 (1.3)	1 (2.4)	χ^2 (3) = 11.47, p = 0.009
	0-24	33 (21.4)	19 (46.3)	
	25-35	69 (44.8)	10 (24.4)	
	36 or higher	50 (32.5)	11 (26.8)	
MRB presence eyelid tremors	No	93 (60.4)	35 (85.4)	χ^2 (1) = 8.96, p = 0.003
	Yes	61 (39.6)	6 (14.6)	
MRB presence body or leg tremors	No	124 (80.5)	33 (80.5)	χ^2 (1) = 0.00, p = 0.996
	Yes	30 (19.5)	8 (19.5)	

WAT completion	Not attempted	5 (3.2)	3 (7.3)	χ^2 (2) = 1.36, p = 0.506
	Attempted but stopped	4 (2.6)	1 (2.4)	
	Attempted and completed	145 (94.2)	37 (90.2)	
WAT balance	Not attempted/completed	7 (4.5)	3 (7.3)	χ^2 (3) = 0.590, p = 0.899
	0	49 (31.8)	13 (31.7)	
	1	76 (49.4)	20 (48.8)	
	2 or higher	22 (14.3)	5 (12.2)	
WAT starts early	Not attempted/completed	7 (4.5)	3 (7.3)	χ^2 (3) = 2.19, p = 0.533
	0	115 (74.7)	27 (65.9)	
	1	30 (19.5)	11 (26.8)	
	2 or higher	2 (1.3)	0 (0)	
WAT1 stops walking	Not attempted/completed	7 (4.5)	3 (7.3)	χ^2 (3) = 3.21, p = 0.360
	0	86 (55.8)	19 (46.3)	
	1	36 (23.4)	8 (19.5)	
	2 or higher	25 (16.2)	11 (26.8)	
WAT1 missed heel to toe	Not attempted/completed	7 (4.5)	3 (7.3)	χ^2 (3) = 1.57, p = 0.667
	0	62 (40.3)	13 (31.7)	
	1	26 (16.9)	9 (22)	
	2 or higher	59 (38.3)	16 (39)	
WAT1 steps off line	Not attempted/completed	7 (4.5)	3 (7.3)	χ^2 (3) = 5.87, p = 0.118
	0	79 (51.3)	16 (39)	
	1	40 (26)	8 (19.5)	
	2 or higher	28 (18.2)	14 (34.1)	
WAT1 raised arms	Not attempted/completed	7 (4.5)	3 (7.3)	χ^2 (3) = 3.74, p = 0.291
	0	62 (40.3)	10 (24.4)	
	1	42 (27.3)	13 (31.7)	
	2 or higher	43 (27.9)	15 (36.6)	
WAT1 steps	Not attempted/completed	7 (4.5)	3 (7.3)	χ^2 (3) = 2.44, p = 0.486
	<9	18 (11.7)	8 (19.5)	
	9	97 (63)	23 (56.1)	
	>9	32 (20.8)	7 (17.1)	
WAT turn	Not attempted/completed	14 (9.2)	6 (14.6)	χ^2 (2) = 2.63, p = 0.269
	Proper turn	43 (28.1)	7 (17.1)	
	Improper turn	96 (62.7)	28 (68.3)	
WAT2 stops walking	Not attempted/completed	10 (6.5)	4 (9.8)	χ^2 (3) = 8.66, p = 0.034
	0	97 (63)	17 (41.5)	
	1	32 (20.8)	10 (24.4)	
	2 or higher	15 (9.7)	10 (24.4)	
WAT2 missed heel to toe	Not attempted/completed	10 (6.5)	4 (9.8)	χ^2 (3) = 2.37, p = 0.499
	0	50 (32.5)	17 (41.5)	
	1	32 (20.8)	6 (14.6)	
	2 or higher	63 (40.9)	14 (34.1)	
WAT2 steps off line	Not attempted/completed	10 (5.8)	4 (9.8)	χ^2 (3) = 5.74, p = 0.125
	0	86 (55.8)	19 (46.3)	

	1	35 (22.7)	6 (14.6)	
	2 or higher	23 (14.9)	12 (29.3)	
WAT2 raised arms	Not attempted/completed	10 (6.5)	4 (9.8)	χ^2 (3) = 3.45, p = 0.327
	0	64 (41.6)	11 (26.8)	
	1	39 (25.3)	11 (26.8)	
	2 or higher	41 (26.6)	15 (36.6)	
WAT2 steps	Not attempted/completed	10 (6.5)	4 (9.8)	χ^2 (3) = 7.38, p = 0.864
	<9	10 (6.5)	3 (7.3)	
	9	103 (66.9)	25 (61)	
	>9	31 (20.1)	9 (22)	
FTN hit count	Not attempted	8 (5.2)	1 (2.4)	χ^2 (7) = 2.33, p = 0.939
	0	64 (41.6)	14 (34.1)	
	1	17 (11)	6 (14.6)	
	2	18 (11.7)	7 (17.1)	
	3	15 (9.7)	5 (12.2)	
	4	9 (5.8)	2 (4.9)	
	5	7 (4.5)	2 (4.9)	
	6	16 (10.4)	4 (9.8)	
FTN used pad	Not available	7 (4.5)	1 (2.4)	χ^2 (2) = 0.37, p = 0.832
	No	73 (47.4)	20 (48.8)	
	Yes	74 (48.1)	20 (48.8)	
FTN used wrong hand	Not available	7 (4.5)	1 (2.4)	χ^2 (2) = 3.68, p = 0.159
	No	129 (83.8)	39 (95.1)	
	Yes	18 (11.7)	1 (2.4)	
FTN does not return arm to side	Not available	7 (4.5)	1 (2.4)	χ^2 (2) = 0.40, p = 0.818
	No	116 (75.3)	31 (75.6)	
	Yes	31 (20.1)	9 (22)	
FTN swaying	Not available	6 (3.9)	1 (2.4)	χ^2 (2) = 0.24, p = 0.888
	No	124 (80.5)	33 (80.5)	
	Yes	24 (15.6)	7 (17.1)	
FTN eyelid tremors	Not available	7 (4.5)	1 (2.4)	χ^2 (2) = 1.09, p = 0.579
	No	112 (72.7)	33 (80.5)	
	Yes	35 (22.7)	7 (17.1)	
FTN body tremors	Not available	7 (4.5)	1 (2.4)	χ^2 (2) = 0.67, p = 0.714
	No	133 (86.4)	35 (85.4)	
	Yes	14 (9.1)	5 (12.2)	
FTN does not keep eyes closed	Not available	7 (4.5)	1 (2.4)	χ^2 (2) = 0.45, p = 0.799
	No	142 (92.2)	39 (95.1)	
	Yes	5 (3.2)	1 (2.4)	
Left pupil size RL	Not available	1 (0.6)	0 (0)	χ^2 (3) = 6.93, p = 0.074
	Below range	19 (12.3)	0 (0)	
	Within range	109 (70.8)	36 (87.8)	
	Above range	25 (16.2)	5 (12.2)	

Left pupil size NTD	Not available	1 (0.6)	1 (2.4)	χ^2 (3) = 9.46, p = 0.024
	Below range	46 (29.9)	3 (7.3)	
	Within range	98 (63.6)	34 (82.9)	
	Above range	9 (5.8)	3 (7.3)	
Left pupil size DL1	Not available	1 (0.6)	0 (0)	χ^2 (3) = 3.51, p = 0.319
	Below range	12 (7.8)	2 (4.9)	
	Within range	125 (81.2)	38 (92.7)	
	Above range	16 (10.4)	1 (2.4)	
Left pupil size DL2	Not available	114 (74)	35 (85.4)	χ^2 (2) = 2.88, p = 0.237
	Within range	33 (21.4)	4 (9.8)	
	Above range	7 (4.5)	2 (4.9)	
Right pupil size RL	Not available	1 (0.6)	1 (2.4)	χ^2 (3) = 7.54, p = 0.056
	Below range	19 (12.3)	0 (0)	
	Within range	108 (70.1)	35 (85.4)	
	Above range	26 (16.9)	5 (12.2)	
Right pupil size NTD	Not available	1 (0.6)	2 (4.9)	χ^2 (3) = 12.07, p = 0.007
	Below range	46 (29.9)	3 (7.3)	
	Within range	95 (61.7)	33 (80.5)	
	Above range	12 (7.8)	3 (7.3)	
Right pupil size DL1	Not available	1 (0.6)	1 (2.4)	χ^2 (3) = 4.06, p = 0.255
	Below range	12 (7.8)	2 (4.9)	
	Within range	125 (81.2)	37 (90.2)	
	Above range	16 (10.4)	1 (2.4)	
Right pupil size DL2	Not available	114 (74)	35 (85.4)	χ^2 (2) = 2.88, p = 0.237
	Within range	33 (21.4)	4 (9.8)	
	Above range	7 (4.5)	2 (4.9)	
Rebound dilation	No	104 (67.5)	35 (85.4)	χ^2 (1) = 5.03, p = 0.025
	Yes	50 (32.5)	6 (14.6)	
Reaction to light	Not available	2 (1.3)	1 (2.4)	χ^2 (3) = 22.03, p <.001
	Normal	68 (44.2)	7 (17.1)	
	Slow	59 (38.3)	32 (78)	
	Little to none	25 (16.2)	1 (2.4)	
Nasal area	Not available	0 (0)	1 (2.4)	χ^2 (2) = 9.18, p = 0.010
	Clear/normal	114 (74)	22 (53.7)	
	Other	40 (26)	18 (43.9)	
Oral cavity	Clear/normal	65 (42.2)	13 (31.7)	χ^2 (1) = 1.49, p = 0.223
	Other	89 (57.8)	28 (68.3)	
Left arm injection sites	None	127 (82.5)	32 (78)	χ^2 (3) = 0.82, p = 0.844
	Old	11 (7.1)	4 (9.8)	
	Fresh	15 (9.7)	5 (12.2)	
	Both	1 (0.6)	0 (0)	
Right arm injection sites	None	132 (85.7)	37 (90.2)	χ^2 (3) = 1.85, p = 0.604
	Old	12 (7.8)	1 (2.4)	
	Fresh	9 (5.8)	3 (7.3)	

	Both	1 (0.6)	0 (0)	
BP systolic	Not available	1 (0.6)	0 (0)	X2(3) = 0.78, p = 0.854
	Below range	38 (24.7)	8 (19.5)	
	Within range	69 (44.8)	20 (48.8)	
	Above range	46 (29.9)	13 (31.7)	
BP diastolic	Not available	1 (0.6)	0 (0)	χ^2 (3) = 6.56, p = 0.087
	Below range	26 (16.9)	1 (2.4)	
	Within range	99 (64.3)	29 (70.7)	
	Above range	28 (18.2)	11 (26.8)	
Body temperature	Not available	3 (1.9)	0 (0)	χ^2 (3) = 2.23, p = 0.527
	Below range	66 (42.9)	22 (53.7)	
	Within range	82 (53.2)	18 (43.9)	
	Above range	3 (1.9)	1 (2.4)	
Muscle tone	Not available	1 (0.6)	0 (0)	χ^2 (3) = 22.25, p <.001
	Normal	69 (44.8)	18 (43.9)	
	Flaccid	76 (49.4)	11 (26.8)	
	Rigid	8 (5.2)	12 (29.3)	

The forward stepwise regression procedure selected one predictor, and the model was significant, $\chi^2(3) = 18.28$, $p < .001$, indicating that a set of face sheet measures significantly predicted CNS stimulants. Table 8 displays a classification table for the model's predictive effectiveness. The overall prediction accuracy was approximately 79%.

Table 8

Classification Table for Regression Predicting CNS Stimulant

	Predicted		
Observed	CNS stimulant not active	CNS stimulant active	% Correct
CNS stimulant not active	154	0	100.0
CNS stimulant active	41	0	0.0
Overall % Correct			79.0

Table 9 displays the regression coefficient results for the model predicting CNS stimulants. Having MRB eyelid tremors (OR = 2.38, $p = .003$) was associated with higher odds of CNS stimulant.

Table 9

Coefficients for Regression Predicting CNS Stimulant

Variable	*B*	*SE*	Wald	Sig.	OR	95% CI OR Lower	Upper
Pulse [ref: Within range]							
Below range	-1.64	1.06	2.39	.122	0.19	0.02	1.55
Above range	0.59	0.38	2.50	.114	1.81	0.87	3.78
MRB eyelid tremors	1.44	0.48	8.98	.003	2.38	0.09	0.60

Narcotic Analgesics

Table 10 displays crosstabulations of each factor with the identification of narcotic analgesic as an active drug category. Factors significantly associated with narcotic analgesics were being sick or injured, being diabetic or epileptic, being under the care of a doctor or dentist, abnormal coordination, abnormal speech, droopy eyelids, no lack of smooth pursuit and no maximum deviation (both eyes), angle of onset not present (both eyes), lack of convergence absent, difficulty on OLS, MRB swaying front to back, no MRB eyelid tremors, stopping walking on WAT2, miss heel to toe on WAT2, stepping off the line on WAT2, steps taken on WAT2, no FTN eyelid tremors, left and right pupil size (all lights), no rebound dilation, abnormal reaction to light, arm injection sites, and flaccid muscle tone.

Table 10

Crosstabulation of Face Sheet Measures with Active Narcotic Analgesic

Variable	Value	Narcotic Analgesic Not Active *n* (%)	Active *n* (%)	Bivariate Test Result
Have you eaten today	Not available	3 (2)	2 (4.5)	χ^2 (2) = 0.94, p = 0.626
	No	34 (22.5)	9 (20.5)	
	Yes	114 (75.5)	33 (75)	
Have you drank today	Not available	2 (1.3)	2 (4.5)	χ^2 (2) = 3.65, p = 0.161
	No	34 (22.5)	14 (31.8)	
	Yes	115 (76.2)	28 (63.6)	
Est. time vs. actual time	Not available	8 (5.3)	4 (9.1)	χ^2 (4) = 7.06, p = 0.133

	10 minutes or less difference	34 (22.5)	8 (18.2)	
	11 to 30 minutes difference	33 (21.9)	9 (20.5)	
	31 to 90 minutes difference	48 (31.8)	8 (18.2)	
	More than 90 minutes difference	28 (18.5)	15 (34.1)	
Duration of last sleep	Not available	14 (9.3)	5 (11.4)	χ^2 (3) = 5.12, p = 0.163
	Less than 4 hours	18 (11.9)	11 (25)	
	4 to 8 hours	97 (64.2)	23 (52.3)	
	More than 8 hours	22 (14.6)	5 (11.4)	
Sick or injured	No	119 (78.8)	25 (56.8)	χ^2 (1) = 8.53, p = 0.003
	Yes	32 (21.2)	19 (43.2)	
Diabetic or epileptic	Not available	1 (0.7)	0 (0)	χ^2 (2) = 10.17, p = 0.006
	No	148 (98)	39 (88.6)	
	Yes	2 (1.3)	5 (11.4)	
Physical disabilities	No	113 (74.8)	30 (68.2)	χ^2 (1) = 0.77, p = 0.380
	Yes	38 (25.2)	14 (31.8)	
Under care of doctor or dentist	Not available	1 (0.7)	0 (0)	χ^2 (2) = 9.27, p = 0.010
	No	99 (65.6)	18 (40.9)	
	Yes	51 (33.8)	26 (59.1)	
Taking medications or drugs	Not available	2 (1.3)	0 (0)	χ^2 (2) = 5.42, p = 0.067
	No	45 (29.8)	6 (13.6)	
	Yes	104 (68.9)	38 (86.4)	
Coordination	Fair/good	39 (25.8)	4 (9.1)	χ^2 (1) = 5.55, p = 0.018
	Other	112 (74.2)	40 (90.9)	
Breath	Normal	81 (53.6)	29 (65.9)	χ^2 (1) = 2.09, p = 0.149
	Other	70 (46.4)	15 (34.1)	
Face	Not available	1 (0.7)	0 (0)	χ^2 (2) = 5.56, p = 0.062
	Normal	70 (46.4)	12 (27.3)	
	Other	80 (53)	32 (72.7)	
Speech	Normal	43 (28.5)	3 (6.8)	χ^2 (1) = 8.87, p = 0.003
	Other	108 (71.5)	41 (93.2)	
Eyes appearance	Not available	0 (0)	2 (4.5)	χ^2 (4) = 8.24, p = 0.083
	Normal	20 (13.2)	8 (18.2)	
	Bloodshot	37 (24.5)	9 (20.5)	
	Watery	24 (15.9)	8 (18.2)	
	Bloodshot and watery	70 (46.4)	17 (38.6)	
Blindness	None	150 (99.3)	44 (100)	χ^2 (1) = 0.29, p = 0.588
	Right eye	1 (0.7)	0 (0)	
Eye tracking stimulus	Equal	150 (99.3)	44 (100)	χ^2 (1) = 0.29, p = 0.588
	Unequal	1 (0.7)	0 (0)	
Ability to follow stimulus	No	9 (6)	2 (4.5)	χ^2 (1) = 0.13, p = 0.720
	Yes	142 (94)	42 (95.5)	

Eyelids	Not available	1 (0.7)	1 (2.3)	χ^2 (2) = 15.68, p <.001
	Normal	52 (34.4)	2 (4.5)	
	Droopy	98 (64.9)	41 (93.2)	
Pulse	Below range	15 (9.9)	7 (15.9)	χ^2 (2) = 3.24, p = 0.198
	Within range	70 (46.4)	24 (54.5)	
	Above range	66 (43.7)	13 (29.5)	
Left eye lack of smooth pursuit	Unable to perform	1 (0.7)	1 (2.3)	χ^2 (2) = 8.69, p = 0.013
	No	58 (38.4)	27 (61.4)	
	Yes or present	92 (60.9)	16 (36.4)	
Left eye maximum deviation	Unable to perform	1 (0.7)	1 (2.3)	χ^2 (2) = 15.76, p <.001
	No	58 (38.4)	31 (70.5)	
	Yes or present	92 (60.9)	12 (27.3)	
Eye angle of onset	Unable to Perform	1 (0.7)	1 (2.3)	χ^2 (3) = 16.32, p <.001
	Not present	67 (44.4)	33 (75)	
	30 to 45 Degrees	82 (54.3)	9 (20.5)	
	Immediate on-set	1 (0.7)	1 (2.3)	
Right eye lack of smooth pursuit	Unable to perform	1 (0.7)	1 (2.3)	χ^2 (2) = 8.69, p = 0.013
	No	58 (38.4)	27 (61.4)	
	Yes or present	92 (60.9)	16 (36.4)	
Right eye maximum deviation	Unable to perform	1 (0.7)	1 (2.3)	χ^2 (2) = 15.76, p <.001
	No	58 (38.4)	31 (70.5)	
	Yes or present	92 (60.9)	12 (27.3)	
Vertical gaze nystagmus	No	124 (82.1)	39 (88.6)	χ^2 (1) = 1.06, p = 0.304
	Yes	27 (17.9)	5 (11.4)	
Lack of convergence	Unable to perform	0 (0)	1 (2.3)	χ^2 (2) = 6.46, p = 0.040
	Absent	33 (21.9)	15 (34.1)	
	Present	118 (78.1)	28 (63.6)	
Completion of one leg stand (left)	Not attempted	5 (3.3)	4 (9.1)	χ^2 (2) = 4.49, p = 0.106
	Attempted but stopped	2 (1.3)	2 (4.5)	
	Attempted and completed	144 (95.4)	38 (86.4)	
Completion of one leg stand (right)	Not attempted	8 (5.3)	6 (13.6)	χ^2 (2) = 4.07, p = 0.131
	Attempted but stopped	2 (1.3)	0 (0)	
	Attempted and completed	141 (93.4)	38 (86.4)	
Left OLS sways while balancing	Not attempted/completed	6 (4)	5 (11.4)	χ^2 (2) = 4.50, p = 0.106
	Not present	20 (13.2)	3 (6.8)	
	Present	125 (82.8)	36 (81.8)	
Left OLS uses arms to balance	Not attempted/completed	6 (4)	5 (11.4)	χ^2 (2) = 9.41, p = 0.009
	Not present	57 (37.7)	7 (15.9)	
	Present	88 (58.3)	32 (72.7)	
Left OLS hopping	Not attempted/completed	6 (4)	5 (11.4)	χ^2 (2) = 13.87, p <.001

	Not present	126 (83.4)	25 (56.8)	
	Present	19 (12.6)	14 (31.8)	
Left OLS puts foot down	Not attempted/completed	6 (4)	5 (11.4)	χ^2 (3) = 13.11, p = 0.004
	0	62 (41.1)	6 (13.6)	
	1	46 (30.5)	17 (38.6)	
	2 or more	37 (24.5)	16 (36.4)	
Left OLS time	Not attempted/completed	19 (12.6)	7 (15.9)	χ^2 (3) = 1.60, p = 0.660
	0-14	31 (20.5)	12 (27.3)	
	15-29	91 (60.3)	23 (52.3)	
	30 or more	10 (6.6)	2 (4.5)	
Right OLS sways while balancing	Not attempted/completed	9 (6)	6 (13.6)	χ^2 (2) = 5.63, p = 0.060
	Not present	28 (18.5)	3 (6.8)	
	Present	114 (75.5)	35 (79.5)	
Right OLS uses arms to balance	Not attempted/completed	9 (6)	6 (13.6)	χ^2 (2) = 7.42, p = 0.024
	Not present	53 (35.1)	7 (15.9)	
	Present	89 (58.9)	31 (70.5)	
Right OLS hopping	Not attempted/completed	9 (6)	7 (15.9)	χ^2 (2) = 4.60, p = 0.100
	Not present	115 (76.2)	29 (65.9)	
	Present	27 (17.9)	8 (18.2)	
Right OLS puts foot down	Not attempted/completed	9 (6)	6 (13.6)	χ^2 (3) = 5.00, p = 0.172
	0	55 (36.4)	10 (22.7)	
	1	42 (27.8)	12 (27.3)	
	2 or more	45 (29.8)	16 (36.4)	
Right OLS time	Not attempted/completed	20 (13.2)	10 (22.7)	χ^2 (3) = 2.86, p = 0.415
	0-14	30 (19.9)	8 (18.2)	
	15-29	88 (58.3)	24 (54.5)	
	30 or more	13 (8.6)	2 (4.5)	
MRB swaying front to back	0	36 (23.8)	5 (11.4)	χ^2 (2) = 6.53, p = 0.038
	< 2 inches	41 (27.2)	8 (18.2)	
	2 inches or more	74 (49)	31 (70.5)	
MRB swaying left to right	0	43 (28.5)	11 (25)	χ^2 (2) = 4.01, p = 0.135
	< 2 inches	35 (23.2)	5 (11.4)	
	2 inches or more	73 (48.3)	28 (63.6)	
MRB internal clock	Not attempted/completed	1 (0.7)	2 (4.5)	χ^2 (3) = 4.88, p = 0.181
	0-24	40 (26.5)	12 (27.3)	
	25-35	65 (43)	14 (31.8)	
	36 or higher	45 (29.8)	16 (36.4)	
MRB presence eyelid tremors	No	90 (59.6)	38 (86.4)	χ^2 (1) = 10.82, p = 0.001
	Yes	61 (40.4)	6 (13.6)	
MRB presence body or leg tremors	No	120 (79.5)	37 (84.1)	χ^2 (1) = 0.46, p = 0.496
	Yes	31 (20.5)	7 (15.9)	

WAT completion	Not attempted	5 (3.3)	3 (6.8)	χ^2 (2) = 5.33, p = 0.070
	Attempted but stopped	2 (1.3)	3 (6.8)	
	Attempted and completed	144 (95.4)	38 (86.4)	
WAT balance	Not attempted/completed	6 (4)	4 (9.1)	χ^2 (3) = 5.26, p = 0.154
	0	52 (34.4)	10 (22.7)	
	1	70 (46.4)	26 (59.1)	
	2 or higher	23 (15.2)	4 (9.1)	
WAT starts early	Not attempted/completed	6 (4)	4 (9.1)	χ^2 (3) = 3.69, p = 0.297
	0	114 (75.5)	28 (63.6)	
	1	30 (19.9)	11 (25)	
	2 or higher	1 (0.7)	1 (2.3)	
WAT1 stops walking	Not attempted/completed	6 (4)	4 (9.1)	χ^2 (3) = 2.37, p = 0.499
	0	82 (54.3)	23 (52.3)	
	1	36 (23.8)	8 (18.2)	
	2 or higher	27 (17.9)	9 (20.5)	
WAT1 missed heel to toe	Not attempted/completed	6 (4)	4 (9.1)	χ^2 (3) = 6.39, p = 0.094
	0	58 (38.4)	17 (38.6)	
	1	32 (21.2)	3 (6.8)	
	2 or higher	55 (36.4)	20 (45.5)	
WAT1 steps off line	Not attempted/completed	6 (4)	4 (9.1)	χ^2 (3) = 6.39, p = 0.094
	0	79 (52.3)	16 (36.4)	
	1	38 (25.2)	10 (22.7)	
	2 or higher	28 (18.5)	14 (31.8)	
WAT1 raised arms	Not attempted/completed	6 (4)	4 (9.1)	χ^2 (3) = 7.29, p = 0.063
	0	57 (37.7)	15 (34.1)	
	1	48 (31.8)	7 (15.9)	
	2 or higher	40 (26.5)	18 (40.9)	
WAT1 steps	Not attempted/completed	6 (4)	4 (9.1)	χ^2 (3) = 2.55, p = 0.466
	<9	19 (12.6)	7 (15.9)	
	9	94 (62.3)	26 (59.1)	
	>9	32 (21.2)	7 (15.9)	
WAT2 stops walking	Not attempted/completed	7 (4.6)	7 (15.9)	χ^2 (3) = 11.42, p = 0.010
	0	89 (58.9)	25 (56.8)	
	1	38 (25.2)	4 (9.1)	
	2 or higher	17 (11.3)	8 (18.2)	
WAT2 missed heel to toe	Not attempted/completed	7 (4.6)	7 (15.9)	χ^2 (3) = 10.69, p = 0.014
	0	58 (38.4)	8 (18.2)	
	1	29 (19.2)	9 (20.5)	
	2 or higher	57 (37.7)	20 (45.5)	
WAT2 steps off line	Not attempted/completed	7 (4.6)	7 (15.9)	χ^2 (3) = 9.59, p = 0.022
	0	87 (57.6)	18 (40.9)	
	1	33 (21.9)	8 (18.2)	
	2 or higher	24 (15.9)	11 (25)	
WAT2 raised arms	Not attempted/completed	7 (4.6)	7 (15.9)	χ^2 (3) = 7.34, p = 0.062

	0	59 (39.1)	16 (36.4)	
	1	42 (27.8)	8 (18.2)	
	2 or higher	43 (28.5)	13 (29.5)	
WAT2 steps	Not attempted/completed	7 (4.6)	7 (15.9)	χ^2 (3) = 13.11, p = 0.004
	<9	8 (5.3)	5 (11.4)	
	9	99 (65.6)	29 (65.9)	
	>9	37 (24.5)	3 (6.8)	
FTN hit count	Not attempted	6 (4)	3 (6.8)	χ^2 (7) = 8.48, p = 0.292
	0	61 (40.4)	17 (38.6)	
	1	19 (12.6)	4 (9.1)	
	2	19 (12.6)	6 (13.6)	
	3	15 (9.9)	5 (11.4)	
	4	10 (6.6)	1 (2.3)	
	5	4 (2.6)	5 (11.4)	
	6	17 (11.3)	3 (6.8)	
FTN used pad	Not available	5 (3.3)	3 (6.8)	χ^2 (2) = 1.38, p = 0.501
	No	71 (47)	22 (50)	
	Yes	75 (49.7)	19 (43.2)	
FTN used wrong hand	Not available	5 (3.3)	3 (6.8)	χ^2 (2) = 1.07, p = 0.584
	No	131 (86.8)	37 (84.1)	
	Yes	15 (9.9)	4 (9.1)	
FTN does not return arm to side	Not available	5 (3.3)	3 (6.8)	χ^2 (2) = 1.17, p = 0.556
	No	114 (75.5)	33 (75)	
	Yes	32 (21.2)	8 (18.2)	
FTN swaying	Not available	4 (2.6)	3 (6.8)	χ^2 (2) = 3.40, p = 0.183
	No	120 (79.5)	37 (84.1)	
	Yes	27 (17.9)	4 (9.1)	
FTN eyelid tremors	Not available	5 (3.3)	3 (6.8)	χ^2 (2) = 7.84, p = 0.020
	No	107 (70.9)	38 (86.4)	
	Yes	39 (25.8)	3 (6.8)	
FTN body tremors	Not available	5 (3.3)	3 (6.8)	χ^2 (2) = 2.64, p = 0.267
	No	129 (85.4)	39 (88.6)	
	Yes	17 (11.3)	2 (4.5)	
FTN does not keep eyes closed	Not available	5 (3.3)	3 (6.8)	χ^2 (2) = 2.77, p = 0.250
	No	140 (92.7)	41 (93.2)	
	Yes	6 (4)	0 (0)	
Left pupil size RL	Not available	1 (0.7)	0 (0)	χ^2 (3) = 33.93, p <.001
	Below range	5 (3.3)	14 (31.8)	
	Within range	117 (77.5)	28 (63.6)	
	Above range	28 (18.5)	2 (4.5)	
Left pupil size NTD	Not available	1 (0.7)	1 (2.3)	χ^2 (3) = 64.53, p <.001
	Below range	18 (11.9)	31 (70.5)	
	Within range	120 (79.5)	12 (27.3)	

	Above range	12 (7.9)	0 (0)	
Left pupil size DL1	Not available	0 (0)	1 (2.3)	χ^2 (3) = 22.60, p <.001
	Below range	5 (3.3)	9 (20.5)	
	Within range	129 (85.4)	34 (77.3)	
	Above range	17 (11.3)	0 (0)	
Left pupil size DL2	Not available	109 (72.2)	40 (90.9)	χ^2 (2) = 7.11, p = 0.029
	Within range	33 (21.9)	4 (9.1)	
	Above range	9 (6)	0 (0)	
Right pupil size RL	Not available	2 (1.3)	0 (0)	χ^2 (3) = 34.33, p = <.001
	Below range	5 (3.3)	14 (31.8)	
	Within range	115 (76.2)	28 (63.6)	
	Above range	29 (19.2)	2 (4.5)	
Right pupil size NTD	Not available	2 (1.3)	1 (2.3)	χ^2 (3) = 63.77, p = <.001
	Below range	18 (11.9)	31 (70.5)	
	Within range	116 (76.8)	12 (27.3)	
	Above range	15 (9.9)	0 (0)	
Right pupil size DL1	Not available	1 (0.7)	1 (2.3)	χ^2 (3) = 19.99, p <.001
	Below range	5 (3.3)	9 (20.5)	
	Within range	128 (84.8)	34 (77.3)	
	Above range	17 (11.3)	0 (0)	
Right pupil size DL2	Not available	109 (72.2)	40 (90.9)	χ^2 (2) = 7.11, p = 0.029
	Within range	33 (21.9)	4 (9.1)	
	Above range	9 (6)	0 (0)	
Rebound dilation	No	99 (65.6)	40 (90.9)	χ^2 (1) = 10.69, p = 0.001
	Yes	52 (34.4)	4 (9.1)	
Reaction to light	Not available	2 (1.3)	1 (2.3)	χ^2 (3) = 52.17, p = <.001
	Normal	67 (44.4)	8 (18.2)	
	Slow	76 (50.3)	15 (34.1)	
	Little to none	6 (4)	20 (45.5)	
Nasal area	Not available	0 (0)	1 (2.3)	χ^2 (2) = 5.87, p = 0.053
	Clear/normal	110 (72.8)	26 (59.1)	
	Other	41 (27.2)	17 (38.6)	
Oral cavity	Clear/normal	58 (38.4)	20 (45.5)	χ^2 (1) = 0.70, p = 0.401
	Other	93 (61.6)	24 (54.5)	
Left arm injection sites	None	130 (86.1)	29 (65.9)	χ^2 (3) = 11.89, p = 0.008
	Old	8 (5.3)	7 (15.9)	
	Fresh	13 (8.6)	7 (15.9)	
	Both	0 (0)	1 (2.3)	
Right arm injection sites	None	136 (90.1)	33 (75)	χ^2 (3) = 8.71, p = 0.033
	Old	8 (5.3)	5 (11.4)	
	Fresh	7 (4.6)	5 (11.4)	
	Both	0 (0)	1 (2.3)	
BP systolic	Not available	1 (0.7)	0 (0)	χ^2 (3) = 1.51, p = 0.681
	Below range	34 (22.5)	12 (27.3)	

	Within range	72 (47.7)	17 (38.6)	
	Above range	44 (29.1)	15 (34.1)	
BP diastolic	Not available	1 (0.7)	0 (0)	χ^2 (3) = 3.02, p = 0.389
	Below range	20 (13.2)	7 (15.9)	
	Within range	96 (63.6)	32 (72.7)	
	Above range	34 (22.5)	5 (11.4)	
Body temperature	Not available	3 (2)	0 (0)	χ^2 (3) = 2.16, p = 0.540
	Below range	68 (45)	20 (45.5)	
	Within range	76 (50.3)	24 (54.5)	
	Above range	4 (2.6)	0 (0)	
Muscle tone	Not available	1 (0.7)	0 (0)	χ^2 (3) = 18.45, p <.001
	Normal	78 (51.7)	9 (20.5)	
	Flaccid	55 (36.4)	32 (72.7)	
	Rigid	17 (11.3)	3 (6.8)	

The forward stepwise regression procedure selected five predictors, and the model was significant, $\chi^2(8) = 43.44$, $p < .001$, indicating that a set of face sheet measures significantly predicted narcotic analgesics. Table 11 displays a classification table for the model's predictive effectiveness. The overall prediction accuracy was approximately 81%.

Table 11

Classification Table for Regression Predicting Narcotic Analgesic

Observed	Predicted		
	Narcotic analgesic not active	Narcotic analgesic active	% Correct
Narcotic analgesic not active	143	8	94.7
Narcotic analgesic active	29	15	34.1
Overall % Correct			81.0

Table 12 displays the regression coefficient results for the model predicting narcotic analgesics. Being sick or injured (OR = 2.45, $p = .037$), having abnormal speech (OR = 3.97, $p = .039$), and hopping during left OLS (OR = 4.43, $p = .002$), were associated with higher odds of narcotic analgesic being an active drug category. Stopping 1 time during WAT2 (OR = 0.20, $p =$

.013) and no rebound dilation (OR = 5.81, p = .003), were associated with lower odds of narcotic analgesic being an active drug category.

Table 12

Coefficients for Regression Predicting Narcotic Analgesic

						95% CI OR	
Variable	*B*	*SE*	Wald	Sig.	OR	Lower	Upper
Sick or injured	0.89	0.43	4.34	.037	2.45	1.05	5.67
Abnormal speech	1.39	0.67	4.24	.039	3.97	1.07	14.73
Left OLS hopping [ref: Not present]							
Not attempted/completed	0.51	0.73	0.49	.484	1.67	0.40	7.04
Present	1.49	0.49	9.19	.002	4.43	1.70	11.60
WAT2 stops walking [ref: 0]							
Not attempted/completed	0.20	0.68	0.87	.768	1.23	0.32	4.70
1	-1.60	0.65	6.17	.013	0.20	0.06	0.71
2 or higher	-0.71	0.59	1.48	.225	0.49	0.16	1.55
Rebound dilation	-1.76	0.59	8.76	.003	0.17	0.54	0.55

Cannabis

Table 13 displays crosstabulations of each factor with the identification of cannabis as an active drug category. Factors significantly associated with cannabis were not being sick or injured, not having a physical disability, not being under the care of a doctor or dentist, abnormal breath, lack of convergence, less difficulty on OLS, MRB eyelid tremors, MRB body or leg tremors, not stepping off line in WAT, FTN eyelid and body tremors, left and right pupil size (all lights), rebound dilation, reaction to light, abnormal oral cavity, within range body temperature, and normal muscle tone.

Table 13

Crosstabulation of Face Sheet Measures with Active Cannabis

		Cannabis		
Variable	Value	Not Active *n* (%)	Active *n* (%)	Bivariate Test Result
Have you eaten today	Not available	4 (3.6)	1 (1.2)	χ^2 (2) = 2.25, p = 0.324

	No	21 (19.1)	22 (25.9)	
	Yes	85 (77.3)	62 (72.9)	
Have you drank today	Not available	2 (1.8)	2 (2.4)	χ^2 (2) = 0.46, p = 0.795
	No	29 (26.4)	19 (22.4)	
	Yes	79 (71.8)	64 (75.3)	
Est. time vs. actual time	Not available	7 (6.4)	5 (5.9)	χ^2 (4) = 1.20, p = 0.878
	10 minutes or less difference	24 (21.8)	18 (21.2)	
	11 to 30 minutes difference	22 (20)	20 (23.5)	
	31 to 90 minutes difference	30 (27.3)	26 (30.6)	
	More than 90 minutes difference	27 (24.5)	16 (18.8)	
Duration of last sleep	Not available	7 (6.4)	12 (14.1)	χ^2 (3) = 3.48, p = 0.323
	Less than 4 hours	18 (16.4)	11 (12.9)	
	4 to 8 hours	69 (62.7)	51 (60)	
	More than 8 hours	16 (14.5)	11 (12.9)	
Sick or injured	No	75 (68.2)	69 (81.2)	χ^2 (1) = 4.19, p = 0.041
	Yes	35 (31.8)	16 (18.8)	
Diabetic or epileptic	Not available	0 (0)	1 (1.2)	χ^2 (2) = 3.79, p = 0.151
	No	104 (94.5)	83 (97.6)	
	Yes	6 (5.5)	1 (1.2)	
Physical disabilities	No	72 (65.5)	71 (83.5)	χ^2 (1) = 8.01, p = 0.005
	Yes	38 (34.5)	14 (16.5)	
Under care of doctor or dentist	Not available	0 (0)	1 (1.2)	χ^2 (2) = 7.39, p = 0.025
	No	58 (52.7)	59 (69.4)	
	Yes	52 (47.3)	25 (29.4)	
Taking medications or drugs	Not available	0 (0)	2 (2.4)	χ^2 (2) = 5.40, p = 0.067
	No	24 (21.8)	27 (31.8)	
	Yes	86 (78.2)	56 (65.9)	
Coordination	Fair/good	21 (19.1)	22 (25.9)	χ^2 (1) = 1.29, p = 0.257
	Other	89 (80.9)	63 (74.1)	
Breath	Normal	72 (65.5)	38 (44.7)	χ^2 (1) = 8.40, p = 0.004
	Other	38 (34.5)	47 (55.3)	
Face	Not available	0 (0)	1 (1.2)	χ^2 (2) = 1.32, p = 0.516
	Normal	47 (42.7)	35 (41.2)	
	Other	63 (57.3)	49 (57.6)	
Speech	Normal	23 (20.9)	23 (27.1)	χ^2 (1) = 1.01, p = 0.316
	Other	87 (79.1)	62 (72.9)	
Eyes appearance	Not available	2 (1.8)	0 (0)	χ^2 (4) = 9.01, p = 0.061
	Normal	21 (19.1)	7 (8.2)	
	Bloodshot	26 (23.6)	20 (23.5)	
	Watery	20 (18.2)	12 (14.1)	
	Bloodshot and watery	41 (37.3)	46 (54.1)	

Blindness	None	109 (99.1)	85 (100)	χ^2 (1) = 0.78, p = 0.378
	Right eye	1 (0.9)	0 (0)	
Eye tracking stimulus	Equal	109 (99.1)	85 (100)	χ^2 (1) = 0.78, p = 0.378
	Unequal	1 (0.9)	0 (0)	
Ability to follow stimulus	No	8 (7.3)	3 (3.5)	χ^2 (1) = 1.26, p = 0.261
	Yes	102 (92.7)	82 (96.5)	
Eyelids	Not available	2 (1.8)	0 (0)	χ^2 (2) = 3.06, p = 0.217
	Normal	34 (30.9)	20 (23.5)	
	Droopy	74 (67.3)	65 (76.5)	
Pulse	Below range	16 (14.5)	6 (7.1)	χ^2 (2) = 2.69, p = 0.261
	Within range	51 (46.4)	43 (50.6)	
	Above range	43 (39.1)	36 (42.4)	
Left eye lack of smooth pursuit	Unable to perform	1 (0.9)	1 (1.2)	χ^2 (2) = 1.41, p = 0.495
	No	44 (40)	41 (48.2)	
	Yes or present	65 (59.1)	43 (50.6)	
Left eye maximum deviation	Unable to perform	1 (0.9)	1 (1.2)	χ^2 (2) = 0.94, p = 0.626
	No	47 (42.7)	42 (49.4)	
	Yes or present	62 (56.4)	42 (49.4)	
Eye angle of onset	Unable to Perform	1 (0.9)	1 (1.2)	χ^2 (3) = 1.94, p = 0.585
	Not present	54 (49.1)	46 (54.1)	
	30 to 45 Degrees	53 (48.2)	38 (44.7)	
	Immediate on-set	2 (1.8)	0 (0)	
Right eye lack of smooth pursuit	Unable to perform	1 (0.9)	1 (1.2)	χ^2 (2) = 1.41, p = 0.495
	No	44 (40)	41 (48.2)	
	Yes or present	65 (59.1)	43 (50.6)	
Right eye maximum deviation	Unable to perform	1 (0.9)	1 (1.2)	χ^2 (2) = 0.94, p = 0.626
	No	47 (42.7)	42 (49.4)	
	Yes or present	62 (56.4)	42 (49.4)	
Vertical gaze nystagmus	No	93 (84.5)	70 (82.4)	χ^2 (1) = 0.17, p = 0.682
	Yes	17 (15.5)	15 (17.6)	
Lack of convergence	Unable to perform	1 (0.9)	0 (0)	χ^2 (2) = 19.89, p <.001
	Absent	40 (36.4)	8 (9.4)	
	Present	69 (62.7)	77 (90.6)	
Completion of one leg stand (left)	Not attempted	8 (7.3)	1 (1.2)	χ^2 (2) = 5.53, p = 0.063
	Attempted but stopped	1 (0.9)	3 (3.5)	
	Attempted and completed	101 (91.8)	81 (95.3)	
Completion of one leg stand (right)	Not attempted	12 (10.9)	2 (2.4)	χ^2 (2) = 5.28, p = 0.071
	Attempted but stopped	1 (0.9)	1 (1.2)	
	Attempted and completed	97 (88.2)	82 (96.5)	
Left OLS sways while balancing	Not attempted/completed	8 (7.3)	3 (3.5)	χ^2 (2) = 4.10, p = 0.128

	Not present	9 (8.2)	14 (16.5)	
	Present	93 (84.5)	68 (80)	
Left OLS uses arms to balance	Not attempted/completed	8 (7.3)	3 (3.5)	χ^2 (2) = 10.02, p = 0.007
	Not present	26 (23.6)	38 (44.7)	
	Present	76 (69.1)	44 (51.8)	
Left OLS hopping	Not attempted/completed	8 (7.3)	3 (3.5)	χ^2 (2) = 1.51, p = 0.469
	Not present	85 (77.3)	66 (77.6)	
	Present	17 (15.5)	16 (18.8)	
Left OLS puts foot down	Not attempted/completed	8 (7.3)	3 (3.5)	χ^2 (3) = 19.08, p <.001
	0	24 (21.8)	44 (51.8)	
	1	42 (38.2)	21 (24.7)	
	2 or more	36 (32.7)	17 (20)	
Left OLS time	Not attempted/completed	17 (15.5)	9 (10.6)	χ^2 (3) = 6.45, p = .092
	0-14	30 (27.3)	13 (15.3)	
	15-29	58 (52.7)	56 (65.9)	
	30 or more	5 (4.5)	7 (8.2)	
Right OLS sways while balancing	Not attempted/completed	12 (10.9)	3 (3.5)	χ^2 (2) = 13.51, p = 0.001
	Not present	9 (8.2)	22 (25.9)	
	Present	89 (80.9)	60 (70.6)	
Right OLS uses arms to balance	Not attempted/completed	12 (10.9)	3 (3.5)	χ^2 (2) = 5.89, p = 0.053
	Not present	28 (25.5)	32 (37.6)	
	Present	70 (63.6)	50 (58.8)	
Right OLS hopping	Not attempted/completed	13 (11.8)	3 (3.5)	χ^2 (2) = 4.53, p = 0.104
	Not present	77 (70)	67 (78.8)	
	Present	20 (18.2)	15 (17.6)	
Right OLS puts foot down	Not attempted/completed	12 (10.9)	3 (3.5)	χ^2 (3) = 18.37, p < 0.001
	0	24 (21.8)	41 (48.2)	
	1	31 (28.2)	23 (27.1)	
	2 or more	43 (39.1)	18 (21.2)	
Right OLS time	Not attempted/completed	22 (20)	8 (9.4)	χ^2 (3) = 10.89, p = 0.012
	0-14	25 (22.7)	13 (15.3)	
	15-29	59 (53.6)	53 (62.4)	
	30 or more	4 (3.6)	11 (12.9)	
MRB swaying front to back	0	25 (22.7)	16 (18.8)	χ^2 (2) = 3.54, p = 0.170
	< 2 inches	22 (20)	27 (31.8)	
	2 inches or more	63 (57.3)	42 (49.4)	
MRB swaying left to right	0	34 (30.9)	20 (23.5)	χ^2 (2) = 5.69, p = 0.058
	< 2 inches	16 (14.5)	24 (28.2)	
	2 inches or more	60 (54.5)	41 (48.2)	
MRB internal clock	Not attempted/completed	2 (1.8)	1 (1.2)	χ^2 (3) = 3.85, p = 0.279
	0-24	33 (30)	19 (22.4)	

	25-35	38 (34.5)	41 (48.2)	
	36 or higher	37 (33.6)	24 (28.2)	
MRB presence eyelid tremors	No	91 (82.7)	37 (43.5)	χ^2 (1) = 32.67, p <.001
	Yes	19 (17.3)	48 (56.5)	
MRB presence body or leg tremors	No	97 (88.2)	60 (70.6)	χ^2 (1) = 9.46, p = 0.002
	Yes	13 (11.8)	25 (29.4)	
WAT completion	Not attempted	6 (5.5)	2 (2.4)	χ^2 (2) = 1.68, p = 0.431
	Attempted but stopped	2 (1.8)	3 (3.5)	
	Attempted and completed	102 (92.7)	80 (94.1)	
WAT balance	Not attempted/completed	7 (6.4)	3 (3.5)	χ^2 (3) = 4.57, p = 0.206
	0	30 (27.3)	32 (37.6)	
	1	60 (54.5)	36 (42.4)	
	2 or higher	13 (11.8)	14 (16.5)	
WAT starts early	Not attempted/completed	7 (6.4)	3 (3.5)	χ^2 (3) = 0.82, p = 0.844
	0	79 (71.8)	63 (74.1)	
	1	23 (20.9)	18 (21.2)	
	2 or higher	1 (0.9)	1 (1.2)	
WAT1 stops walking	Not attempted/completed	7 (6.4)	3 (3.5)	χ^2 (3) = 1.09, p = 0.779
	0	60 (54.5)	45 (52.9)	
	1	23 (20.9)	21 (24.7)	
	2 or higher	20 (18.2)	16 (18.8)	
WAT1 missed heel to toe	Not attempted/completed	7 (6.4)	3 (3.5)	χ^2 (3) = 1.07, p = 0.783
	0	43 (39.1)	32 (37.6)	
	1	20 (18.2)	15 (17.6)	
	2 or higher	40 (36.4)	35 (41.2)	
WAT1 steps off line	Not attempted/completed	7 (6.4)	3 (3.5)	χ^2 (3) = 10.13, p = 0.018
	0	43 (39.1)	52 (61.2)	
	1	30 (27.3)	18 (21.2)	
	2 or higher	30 (27.3)	12 (14.1)	
WAT1 raised arms	Not attempted/completed	7 (6.4)	3 (3.5)	χ^2 (3) = 3.82, p = 0.282
	0	35 (31.8)	37 (43.5)	
	1	31 (28.2)	24 (28.2)	
	2 or higher	37 (33.6)	21 (24.7)	
WAT1 steps	Not attempted/completed	7 (6.4)	3 (3.5)	χ^2 (3) = 6.11, p = 0.106
	<9	19 (17.3)	7 (8.2)	
	9	60 (54.5)	60 (70.6)	
	>9	24 (21.8)	15 (17.6)	
WAT2 stops walking	Not attempted/completed	9 (8.2)	5 (5.9)	χ^2 (3) = 5.68, p = 0.128
	0	58 (52.7)	56 (65.9)	
	1	24 (21.8)	18 (21.2)	
	2 or higher	19 (17.3)	6 (7.1)	
WAT2 missed heel to toe	Not attempted/completed	9 (7.3)	5 (5.9)	χ^2 (3) = 0.48, p = 0.922
	0	36 (32.7)	30 (35.3)	

	1	21 (19.1)	17 (20)	
	2 or higher	44 (40)	33 (38.8)	
WAT2 steps off line	Not attempted/completed	9 (8.2)	5 (5.9)	χ^2 (3) = 11.02, p = 0.012
	0	51 (46.4)	54 (63.5)	
	1	22 (20)	19 (22.4)	
	2 or higher	28 (25.5)	7 (8.2)	
WAT2 raised arms	Not attempted/completed	9 (8.2)	5 (5.9)	χ^2 (3) = 2.57, p = 0.464
	0	37 (33.6)	38 (44.7)	
	1	30 (27.3)	20 (23.5)	
	2 or higher	34 (30.9)	22 (25.9)	
WAT2 steps	Not attempted/completed	9 (8.2)	5 (5.9)	χ^2 (3) = 0.75, p = 0.861
	<9	7 (6.4)	6 (7.1)	
	9	70 (63.6)	58 (68.2)	
	>9	24 (21.8)	16 (18.8)	
FTN hit count	Not attempted	7 (6.4)	2 (2.4)	χ^2 (7) = 12.64, p = 0.081
	0	36 (32.7)	42 (49.4)	
	1	18 (16.4)	5 (5.9)	
	2	16 (14.5)	9 (10.6)	
	3	9 (8.2)	11 (12.9)	
	4	5 (4.5)	6 (7.1)	
	5	6 (5.5)	3 (3.5)	
	6	13 (11.8)	7 (8.2)	
FTN used pad	Not available	6 (5.5)	2 (2.4)	χ^2 (2) = 3.11, p = 0.211
	No	47 (42.7)	46 (54.1)	
	Yes	57 (51.8)	37 (43.5)	
FTN used wrong hand	Not available	6 (5.5)	2 (2.4)	χ^2 (2) = 3.98, p = 0.137
	No	90 (81.8)	78 (91.8)	
	Yes	14 (12.7)	5 (5.9)	
FTN does not return arm to side	Not available	6 (5.5)	2 (2.4)	χ^2 (2) = 2.15, p = 0.341
	No	79 (71.8)	68 (80)	
	Yes	25 (22.7)	15 (17.6)	
FTN swaying	Not available	6 (5.5)	1 (1.2)	χ^2 (2) = 2.65, p = 0.266
	No	86 (78.2)	71 (83.5)	
	Yes	18 (16.4)	13 (15.3)	
FTN eyelid tremors	Not available	6 (5.5)	2 (2.4)	χ^2 (2) = 23.46, p <.001
	No	94 (85.5)	51 (60)	
	Yes	10 (9.1)	32 (37.6)	
FTN body tremors	Not available	6 (5.5)	2 (2.4)	χ^2 (2) = 11.45, p = 0.003
	No	100 (90.9)	68 (80)	
	Yes	4 (3.6)	15 (17.6)	
FTN does not keep eyes closed	Not available	6 (5.5)	2 (2.4)	χ^2 (2) = 1.25, p = 0.535
	No	101 (91.8)	80 (94.1)	
	Yes	3 (2.7)	3 (3.5)	

Left pupil size RL	Not available	0 (0)	1 (1.2)	χ^2 (3) = 18.56, p <.001
	Below range	16 (14.5)	3 (3.5)	
	Within range	86 (78.2)	59 (69.4)	
	Above range	8 (7.3)	22 (25.9)	
Left pupil size NTD	Not available	1 (0.9)	1 (1.2)	χ^2 (3) = 17.27, p <.001
	Below range	39 (35.5)	10 (11.8)	
	Within range	67 (60.9)	65 (76.5)	
	Above range	3 (2.7)	9 (10.6)	
Left pupil size DL1	Not available	1 (0.9)	0 (0)	χ^2 (3) = 4.09, p = 0.252
	Below range	8 (7.3)	6 (7.1)	
	Within range	95 (86.4)	68 (80)	
	Above range	6 (5.5)	11 (12.9)	
Left pupil size DL2	Not available	101 (91.8)	48 (56.5)	χ^2 (2) = 33.56, p <.001
	Within range	8 (7.3)	29 (34.1)	
	Above range	1 (0.9)	8 (9.4)	
Right pupil size RL	Not available	1 (0.9)	1 (1.2)	χ^2 (3) = 18.35, p <.001
	Below range	16 (14.5)	3 (3.5)	
	Within range	85 (77.3)	58 (68.2)	
	Above range	8 (7.3)	23 (27.1)	
Right pupil size NTD	Not available	2 (1.8)	1 (1.2)	χ^2 (3) = 20.15, p <.001
	Below range	39 (35.5)	10 (11.8)	
	Within range	66 (60)	62 (72.9)	
	Above range	3 (2.7)	12 (14.1)	
Right pupil size DL1	Not available	2 (1.8)	0 (0)	χ^2 (3) = 4.80, p = 0.187
	Below range	8 (7.3)	6 (7.1)	
	Within range	94 (85.5)	68 (80)	
	Above range	6 (5.5)	11 (12.9)	
Right pupil size DL2	Not available	101 (91.8)	48 (56.5)	χ^2 (2) = 33.56, p <.001
	Within range	8 (7.3)	29 (34.1)	
	Above range	1 (0.9)	8 (9.4)	
Rebound dilation	No	99 (90)	40 (47.1)	χ^2 (1) = 43.19, p <.001
	Yes	11 (10)	45 (52.9)	
Reaction to light	Not available	3 (2.7)	0 (0)	χ^2 (3) = 16.13, p = 0.001
	Normal	31 (28.2)	44 (51.8)	
	Slow	55 (50)	36 (42.4)	
	Little to none	21 (19.1)	5 (5.9)	
Nasal area	Not available	1 (0.9)	0 (0)	χ^2 (2) = 0.79, p = 0.672
	Clear/normal	76 (69.1)	60 (70.6)	
	Other	33 (30)	25 (29.4)	
Oral cavity	Clear/normal	54 (49.1)	24 (28.2)	χ^2 (1) = 8.69, p = 0.003
	Other	56 (50.9)	61 (71.8)	
Left arm injection sites	None	89 (80.9)	70 (82.4)	χ^2 (3) = 1.76, p = 0.623
	Old	10 (9.1)	5 (5.9)	
	Fresh	10 (9.1)	10 (11.8)	

	Both	1 (0.9)	0 (0)	
Right arm injection sites	None	95 (86.4)	74 (87.1)	χ^2 (3) = 1.85, p = 0.605
	Old	6 (5.5)	7 (8.2)	
	Fresh	8 (7.3)	4 (4.7)	
	Both	1 (0.9)	0 (0)	
BP systolic	Not available	0 (0)	1 (1.2)	χ^2 (3) = 1.84, p = 0.605
	Below range	25 (22.7)	21 (24.7)	
	Within range	53 (48.2)	36 (42.4)	
	Above range	32 (29.1)	27 (31.8)	
BP diastolic	Not available	0 (0)	1 (1.2)	χ^2 (3) = 6.25, p = 0.100
	Below range	10 (9.1)	17 (20)	
	Within range	77 (70)	51 (60)	
	Above range	23 (20.9)	16 (18.8)	
Body temperature	Not available	3 (2.7)	0 (0)	χ^2 (3) = 8.52, p = 0.036
	Below range	54 (49.1)	34 (40)	
	Within range	49 (44.5)	51 (60)	
	Above range	4 (3.6)	0 (0)	
Muscle tone	Not available	1 (0.9)	0 (0)	χ^2 (3) = 9.97, p = 0.019
	Normal	39 (35.5)	48 (56.5)	
	Flaccid	55 (50)	32 (37.6)	
	Rigid	15 (13.6)	5 (5.9)	

The forward stepwise regression procedure selected four predictors, and the model was significant, $\chi^2(4) = 75.62$, $p < .001$, indicating that a set of face sheet measures significantly predicted cannabis. Table 14 displays a classification table for the model's predictive effectiveness. The overall prediction accuracy was approximately 76%.

Table 14

Classification Table for Regression Predicting Cannabis

	Predicted		
Observed	Cannabis not active	Cannabis active	% Correct
Cannabis not active	88	22	80.0
Cannabis active	24	61	71.8
Overall % Correct			76.4

Table 15 displays the regression coefficient results for the model predicting cannabis. Having abnormal breath (OR = 2.41, $p = .015$), MRB eyelid tremors (OR = 4.93, $p < .001$), and

rebound dilation (OR = 7.41, $p < .001$) were associated with higher odds of cannabis being an active drug category. Having a physical disability (OR = 0.37, $p = .025$) was associated with lower odds of cannabis being an active drug category.

Table 15

Coefficients for Regression Predicting Cannabis

						95% CI OR	
Variable	*B*	*SE*	Wald	Sig.	OR	Lower	Upper
Physical disability	-1.00	0.45	5.00	.025	0.37	0.15	0.88
Abnormal breath	0.88	0.36	5.96	.015	2.41	1.19	4.89
MRB eyelid tremors	1.59	0.38	17.76	< .001	4.93	2.35	10.34
Rebound dilation	2.00	0.41	23.51	< .001	7.41	3.30	16.64

Hypothesis 2 Conclusion

The analyses revealed significant associations between the face sheet measures and the active drug categories of CNS depressant, CNS stimulant, narcotic analgesic, and cannabis. The regression models for these drug categories were significant, indicating that there are sets of measures from the face sheet that can significantly predict active drug categories. Therefore, the null hypothesis was rejected.

Hypothesis 3

The focus of Hypothesis 3 was determining what set of measures (signs and symptoms) from the face sheet significantly predict the drug categories inaccurately called by the DREs. To answer the research question and test the hypothesis, crosstabulations and bivariate tests (i.e., chi-square tests) were performed on the cases with missed opinions ($n = 23$) to determine which factors from the face sheets were significantly associated with the drug categories that were called incorrectly. Regressions were not performed due to the small subsample of cases with missed opinions. There were 13 cases that incorrectly called CNS depressant, three cases that

incorrected called CNS stimulant, seven cases that incorrectly called narcotic analgesic, one case that incorrectly called inhalant, and eight cases that incorrectly called cannabis. Because there was only one incorrect call for inhalant, this drug category was not analyzed further.

Table 16 displays crosstabulations of each factor with the misidentification of CNS depressant as an active drug category. Factors significantly associated with missed calls of CNS depressant were lack of smooth pursuit and maximum deviation (both eyes), 30-to-45-degree angle of onset (both eyes), no FTN eyelid tremors, left and right pupil size DL, and abnormal nasal area.

Table 16

Crosstabulation of Face Sheet Measures with Missed CNS Depressant Call

		CNS Depressant		
Variable	Value	Not Missed *n* (%)	Missed *n* (%)	Bivariate Test Result
Have you eaten today	Not available	1 (10)	0 (0)	χ^2 (2) = 5.77, p = 0.056
	No	0 (0)	5 (38.5)	
	Yes	9 (90)	8 (61.5)	
Have you drank today	No	2 (20)	4 (30.8)	χ^2 (1) = 0.34, p = 0.560
	Yes	8 (80)	9 (69.2)	
Est. time vs. actual time	10 minutes or less difference	2 (20)	1 (7.7)	χ^2 (3) = 5.10, p = 0.165
	11 to 30 minutes difference	4 (40)	1 (7.7)	
	31 to 90 minutes difference	3 (30)	8 (61.5)	
	More than 90 minutes difference	1 (10)	3 (23.1)	
Duration of last sleep	Not available	2 (20)	1 (7.7)	χ^2 (3) = 0.91, p = 0.823
	Less than 4 hours	1 (10)	2 (15.4)	
	4 to 8 hours	6 (60)	8 (61.5)	
	More than 8 hours	1 (10)	2 (15.4)	
Sick or injured	No	6 (60)	11 (84.6)	χ^2 (1) = 1.78, p = 0.183
	Yes	4 (40)	2 (15.4)	
Physical disabilities	No	7 (70)	8 (61.5)	χ^2 (1) = 0.18, p = 0.673
	Yes	3 (30)	5 (38.5)	
Under care of doctor or dentist	No	7 (70)	7 (53.8)	χ^2 (1) = 0.62, p = 0.431
	Yes	3 (30)	6 (46.2)	

Taking medications or drugs	No	5 (50)	5 (38.5)	χ^2 (1) = 0.31, p = 0.580
	Yes	5 (50)	8 (61.5)	
Coordination	Fair/good	3 (30)	2 (15.4)	χ^2 (1) = 0.71, p = 0.400
	Other	7 (70)	11 (84.6)	
Breath	Normal	7 (70)	7 (53.8)	χ^2 (1) = 0.62, p = 0.431
	Other	3 (30)	6 (46.2)	
Face	Normal	3 (30)	7 (53.8)	χ^2 (1) = 1.31, p = 0.253
	Other	7 (70)	6 (46.2)	
Speech	Normal	4 (40)	3 (23.1)	χ^2 (1) = 0.77, p = 0.382
	Other	6 (60)	10 (76.9)	
Eyes appearance	Normal	3 (30)	1 (7.7)	χ^2 (3) = 3.82, p = 0.282
	Bloodshot	4 (40)	3 (23.1)	
	Watery	1 (10)	3 (23.1)	
	Bloodshot and watery	2 (20)	6 (46.2)	
Eyelids	Normal	7 (70)	6 (46.2)	χ^2 (1) = 1.31, p = 0.253
	Droopy	3 (30)	7 (53.8)	
Pulse	Below range	2 (20)	1 (7.7)	χ^2 (2) = 0.76, p = 0.686
	Within range	4 (40)	6 (46.2)	
	Above range	4 (40)	6 (46.2)	
Left eye lack of smooth pursuit	No	8 (80)	0 (0)	χ^2 (1) = 15.95, p <.001
	Yes or present	2 (20)	13 (100)	
Left eye maximum deviation	No	8 (80)	0 (0)	χ^2 (1) = 15.95, p <.001
	Yes or present	2 (20)	13 (100)	
Eye angle of onset	Not present	8 (80)	0 (0)	χ^2 (1) = 15.95, p <.001
	30 to 45 Degrees	2 (20)	13 (100)	
Right eye lack of smooth pursuit	No	8 (80)	0 (0)	χ^2 (1) = 15.95, p <.001
	Yes or present	2 (20)	13 (100)	
Right eye maximum deviation	No	8 (80)	0 (0)	χ^2 (1) = 15.95, p = <.001
	Yes or present	2 (20)	13 (100)	
Vertical gaze nystagmus	No	9 (90)	10 (76.9)	χ^2 (1) = 0.67, p = 0.412
	Yes	1 (10)	3 (23.1)	
Lack of convergence	Absent	3 (30)	2 (15.4)	χ^2 (1) = 0.71, p = 0.400
	Present	7 (70)	11 (84.6)	
Completion of one leg stand (left)	Not attempted	1 (10)	2 (15.4)	χ^2 (1) = 0.14, p = 0.704
	Attempted and completed	9 (90)	11 (84.6)	
Completion of one leg stand (right)	Not attempted	1 (10)	2 (15.4)	χ^2 (1) = 0.14, p = 0.704
	Attempted and completed	9 (90)	11 (84.6)	
Left OLS sways while balancing	Not attempted/completed	1 (10)	2 (15.4)	χ^2 (2) = 1.98, p = 0.372
	Not present	0 (0)	2 (15.4)	
	Present	9 (90)	9 (69.2)	

Left OLS uses arms to balance	Not attempted/completed	1 (10)	2 (15.4)	χ^2 (2) = 0.15, p = 0.929
	Not present	4 (40)	5 (38.5)	
	Present	5 (50)	6 (46.2)	
Left OLS hopping	Not attempted/completed	1 (10)	2 (15.4)	χ^2 (1) = 0.14, p = 0.704
	Not present	9 (90)	11 (84.6)	
Left OLS puts foot down	Not attempted/completed	1 (10)	2 (15.4)	χ^2 (3) = 0.94, p = 0.817
	0	4 (40)	5 (38.5)	
	1	3 (30)	2 (15.4)	
	2 or more	2 (20)	4 (30.8)	
Left OLS time	Not attempted/completed	2 (20)	3 (23.1)	χ^2 (3) = 0.48, p = 0.922
	0-14	2 (20)	4 (30.8)	
	15-29	3 (30)	3 (23.1)	
	30 or more	1 (10)	1 (7.7)	
Right OLS sways while balancing	Not attempted/completed	1 (10)	2 (15.4)	χ^2 (2) = 1.01, p = 0.603
	Not present	0 (0)	1 (7.7)	
	Present	9 (90)	10 (76.9)	
Right OLS uses arms to balance	Not attempted/completed	1 (10)	2 (15.4)	χ^2 (2) = 2.95, p = 0.229
	Not present	1 (10)	5 (38.5)	
	Present	8 (80)	6 (46.2)	
Right OLS hopping	Not attempted/completed	1 (10)	2 (15.4)	χ^2 (2) = 0.17, p = 0.920
	Not present	8 (80)	10 (76.9)	
	Present	1 (10)	1 (7.7)	
Right OLS puts foot down	Not attempted/completed	1 (10)	2 (15.4)	$X^2(3) = 0.26$, p = 0.968
	0	3 (30)	3 (23.1)	
	1	2 (20)	3 (23.1)	
	2 or more	2 (20)	3 (23.1)	
Right OLS time	Not attempted/completed	1 (10)	2 (15.4)	χ^2 (2) = 1.38, p = 0.515
	0-14	2 (20)	5 (38.5)	
	15-29	7 (70)	6 (46.2)	
	30 or more	0 (0)	0 (0)	
MRB swaying front to back	0	5 (50)	4 (30.8)	χ^2 (2) = 1.66, p = 0.436
	<2 inches	1 (40)	4 (30.8)	
	2 inches or more	4 (40)	5 (38.5)	
MRB swaying left to right	0	4 (40)	4 (30.8)	χ^2 (2) = 1.43, p = 0.488
	< 2 inches	1 (10)	4 (30.8)	
	2 inches or more	5 (50)	5 (38.5)	
MRB internal clock	0-24	3 (30)	4 (30.8)	χ^2 (2) = 0.43, p = 0.808
	25-35	2 (20)	4 (30.8)	
	36 or higher	5 (50)	5 (38.5)	
MRB presence eyelid tremors	No	6 (60)	9 (69.2)	χ^2 (1) = 0.21, p = 0.645

	Yes	4 (40)	4 (30.8)	
MRB presence body or leg tremors	No	10 (100)	12 (92.3)	χ^2 (1) = 0.80, p = 0.370
	Yes	0 (0)	1 (7.7)	
WAT completion	Not attempted	0 (0)	1 (7.7)	χ^2 (1) = 0.80, p = 0.370
	Attempted and completed	10 (100)	12 (92.3)	
WAT balance	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (3) = 2.61, p = 0.455
	0	3 (30)	4 (30.8)	
	1	4 (40)	7 (53.8)	
	2 or higher	3 (30)	1 (7.7)	
WAT starts early	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (2) = 2.65, p = 0.265
	0	10 (100)	10 (76.9)	
	1	0 (0)	2 (15.4)	
WAT1 stops walking	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (3) = 6.87, p = 0.076
	0	9 (90)	5 (38.5)	
	1	1 (10)	3 (23.1)	
	2 or higher	0 (0)	4 (30.8)	
WAT1 missed heel to toe	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (3) = 2.55, p = 0.466
	0	5 (50)	6 (46.2)	
	1	4 (40)	3 (23.1)	
	2 or higher	1 (10)	3 (23.1)	
WAT1 steps off line	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (3) = 1.03, p = 0.795
	0	5 (50)	5 (38.5)	
	1	4 (40)	6 (46.2)	
	2 or higher	1 (10)	1 (7.7)	
WAT1 raised arms	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (3) = 5.97, p = 0.112
	0	4 (40)	7 (53.8)	
	1	1 (10)	4 (30.8)	
	2 or more	5 (50)	1 (7.7)	
WAT1 steps	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (3) = 1.73, p = 0.631
	< 9	1 (10)	1 (7.7)	
	9	6 (60)	5 (38.5)	
	> 9	3 (30)	6 (46.2)	
WAT2 stops walking	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (3) = 4.17, p = 0.244
	0	8 (80)	6 (46.2)	
	1	2 (20)	3 (23.1)	
	2 or higher	0 (0)	3 (23.1)	
WAT2 missed heel to toe	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (3) = 3.59, p = 0.309
	0	5 (50)	4 (30.8)	
	1	1 (10)	5 (38.5)	
	2 or higher	4 (40)	3 (23.1)	
WAT2 steps off line	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (3) = 2.38, p = 0.497
	0	8 (80)	7 (53.8)	
	1	2 (20)	4 (30.8)	
	2 or higher	0 (0)	1 (7.7)	

WAT2 raised arms	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (4) = 6.48, p = 0.166
	0	5 (50)	6 (46.2)	
	1	1 (10)	5 (38.5)	
	2 or higher	4 (40)	1 (7.7)	
WAT2 steps	Not attempted/completed	0 (0)	1 (7.7)	χ^2 (4) = 2.23, p = 0.694
	< 9	1 (10)	2 (15.4)	
	9	7 (70)	7 (53.8)	
	> 9	2 (20)	3 (23.1)	
FTN hit count	Not attempted	0 (0)	3 (23.1)	χ^2 (4) = 4.38, p = 0.357
	0	3 (30)	5 (38.5)	
	1	3 (30)	3 (23.1)	
	4	1 (10)	0 (0)	
	6	3 (30)	2 (15.4)	
FTN used pad	Not available	0 (0)	2 (15.4)	χ^2 (2) = 1.78, p = 0.410
	No	3 (30)	4 (30.8)	
	Yes	7 (70)	7 (53.8)	
FTN used wrong hand	Not available	0 (0)	2 (15.4)	χ^2 (2) = 2.71, p = 0.257
	No	9 (90)	8 (61.5)	
	Yes	1 (10)	3 (23.1)	
FTN does not return arm to side	Not available	0 (0)	2 (15.4)	χ^2 (2) = 2.22, p = 0.329
	No	7 (70)	6 (46.2)	
	Yes	3 (30)	5 (38.5)	
FTN swaying	Not available	0 (0)	2 (15.4)	χ^2 (2) = 1.70, p = 0.426
	No	7 (70)	8 (61.5)	
	Yes	3 (30)	3 (23.1)	
FTN eyelid tremors	Not available	0 (0)	2 (15.4)	χ^2 (2) = 6.05, p = 0.049
	No	5 (50)	10 (76.9)	
	Yes	5 (50)	1 (7.7)	
FTN body tremors	Not available	0 (0)	2 (15.4)	χ^2 (2) = 4.15, p = 0.125
	No	8 (80)	11 (84.6)	
	Yes	2 (20)	0 (0)	
FTN does not keep eyes closed	Not available	0 (0)	2 (15.4)	χ^2 (2) = 1.69, p = 0.430
	No	9 (90)	10 (76.9)	
	Yes	1 (10)	1 (7.7)	
Left pupil size RL	Below range	1 (10)	1 (7.7)	χ^2 (2) = 2.98, p = 0.226
	Within range	7 (70)	12 (92.3)	
	Above range	2 (20)	0 (0)	
Left pupil size NTD	Below range	2 (20)	5 (38.5)	χ^2 (1) = 0.91, p = 0.340
	Within range	8 (80)	8 (61.5)	
Left pupil size DL1	Within range	8 (80)	13 (100)	χ^2 (1) = 2.85, p = 0.092
	Above range	2 (20)	0 (0)	
Left pupil size DL2	Not available	6 (60)	13 (100)	χ^2 (1) = 6.30, p = 0.012
	Within range	4 (40)	0 (0)	

Right pupil size RL	Below range	1 (10)	1 (7.7)	χ^2 (2) = 2.98, p = 0.226
	Within range	7 (70)	12 (92.3)	
	Above range	2 (20)	0 (0)	
Right pupil size NTD	Below range	2 (20)	5 (38.5)	χ^2 (1) = 0.91, p = 0.340
	Within range	8 (80)	8 (61.5)	
Right pupil size DL1	Within range	8 (80)	13 (100)	χ^2 (1) = 2.85, p = 0.092
	Above range	2 (20)	0 (0)	
Right pupil size DL2	Not available	6 (60)	13 (100)	χ^2 (1) = 6.30, p = 0.012
	Within range	4 (40)	0 (0)	
Rebound dilation	No	6 (60)	12 (92.3)	χ^2 (1) = 3.47, p = 0.063
	Yes	4 (40)	1 (7.7)	
Reaction to light	Not available	0 (0)	1 (7.7)	χ^2 (3) = 1.07, p = 0.784
	Normal	5 (50)	5 (38.5)	
	Slow	4 (40)	5 (38.5)	
	Little to none	1 (10)	2 (15.4)	
Nasal area	Clear/normal	10 (100)	8 (61.5)	χ^2 (1) = 4.92, p = 0.027
	Other	0 (0)	5 (38.5)	
Oral cavity	Clear/normal	5 (50)	5 (38.5)	χ^2 (1) = 0.31, p = 0.580
	Other	5 (50)	8 (61.5)	
Left arm injection sites	None	8 (80)	11 (84.6)	χ^2 (2) = 1.44, p = 0.487
	Old	0 (0)	1 (7.7)	
	Fresh	2 (20)	1 (7.7)	
Right arm injection sites	None	8 (80)	12 (92.3)	χ^2 (2) = 3.47, p = 0.177
	Old	0 (0)	1 (7.7)	
	Fresh	2 (20)	0 (0)	
BP systolic	Below range	3 (30)	3 (23.1)	χ^2 (2) = 0.91, p = 0.634
	Within range	5 (50)	5 (38.5)	
	Above range	2 (20)	5 (38.5)	
BP diastolic	Within range	8 (80)	9 (69.2)	χ^2 (1) = 0.34, p = 0.560
	Above range	2 (20)	4 (30.8)	
Body temperature	Below range	6 (60)	8 (61.5)	χ^2 (2) = 3.62, p = 0.163
	Within range	4 (40)	2 (15.4)	
	Above range	0 (0)	3 (23.1)	
Muscle tone	Not available	1 (10)	0 (0)	χ^2 (3) = 3.36, p = 0.340
	Normal	6 (60)	5 (38.5)	
	Flaccid	3 (30)	7 (53.8)	
	Rigid	0 (0)	1 (7.7)	

Table 17 displays crosstabulations of each factor with the misidentification of CNS stimulant as an active drug category. Factors significantly associated with missed calls of CNS stimulant were droopy eyelids and slow to no reaction to light.

Table 17

Crosstabulation of Face Sheet Measures with Missed CNS Stimulant Call

Variable	Value	CNS Stimulant		Bivariate Test Result
		Not Missed *n* (%)	Missed *n* (%)	
Have you eaten today	Not available	1 (5)	0 (0)	χ^2 (2) = 0.39, p = 0.824
	No	4 (20)	1 (33.3)	
	Yes	15 (75)	2 (66.7)	
Have you drank today	No	5 (25)	1 (33.3)	χ^2 (1) = 0.09, p = 0.759
	Yes	15 (75)	2 (66.7)	
Est. time vs. actual time	10 minutes or less difference	3 (15)	0 (0)	χ^2 (3) = 7.13, p = 0.068
	11 to 30 minutes difference	4 (20)	1 (33.3)	
	31 to 90 minutes difference	11 (55)	0 (0)	
	More than 90 minutes difference	2 (10)	2 (66.7)	
Duration of last sleep	Not available	3 (15)	0 (0)	χ^2 (3) = 2.22, p = 0.528
	Less than 4 hours	3 (15)	0 (0)	
	4 to 8 hours	11 (55)	3 (100)	
	More than 8 hours	3 (15)	0 (0)	
Sick or injured	No	15 (75)	2 (66.7)	χ^2 (1) = 0.09, p = 0.759
	Yes	5 (25)	1 (33.3)	
Physical disabilities	No	13 (65)	2 (66.7)	χ^2 (1) = 0.00, p = 0.955
	Yes	7 (35)	1 (33.3)	
Under care of doctor or dentist	No	12 (60)	2 (66.7)	χ^2 (1) = 0.05, p = 0.825
	Yes	8 (40)	1 (33.3)	
Taking medications or drugs	No	8 (40)	2 (66.7)	χ^2 (1) = 0.76, p = 0.385
	Yes	12 (60)	1 (33.3)	
Coordination	Fair/good	5 (25)	0 (0)	χ^2 (1) = 0.96, p = 0.328
	Other	15 (75)	3 (100)	
Breath	Normal	13 (65)	1 (33.3)	χ^2 (1) = 1.10, p = 0.295
	Other	7 (35)	2 (66.7)	
Face	Normal	9 (45)	1 (33.3)	χ^2 (1) = 0.14, p = 0.704
	Other	11 (55)	2 (66.7)	
Speech	Normal	7 (35)	0 (0)	χ^2 (1) = 1.51, p = 0.219
	Other	13 (65)	3 (100)	
Eyes appearance	Normal	3 (15)	1 (33.3)	χ^2 (3) = 2.22, p = 0.528
	Bloodshot	6 (30)	1 (33.3)	
	Watery	3 (15)	1 (33.3)	
	Bloodshot and watery	8 (40)	0 (0)	
Eyelids	Normal	13 (65)	0 (0)	χ^2 (1) = 4.49, p = 0.034

	Droopy	7 (35)	3 (100)	
Pulse	Below range	3 (15)	0 (0)	χ^2 (2) = 4.49, p = 0.106
	Within range	10 (50)	0 (0)	
	Above range	7 (35)	3 (100)	
Left eye lack of smooth pursuit	No	7 (35)	1 (33.3)	χ^2 (1) = 0.00, p = 0.955
	Yes or present	13 (65)	2 (66.7)	
Left eye maximum deviation	No	7 (35)	1 (33.3)	χ^2 (1) = 0.00, p = 0.955
	Yes or present	13 (65)	2 (66.7)	
Eye angle of onset	Not present	7 (35)	1 (33.3)	χ^2 (1) = 0.00, p = 0.955
	30 to 45 Degrees	13 (65)	2 (66.7)	
Right eye lack of smooth pursuit	No	7 (35)	1 (33.3)	χ^2 (1) = 0.00, p = 0.955
	Yes or present	13 (65)	2 (66.7)	
Right eye maximum deviation	No	7 (35)	1 (33.3)	χ^2 (1) = 0.00, p = 0.955
	Yes or present	13 (65)	2 (66.7)	
Vertical gaze nystagmus	No	16 (80)	3 (100)	χ^2 (1) = 0.73, p = 0.394
	Yes	4 (20)	0 (0)	
Lack of convergence	Absent	4 (20)	1 (33.3)	χ^2 (1) = 0.27, p = 0.602
	Present	16 (80)	2 (66.7)	
Completion of one leg stand (left)	Not attempted	3 (15)	0 (0)	χ^2 (1) = 0.52, p = 0.472
	Attempted and completed	17 (85)	3 (100)	
Completion of one leg stand (right)	Not attempted	3 (15)	0 (0)	χ^2 (1) = 0.52, p = 0.472
	Attempted and completed	17 (85)	3 (100)	
Left OLS sways while balancing	Not attempted/completed	3 (15)	0 (0)	χ^2 (2) = 0.96, p = 0.619
	Not present	2 (10)	0 (0)	
	Present	15 (75)	3 (100)	
Left OLS uses arms to balance	Not attempted/completed	3 (15)	0 (0)	χ^2 (2) = 0.74, p = 0.692
	Not present	8 (40)	1 (33.3)	
	Present	9 (45)	2 (66.7)	
Left OLS hopping	Not attempted/completed	3 (15)	0 (0)	χ^2 (1) = 0.52, p = 0.472
	Not present	17 (85)	3 (100)	
Left OLS puts foot down	Not attempted/completed	3 (15)	0 (0)	χ^2 (3) = 3.41, p = 0.333
	0	8 (40)	1 (33.3)	
	1	5 (25)	0 (0)	
	2 or more	4 (20)	2 (66.7)	
Left OLS time	Not attempted/completed	5 (25)	0 (0)	χ^2 (3) = 3.31, p = 0.346
	0-14	4 (20)	2 (66.7)	
	15-29	9 (45)	1 (33.3)	
	30 or more	2 (10)	0 (0)	
Right OLS sways while balancing	Not attempted/completed	3 (15)	0 (0)	χ^2 (2) = 0.73, p = 0.695

	Not present	1 (5)	0 (0)	
	Present	16 (80)	3 (100)	
Right OLS uses arms to balance	Not attempted/completed	3 (15)	0 (0)	χ^2 (2) = 2.22, p = 0.330
	Not present	6 (30)	0 (0)	
	Present	11 (55)	3 (100)	
Right OLS hopping	Not attempted/completed	3 (15)	0 (0)	χ^2 (2) = 0.96, p = 0.619
	Not present	15 (75)	3 (100)	
	Present	2 (10)	0 (0)	
Right OLS puts foot down	Not attempted/completed	3 (15)	0 (0)	χ^2 (3) = 2.23, p = 0.526
	0	6 (30)	0 (0)	
	1	4 (20)	1 (33.3)	
	2 or more	7 (25)	2 (66.7)	
Right OLS time	Not attempted/completed	3 (15)	0 (0)	χ^2 (2) = 2.27, p = 0.322
	0-14	5 (25)	2 (66.7)	
	15-29	12 (60)	1 (33.3)	
	30 or more	0 (0)	0 (0)	
MRB swaying front to back	0	8 (40)	1 (33.3)	χ^2 (2) = .273, p = 0.873
	< 2 inches	4 (20)	1 (33.3)	
	2 inches or more	8 (40)	1 (33.3)	
MRB swaying left to right	0	7 (35)	1 (33.3)	χ^2 (2) = 1.18, p = 0.555
	< 2 inches	5 (25)	0 (0)	
	2 inches or more	8 (40)	2 (66.7)	
MRB internal clock	0-24	6 (30)	1 (33.3)	χ^2 (2) = 3.68, p = 0.158
	25-35	4 (20)	2 (66.7)	
	36 or higher	10 (50)	0 (0)	
MRB presence eyelid tremors	No	14 (70)	1 (33.3)	χ^2 (1) = 1.55, p = 0.214
	Yes	6 (30)	2 (66.7)	
MRB presence body or leg tremors	No	19 (95)	3 (100)	χ^2 (1) = 0.16, p = 0.692
	Yes	1 (5)	0 (0)	
WAT completion	Not attempted	1 (5)	0 (0)	χ^2 (1) = 0.16, p = 0.692
	Attempted and completed	19 (95)	3 (100)	
WAT balance	Not attempted/completed	1 (5)	0 (0)	χ^2 (3) = 1.02, p = 0.797
	0	6 (30)	1 (33.3)	
	1	9 (45)	2 (66.7)	
	2 or higher	4 (20)	0 (0)	
WAT starts early	Not attempted/completed	1 (5)	0 (0)	χ^2 (2) = 0.52, p = 0.772
	0	17 (85)	3 (100)	
	1	2 (10)	0 (0)	
WAT1 stops walking	Not attempted/completed	1 (5)	0 (0)	χ^2 (3) = 1.59, p = 0.662
	0	13 (65)	1 (33.3)	
	1	3 (15)	1 (33.3)	

	2 or higher	3 (15)	1 (33.3)	
WAT1 missed heel to toe	Not attempted/completed	1 (5)	0 (0)	χ^2 (3) = .738, p = 0.864
	0	9 (45)	1 (33.3)	
	1	3 (15)	1 (33.3)	
	2 or higher	7 (35)	1 (33.3)	
WAT1 steps off line	Not attempted/completed	1 (5)	0 (0)	χ^2 (3) = 0.96, p = 0.811
	0	9 (45)	1 (33.3)	
	1	8 (40)	2 (66.7)	
	2 or higher	2 (10)	0 (0)	
WAT1 raised arms	Not attempted/completed	1 (5)	0 (0)	χ^2 (3) = 4.19, p = 0.242
	0	11 (55)	0 (0)	
	1	4 (20)	1 (33.3)	
	2 or higher	4 (20)	2 (66.7)	
WAT1 steps	Not attempted/completed	1 (5)	0 (0)	χ^2 (3) = .77, p = 0.865
	< 9	2 (10)	0 (0)	
	9	9 (45)	2 (66.7)	
	> 9	8 (40)	1 (33.3)	
WAT2 stops walking	Not attempted/completed	1 (5)	0 (0)	χ^2 (3) = 4.23, p = 0.237
	0	13 (65)	1 (33.3)	
	1	3 (15)	2 (66.7)	
	2 or higher	3 (15)	0 (0)	
WAT2 missed heel to toe	Not attempted/completed	1 (5)	0 (0)	χ^2 (3) = 3.69, p = 0.297
	0	9 (45)	0 (0)	
	1	4 (20)	2 (66.7)	
	2 or more	6 (30)	1 (33.3)	
WAT2 steps off line	Not attempted/completed	1 (5)	0 (0)	χ^2 (3) = 3.02, p = 0.389
	0	14 (70)	1 (33.3)	
	1	4 (20)	2 (66.7)	
	2 or higher	1 (5)	0 (0)	
WAT2 raised arms	Not attempted/completed	1 (5)	0 (0)	χ^2 (3) = 5.07, p = 0.167
	0	11 (55)	0 (0)	
	1	5 (25)	1 (33.3)	
	2 or higher	3 (15)	2 (66.7)	
WAT2 steps	Not attempted/completed	1 (5)	0 (0)	χ^2 (3) = 0.83, p = 0.842
	< 9	3 (15)	0 (0)	
	9	12 (60)	2 (66.7)	
	> 9	4 (20)	1 (33.3)	
FTN hit count	Not attempted	3 (15)	0 (0)	χ^2 (4) = 6.47, p = 0.167
	0	5 (25)	3 (100)	
	1	6 (30)	0 (0)	
	4	1 (5)	0 (0)	
	6	5 (25)	0 (0)	
FTN used pad	Not available	2 (10)	0 (0)	χ^2 (2) = 2.22, p = 0.330
	No	7 (35)	0 (0)	

	Yes	11 (55)	3 (100)	
FTN used wrong hand	Not available	2 (10)	0 (0)	χ^2 (2) = 0.83, p = 0.661
	No	15 (75)	2 (66.7)	
	Yes	3 (15)	1 (33.3)	
FTN does not return arm to side	Not available	2 (10)	0 (0)	χ^2 (2) = 2.65, p = 0.265
	No	10 (50)	3 (100)	
	Yes	8 (40)	0 (0)	
FTN swaying	Not available	2 (10)	0 (0)	χ^2 (2) = 3.02, p = 0.221
	No	14 (70)	1 (33.3)	
	Yes	4 (20)	2 (66.7)	
FTN eyelid tremors	Not available	2 (10)	0 (0)	χ^2 (2) = 0.37, p = 0.831
	No	13 (65)	2 (66.7)	
	Yes	5 (25)	1 (33.3)	
FTN body tremors	Not available	2 (10)	0 (0)	χ^2 (2) = 0.73, p = 0.695
	No	16 (80)	3 (100)	
	Yes	2 (10)	0 (0)	
FTN does not keep eyes closed	Not available	2 (10)	0 (0)	χ^2 (2) = 2.81, p = 0.245
	No	17 (85)	2 (66.7)	
	Yes	1 (5)	1 (33.3)	
Left pupil size RL	Below range	2 (10)	0 (0)	χ^2 (2) = 0.73, p = 0.695
	Within range	16 (80)	3 (100)	
	Above range	2 (10)	0 (0)	
Left pupil size NTD	Below range	6 (30)	1 (33.3)	χ^2 (1) = 0.01, p = 0.907
	Within range	14 (70)	2 (66.7)	
Left pupil size DL1	Within range	18 (90)	3 (100)	χ^2 (1) = 0.33, p = 0.567
	Above range	2 (10)	0 (0)	
Left pupil size DL2	Not available	16 (80)	3 (100)	χ^2 (1) = 0.73, p = 0.394
	Within range	4 (20)	0 (0)	
Right pupil size RL	Below range	2 (10)	0 (0)	χ^2 (2) = 0.73, p = 0.695
	Within range	16 (80)	3 (100)	
	Above range	2 (10)	0 (0)	
Right pupil size NTD	Below range	6 (30)	1 (33.3)	χ^2 (1) = 0.01, p = 0.907
	Within range	14 (70)	2 (66.7)	
Right pupil size DL1	Within range	18 (90)	3 (100)	χ^2 (1) = 0.33, p = 0.567
	Above range	2 (10)	0 (0)	
Right pupil size DL2	Not available	16 (80)	3 (100)	χ^2 (1) = 0.73, p = 0.394
	Within range	4 (20)	0 (0)	
Rebound dilation	No	15 (75)	3 (100)	χ^2 (1) = 0.96, p = 0.328
	Yes	5 (25)	0 (0)	
Reaction to light	Not available	0 (0)	1 (33.3)	χ^2 (3) = 9.29, p = 0.026
	Normal	10 (50)	0 (0)	
	Slow	8 (40)	1 (33.3)	
	Little to none	2 (10)	1 (33.3)	

Nasal area	Clear/normal	16 (80)	2 (66.7)	χ^2 (1) = 0.27, p = 0.602
	Other	4 (20)	1 (33.3)	
Oral cavity	Clear/normal	10 (50)	0 (0)	χ^2 (1) = 2.65, p = 0.103
	Other	10 (50)	3 (100)	
Left arm injection sites	None	17 (85)	2 (66.7)	χ^2 (2) = 1.35, p = 0.510
	Old	1 (5)	0 (0)	
	Fresh	2 (10)	1 (33.3)	
Right arm injection sites	None	18 (90)	2 (66.7)	χ^2 (2) = 2.72, p = 0.256
	Old	1 (5)	0 (0)	
	Fresh	1 (5)	1 (33.3)	
BP systolic	Below range	4 (20)	2 (66.7)	χ^2 (2) = 3.69, p = 0.158
	Within range	10 (50)	0 (0)	
	Above range	6 (30)	1 (33.3)	
BP diastolic	Within range	14 (70)	3 (100)	χ^2 (1) = 1.22, p = 0.270
	Above range	6 (30)	0 (0)	
Body temperature	Below range	12 (60)	2 (66.7)	χ^2 (2) = 2.01, p = 0.366
	Within range	6 (30)	0 (0)	
	Above range	2 (10)	1 (33.3)	
Muscle tone	Not available	1 (5)	0 (0)	χ^2 (3) = 0.64, p = 0.888
	Normal	9 (45)	2 (66.7)	
	Flaccid	9 (45)	1 (33.3)	
	Rigid	1 (5)	0 (0)	

Table 18 displays crosstabulations of each factor with the misidentification of narcotic analgesic as an active drug category. Factors significantly associated with missed calls of narcotic analgesic were slow pulse rates and right arm injection sites.

Table 18

Crosstabulation of Face Sheet Measures with Missed Narcotic Analgesic Call

		Narcotic Analgesic		
Variable	Value	Not Missed *n* (%)	Missed *n* (%)	Bivariate Test Result
Have you eaten today	Not available	0 (0)	1 (14.3)	χ^2 (2) = 2.55, p = 0.279
	No	4 (25)	1 (14.3)	
	Yes	12 (75)	5 (71.4)	
Have you drank today	No	3 (18.8)	3 (42.9)	χ^2 (1) = 1.47, p = 0.226
	Yes	13 (81.3)	4 (57.1)	
Est. time vs. actual time	10 minutes or less difference	2 (12.5)	1 (14.3)	χ^2 (3) = 2.16, p = 0.540
	11 to 30 minutes difference	3 (18.8)	2 (28.6)	

	31 to 90 minutes difference	7 (43.8)	4 (57.1)	
	More than 90 minutes difference	4 (25)	0 (0)	
Duration of last sleep	Not available	3 (18.8)	0 (0)	χ^2 (3) = 3.21, p = 0.361
	Less than 4 hours	1 (6.3)	2 (28.6)	
	4 to 8 hours	10 (62.5)	4 (57.1)	
	More than 8 hours	2 (12.5)	1 (14.3)	
Sick or injured	No	14 (87.5)	3 (42.9)	χ^2 (1) = 5.03, p = 0.025
	Yes	2 (12.5)	4 (57.1)	
Physical disabilities	No	11 (68.8)	4 (57.1)	χ^2 (1) = 0.29, p = 0.591
	Yes	5 (31.3)	3 (42.9)	
Under care of doctor or dentist	No	9 (56.3)	5 (71.4)	χ^2 (1) = 0.47, p = 0.493
	Yes	7 (43.8)	2 (28.6)	
Taking medications or drugs	No	7 (43.8)	3 (42.9)	χ^2 (1) = 0.00, p = 0.968
	Yes	9 (56.3)	4 (57.1)	
Coordination	Fair/good	5 (31.3)	0 (0)	χ^2 (1) = 2.8, p = 0.095
	Other	11 (68.8)	7 (100)	
Breath	Normal	9 (56.3)	5 (71.4)	χ^2 (1) = 0.47, p = 0.493
	Other	7 (43.8)	2 (28.6)	
Face	Normal	9 (56.3)	1 (14.3)	χ^2 (1) = 3.49, p = 0.062
	Other	7 (43.8)	6 (85.7)	
Speech	Normal	6 (37.5)	1 (14.3)	χ^2 (1) = 1.24, p = 0.266
	Other	10 (62.5)	6 (85.7)	
Eyes appearance	Normal	2 (12.5)	2 (28.6)	χ^2 (3) = 2.42, p = 0.490
	Bloodshot	6 (37.5)	1 (14.3)	
	Watery	2 (12.5)	2 (28.6)	
	Bloodshot and watery	6 (37.5)	2 (28.6)	
Eyelids	Normal	9 (56.3)	4 (57.1)	χ^2 (1) = 0.00, p = 0.968
	Droopy	7 (43.8)	3 (42.9)	
Pulse	Below range	0 (0)	3 (42.9)	χ^2 (2) = 7.89, p = 0.019
	Within range	8 (50)	2 (28.6)	
	Above range	8 (50)	2 (28.6)	
Left eye lack of smooth pursuit	No	4 (25)	4 (57.1)	χ^2 (1) = 2.22, p = 0.136
	Yes or present	12 (75)	3 (42.9)	
Left eye maximum deviation	No	4 (25)	4 (57.1)	χ^2 (1) = 2.22, p = 0.136
	Yes or present	12 (75)	3 (42.9)	
Eye angle of onset	Not present	4 (25)	4 (57.1)	χ^2 (1) = 2.22, p = 0.136
	30 to 45 Degrees	12 (75)	3 (42.9)	
Right eye lack of smooth pursuit	No	4 (25)	4 (57.1)	χ^2 (1) = 2.22, p = 0.136
	Yes or present	12 (75)	3 (42.9)	
Right eye maximum deviation	No	4 (25)	4 (57.1)	χ^2 (1) = 2.22, p = 0.136

	Yes or present	12 (75)	3 (42.9)	
Vertical gaze nystagmus	No	12 (75)	7 (100)	χ^2 (1) = 2.12, p = 0.146
	Yes	4 (25)	0 (0)	
Lack of convergence	Absent	3 (18.8)	2 (28.6)	χ^2 (1) = 0.28, p = 0.599
	Present	13 (81.3)	5 (71.4)	
Completion of one leg stand (left)	Not attempted	1 (6.3)	2 (28.6)	χ^2 (1) = 2.14, p = 0.144
	Attempted and completed	15 (93.8)	5 (71.4)	
Completion of one leg stand (right)	Not attempted	1 (6.3)	2 (28.6)	χ^2 (1) = 2.14, p = 0.144
	Attempted and completed	15 (93.8)	5 (71.4)	
Left OLS sways while balancing	Not attempted/completed	1 (6.3)	2 (28.6)	χ^2 (2) = 2.8, p = 0.247
	Not present	1 (6.3)	1 (14.3)	
	Present	14 (87.5)	4 (57.1)	
Left OLS uses arms to balance	Not attempted/completed	1 (6.3)	2 (28.6)	χ^2 (2) = 2.68, p = 0.262
	Not present	6 (37.5)	3 (42.9)	
	Present	9 (56.3)	2 (28.6)	
Left OLS hopping	Not attempted/completed	1 (6.3)	2 (28.6)	χ^2 (1) = 2.14, p = 0.144
	Not present	15 (93.8)	5 (71.4)	
Left OLS puts foot down	Not attempted/completed	1 (6.3)	2 (28.6)	χ^2 (3) = 4.74, p = 0.192
	0	6 (37.5)	3 (42.9)	
	1	3 (18.8)	2 (28.6)	
	2 or more	6 (37.5)	0 (0)	
Left OLS time	Not attempted/completed	3 (18.8)	2 (28.6)	χ^2 (3) = 1.12, p = 0.773
	0-14	5 (31.3)	1 (14.3)	
	15-29	7 (43.8)	3 (42.9)	
	30 or more	1 (6.3)	1 (14.3)	
Right OLS sways while balancing	Not attempted/completed	1 (6.3)	2 (28.6)	χ^2 (2) = 2.45, p = 0.294
	Not present	1 (6.3)	0 (0)	
	Present	14 (87.5)	5 (71.4)	
Right OLS uses arms to balance	Not attempted/completed	1 (6.3)	2 (28.6)	χ^2 (2) = 2.42, p = 0.298
	Not present	5 (31.3)	1 (14.3)	
	Present	10 (62.5)	4 (57.1)	
Right OLS hopping	Not attempted/completed	1 (6.3)	2 (28.6)	χ^2 (2) = 2.80, p = 0.247
	Not present	13 (81.3)	5 (71.4)	
	Present	2 (12.5)	0 (0)	
Right OLS puts foot down	Not attempted/completed	1 (6.3)	2 (28.6)	χ^2 (4) = 7.89, p = 0.096
	0	4 (25)	2 (28.6)	
	1	2 (12.5)	3 (42.9)	
	2 or more	9 (56.3)	0 (0)	
Right OLS time	Not attempted/completed	1 (6.3)	2 (28.6)	χ^2 (2) = 2.73, p = 0.256
	0-14	6 (37.5)	1 (14.3)	

	15-29	9 (56.3)	4 (57.1)	
	30 or more	0 (0)	0 (0)	
MRB swaying front to back	0	5 (31.3)	4 (57.1)	χ^2 (2) = 1.38, p = 0.502
	< 2 inches	4 (25)	1 (14.3)	
	2 inches or more	7 (43.8)	2 (28.6)	
MRB swaying left to right	0	5 (31.3)	3 (42.9)	χ^2 (2) = 0.92, p = 0.632
	< 2 inches	3 (18.8)	2 (28.6)	
	2 inches or more	8 (50)	2 (28.6)	
MRB internal clock	0-24	6 (37.5)	1 (14.3)	χ^2 (2) = 1.95, p = 0.378
	25-35	3 (18.8)	3 (42.9)	
	36 or higher	7 (43.8)	3 (42.9)	
MRB presence eyelid tremors	No	9 (56.3)	6 (85.7)	χ^2 (1) = 1.86, p = 0.172
	Yes	7 (43.8)	1 (14.3)	
MRB presence body or leg tremors	No	15 (93.8)	7 (100)	χ^2 (1) = 0.46, p = 0.499
	Yes	1 (6.3)	0 (0)	
WAT completion	Not attempted	0 (0)	1 (14.3)	χ^2 (1) = 2.39, p = 0.122
	Attempted and completed	16 (100)	6 (85.7)	
WAT balance	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (3) = 3.63, p = 0.304
	0	4 (25)	3 (42.9)	
	1	9 (56.3)	2 (28.6)	
	2 or higher	3 (18.8)	1 (14.3)	
WAT starts early	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (2) = 3.16, p = 0.206
	0	14 (87.5)	6 (85.7)	
	1	2 (12.5)	0 (0)	
WAT1 stops walking	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (3) = 4.28, p = 0.233
	0	9 (56.3)	5 (71.4)	
	1	4 (25)	0 (0)	
	2 or higher	3 (18.8)	1 (14.3)	
WAT1 missed heel to toe	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (3) = 5.17, p = 0.160
	0	9 (56.3)	1 (14.3)	
	1	2 (12.5)	2 (28.6)	
	2 or higher	5 (31.3)	3 (42.9)	
WAT1 steps off line	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (3) = 5.05, p = 0.168
	0	9 (56.3)	1 (14.3)	
	1	6 (37.5)	4 (57.1)	
	2 or higher	1 (6.3)	1 (14.3)	
WAT1 raised arms	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (3) = 4.41, p = 0.221
	0	9 (56.3)	2 (28.6)	
	1	4 (25)	1 (14.3)	
	2 or higher	3 (18.8)	3 (42.9)	
WAT1 steps	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (3) = 3.25, p = 0.355
	< 9	2 (12.5)	0 (0)	
	9	8 (50)	3 (42.9)	

	> 9	6 (37.5)	3 (42.9)	
WAT2 stops walking	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (3) = 3.05, p = 0.384
	0	11 (68.8)	3 (42.9)	
	1	3 (18.8)	2 (28.6)	
	2 or higher	2 (12.5)	1 (14.3)	
WAT2 missed heel to toe	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (3) = 4.97, p = 0.174
	0	8 (50)	1 (14.3)	
	1	3 (18.8)	3 (42.9)	
	2 or higher	5 (31.3)	2 (28.6)	
WAT2 steps off line	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (3) = 4.58, p = 0.205
	0	12 (75)	3 (42.9)	
	1	3 (18.8)	3 (42.9)	
	2 or higher	1 (6.3)	0 (0)	
WAT2 raised arms	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (3) = 6.74, p = 0.081
	0	10 (62.5)	1 (14.3)	
	1	4 (25)	2 (28.6)	
	2 or higher	2 (12.5)	3 (42.9)	
WAT2 steps	Not attempted/completed	0 (0)	1 (14.3)	χ^2 (3) = 4.04, p = 0.257
	< 9	3 (18.8)	0 (0)	
	9	9 (56.3)	5 (71.4)	
	> 9	4 (25)	1 (14.3)	
FTN hit count	Not attempted	2 (12.5)	1 (14.3)	χ^2 (4) = 1.39, p = 0.846
	0	5 (31.3)	3 (42.9)	
	1	5 (31.3)	1 (14.3)	
	4	1 (6.3)	0 (0)	
	6	3 (18.8)	2 (28.6)	
FTN used pad	Not available	1 (6.3)	1 (14.3)	χ^2 (2) = 1.41, p = 0.495
	No	6 (37.5)	1 (14.3)	
	Yes	9 (56.3)	5 (71.4)	
FTN used wrong hand	Not available	1 (6.3)	1 (14.3)	χ^2 (2) = 2.30, p = 0.316
	No	11 (68.8)	6 (85.7)	
	Yes	4 (25)	0 (0)	
FTN does not return arm to side	Not available	1 (6.3)	1 (14.3)	χ^2 (2) = 0.88, p = 0.643
	No	10 (62.5)	3 (42.9)	
	Yes	5 (31.3)	3 (42.9)	
FTN swaying	Not available	1 (6.3)	1 (14.3)	χ^2 (2) = 0.96, p = 0.619
	No	10 (62.5)	5 (71.4)	
	Yes	5 (31.3)	1 (14.3)	
FTN eyelid tremors	Not available	1 (6.3)	1 (14.3)	χ^2 (2) = 3.64, p = 0.162
	No	9 (56.3)	6 (85.7)	
	Yes	6 (37.5)	0 (0)	
FTN body tremors	Not available	1 (6.3)	1 (14.3)	χ^2 (2) = 1.25, p = 0.536
	No	13 (81.3)	6 (85.7)	
	Yes	2 (12.5)	0 (0)	

FTN does not keep eyes closed	Not available	1 (6.3)	1 (14.3)	χ^2 (2) = 5.72, p = 0.057
	No	15 (93.8)	4 (57.1)	
	Yes	0 (0)	2 (28.6)	
Left pupil size RL	Below range	0 (0)	2 (28.6)	χ^2 (2) = 5.72, p = 0.057
	Within range	15 (93.8)	4 (57.1)	
	Above range	1 (6.3)	1 (14.3)	
Left pupil size NTD	Below range	3 (18.8)	4 (57.1)	χ^2 (1) = 3.39, p = 0.066
	Within range	13 (81.3)	3 (42.9)	
Left pupil size DL1	Within range	15 (93.8)	6 (85.7)	χ^2 (1) = 0.40, p = 0.529
	Above range	1 (6.3)	1 (14.3)	
Left pupil size DL2	Not available	13 (81.3)	6 (85.7)	χ^2 (1) = 0.07, p = 0.795
	Within range	3 (18.8)	1 (14.3)	
Right pupil size RL	Below range	0 (0)	2 (28.6)	χ^2 (2) = 5.72, p = 0.057
	Within range	15 (93.8)	4 (57.1)	
	Above range	1 (6.3)	1 (14.3)	
Right pupil size NTD	Below range	3 (18.8)	4 (57.1)	χ^2 (1) = 3.39, p = 0.066
	Within range	13 (81.3)	3 (42.9)	
Right pupil size DL1	Within range	15 (93.8)	6 (85.7)	χ^2 (1) = 0.40, p = 0.529
	Above range	1 (6.3)	1 (14.3)	
Right pupil size DL2	Not available	13 (81.3)	6 (85.7)	χ^2 (1) = 0.07, p = 0.795
	Within range	3 (18.8)	1 (14.3)	
Rebound dilation	No	12 (75)	6 (85.7)	χ^2 (1) = 0.33, p = 0.567
	Yes	4 (25)	1 (14.3)	
Reaction to light	Not available	1 (6.3)	0 (0)	χ^2 (3) = 2.85, p = 0.416
	Normal	8 (50)	2 (28.6)	
	Slow	6 (37.5)	3 (42.9)	
	Little to none	1 (6.3)	2 (28.6)	
Nasal area	Clear/normal	12 (75)	6 (85.7)	χ^2 (1) = 0.33, p = 0.567
	Other	4 (25)	1 (14.3)	
Oral cavity	Clear/normal	6 (37.5)	4 (57.1)	χ^2 (1) = 0.77, p = 0.382
	Other	10 (62.5)	3 (42.9)	
Left arm injection sites	None	15 (93.8)	4 (57.1)	χ^2 (2) = 4.94, p = 0.085
	Old	0 (0)	1 (14.3)	
	Fresh	1 (6.3)	2 (28.6)	
Right arm injection sites	None	16 (100)	4 (57.1)	χ^2 (2) = 7.89, p = 0.019
	Old	0 (0)	1 (14.3)	
	Fresh	0 (0)	2 (28.6)	
BP systolic	Below range	3 (18.8)	3 (42.9)	χ^2 (2) = 1.61, p = 0.447
	Within range	8 (50)	2 (28.6)	
	Above range	5 (31.3)	2 (28.6)	
BP diastolic	Within range	11 (68.8)	6 (85.7)	χ^2 (1) = 0.73, p = 0.394
	Above range	5 (31.3)	1 (14.3)	
Body temperature	Below range	9 (56.3)	5 (71.4)	χ^2 (2) = 0.73, p = 0.693
	Within range	5 (31.3)	1 (14.3)	

	Above range	2 (12.5)	1 (14.3)	
Muscle tone	Not available	1 (6.3)	0 (0)	χ^2 (3) = 2.78, p = 0.427
	Normal	8 (50)	3 (42.9)	
	Flaccid	7 (43.8)	3 (42.9)	
	Rigid	0 (0)	1 (14.3)	

Table 19 displays crosstabulations of each factor with the misidentification of cannabis as an active drug category. Factors significantly associated with missed calls of cannabis were MRB eyelid tremors and rebound dilation.

Table 19

Crosstabulation of Face Sheet Measures with Missed Cannabis Call

		Cannabis		
Variable	Value	Not Missed *n* (%)	Missed *n* (%)	Bivariate Test Result
Have you eaten today	Not available	1 (6.7)	0 (0)	χ^2 (2) = 4.33, p = 0.115
	No	5 (33.3)	0 (0)	
	Yes	9 (60)	8 (100)	
Have you drank today	No	5 (33.3)	1 (12.5)	χ^2 (1) = 1.17, p = 0.278
	Yes	10 (66.7)	7 (87.5)	
Est. time vs. actual time	10 minutes or less difference	1 (6.7)	2 (25)	χ^2 (3) = 4.25, p = 0.236
	11 to 30 minutes difference	2 (13.3)	3 (37.5)	
	31 to 90 minutes difference	9 (60)	2 (25)	
	More than 90 minutes difference	3 (20)	1 (12.5)	
Duration of last sleep	Not available	2 (13.3)	1 (12.5)	χ^2 (3) = 4.63, p = 0.201
	Less than 4 hours	3 (20)	0 (0)	
	4 to 8 hours	7 (46.7)	7 (87.5)	
	More than 8 hours	3 (20)	0 (0)	
Sick or injured	No	12 (80)	5 (62.5)	χ^2 (1) = 0.83, p = 0.363
	Yes	3 (20)	3 (37.5)	
Physical disabilities	No	9 (60)	6 (75)	χ^2 (1) = 0.52, p = 0.472
	Yes	6 (40)	2 (25)	
Under care of doctor or dentist	No	9 (60)	5 (62.5)	χ^2 (1) = 0.01, p = 0.907
	Yes	6 (40)	3 (37.5)	
Taking medications or drugs	No	5 (33.3)	5 (62.5)	χ^2 (1) = 1.81, p = 0.179
	Yes	10 (66.7)	3 (37.5)	
Coordination	Fair/good	3 (20)	2 (25)	χ^2 (1) = 0.08, p = 0.782

	Other	12 (80)	6 (75)	
Breath	Normal	9 (60)	5 (62.5)	χ^2 (1) = 0.01, p = 0.907
	Other	6 (40)	3 (37.5)	
Face	Normal	5 (33.3)	5 (62.5)	χ^2 (1) = 1.81, p = 0.179
	Other	10 (66.7)	3 (37.5)	
Speech	Normal	3 (20)	4 (50)	χ^2 (1) = 2.22, p = 0.136
	Other	12 (80)	4 (50)	
Eyes appearance	Normal	3 (20)	1 (12.5)	χ^2 (3) = 2.22, p = 0.528
	Bloodshot	3 (20)	4 (50)	
	Watery	3 (20)	1 (12.5)	
	Bloodshot and watery	6 (40)	2 (25)	
Eyelids	Normal	7 (46.7)	6 (75)	χ^2 (1) = 1.70, p = 0.192
	Droopy	8 (53.3)	2 (25)	
Pulse	Below range	2 (13.3)	1 (12.5)	χ^2 (2) = 0.22, p = 0.894
	Within range	6 (40)	4 (50)	
	Above range	7 (46.7)	3 (37.5)	
Left eye lack of smooth pursuit	No	4 (26.7)	4 (50)	χ^2 (1) = 1.25, p = 0.263
	Yes or present	11 (73.3)	4 (50)	
Left eye maximum deviation	No	4 (26.7)	4 (50)	χ^2 (1) = 1.25, p = 0.263
	Yes or present	11 (73.3)	4 (50)	
Eye angle of onset	Not present	4 (26.7)	4 (50)	χ^2 (1) = 1.25, p = 0.263
	30 to 45 Degrees	11 (73.3)	4 (50)	
Right eye lack of smooth pursuit	No	4 (26.7)	4 (50)	χ^2 (1) = 1.25, p = 0.263
	Yes or present	11 (73.3)	4 (50)	
Right eye maximum deviation	No	4 (26.7)	4 (50)	χ^2 (1) = 1.25, p = 0.263
	Yes or present	11 (73.3)	4 (50)	
Vertical gaze nystagmus	No	11 (73.3)	8 (100)	χ^2 (1) = 2.58, p = 0.108
	Yes	4 (26.7)	0 (0)	
Lack of convergence	Absent	2 (13.3)	3 (37.5)	χ^2 (1) = 1.79, p = 0.181
	Present	13 (86.7)	5 (62.5)	
Completion of one leg stand (left)	Not attempted	3 (20)	0 (0)	χ^2 (1) = 1.84, p = 0.175
	Attempted and completed	12 (80)	8 (100)	
Completion of one leg stand (right)	Not attempted	3 (20)	0 (0)	χ^2 (1) = 1.84, p = 0.175
	Attempted and completed	12 (80)	8 (100)	
Left OLS sways while balancing	Not attempted/completed	3 (20)	0 (0)	χ^2 (2) = 5.37, p = 0.068
	Not present	0 (0)	2 (25)	
	Present	12 (80)	6 (75)	
Left OLS uses arms to balance	Not attempted/completed	3 (20)	0 (0)	χ^2 (2) = 2.16, p = 0.339
	Not present	6 (40)	3 (37.5)	
	Present	6 (40)	5 (62.5)	

Left OLS hopping	Not attempted/completed	3 (20)	0 (0)	χ^2 (1) = 1.84, p = 0.175
	Not present	12 (80)	8 (100)	
Left OLS puts foot down	Not attempted/completed	3 (20)	0 (0)	χ^2 (3) = 2.04, p = 0.565
	0	5 (33.3)	4 (50)	
	1	3 (20)	2 (25)	
	2 or more	4 (26.7)	2 (25)	
Left OLS time	Not attempted/completed	4 (26.7)	1 (12.5)	χ^2 (3) = 2.58, p = 0.462
	0-14	5 (33.3)	1 (12.5)	
	15-29	5 (33.3)	5 (62.5)	
	30 or more	1 (6.7)	1 (12.5)	
Right OLS sways while balancing	Not attempted/completed	3 (20)	0 (0)	χ^2 (2) = 3.51, p = 0.173
	Not present	0 (0)	1 (12.5)	
	Present	12 (80)	7 (87.5)	
Right OLS uses arms to balance	Not attempted/completed	3 (20)	0 (0)	χ^2 (2) = 3.90, p = 0.142
	Not present	5 (33.3)	1 (12.5)	
	Present	7 (46.7)	7 (87.5)	
Right OLS hopping	Not attempted/completed	3 (20)	0 (0)	χ^2 (2) = 1.94, p = 0.379
	Not present	11 (73.3)	7 (87.5)	
	Present	1 (6.7)	1 (12.5)	
Right OLS puts foot down	Not attempted/completed	3 (20)	0 (0)	χ^2 (3) = 2.04, p = 0.565
	0	4 (26.7)	2 (25)	
	1	3 (20)	2 (25)	
	2 or more	5 (33.3)	4 (50)	
Right OLS time	Not attempted/completed	3 (20)	0 (0)	χ^2 (2) = 1.88, p = 0.391
	0-14	4 (26.7)	3 (37.5)	
	15-29	8 (53.3)	5 (62.5)	
	30 or more	5 (33.3)	1 (12.5)	
MRB swaying front to back	0	5 (33.3)	4 (50)	χ^2 (2) = 0.86, p = 0.650
	< 2 inches	4 (26.7)	1 (12.5)	
	2 inches or more	6 (40)	3 (37.5)	
MRB swaying left to right	0	4 (26.7)	4 (50)	χ^2 (2) = 1.40, p = 0.497
	< 2 inches	4 (26.7)	1 (12.5)	
	2 inches or more	7 (46.7)	3 (37.5)	
MRB internal clock	0-24	4 (26.7)	3 (37.5)	χ^2 (2) = 1.19, p = 0.552
	25-35	5 (33.3)	1 (12.5)	
	36 or higher	6 (40)	4 (50)	
MRB presence eyelid tremors	No	12 (80)	3 (37.5)	χ^2 (1) = 4.15, p = 0.042
	Yes	3 (20)	5 (62.5)	
MRB presence body or leg tremors	No	15 (100)	7 (87.5)	χ^2 (1) = 1.96, p = 0.161
	Yes	0 (0)	1 (12.5)	
WAT completion	Not attempted	1 (6.7)	0 (0)	χ^2 (1) = 0.56, p = 0.455

	Attempted and completed	14 (93.3)	8 (100)	
WAT balance	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (3) = 2.79, p = 0.425
	0	6 (40)	1 (12.5)	
	1	6 (40)	5 (62.5)	
	2 or higher	2 (13.3)	2 (25)	
WAT starts early	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (2) = 0.74, p = 0.691
	0	13 (86.7)	7 (87.5)	
	1	1 (6.7)	1 (12.5)	
WAT1 stops walking	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (3) = 1.27, p = 0.736
	0	8 (53.3)	6 (75)	
	1	3 (20)	1 (12.5)	
	2 or higher	3 (20)	1 (12.5)	
WAT1 missed heel to toe	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (3) = 1.62, p = 0.655
	0	7 (46.7)	3 (37.5)	
	1	3 (20)	1 (12.5)	
	2 or higher	4 (26.7)	4 (50)	
WAT1 steps off line	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (3) = 2.72, p = 0.437
	0	5 (33.3)	5 (62.5)	
	1	7 (46.7)	3 (37.5)	
	2 or higher	2 (13.3)	0 (0)	
WAT1 raised arms	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (3) = 0.61, p = 0.894
	0	7 (46.7)	4 (50)	
	1	3 (20)	2 (25)	
	2 or higher	4 (26.7)	2 (25)	
WAT1 steps	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (3) = 2.16, p = 0.540
	< 9	2 (13.3)	0 (0)	
	9	6 (40)	5 (62.5)	
	> 9	6 (40)	3 (37.5)	
WAT2 stops walking	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (3) = 0.60, p = 0.896
	0	9 (60)	5 (62.5)	
	1	3 (20)	2 (25)	
	2 or higher	2 (13.3)	1 (12.5)	
WAT2 missed heel to toe	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (3) = 1.97, p = 0.578
	0	5 (33.3)	4 (50)	
	1	5 (33.3)	1 (12.5)	
	2 or higher	4 (26.7)	3 (37.5)	
WAT2 steps off line	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (3) = 1.25, p = 0.741
	0	9 (60)	6 (75)	
	1	4 (26.7)	2 (25)	
	2 or higher	1 (6.7)	0 (0)	
WAT2 raised arms	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (3) = 1.57, p = 0.666
	0	6 (40)	5 (62.5)	
	1	4 (26.7)	2 (25)	
	2 or higher	4 (26.7)	1 (12.5)	

WAT2 steps	Not attempted/completed	1 (6.7)	0 (0)	χ^2 (3) = 2.60, p = 0.458
	< 9	3 (20)	0 (0)	
	9	8 (53.3)	6 (75)	
	> 9	3 (20)	2 (25)	
FTN hit count	Not attempted	1 (6.7)	2 (25)	χ^2 (4) = 6.80, p = 0.147
	0	7 (46.7)	1 (12.5)	
	1	2 (13.3)	4 (50)	
	4	1 (6.7)	0 (0)	
	6	4 (26.7)	1 (12.5)	
FTN used pad	Not available	1 (6.7)	1 (12.5)	χ^2 (2) = 0.33, p = 0.848
	No	5 (33.3)	2 (25)	
	Yes	9 (60)	5 (62.5)	
FTN used wrong hand	Not available	1 (6.7)	1 (12.5)	χ^2 (2) = 0.38, p = 0.829
	No	11 (73.3)	6 (75)	
	Yes	3 (20)	1 (12.5)	
FTN does not return arm to side	Not available	1 (6.7)	1 (12.5)	χ^2 (2) = 0.62, p = 0.734
	No	8 (53.3)	5 (62.5)	
	Yes	6 (40)	2 (25)	
FTN swaying	Not available	1 (6.7)	1 (12.5)	χ^2 (2) = 0.22, p = 0.894
	No	10 (66.7)	5 (62.5)	
	Yes	4 (26.7)	2 (25)	
FTN eyelid tremors	Not available	1 (6.7)	1 (12.5)	χ^2 (2) = 4.34, p = 0.114
	No	12 (80)	3 (37.5)	
	Yes	2 (13.3)	4 (50)	
FTN body tremors	Not available	1 (6.7)	1 (12.5)	χ^2 (2) = 0.49, p = 0.781
	No	13 (86.7)	6 (75)	
	Yes	1 (6.7)	1 (12.5)	
FTN does not keep eyes closed	Not available	1 (6.7)	1 (12.5)	χ^2 (2) = 1.31, p = 0.520
	No	12 (80)	7 (87.5)	
	Yes	2 (13.3)	0 (0)	
Left pupil size RL	Below range	2 (13.3)	0 (0)	χ^2 (2) = 1.31, p = 0.520
	Within range	12 (80)	7 (87.5)	
	Above range	1 (6.7)	1 (12.5)	
Left pupil size NTD	Below range	5 (33.3)	2 (25)	χ^2 (1) = 0.17, p = 0.679
	Within range	10 (66.7)	6 (75)	
Left pupil size DL1	Within range	14 (93.3)	7 (87.5)	χ^2 (1) = 0.22, p = 0.636
	Above range	1 (6.7)	1 (12.5)	
Left pupil size DL2	Not available	14 (93.3)	5 (62.5)	χ^2 (1) = 3.45, p = 0.063
	Within range	1 (6.7)	3 (37.5)	
Right pupil size RL	Below range	2 (13.3)	0 (0)	χ^2 (2) = 1.31, p = 0.520
	Within range	12 (80)	7 (87.5)	
	Above range	1 (6.7)	1 (12.5)	
Right pupil size NTD	Below range	5 (33.3)	2 (25)	χ^2 (1) = 0.17, p = 0.679

	Within range	10 (66.7)	6 (75)	
Right pupil size DL1	Within range	14 (93.3)	7 (87.5)	χ^2 (1) = 0.22, p = 0.636
	Above range	1 (6.7)	1 (12.5)	
Right pupil size DL2	Not available	14 (93.3)	5 (62.5)	χ^2 (1) = 3.45, p = 0.063
	Within range	1 (6.7)	3 (37.5)	
Rebound dilation	No	14 (93.3)	4 (50)	χ^2 (1) = 5.76, p = 0.016
	Yes	1 (6.7)	4 (50)	
Reaction to light	Not available	1 (6.7)	0 (0)	χ^2 (3) = 5.56, p = 0.135
	Normal	4 (26.7)	6 (75)	
	Slow	7 (46.7)	2 (25)	
	Little to none	3 (20)	0 (0)	
Nasal area	Clear/normal	11 (73.3)	7 (87.5)	χ^2 (1) = 0.62, p = 0.433
	Other	4 (26.7)	1 (12.5)	
Oral cavity	Clear/normal	6 (40)	4 (50)	χ^2 (1) = 0.21, p = 0.645
	Other	9 (60)	4 (50)	
Left arm injection sites	None	11 (73.3)	8 (100)	χ^2 (2) = 2.58, p = 0.275
	Old	1 (6.7)	0 (0)	
	Fresh	3 (20)	0 (0)	
Right arm injection sites	None	12 (80)	8 (100)	χ^2 (2) = 1.84, p = 0.399
	Old	1 (6.7)	0 (0)	
	Fresh	2 (13.3)	0 (0)	
BP systolic	Below range	4 (26.7)	2 (25)	χ^2 (2) = 0.25, p = 0.885
	Within range	6 (40)	4 (50)	
	Above range	5 (33.3)	2 (25)	
BP diastolic	Within range	13 (86.7)	4 (50)	χ^2 (1) = 3.64, p = 0.056
	Above range	2 (13.3)	4 (50)	
Body temperature	Below range	10 (66.7)	4 (50)	χ^2 (2) = 0.85, p = 0.653
	Within range	3 (20)	3 (37.5)	
	Above range	2 (13.3)	1 (12.5)	
Muscle tone	Not available	0 (0)	1 (12.5)	χ^2 (3) = 7.01, p = 0.072
	Normal	5 (33.3)	6 (75)	
	Flaccid	9 (60)	1 (12.5)	
	Rigid	1 (6.7)	0 (0)	

Hypothesis 3 Conclusion

The analyses revealed significant associations between the face sheet measures and missed calls of CNS depressant, CNS stimulant, narcotic analgesic, and cannabis. The results indicate that there are face sheet measures associated with drug categories inaccurately called by DREs. Therefore, the null hypothesis was rejected.

Conclusion

DRE opinions compared to the toxicology results for drug influence evaluations completed by DREs in Florida during 2019 resulted in an accuracy rate of approximately 88%. The accuracy rate was higher than previous studies that reported 80% (Beirness et al., 2007) but were less than the 95% reported in a study of the DECP in Canada (Beirness et al., 2009). Due to the difference in the accuracy rates of previous studies, the null hypothesis for research question 1 (RQ1) was rejected. However, the analysis did report that the Florida DREs measures of accuracy had a sensitivity rate of 97% and a corroboration rate of 91%. Chapter five will discuss the additional measures of accuracy (sensitivity, specificity, false alarm rate, miss rate, and corroboration rate).

The study revealed signs and symptoms from the DIE face sheet significantly associated with the four drug categories of CNS depressant, CNS stimulant, narcotic analgesic, and cannabis. CNS depressant had seventeen signs and symptoms, CNS stimulant had eleven signs and symptoms, narcotic analgesic had thirty-five signs and symptoms, and cannabis had twenty-seven signs and symptoms that were significantly associated. A binary logistic regression revealed a prediction model accuracy of approximately 74% for CNS depressant, 79% for CNS stimulant, 81% for narcotic analgesics, and 76% for cannabis. The forward stepwise regression selected three predictors for CNS depressants, one predictor for CNS stimulants, five predictors for narcotic analgesics, and four predictors for cannabis. The regression models for these drug categories were significant, indicating that there are sets of measures from the face sheet that can significantly predict active drug categories. Therefore, the null hypothesis for research question 2 (RQ2) was rejected. Chapter five will also discuss each set of measures from the DIE face sheets associated with their respective drug categories.

The null hypothesis for research question 3 (RQ3) was also rejected due to analysis revealing a significant association between the DIE face sheet measures and missed opinion calls of CNS depressant, CNS stimulant, narcotic analgesic, and cannabis. In addition, the analysis revealed twenty-one signs and symptoms significantly associated with the four drug categories. Chapter five discusses each of the signs and symptoms identified by the analysis.

The signs and symptoms identified in the study have a significant association with their respective drug categories and correspond with the Drug Evaluation and Classification Program (DECP) curriculum and symptomology drug matrix (appendix B). The findings of this study reinforce and corroborate the various signs and symptoms the DECP has identified as being associated with the seven drug categories. Chapter five will discuss the study's findings and how the results compare and impact the DECP.

CHAPTER FIVE: CONCLUSIONS

Overview

This study was a quantitative cross-sectional descriptive and predictive examination of Florida's DECP. Chapter five discusses the study's findings on the measures of accuracy, the identified set of measurements (signs and symptoms) significantly associated with the four drug categories (CNS depressant, CNS stimulant, narcotic analgesic, cannabis), and the identified set of measurements from the missed DRE opinions significantly associated with the four drug categories. The study's limitations when interpreting the study's findings are discussed in this chapter to include data collection, documentation inconsistency, sample size, and toxicology procedures. Implications of this study for the DECP were addressed by identifying trends, associations, and relationships from the results to assist the DECP curriculum. Finally, future research, suggestions, and recommendations are identified after chapter five.

Discussion

The purpose of this study was to evaluate the drug evaluation and classification program (DECP) in Florida to determine the accuracy rates of drug recognition experts (DREs) and determine which core set of measurements (signs and symptoms) from the Drug Influence Evaluation (DIE) face sheets correspond to each of the seven drug categories, and to determine if any common themes or indicators from the DIEs are identified with the inaccuracies of DRE opinions.

Research Question 1

Research question 1 (RQ1) asks: what is the accuracy rate of DRE opinions compared to the toxicology results for drug influence evaluations completed by DREs in Florida during 2019? DRE opinions compared to the toxicology results for drug influence evaluations completed by DREs in Florida during 2019 resulted in an accuracy rate of approximately 88%. The accuracy

rate was higher than previous studies that reported 80% (Beirness et al., 2007), 85% (Adler & Burns, 1994), and 87% (Compton, 1986) but was less than the 95% reported in a study of the DECP in Canada (Beirness et al., 2009). Due to the difference in the accuracy rates of previous studies, the null hypothesis for research question 1 (RQ1) was rejected. The DECP's third training phase consists of field evaluation certifications requiring a passing rate (overall accuracy rate) of 75% for the DRE drug category opinions compared to toxicological specimens (International Association of Chiefs of Police [IACP], 2018c). This study was consistent with previous studies of the DECP field evaluation accuracy rates exceeding the minimum requirement of 75% of the DECP certification phase by DRE candidates (Adler & Burns, 1994; Beirness et al., 2007; Beirness et al., 2009).

The goals of the DECP training program are to determine if a subject is impaired and, if impaired by drugs, then which category (or categories) of drugs are likely causing the subject's impairment (International Association of Chiefs of Police [IACP], 2018c). As stated in chapter two, program evaluation theory's function is to ascertain the theoretical sensibility of the program evaluated (Sharpe, 2011). A program evaluation theory consists of a set of statements that describe a particular program, explain why, how, and under what conditions the program effects occur, predict the outcomes of the program, and specify the requirements necessary to bring about the desired program effects (Sedani & Sechrest, 1999; Sharpe, 2011). In this study, the measures of accuracy (sensitivity, specificity, false alarm rate, miss rate, and corroboration rate) for the DECP assists in determining if the 12-step DRE protocol successfully achieves the program's goals. The Florida DREs in this study had 172 correct opinions and 23 missed opinions resulting in a sensitivity rate of 97%, specificity rate of 23%, false alarm rate of 77%, a miss rate of 3%, and a corroboration rate of 91%.

Sensitivity addresses if the 12-step DRE protocol can correctly identify a suspected driver being under the influence of a drug and correctly identify the drug causing the impairment (Beirness et al., 2009). The sensitivity results are approximately 97%, with the DRE's opinion correctly identifying 167 (true-positive) drug-positive cases divided by the total number of drug-positive cases identified by toxicology (184 cases). It is desirable to have a procedure that maximizes sensitivity (Beirness et al., 2009). Regarding the DECP goals, the sensitivity measure of 97% indicates the 12-step DRE protocol is having the desired effect on DREs formulating correct opinions.

Specificity is the correct rejection rate and identifies if the 12-step DRE protocol can correctly identify drivers, not under the influence of a drug (Beirness et al., 2009). The specificity results are approximately 23%, with the DREs opinion correctly identifying 5 (true-negative) drug-negative cases divided by the total number of drug-negative cases identified by toxicology (22 cases). It is desirable to have a procedure with high specificity (Beirness et al., 2009). Regarding the DECP goals, the specificity measure of 23% indicates the 12-step DRE protocol is not having the desired effect on DREs formulating correct opinions. The lack of specificity was addressed in this chapter's research question 3 (RQ3) section.

The *false alarm rate* is the likelihood of a DRE falsely identifying a driver as being under the influence of a drug when the toxicology results indicate no drugs are found. The false alarm rate is approximately 77%, with the DRE's opinion identifying 17 (false-positive) cases divided by the total number of drug-negative cases identified by toxicology (22 cases). It is desirable to have a procedure with a low false alarm rate (Beirness et al., 2009). Regarding the DECP goals, the false alarm rate of 77% indicates the 12-step DRE protocol is not having the desired effect on

DREs formulating correct opinions. The high false alarm rate was addressed in the research question 3 (RQ3) section of this chapter.

Miss rate is the cases DREs did not identify the correct drug category identified by toxicology results as being the drug category causing the impairment (a psychoactive drug). The miss rate was approximately 3%, with the DRE's opinion identifying 6 (false-negative) cases divided by the total drug-positive cases (173 cases). It is desirable to have a procedure with a low miss rate (Beirness et al., 2009). Regarding the DECP goals, the miss rate of 3% indicates the 12-step DRE protocol is having the desired effect on DREs formulating correct opinions.

The *corroboration rate* is what most legal representatives in the criminal justice court system reference when examining validation studies (Beirness et al., 2007). DREs in this study determined that the individuals under the influence of a drug (DRE opinion) were correct 91% of the time when confirmed by toxicology. Previous studies of validation for the DECP resulted in 73% (Compton, 1986), 87% (Hardin et al., 1993), 82.7% (Alder, 1990), 90% (Adler & Burns, 1994), 92% (Bigelow et al., 1985). The range of corroboration rates from previous studies was 73% to 92% (Beirness et al., 2007; Talpins et al., 2018). This study resulted in a 91% corroboration rate on the higher end of the previous studies range. Regarding the DECP goals, the corroboration rate of 91% indicates the 12-step DRE protocol is having the desired effect on DREs formulating correct opinions.

Research Question 2

Research question 2 (RQ2) asks: What set of measures (signs and symptoms) from the drug influence evaluations that completed by DREs in Florida during 2019 significantly predict the drug categories? To answer the research question and test the hypothesis, logistic regression models were performed. Due to the low frequencies of specific combinations of active drug

categories, binary logistic regressions were performed to predict each active drug category observed in the data (CNS depressant, CNS stimulant, narcotic analgesic, and cannabis). Before conducting each regression, bivariate tests (i.e., chi-square tests) were performed to determine which factors from the face sheets were significantly associated with the drug category and to test the assumption of adequate expected frequencies. Factors significantly associated with the drug category were entered into the regression using a forward (conditional) stepwise procedure to select the factors that contribute most significantly to the prediction of the drug category.

The analyses revealed significant associations between the face sheet measures and the active drug categories of CNS depressant, CNS stimulant, narcotic analgesic, and cannabis. The regression models for these drug categories were significant, indicating that there are sets of measures from the face sheet that can significantly predict active drug categories. Therefore, the null hypothesis for research question 2 (RQ2) was rejected.

Before each binary logistic regression, bivariate tests (i.e., chi-square tests) were performed to determine which factors from the face sheets were significantly associated with the drug category and to test the assumption of adequate expected frequencies. The factors obtained from each DIE face sheet were entered into an SPSS data set using the coding instrument obtained from Dr. Porath-Waller. The coding instrument (appendix C) was adjusted for this study to take a detailed approach to the variables obtained from the DIE face sheets. Porath-Waller et al., (2021) identified 22 signs and symptoms with a significant association with the seven drug categories. This study broke down each of the signs and symptoms into a more restrictive detail analysis.

An example is in Porath-Waller et al., (2021) study, one of the factors identified was Horizontal Gaze Nystagmus and is classified as not impaired and impaired. The bivariate tests

performed in this study classified Horizontal Gaze Nystagmus according to the indicators of impairment identified in the DRE course curriculum as lack of smooth pursuit, distinct and sustained nystagmus at maximum deviation, and angle of nystagmus for both eyes for a total of six factors (International Association of Chiefs of Police [IACP], 2018c) instead of the two factors identified in the Porath-Waller et al., (2021) study. In addition, detailing each variable from the DIE face sheet allowed the study to conduct a bivariate test for each sign and symptom at varying levels instead of an overall summary of the sign and symptoms.

Bivariate Results

Multiple research studies focused on the signs and symptoms (factors) produced by individual types of drugs on how the drugs affected the human body and compared these results with the DECP curriculum for validation (Bramness et al., 2003; Downey et al., 2016; Hartman et al., 2016; Heishman et al., 1998; Perry et al., 2015; Silber et al., 2005; Vaillancourt et al., 2021). The DECP places these various effects of drugs on the human body into seven drug categories each having singular drug factors identified associated with each drug category (International Association of Chiefs of Police [IACP], 2018c). These individual drug effect factors are identified in the symptomology drug matrix as sign and symptoms of the seven drug categories. This study examined each of these signs and symptoms as they are related to four of the drug categories (CNS depressant, CNS stimulant, narcotic analgesic, and cannabis).

CNS Depressants. Factors significantly associated with CNS depressants were abnormal speech, bloodshot eye appearance, lack of smooth pursuit and maximum deviation (both eyes), 30 to 45-degree angle of onset (both eyes), vertical gaze nystagmus, putting the foot down on the right OLS, starting WAT before instructions are finished, stepping off the line in WAT1, both

pupil size in near total darkness (NTD) was within normal ranges, abnormal reaction to light, below range blood pressure, and flaccid muscle tone.

The symptomology drug matrix (appendix B) lists in the general indicator for a CNS depressant that a subject could have thick, slurred speech (abnormal speech). Bloodshot eye appearance is also an indicator outlined in the DECP curriculum (International Association of Chiefs of Police [IACP], 2018c). In addition, Porath-Waller et al. (2021) identified horizontal gaze nystagmus (HGN) as being a factor of impairment associated with CNS depressants. HGN contains six indicators in the DRE evaluation: a lack of smooth pursuit in both eyes, distinct and sustained nystagmus at maximum deviation in both eyes, and an angle of nystagmus for both eyes (International Association of Chiefs of Police [IACP], 2018c).

Several medical validation studies have shown drug impairment can cause HGN in subjects under the influence of a CNS depressant above the normal therapeutic dose for the subject (Dhingra et al., 2019; Kosnoski et al., 1998). The results of the bivariate test in this study confirm that all six factors of HGN independently had a significant association with a subject being under the influence of a CNS depressant. The results of all six HGN indicators are also identified in the DECP curriculum as being indicators of impairment for a subject under the influence of a CNS depressant (International Association of Chiefs of Police [IACP], 2018c).

The purpose of field sobriety testing (MRB, OLS, WAT, FTN) in a DRE evaluation is to assist the DRE in determining the secondary goal of the DECP of whether or not the subject is impaired (International Association of Chiefs of Police [IACP], 2018c). Validation studies were conducted and suggested the usefulness of identifying drug impairment in individuals through the administration of the field sobriety testing (Alder & Burns, 1994; Downey et al., 2012; Downey et al., 2016; Fiorentino et al., 2020; Ip et al., 2013; Perry et al., 2015; Porath-Waller &

Beirness, 2013). CNS depressant active cases identified a significant association of a subject placing their right foot down on OLS (73.4%), starting WAT before instructions are finished (34.4%), and stepping off the line in first nine step of WAT (59.4%).

The symptomology drug matrix also indicated the pupil sizes will be normal for a subject under the influence of a CNS depressant except for the drugs of Soma, Quaaludes, and some Anti-depressant medications, which usually dilate pupils (International Association of Chiefs of Police [IACP], 2018c). Bivariate tests in this study identified that 76.6% of subjects in the CNS depressant cases had normal pupil size in near total darkness conditions, and 9.4% of subjects had dilated pupils.

A subject's reaction to light will usually be slowed when estimated in the darkroom evaluation for subjects under the influence of a CNS depressant (Dargan et al., 2013; Stephenson et al., 2013). In addition, the symptomology drug matrix also indicated a slow reaction to light during the 12-step DRE protocol, which was also corroborated in the bivariate tests of this study, revealing that 60.9% of subjects under the influence of CNS depressant cases had a slow reaction to light.

The final two factors in bivariate tests are below the normal DRE range for blood pressure (34.4%) and flaccid muscle tone (59.4%). These factors are identified in the symptomology drug matrix as blood pressure being down for CNS depressant and the subject having a flaccid muscle tone (International Association of Chiefs of Police [IACP], 2018c; Snozek, 2020; Stephenson et al., 2013).

Seventeen signs and symptoms from the DIE face sheet were significantly associated with the CNS depressant drug category. The results of the bivariate tests help solidify the DECP

curriculum in identifying the signs and symptoms associated with subjects under the influence of a CNS depressant.

CNS Stimulant. Factors significantly associated with CNS stimulants were inability to follow stimulus, above range pulse rates, faster MRB internal clock, MRB eyelid tremors, stopped walking on the second nine steps of the walk-and-turn test, pupil size in near total darkness for both eyes, no rebound dilation, slow reaction to light in the dark room, abnormal nasal area, and rigid muscle tone.

The symptomology drug matrix and previous studies indicate that subjects under a CNS stimulant will exhibit a faster pulse rate above the average range (Caplan et al., 2007; Porath & Beirness, 2019). CNS stimulant active cases identified a significant association of a subject having a faster pulse rate (53.7%). In addition, active cases also identified a significant association of subjects having a faster internal clock (46.3%) on the Modified Romberg Balance test, which the DECP curriculum identifies as an indicator of CNS stimulant use (International Association of Chiefs of Police [IACP], 2018c).

The lack of a sign or symptoms is just as crucial as a sign or symptom being present to assist DREs in making an opinion of drug categories being psychoactive at the time of the evaluation. For example, no rebound dilation (85.4%) had a significant association for CNS stimulant in this study and is also identified in the DECP curriculum as not being present for a CNS stimulant (International Association of Chiefs of Police [IACP], 2018c). Significant association of subjects having eyelid tremors (85.4%), slow reaction to light (78%), and a rigid muscle tone (29.3%) are considered a sign and symptoms by previous studies for subjects under the influence of a CNS stimulant (Caplan et al., 2007; Chang et al., 2019; Dhingra et al., 2019;

International Association of Chiefs of Police [IACP], 2018a; International Association of Chiefs of Police [IACP], 2018c; Porath & Beirness, 2019).

Eleven signs and symptoms from the DIE face sheet were significantly associated with the CNS stimulant drug category. The results of the bivariate tests help validate the DECP curriculum identifying the signs and symptoms associated with subjects under the influence of a CNS stimulant.

Narcotic Analgesic. Factors significantly associated with narcotic analgesics were being sick or injured, being diabetic or epileptic, being under the care of a doctor or dentist, abnormal coordination, abnormal speech, droopy eyelids, no lack of smooth pursuit, and no maximum deviation (both eyes), angle of onset not present (both eyes), lack of convergence absent, difficulty on OLS, MRB swaying front to back, no MRB eyelid tremors, stopping walking on WAT2, miss heel to toe on WAT2, stepping off the line on WAT2, steps taken on WAT2, no FTN eyelid tremors, left and right pupil size (all lights), no rebound dilation, abnormal reaction to light, arm injection sites, and flaccid muscle tone.

As stated previously, the lack of a sign or symptoms is just as crucial as a sign or symptom being present to assist DREs in making an opinion of drug categories being psychoactive at the time of the evaluation. DREs formulate their opinions on active drug categories not only on what factors are present in the evaluations but also on factors not present in the evaluation. Previous studies have identified that subjects on a narcotic analgesic will not exhibit horizontal gaze nystagmus, lack of convergence, eyelid tremors, or rebound dilation (International Association of Chiefs of Police [IACP], 2018c). Factors of not having lack of smooth pursuit in both eyes (61.4%), no distinct and sustained nystagmus at maximum deviation in both eyes (70.5%), no angle of onset in both eyes (75%), the absence of lack of convergence

(34.1%), no MRB eyelid tremors (86.4%), no FTN eyelid tremors (86.4%), and no rebound dilation (90.9%) are all significantly associated with narcotic analgesics.

Narcotic analgesic drug category is unique because it is the only DRE drug category that causes miosis and little to no reaction to light (Armenian et al., 2018; Dhingra et al., 2019; Edwards, 2019; Finegan, 2021). Miosis in near total darkness (70.5%) and little to no reaction to light (45.5%) had significant associations with narcotic analgesics.

A common side effect of narcotic analgesics is sedation, which may impact psychomotor performance (Ferreira et al., 2018). The impact on psychomotor performance is prevalent with the significant associations identified in this study with difficulty on the field sobriety tests. On OLS, subjects used their arms for balance on the left foot (72.7%), placed their left foot down (75%), and used their arms for balance on the right foot (70.5%). MRB subjects had more than a 2-inch sway from front to back (70.5%). On WAT, subjects had difficulties on the second nine steps of the test by stepping off the line (43.2%) and missing heel to toe (66%).

The third step (Preliminary Examination) in the 12-step DRE protocol assists DREs in formulating drug category opinions by documenting several signs and symptoms associated with drug categories. The subject's medical history is also obtained during the preliminary examination (International Association of Chiefs of Police [IACP], 2018c). DREs document and observe the subjects' physical behavior, speech, and visual observations and ascertain medical history. Significant associations of narcotic analgesics were being sick or injured (43.2%), diabetic or epileptic (88.6%), under the care of a doctor or dentist (59.1%), poor coordination (90.9%), abnormal speech (93.2%), and droopy eyelids (93.2%).

Thirty-five signs and symptoms from the DIE face sheet were significantly associated with the narcotic analgesic drug category. The results of the bivariate tests help reinforce the

DECP curriculum is identifying the signs and symptoms associated with subjects under the influence of a narcotic analgesic.

Cannabis. Factors significantly associated with cannabis were not being sick or injured, not having a physical disability, not being under the care of a doctor or dentist, abnormal breath, lack of convergence, less difficulty on OLS, MRB eyelid tremors, MRB body or leg tremors, not stepping off the line in WAT, FTN eyelid and body tremors, left and right pupil size (all lights), rebound dilation, reaction to light, abnormal oral cavity, within range body temperature, and normal muscle tone.

Similar to narcotic analgesic bivariate results, step three (Preliminary Examination) in the 12-step DRE protocol indicated several signs and symptoms associated with cannabis. Significant associations with cannabis were not being sick or injured (81.2%), being under the care of a doctor or dentist (69.4%), and having abnormal breath (55.3%).

The DECP curriculum identifies a strong association of subjects having eyelid and body tremors, rebound dilation, normal body temperature, normal muscle tone, and a slow reaction to light as being under the influence of cannabis (International Association of Chiefs of Police [IACP], 2018c). In addition, the bivariate results identified the same factors as having a significant association with cannabis.

Twenty-seven signs and symptom from the DIE face sheet were significantly associated with the narcotic analgesic drug category. The results of the bivariate tests help corroborate the DECP curriculum is identifying the signs and symptoms associated with subjects under the influence of a cannabis.

Binary Logistics Regression

A binary logistic regression revealed a prediction model accuracy of approximately 74% for CNS depressants, 79% for CNS stimulants, 81% for narcotic analgesics, and 76% for cannabis. The forward stepwise regression selected three predictors for CNS depressants (bloodshot eye appearance, vertical gaze nystagmus, and stepping off the line for WAT first nine steps), one predictor for CNS stimulants (MRB eyelid tremors), five predictors for narcotic analgesics (sick or injured, abnormal speech, hooping during left OLS, stopping one time during WAT second nine steps, and no rebound dilation), and four predictors for cannabis (physical disability, abnormal breath, MRB eyelid tremors, and rebound dilation).

Porath-Waller et al. (2019) identified twenty-two drug-related signs and symptoms that significantly predicted the correct drug category associated with four drug categories (CNS depressant, CNS stimulant, narcotic analgesics, and cannabis) with an overall classification rate of 86%. Porath-Waller et al. (2019) grouped the twenty-two signs and symptoms into four conceptual blocks of clinical indicators, performance on psychophysical tests, appearance and physiological response of the eyes, and observations and self-reported statements. The four conceptual blocks were then entered into a "sequential multinomial logistic regression procedure to determine the relative importance of the four groups of indicators in predicting drug category" (p. 258).

Building upon previous research studies of the DECP analyzing the predictability of signs and symptoms for the drug categories (Porath-Waller et al., 2009; Porath & Beirness, 2010; Porath-Waller, 2019), this study intended to take a more detailed approach to the classification of the independent variables of the signs and symptoms. Therefore, this study examined eighty-four independent variables versus the twenty-two independent variables used by previous researchers.

Previous studies completed logistic regression models to identify which signs and symptoms predict drug categories (Porath-Waller et al., 2009; Porath & Beirness, 2010; Porath-Waller, 2019). The previous studies grouped signs and symptoms into a binary outcome of not impaired versus impaired or present versus not present for the various factors. This study built upon the previous literature by analyzing these factors into a detailed set of criteria versus a binary outcome. Instead of impaired versus not impaired for the field sobriety tests, this study extended the findings of previous studies by re-coding the individual indicators of impairment outcomes into independent variables with various categorical outcomes. For example, Porath & Beirness (2010) identified performance on the OLS test as not impaired and impaired. This study identified performance on the OLS by the indicators of impairment outlined in the DECP curriculum as left OLS swaying while balancing, left OLS using arms to balance, left OLS hopping, and left OLS putting a foot down (0, 1, and 2 or more times), left OLS time (0-14, 15-29, and 30 or more). This re-coding was repeated for the right foot section of the OLS test for a total of 10 variables versus the one variable used in previous studies.

The lower predictability rates and identification of a low number of signs and symptoms as a predictor between this study and previous studies reveal that creating a detailed approach versus a grouping classification does not increase the predictability model. DECP curriculum is designed to teach DREs to utilize the entire 12-step DRE protocol and not be selective on which steps to consider in formulating an opinion. This study reinforces the concept set by the DECP that a holistic approach to identifying the signs and symptoms associated with the DIE creates a higher probability of classifying the correct drug categories causing impairment.

The bivariate test showed significant associations between independent variables of signs and symptoms. The binary logistic regression revealed that being too detailed in the process on

categorizing the signs and symptoms can lead to lower drug classification rates for DREs. Previous research has answered this dilemma with a stronger level of the association by identifying the independent variables and then grouping these significant association variables into conceptual blocks for analysis (Porath & Beirness, 2009; Porath-Waller et al., 2010: Porath-Waller et al., 2019). The results of grouping the significant association variables into blocks created a higher predictability of correct drug classification, which in turn assists the DECP in identifying a core set of measures for signs and symptoms that DREs can focus on for formulating an opinion of drug classification.

Research Question 3

Research question 3 (RQ3) asks: Among the inaccurate drug influence evaluations (missed opinions) completed by DREs in Florida during 2019, what set of measures (signs and symptoms) significantly predict the drug categories inaccurately determined by the DREs? To answer the research question and test the hypothesis, crosstabulations and bivariate tests (i.e., chi-square tests) were performed on the cases with missed opinions (23 cases) to determine which factors from the face sheets were significantly associated with the drug categories (CNS depressant, CNS stimulant, narcotic analgesic, cannabis) that were called incorrectly. Bivariate test results indicate that DREs inaccurately call the face sheet measures associated with drug categories. Therefore, the null hypothesis was rejected.

DRE's opinioned seventeen cases as being drug positive when the toxicology report indicated no drugs were found in the subject's biological samples. This resulted in a 77% false alarm rate and a 23% specificity rate in research question 1 (RQ1). Thirteen cases were incorrectly called CNS depressants; bivariate results identified all six indicators of HGN, no FTN eyelid tremors, pupil size in DL, and abnormal nasal are significantly associated with the missed

calls. In three cases incorrectly called CNS stimulants, bivariate results identified droopy eyelids, MRB swaying, MRB internal clock, and slow reaction to light are significantly associated with the missed calls. In seven cases incorrectly called a narcotic analgesic, bivariate results identified slow pulse rate and right arm injection sites. DREs incorrectly called cannabis for eight cases with bivariate results identifying MRB eyelid tremors and rebound dilation as significantly associated.

A review of the individual DIE face sheets confirmed that all thirteen CNS depressant missed opinion face sheets indicated the subjects had a lack of smooth pursuit, distinct and sustained nystagmus at maximum deviation, and an angle of onset between 30 to 45 degrees. CNS depressants, inhalants, and dissociative anesthetics may cause HGN. CNS stimulants, hallucinogens, narcotic analgesics, and cannabis do not cause HGN (International Association of Chiefs of Police [IACP], 2018c). The toxicology results for the thirteen cases indicate that no drugs were found in 10 of the subject's biological samples.

In researching the missed opinions of the DREs and examining the individual DIE face sheets, it was apparent that the general and clinical indicators outlined in the DECP curriculum were present. The question is then: if the signs and symptoms of a drug category match the curriculum reinforced by validation studies as being reliable, then why are toxicology results showing no drugs present?

Toxicologists will only analyze the biological samples for drugs controlled under Florida Statute 893. The commonly abused drugs Florida Department of Law Enforcement (FDLE) laboratories analyze for are amphetamines, methamphetamine, ecstasy, barbiturates, benzodiazepines, carisoprodol, cocaine, methadone, heroin, oxycodone, codeine, morphine, hydrocodone, and Tetrahydrocannabinols. Over-the-counter and many prescription medications

are not routinely included in drug analysis (Florida Department of Law Enforcement [FDLE], 2021).

FDLE Testing Limitations

Most prescription medications in Florida are routinely not analyzed in biological samples submitted to FDLE laboratories in DUI-related cases unless the criminal case involves a fatality (Florida Department of Law Enforcement [FDLE], 2021). "Analysts do not routinely test for non-controlled substances, such as over-the-counter medications of antihistamines or prescribed antidepressants in DUI casework" (Florida Department of Law Enforcement [FDLE], 2022, pg. 3). The first step in the FDLE toxicology testing procedure is to conduct a sample screening which consists of cutoff concentration levels. If a drug is below the assigned cutoff concentration level, the sample screening produces no detected drug (Florida Department of Law Enforcement [FDLE], 2022). FDLE will not continue to analyze the sample if the test results in no drugs being detected even though the drug may be present. FDLE (2022) toxicology reported they do not routinely test for: "Klonopin (Clonazepam), Ativan (Lorazepam), GHB, Demerol, Phencyclidine (PCP), Ketamine, Fentanyl, Propoxyphene (Darvon), Ambien, Tramadol, and other novel psychoactive substances (designer drugs)" (p. 4).

In addition to the lack of drugs tested by FDLE toxicology laboratories is the detection time associated with the drugs they test. Amphetamines (Adderall), Methamphetamine, and MDMA (Molly or Ecstasy) are CNS stimulants with a detection time in the urine of three to 5 days. Barbiturates like Secobarbital and Amytal are CNS depressants with a detection time in the urine of four to six days. Other CNS depressants of Alprazolam (Xanax) or Diazepam (Valium) have a detection time in the urine of two to seven days (Florida Department of Law Enforcement [FDLE], 2022). Every drug category has a list of detection times, according to FDLE

toxicologists. This means that if a subject decides to ingest a handful of Alprazolam, they would most likely be unable to operate a motor vehicle due to their level of impairment from the CNS depressant. However, if the subject did not previously take the drug, a urine sample would yield a negative drug presence and produce a no-drug found result because of the detention time.

A review of missed opinions by DREs in this study consisted of examining the individual DIE face sheets. Twenty-two of the twenty-three contained signs and symptoms identified in the bivariate testing as having a significant association with the drug category opinioned by the DRE. The toxicology results indicated no drugs were found, resulting in the case being classified as a missed opinion. After reviewing the literature provided by FDLE, it is apparent that these individual cases could have been drug positive. However, low cutoff concentration levels, detection time restraints, or the lack of not testing the particular drug the subject ingested resulted in a missed opinion.

Designer Drugs

Designer drugs are another influencer of possible missed opinions for DRE evaluations. Currently, in Florida, kratom (mitragynine) is sold over the counter at local convenience stores and is a popular drug used by subjects. *Kratom* is a natural opioid that exerts opioid and alpha-2 agonistic effects with stimulant properties that do not require a prescription in the United States (White, 2019). Kratom has been documented to have stimulating effects at low doses and opioid-like effects at higher doses (Bowe & Kerr, 2020; Schmitt, 2021; White, 2019). Wright (2018) conducted a study on a subject who participated in a DIE administered by a DRE after she was arrested for DUI in Virginia. The DIE face sheet indicated the subject was under the influence of a CNS stimulant and cannabis due to the signs and symptoms she exhibited being consistent with the two drug categories. The DRE in White's (2018) study reported the subject had dilated

pupils, slowed reaction to light, elevated pulse, elevated blood pressure, normal body temperature, eyelid and body tremors, restlessness, talkativeness, faster internal clock on MRB (White, 2019). During the 12-step DRE protocol interview, the subject reported having used kratom for opioid withdrawal relief. A biological blood sample was collected from the subject, and the results indicated kratom (mitragynine) was present in the sample.

Some designer drugs are extracted from a natural source, and others are created in laboratories. These drugs produce the same signs and symptoms as all seven drug categories in the DECP curriculum. Researchers use the terminology of novel psychoactive substances (NPS), designer drugs, and synthetic drugs to describe these various drugs (Logan et al., 2017). Examples of designer drugs are synthetic cannabinoids (AMB-FUBINACA), salvia divinorum (natural perennial herb), synthetic stimulants (Alpha-PVP, 4-Fluoroamphetamine, Ethylone, Methylone), novel hallucinogens (25I-NBOMe, MXE, MXP), designer benzodiazepines (Phenazepam, Clonazolam, Flubromazolam), designer opioids (Acetyl fentanyl, Butyryl fentanyl), novel synthetic opioid agonists (Mitraynine- kratom), liberty caps (mushrooms with psilocybin) (Logan et al., 2017). Multiple research studies have been conducted on the various designer drugs, which resulted in the drugs producing similar effects on the human body being consistent with all seven drug categories of the DECP (Logan et al., 2017; Logan et al., 2018; Mohr et al., 2018; Tabarra, 2019; White, 2018; White, 2019).

Implications

The results of this study have important implications for the DECP, Florida legislators, and DREs performing drug influence evaluations. This study reduced the signs and symptoms into a detailed categorial list of independent variables. By narrowing down the summary of independent variables into detailed indicators of impairment, this study assists the DECP curriculum in identifying which singular indicators have significant associations with the various

drug categories. The study revealed individual characteristics of the signs and symptoms in relation to the drug categories. The study also showed that taking a holistic approach to conducting a drug evaluation and formulating an opinion has a higher predictability of identifying the appropriate drug category causing impairment. The DECP curriculum focuses on a holistic approach to teaching DREs to conduct the entire systematic and standardized 12-step DRE protocol before rendering an opinion on drug classification.

This study assists the Florida legislature in their confidence in the DECP accuracy and corroboration rates. Florida is currently trying to amend the driving under the influence law to include language identifying "any substance that causes impairment" versus only "controlled substances." If the law is changed, then the role of the DRE will be to conduct a DIE to show the impairment of subjects. The findings of this study assist legislators in showing that DREs have a 91% corroboration rate in opening impaired subjects on drugs. The study also showed that the miss identification by toxicology results is possibly due to the low cutoff rates, subjects being under the influence of prescription medications or designer drugs not tested by FDLE laboratories, or drug detection time restraints.

Previous studies focusing on accuracy rates of the DECP in the United States contain data over thirty years old. With the updated data obtained in this study, in combination with performing a program evaluation, this study reinforces that the DECP curriculum is meeting the program's goals. Each research question helped identify whether the DECP curriculum was meeting the standards and goals of the program by providing statistical analysis and confirmation of the DECP 12-step DRE protocol. This study built upon previous studies focusing on individual signs and symptoms and their associations with drug categories. The results of this

study confirm the previous studies finding with current data versus data obtained over twenty years ago.

This study also assists the DECP with understanding which signs and symptoms are significantly associated with missed DRE opinions. This type of analysis of miss opinions was previously lacking from prior research studies. In addition, identifying the significant associations of signs and symptoms of missed opinions with drug categories revealed a gap in the literature on the possible misidentification of positive drug cases due to toxicology testing procedures.

Limitations

Potential limitations should be considered when interpreting the study's findings, including data collection, documentation inconsistency, sample size, and toxicology procedures. First, data collection was complex in this study due to the DRE database only containing the opinion of the DRE and the toxicology results for completed DIEs in 2019. An email requesting the DIE face sheets was sent to 405 certified DREs. Several DREs responded to the email advising that they were not certified in 2019, and this study could not obtain a list of 2019-certified DREs. DREs also responded to the email advising they do not keep copies of their evaluations or they do not produce a DIE face sheet and narrative report unless the State's Attorney Office request it for court. In addition, many DREs who participated in the program in 2019 had retired, transitioned to another agency, or left the criminal justice profession. The lack of a centralized database containing the DIE face sheets, narrative reports, and toxicology limited this study's data collection. A total of 236 DIE face sheets and corresponding toxicology results were collected out of 986 enforcement drug influence evaluations completed in 2019.

Second, the study lacked consistency in documenting signs and symptoms on the DIE face sheets. DREs independently have their version of shorthand to document the various signs

and symptoms. The DECP is a systematic and standardized program but lacks the standardization of the documentation portion of the DIE face sheets. On several occasions, additional contact was made with the DREs to interrupt the shorthand they had documented on the DIE face sheets. Unfortunately, not all DREs responded to the request, which led the study to enter a non-available or missing data set for the particular sign and symptom.

Third, the target sample size calculation indicated that a total of 177 cases were needed for the analysis, which was achieved. However, a limitation of the study was the lack of no-drug cases. Therefore, the study could not complete a multinomial logistic regression due to not having a decent number of no-drug cases to be used as a reference for the seven drug categories. In order to overcome this limitation, future studies will need to collect 177 cases from each drug category to include another 177 cases from the no-drugs opinioned by DREs. The findings also showed several drug combinations in the selected DIE cases. When poly-drug or poly-category is present, the analysis cannot separate the signs and symptoms from drug combinations into distinct drug categories due to null, overlapping, additive, or antagonistic drug effects described in the DECP curriculum.

The last limitation identified in this study is the lack of standardized toxicology testing in Florida which created another limitation in this study. The low cut-off rates for drugs, selective drug testing, drug detection times, and lack of testing for all impairing substances limited the findings of this study. The missed opinions by DREs were identified due to "no-drugs" being located in the biological sample. This classification could be false due to the Florida toxicology testing procedures.

Recommendations for Future Research

The data collection limitations were also recognized in Porath-Waller's et al. (2021) study. The DECP changed procedures for the IACP-NHTSA DRE database in 2020 based on the

recommendations from Porath-Waller et al. (2021) study. DREs are now required to enter the entire DIE face sheet and narrative into the database to assist with future data collection. The DIEs are also being reviewed by the DECP regional or state coordinators for the accuracy of the data. Although the DECP has corrected many of the limitations identified in this study, there is still room for improvement.

This study recommends that the DECP provide more consistent training on standardizing documentation of the DIE face sheets. As stated previously, the DIE face sheets collected for this study contained individual DREs shorthand which was difficult to interpret on several occasions leading the study to identify the variable as being unavailable or missing. The loss of data could have influenced the statistical analysis outcomes. This study recommends that the DECP implement a standardized and systematic documentation procedure for all DREs when completing the DIE face sheets. Providing a standardized procedure of DRE shorthand on the DIEs will assist future researchers in interpreting the face sheets. It will also assist other DREs when reviewing their peer's face sheets.

Research question 3 identified several issues relating to the missed opinions of the DREs. First, further research is needed to identify the various designer drugs that cause impairment and their association with the signs and symptoms of the seven drug categories. Suppose the associated research determines that designer drugs contain poly-category similarities. In that case, the DECP should research adding a drug category to the DECP for designer drugs. Another limitation identified in the study was the FDLE testing procedures. The low cut-off rates of tested drugs, the lack of testing prescription medications, and the lack of testing non-controlled substances hinder the DECP. A recommendation for further studies is to ascertain the number of no-drug cases identified by FDLE testing procedures that contain an impairing substance in their

biological sample. This study could assist Florida legislators in changing the language of the DUI law to "any impairing substances."

The last recommendation of this study is the sample size used for analysis. Further studies need to be conducted using the 177 cases identified as the appropriate number of cases for a sample size. However, 177 cases will need to be collected for each of the seven drug categories, 177 for each drug combination case, and 177 cases of no impairment (rule out) opinioned by DREs. Collecting the sample size for each drug category to include the rule-out cases will assist the DECP in obtaining accurate results regarding the significant associations between the drug category and the set of measurements (signs and symptoms) from the DIEs.

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Appendix A

Drug Influence Evaluation (DIE) Face Sheet

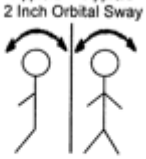
DRUG INFLUENCE EVALUATION

Evaluator [redacted]	DRE # 31515	Rolling Log # 19-15-15	Evaluator's Agency [redacted]	Case # [redacted]
Recorder/Witness	Crash: ☒ None ☐ Fatal ☐ Injury ☐ Property		Arresting Officer's Agency [redacted]	
Arrestee's Name (Last, First, Middle) [redacted]	Date of Birth [redacted]	Sex F	Race W	Arresting Officer (Name, ID#) [redacted]
Date Examined / Time /Location 06 / 08 / 2019 0155 IRC Jail	Breath Test: Results: .000 .000	Test Refused ☐ Instrument #: 80-001329	Chemical Test: Urine ☒ Blood ☐ Oral Fluid ☐ Test or tests refused ☐	
Miranda Warning Given Given by: D/S Brashears	☒ Yes ☐ No	What have you eaten today? (1) Muffin	When? 1200	What have you been drinking? How much? (1) Soda — Time of last drink? 2330
Time now/ Actual 0130 / 0206	When did you last sleep? "4 days ago"	How long? 8 Hours	Are you sick or injured? ☐ Yes ☒ No	Are you diabetic or epileptic? ☐ Yes ☒ No
Do you take insulin? ☐ Yes ☒ No	Do you have any physical defects? ☐ Yes ☒ No		Are you under the care of a doctor or dentist? ☒ Yes ☐ No Brevard Health Alliance Aspren Dental	
Are you taking any medication or drugs? ☒ Yes ☐ No "Xanax, Adderall, Suboxone"	Attitude: Cooperative		Coordination: Poor	
Speech: Slow but quick at times	Breath odor: Fine		Face: Droopy eyelids / On the nod	
Corrective Lenses: ☒ None ☐ Glasses ☐ Contacts, if so ☐ Hard ☐ Soft	Eyes: ☒ Normal ☐ Bloodshot ☐ Watery		Blindness: ☒ None ☐ Left ☐ Right	Tracking: ☒ Equal ☐ Unequal
Pupil Size: ☒ Equal ☐ Unequal (explain)	Resting Nystagmus ☐ Yes ☒ No	Vertical Nystagmus ☐ Yes ☒ No	Able to follow stimulus ☒ Yes ☐ No	Eyelids ☐ Normal ☒ Droopy

Pulse and Time	HGN	Left Eye	Right Eye
1. 104 / 0225	Lack of Smooth Pursuit	Present	Present
2. 102 / 0240	Maximum Deviation	Present	Present
3. 104 / 0255	Angle of Onset	35	35

Convergence — Right eye / Left eye

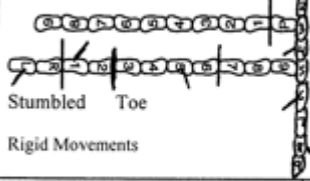
Modified Romberg Balance — Approx. 2 Inch Orbital Sway



Stumbled Backwards

Walk and Turn Test

2nd 9 steps went off line (See Diagram)



Stumbled Toe

Rigid Movements

Cannot keep balance — Stumbled

Starts too soon

	1st Nine	2nd Nine
Stops walking		
Misses heel-toe	2	
Steps off line	3	3
Raises arms	4	4
Actual steps taken	9	9

5/30 **One Leg Stand** 21/30

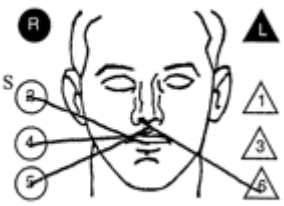
Stopped after count 5

L	R	
X	X	Sways while balancing
X	X	Uses arms to balance
		Hopping
X	X	Puts foot down

Swaying, leaning, Raising Arms

Time Estimation			
29 estimated as 30 seconds	Describe turn Reset Feet – Faced off the line	Cannot do test (explain)	Type of footwear: Sandals

Finger to Nose (Draw lines to spots touched)



Rigid Search

Left Hand Up

Quick Rigid Movements

PUPIL SIZE	Room light (2.5 – 5.0)	Darkness (5.0 – 8.5)	Direct (2.0 – 4.5)
Left Eye	3.0	6.5	4.0
Right Eye	3.0	6.5	4.0

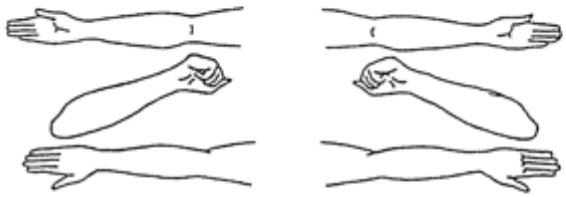
Nasal area: Clear

Oral cavity: UV Orange Coating on Tongue

Rebound Dilation: ☐ Yes ☒ No

Reaction to Light: Slow

RIGHT ARM **LEFT ARM**



Piloerection Shivering

Blood Pressure	Temperature
110 / 90	95.8 °F

Muscle Tone: ☒ Normal ☐ Flaccid ☐ Rigid

Comments:

What drugs or medications have you been using?	How much?	Time of use?	Where were the drugs used? (Location)
Suboxone, Adderall, Xanax, Cannabis	"What is prescribed"	0900	At Home

Date / Time of arrest:	Time DRE was notified:	Evaluation start time:	Evaluation completion time:	☐ Subject refused entire evaluation ☐ Subject stopped participating during evaluation
06 / 08/2019	0038	0200	0306	

Officer's Signature: — Reviewed/approved by / date: — DRE # 31515

Opinion of Evaluator:

☐ Not Impaired	☐ Alcohol	☒ CNS Stimulant	☐ Dissociative Anesthetic	☐ Inhalant
☐ Medical	☒ CNS Depressant	☐ Hallucinogen	☒ Narcotic Analgesic	☐ Cannabis

Appendix B

Drug Evaluation and Classification Program Signs and Symptomology Matrix

INDICATORS CONSISTENT WITH DRUG CATEGORIES

MAJOR INDICATORS	CNS DEPRESSANTS	CNS STIMULANTS	HALLUCINOGENS	DISSOCIATIVE ANESTHETICS	NARCOTIC ANALGESIC	INHALANTS	CANNABIS
HGN	PRESENT	NONE	NONE	PRESENT	NONE	PRESENT	NONE
VERTICAL GAZE NYSTAGMUS	PRESENT *HIGH DOSES	NONE	NONE	PRESENT	NONE	PRESENT *HIGH DOSES	NONE
LACK OF CONVERGENCE	PRESE NT	NONE	NONE	PRESENT	NONE	PRESENT	PRESENT
PUPIL SIZE	NORMAL (1)	DILATED	DILATED	NORMAL	CONSTRICTED	NORMAL (4)	DILATED (6)
REACTION TO LIGHT	SLOW	SLOW	NORMAL (3)	NORMAL	LITTLE OR NONE VISIBLE	SLOW	NORMAL
PULSE RATE	DOWN (2)	UP	UP	UP	DOWN	UP	UP
BLOOD PRESSURE	DOWN	UP	UP	UP	DOWN	UP or DOWN (5)	UP
BODY TEMPERATURE	NORMAL	UP	UP	UP	DOWN	UP, DOWN or NORMAL	NORMAL
MUSCLE TONE	FLACCID	RIGID	RIGID	RIGID	FLACCID	NORMAL / FLACCID	NORMAL
GENERAL INDICATORS	DISORIENTATION DROOPY EYES DROWSINESS DRUNK LIKE BEHAVIOR UNSTEADY WALK SLOW, SLUGGISH REACTIONS THICK, SLURRED SPEECH UNCOORDINATED	ANXIETY BODY TREMORS DRY MOUTH EUPHORIA EXAGGERATED REFLEXES EXCITED EYELID TREMORS GRINDING TEETH INCREASED ALERTNESS INSOMNIA IRRITABILITY REDNESS TO NASAL AREA RESTLESSNESS RUNNY NOSE TALKATIVE	BODY TREMORS DAZED APPEARANCE DIFFICULTY IN SPEECH FLASHBACKS HALLUCINATIONS MEMORY LOSS NAUSEA PARANOIA PERSPIRING POOR PERCEPTION OF TIME / DISTANCE SYNESTHESIA UNCOORDINATED *NOTE: WITH LSD PILOERECTION (GOOSE BUMPS, HAIR STANDING ON END) MAY BE OBSERVED	BLANK STARE CONFUSION CHEMICAL ODOR (PCP) CYCLIC BEHAVIOR DIFFICULTY WITH SPEECH DISORIENTED EARLY HGN ONSET HALLUCINATIONS INCOMPLETE VERBAL RESPONSES INCREASED PAIN THRESHOLD "MOON WALKING" NON-COMMUNICATIVE PERSPIRING (PCP) POSSIBLY VIOLENT SENSORY DISTORTIONS SLOW, SLURRED SPEECH SLOW RESPONSES WARM TO TOUCH (PCP)	DEPRESSED REFLEXES DROOPY EYELIDS DROWSINESS DRY MOUTH EUPHORIA FACIAL ITCHING INABILITY TO CONCENTRATE NAUSEA "ON THE NOD" PUNCTURE MARKS SLOW, LOW, RASPY SPEECH SLOWED BREATHING SLOW, DELIBERATE MOVEMENTS *NOTE: TOLERANT USERS EXHIBIT RELATIVELY LITTLE PSYCHOMOTOR IMPAIRMENT	BLOODSHOT EYES CONFUSION DISORIENTED FLUSHED FACE INTENSE HEADACHES LACK OF MUSCLE CONTROL NON-COMMUNICATIVE ODOR OF SUBSTANCE POSSIBLE NAUSEA RESIDUE OF SUBSTANCE SLOW, THICK, SLURRED SPEECH WATERY EYES	ALTERED TIME / DISTANCE PERCEPTION ALTERATIONS IN THOUGHT FORMATION BODY TREMORS BLOODSHOT EYES DISOREINTED DROWSINESS EYELID TREMORS EUPHORIA IMPAIRED MEMORY INCREASED APPETITE LACK OF CONCENTRATION ODOR OF MARIJUANA, RELAXED INHIBITIONS, MOOD CHANGES, REBOUND DILATION, SEDATION.
DURATION OF EFFECTS	ULTRASHORT:A FEW MINUTES SHORT:UP TO 5 HOURS INTERMEDIATE: 6-8 HOURS LONG: 8-14 HOURS	COCAINE: 5-90 MINUTES : METH-AMPHETAMINES: UP TO 12 HOURS	DURATION VARIES WIDELY FROM ONE HALLUCINOGEN TO ANOTHER LSD: 10-12 HOURS PSILOCYBIN: 2-3 HOURS	PCP ONSET: 1-5 MINUTES PEAK EFFECTS: 15-30 MINUTES EXHIBITS EFFECTS UP TO 4-6 HOURS DXM: ONSET 15-30 MIN. EFFECTS: 3-6 HRS	HEROIN: 4-6 HOURS METHADONE: UP TO 24 HOURS Others: Vary	MOST VOLATILE SOLVENTS: 6-8 HOURS ANESTHETIC GASES AND AEROSOLS: VERY SHORT DURATION	EXHIBITS EFFECTS: 2-3 HOURS IMPAIRMENT MAY LAST UP TO 24 HOURS WITHOUT AWARENESS OF EFFECT.
USUAL METHODS OF ADMINISTRATION	ORAL INJECTED (OCCASIONALLY) INSUFFLATION	INSUFFLATION SMOKED INJECTED ORAL	ORAL INSUFFLATION SMOKED TRANSDERMAL	SMOKED, INSUFFLATION , INJECTED, ORAL, TRANSDERMAL	INJECTED ORAL SMOKED INSUFFLATED TRANSDERMAL	INHALATION	SMOKED ORAL TRANSDERMAL
OVERDOSE SIGNS	SHALLOW BREATHING CLAMMY SKIN RAPID, WEAK PULSE COMA	AGITATION HALLUCINATIONS,	INTENSE BAD "TRIP" HYPERTHERMIA, CONVULSIONS	DEEP COMA SEIZURES & CONVULSIONS	SLOW, SHALLOW BREATHNG COLD, CLAMMY SKIN COMA CONVULSIONS	CARDIAC ARRYTHMIA, POSSIBLE PSYCHOSIS, RESPIRATION CEASES, SEVERE NAUSEA/VOMITING RISK OF DEATH	FATIGUE PARANOIA POSSIBLE PSYCHOSIS EXCESSIVE VOMITING

FOOTNOTE: THESE INDICATORS ARE THE MOST CONSISTENT WITH THE CATEGORY. KEEP IN MIND THAT THERE MAY BE VARIATIONS DUE TO INDIVIDUAL REACTION, DOSE TAKEN AND DRUG INTERACTIONS.

1. SOMA, QUAALUDES AND SOME ANTIDEPRESSANTS USUALLY DILATE PUPILS
2. QUAALUDES, ETOH, AND SOME ANTIDEPRESSANTS MAY ELEVATE
3. CERTAIN PSYCHEDELIC AMPHETAMINES MAY CAUSE SLOWING
4. NORMAL, BUT MAY BE DILATED
5. DOWN WITH ANESTHETIC GASES, UP WITH VOLATILE SOLVENTS AND AEROSOLS
6. PUPIL SIZE POSSIBLY NORMAL

NORMAL RANGES

PULSE: 60 - 90 BEATS PER MINUTE

PUPIL SIZE: ROOM LIGHT- AVG: 4.0mm Range: 2.5-5.0mm
NEAR TOTAL DARKNESS- AVG: 6.5mm Range: 5.0-8.5mm
DIRECT LIGHT- AVG: 3.0mm Range: 2.0-4.5mm

BLOOD PRESSURE: 120 - 140 SYSTOLIC
70 - 90 DIASTOLIC.

BODY TEMPERATURE: 98.6 +/- 1.0 DEGREE

04/18 - REVISION 1

Appendix C

Drug Influence Evaluation Coding Instrument

**If there are any of the following codes that are missing from the face sheets then enter a value of -999.

1. File number (1) *assign each face sheet with a number (i.e., the first file you enter into the database will be assigned number 1, etc.) and write this number on the actual face sheet and corresponding toxicology report or rolling log.

2. Age
    -enter two-digit age

3. Age (recoded)
    0 – 24 or younger
    1 – 25 to 34
    2 – 35 to 44
    3 – 45 or older
    -if missing from the face sheet, enter -999

4. Gender
    0 – male
    1 – female

5. Race
    0—white
    1—black
    2—Hispanic
    3—Indian
    4—other

6. Type of Crash (1)
    0 – none
    1 – fatal
    2 – injury
    3 – property
    -if missing from the face sheet, enter -999

7. Type of Crash (2)
    0 – none
    1 – fatal
    2 – injury
    3 – property
    -if missing from the face sheet, enter -999

8. Date Examined
    -enter the date as is on the face sheet without any spaces or hyphens

9. Time Examined
    -enter time without any spaces or colons according to the 24-hour clock

10. Breath Results
    -enter number without any decimals (usually it will be expressed as a percent)
    -if the test was refused, then enter -999
    -if the words "fail" are included in this section, then enter 100 (as per Evan's instructions)
    -the Instrument # is not required

11. Chemical Test
    0 – refused
    1 – urine
    2 – blood
    -if none, then enter -999

12. Eaten Today (what the suspect has eaten is not important; just whether or not he/she has eaten)
    0 – no
    1 – yes

13. Time of Eating Today
    -enter time without any spaces or colons according to the 24-hour clock
    -enter -999 if not applicable

14. Have you drank today
    0—no
    1—yes
    -enter 999 if not applicable

15. Time of Last Drink
    -enter time without any spaces or colons according to the 24-hour clock
    -enter -999 if not applicable

16. Time Now
    -enter time without any spaces or colons according to the 24-hour clock

17. Actual time
    -enter time without any spaced or colons according to the 24-hour clock

18. Minutes Difference
    -enter total difference of minutes between “time now and actual time”

19. Minutes Difference (recoded)

0 – 10 minutes or less difference
1 – 11 to 30 minutes difference
2 – 31 to 90 minutes difference
3 – more than 90 minutes difference
-enter -999 if not applicable

20. Time of Last Sleep
-enter what is written in this section of the face sheet
-enter -999 if not applicable

21. Duration of Last Sleep (in hours)
-enter the number

22. Duration of Sleep (recoded)
0 – less than 4 hours
1 – 4 to 8 hours
2 – more than 8 hours

23. Sick or Injured
0 – no
1 – yes

24. Sick or Injured Commentary
-enter any text that is written in this section of the face sheet

25. Diabetic or Epileptic
0 – no
1 – yes

26. Taking of Insulin
0 – no
1 – yes

27. Physical Defects or Disabilities
0 – no
1 – yes

28. Type of Physical Defects or Disabilities or other Commentary
-enter any text that is written in this section of the face sheet

29. Under Care of Doctor or Dentist
0 – no
1 – yes

30. Taking of Medication or Drugs
0 – no

1 – yes

31. Taking of Medication or Drugs Commentary
    -enter any text that is written in this section of the face sheet

32. Attitude
    -enter any text that is written in this section of the face sheet

33. Coordination
    -enter any text that is written in this section of the face sheet

34. Coordination (recoded) *recode #33 into binary below
    0 – fair/good
    1 – Other

35. Breath
    -enter any text that is written in this section of the face sheet

36. Breath (recoded) *recode #35 into binary below
    0 – normal
    1 – Other

37. Face
    -enter any text that is written in this section of the face sheet

38. Face (recoded) *recode # 37 into binary below
    0 – normal
    1 – other
    -enter -999 if not applicable

39. Speech
    -enter any text that is written in this section of the face sheet

40. Speech (recoded) *recode # 37 into binary below
    0 – normal
    1 – Other

41. Eyes Appearance
    0 – normal
    1 – bloodshot
    2 – watery
    3 – bloodshot and watery
    -enter -999 if not applicable

42. Blindness
    0 – none

1 – left eye
2 – right eye
3 – partial
4 – total
-enter -999 if not applicable

43. Tracking
    0 – equal
    1 – unequal
    -enter -999 if not applicable

44. Corrective Lenses
    0 – none
    1 – glasses
    2 – contacts
    -enter -999 if not applicable

45. Pupil Size
    0 – equal
    1 – unequal
    -enter -999 if not applicable

46. Ability to Follow Stimulus
    0 – no
    1 – yes
    -enter -999 if not applicable

47. Eyelids
    0 – normal
    1 – droopy
    -enter -999 if not applicable

48. Pulse 1
    -enter the number that is written in this section of the face sheet

49. Pulse 1 Time
    -enter time without any spaces or colons according to the 24-hour clock

50. Pulse 2
    -enter the number that is written in this section of the face sheet

51. Pulse 2 Time
    -enter time without any spaces or colons according to the 24-hour clock

52. Pulse 3
    -enter the number that is written in this section of the face sheet

53. Pulse 3 Time
    -enter time without any spaces or colons according to the 24-hour clock

54. Pulse (recoded) * Pulse range 60 – 90 beats per minute, if any pulse rate from pulse 1, 2, or 3 falls into the below category
    0 – below range
    1 – within range
    2 – above range
    -enter -999 if not applicable

55. Left Eye Lack of Smooth Pursuit
    0 – no
    1 – yes or "present"
    -999 – unable to perform test

56. Left Eye Maximum Deviation
    0 – no
    1 – yes or "present"
    -999 unable to perform test

57. Left Eye Angle of Onset
    -enter the angle number
    -if "none", then enter zero
    -if the word "present" is written, then leave blank
    -999 – unable to perform test

58. Left Eye Angle of Onset (recoded)
    0 – not present
    1 – 30 to 45 degrees
    2 – immediate on-set
    -999 – unable to perform test

59. Right Eye Lack of Smooth Pursuit
    0 – no
    1 – yes or "present"
    -999 – unable to perform test

60. Right Eye Maximum Deviation
    0 – no
    1 – yes or "present"
    -999 – unable to perform test

61. Right Eye Angle of Onset
    -enter the angle number
    -if "none", enter zero

-if the word "present" is written, then leave blank
-999 – unable to perform test

62. Right Eye Angle of Onset (recoded)
0 – not present
1 – 30 to 45 degrees
2 – immediate on-set
-999 – unable to perform test

63. Vertical Nystagmus
0 – no
1 – yes

64. Convergence *If the arrows for both eyes are pointing together (right eye at 3 o'clock position and left eye at 9 o'clock position) then this indicates that convergence is present; otherwise, there is an absence of convergence.
0 – absent
1 – present
-enter -999 if unable to perform the test

65. Completion of One Leg Stand Test for the Left Leg *there is not a specific box on the face sheet for this. There will often be a comment in the One Leg Stand diagram portion of the face sheet indicating "Test Stopped." You can also determine which portion of the test (i.e., left leg or the right leg) was stopped by looking at the diagram and the checklist that is located below the diagram. (Note that the test for the left leg appears on the left side of the diagram and the test for the right leg appears on the right side of the diagram). If there is/are no (often circled) number(s) above a set of "footprints" and no check marks in the corresponding column below, then this suggests that the test was not completed for that particular leg.
0 – not attempted
1 – attempted but stopped
2 – attempted and completed

66. Completion of One Leg Stand Test for the Right Leg *there is also not a specific box on the face sheet for this.
0 – not attempted
1 – attempted but stopped
2 – attempted and completed

67. Left One Leg Stand – Sways While Balancing
0—not present
1—present

68. Left One Leg Stand – Uses Arms to Balance
0—not present
1—present

69. Left One Leg Stand - Hopping
    0—not present
    1—present

70. Left One Leg Stand – Puts Foot Down
    -enter the number of check marks/tallies. If none, then enter zero. If there are no check marks/tallies because the test was not attempted or completed, then assign a value of -999

71. Left One Leg Stand – Puts Foot Down (recoded)
    0 – none
    1 – 1 time down
    2 – 2 or more down
    -enter -999 if not applicable

72. Left One Leg Stand- Time
    -enter the number subject count was on at end of 30 seconds, indicated in box on top left

73. Left One Leg Stand- Time (recoded)
    0 – 0 to 14
    1 – 15 to 29
    2 – 30 or more
    -enter -999 if not applicable

74. Right One Leg Stand – Sways While Balancing
    0—not present
    1—present

75. Right One Leg Stand – Uses Arms to Balance
    0—not present
    1—present

76. Right One Leg Stand - Hopping
    0—not present
    1—present

77. Right One Leg Stand – Puts Foot Down
    -enter the number of check marks/tallies. If none, then enter zero. If there are no check marks/tallies because the test was not attempted or completed, then assign a value of -999

78. Right One Leg Stand – Puts Foot Down (recoded)
    0 – 0
    1 – 1 time down
    2 – 2 or more down
    -enter -999 if not applicable

79. Right One Leg Stand- Time

-enter the number subject count was on at end of 30 seconds, indicated in box on top right

80. Right One Leg Stand- Time (recoded)
0 – 0 to 14
1 – 15 to 29
2 – 30 or more
-enter -999 if not applicable

81. Type of Footwear
-enter any text that is written in this section of the face sheet

82. Completion of Modified Romberg Balance Test (i.e., "stickman" on the left side of the diagram) *there is not a specific box on the face sheet for this. There will often be a comment in the Modified Romberg Balance diagram portion of the face sheet indicating "Test Stopped." There will also be information in the narrative section of the face sheet.
0 – not attempted
1 – attempted but stopped
2 – attempted and completed

83. Modified Romberg Balance Front to Back Sway – Front Measurement in inches
-enter the first number above the "stickman"
-if no number is provided, then enter zero if the test was done
-enter -999 if the test was not completed

84. Modified Romberg Balance Front to Back Sway – Back Measurement
-enter the second number above the "stickman"
-if no number is provided, then enter zero if the test was done
-enter -999 if the test was not completed

85. Modified Romberg Balance Front to Back Sway (recoded)
0 – none
1 – less than 2 inches
2 – 2 inches or more

86. Modified Romberg Balance Side to Side Sway – Left Side Measurement
-enter the first number (is in inches) above the "stickman"
-if no number is provided, then enter zero if the test was done
-enter -999 if the test was not completed

87. Modified Romberg Balance Side to Side Sway – Right Side Measurement
-enter the second number (is in inches) above the "stickman"
-if no number is provided, then enter zero if the test was done
-enter -999 if the test was not completed

88. Modified Romberg Balance Side to Side Sway (recoded)
0 – none

1 – less than 2 inches
2 – 2 inches or more

89. Modified Romberg Balance Internal Clock
-enter the number (in secs)
-if test was not attempted or completed, enter -999

90. Modified Romberg Balance Internal Clock (recoded)
0 – 0 to 24 seconds (fast)
1 – 25 – 35 seconds (normal range)
2 – 36 or higher (slow)
-enter -999 if not applicable

91. Presence of Eyelid Tremors (there isn't a separate box for this – it would be written in the Modified Romberg test box)
0 = no
1 = yes

92. Presence of Body or Leg Tremors (there isn't a separate box for this – it would be written in the Modified Romberg test box)
0 = no
1 = yes

93. Completion of Walk and Turn Test *there is not a specific box on the face sheet for this. There will often be a comment in the Walk and Turn Test diagram portion of the face sheet indicating "Test Stopped."
0 – not attempted
1 – attempted but stopped
2 – attempted and completed

94. Walk and Turn Test - Cannot Keep Balance *In cases where the words "continuous" or "all" are provided in the various boxes for this test (instead of check marks or tallies), enter the number 5
-enter the number of check marks/tallies (if none, then enter zero)
-if none because the test was stopped or not attempted, then enter -999

95. Walk and Turn Test - Starts too Soon
-enter the number of check marks/tallies (if none, then enter zero)
-if none because the test was stopped or not attempted, then enter -999

96. Walk and Turn Test 1st Nine – Stops Walking
-enter the number of check marks/tallies (if none, then enter zero)
-if none because the test was stopped or not attempted, then enter -999

97. Walk and Turn Test 1st Nine – Misses Heel to Toe
-enter the number of check marks/tallies (if none, then enter zero)

-if none because the test was stopped or not attempted, then enter -999

98. Walk and Turn Test 1st Nine – Steps Off Line
    -enter the number of check marks/tallies (if none, then enter zero)
    -if none because the test was stopped or not attempted, then enter -999

99. Walk and Turn Test 1st Nine – Raises Arms
    -enter the number of check marks/tallies (if none, then enter zero)
    -if none because the test was stopped or not attempted, then enter -999

100. Walk and Turn Test 1st Nine – Actual # of Steps
    -enter the number from the box (if none, then enter zero)
    -if the test was stopped or not attempted, then enter -999

101. Walk and Turn Test 2nd Nine – Stops Walking
    -enter the number of check marks/tallies (if none, then enter zero)
    -if none because the test was stopped or not attempted, then enter -999

102. Walk and Turn Test 2nd Nine – Misses Heel to Toe
    -enter the number of check marks/tallies (if none, then enter zero)
    -if none because the test was stopped or not attempted, then enter -999

103. Walk and Turn Test 2nd Nine – Steps Off Line
    -enter the number of check marks/tallies (if none, then enter zero)
    -if none because the test was stopped or not attempted, then enter -999

104. Walk and Turn Test 2nd Nine – Raises Arms
    -enter the number of check marks/tallies (if none, then enter zero)
    -if none because the test was stopped or not attempted, then enter -999

105. Walk and Turn Test 2nd Nine – Actual # of Steps
    -enter the number from the box (if none, then enter zero)
    -if the test was stopped or not attempted, then enter -999

106. Walk and Turn Test - Cannot Keep Balance (recoded)
    -if test was stopped or not attempted, then enter -999
    0 – 0 marks or numbers
    1 – 1 mark or numbers
    2 – 2 or higher

107. Walk and Turn Test - Starts too Soon (recoded)
    -if the test was stopped or not attempted, then enter -999
    0 – 0 marks or numbers
    1 – 1 mark or numbers
    2 – 2 or higher

108. Walk and Turn Test 1st Nine – Stops Walking (recoded)
-if the test was stopped or not attempted, then enter -999
0 – 0 marks or numbers
1 – 1 mark or numbers
2 – 2 or higher

109. Walk and Turn Test 1st Nine – Misses Heel to Toe (recoded)
-if the test was stopped or not attempted, then enter -999
0 – 0 marks or numbers
1 – 1 mark or numbers
2 – 2 or more

110. Walk and Turn Test 1st Nine – Steps Off Line (recoded)
-if the test was stopped or not attempted, then enter -999
0 – 0 marks or numbers
1 – 1 mark or numbers
2 – 2 or higher

111. Walk and Turn Test 1st Nine – Raises Arms (recoded)
-if the test was stopped or not attempted, then enter -999
0 – 0 marks or numbers
1 – 1 mark or numbers
2 – 2 or more

112. Walk and Turn Test 1st Nine – Actual # of Steps (recoded)
-if the test was stopped or not attempted, then enter -999
0 – 0 steps
1 - < 9 steps
2 – 9 steps
3 - > 9 steps

113. Walk and Turn Test 2nd Nine – Stops Walking (recoded)
-if the test was stopped or not attempted, then enter -999
0 – 0 marks or numbers
1 – 1 mark or numbers
2 – 2 or higher

114. Walk and Turn Test 2nd Nine – Misses Heel to Toe (recoded)
-if the test was stopped or not attempted, then enter -999
0 – 0 marks or numbers
1 – 1 mark or numbers
2 – 2 or more

115. Walk and Turn Test 2nd Nine – Steps Off Line (recoded)
-if the test was stopped or not attempted, then enter -999
0 – 0 marks or numbers

1 – 1 mark or numbers
2 – 2 or higher

116. Walk and Turn Test 2nd Nine – Raises Arms (recoded)
-if the test was stopped or not attempted, then enter -999
0 – 0 marks or numbers
1 – 1 mark or numbers
2 – 2 or more

117. Walk and Turn Test 2nd Nine – Actual # of Steps (recoded)
-if the test was stopped or not attempted, then enter -999
0 – 0 steps
1 - < 9 steps
2 – 9 steps
3 - > 9 steps

118. Describe Turn from Walk and Turn Test
-enter any text from this section of the face sheet

119. Describe Turn from Walk and Turn Test (recoded)
- if the test was stopped or not attempted, then enter -999
0 – proper turn
1 – improper turn

120. Hit on Finger to Nose Test 1 (Draw Lines to Spots Touched) *each test corresponds to the triangle with the corresponding number inside it. A hit is when the tip of the finger touches the tip of the nose. If pad is used it does not count as a hit.
0 – no
1 – yes
-999 did not attempt/complete

121. Hit on Finger to Nose Test 2
0 – no
1 – yes
-999 did not attempt/complete

122. Hit on Finger to Nose Test 3
0 – no
1 – yes
-999 did not attempt/complete

123. Hit on Finger to Nose Test 4
0 – no
1 – yes
-999 did not attempt/complete

124. Hit on Finger to Nose Test 5
    0 – no
    1 – yes
    -999 did not attempt/complete

125. Hit on Finger to Nose Test 6
    0 – no
    1 – yes
    -999 did not attempt/complete

126. Total Hit count on Finger to Nose Test (recoded)
    0 – 0
    1 – 1
    2 – 2
    3 – 3
    4 – 4
    5 – 5
    6 – 6
    -999 did not attempt/complete

127. Use of Pad of the Finger during Finger to Nose Test *This will be noted on the face sheet. If this happens at least once, then code as "yes"
    0 – no
    1 – yes
    -999 not available

128. Use wrong hand for test when instructed *This will be noted on the face sheet.
    0 – no
    1 – yes
    -999 not available

129. Does not return arm to front or side *This will be noted on face sheet.
    0 – no
    1 – yes
    -999 not available

130. Swaying during test *This will be noted on face sheet.
    0 – no
    1 – yes
    -999 not available

131. Eyelid tremors *This will be noted on face sheet.
    0 – no
    1 – yes
    -999 not available

132. Body or leg tremors *This will be noted on face sheet.
0 – no
1 – yes
-999 not available

133. Does not keep eyes closed during test *This will be noted on face sheet.
0 – no
1 – yes
-999 not available

134. Left Pupil Size – Room Light
-enter the number (with the decimal)

135. Left Pupil Size – Near Total Darkness
-enter the number (with the decimal)

136. Left Pupil Size – Direct Light
-enter the number (with the decimal)

137. Left Pupil Size – Direct Light 2 (recoded)**if rebound dilation is present a 2nd estimated is on the face sheet
-enter the number (with the decimal)

138. Right Pupil Size – Room Light
-enter the number (with the decimal)

139. Right Pupil Size – Near Total Darkness
-enter the number (with the decimal)

140. Right Pupil Size – Direct Light
-enter the number (with the decimal)

141. Right Pupil Size – Direct Light 2 (recoded)**if rebound dilation is present a 2nd estimated is on the face sheet
-enter the number (with the decimal)

142. Left Pupil Room Light within Average DRE Range (recoded). Face sheet contains ranges for all three lighting conditions.
0—below range (<2.5mm)
1—within range (2.5 – 5.0mm)
2—above range (>5.0mm)
-999 not available

143. Left Pupil Near Total Darkness within Average DRE Range (recoded). Face sheet contains ranges for all three lighting conditions.
0—below range (<5.0mm)

1—within range (5.0 – 8.5mm)
2—above range (>8.5mm)
-999 not available

144. Left Pupil Direct Light within Average DRE Range (recoded). Face sheet contains ranges for all three lighting conditions.
0—below range (<2.0mm)
1—within range (2.0 – 4.5mm)
2—above range (>4.5mm)
-999 not available

145. Left Pupil Direct Light 2 within Average DRE Range (recoded). Face sheet contains ranges for all three lighting conditions.
0—below range (<2.0mm)
1—within range (2.0 – 4.5mm)
2—above range (>4.5mm)
-999 not available

146. Right Pupil Room Light within Average DRE Range (recoded). Face sheet contains ranges for all three lighting conditions.
0—below range (<2.5mm)
1—within range (2.5 – 5.0mm)
2—above range (>5.0mm)
-999 not available

147. Right Pupil Near Total Darkness within Average DRE Range (recoded). Face sheet contains ranges for all three lighting conditions.
0—below range (<5.0mm)
1—within range (5.0 – 8.5mm)
2—above range (>8.5mm)
-999 not available

148. Right Pupil Direct Light within Average DRE Range (recoded). Face sheet contains ranges for all three lighting conditions.
0—below range (<2.0mm)
1—within range (2.0 – 4.5mm)
2—above range (>4.5mm)
-999 not available

149. Right Pupil Direct Light 2 within Average DRE Range (recoded). Face sheet contains ranges for all three lighting conditions.
0—below range (<2.0mm)
1—within range (2.0 – 4.5mm)
2—above range (>4.5mm)
-999 not available

150. Rebound Dilation
    0 – no
    1 – yes

151. Reaction to Light
    0—normal
    1—slow
    2—little to none
    -999 not available

152. Nasal Area
    -enter any text that is written in this section of the face sheet

153. Nasal Area (recoded)
    0 – clear / normal
    1 – other
    -999 not available

154. Oral Cavity
    -enter any text that is written in this section of the face sheet

155. Oral Cavity (recoded)
    0 – clear / normal
    1 – other
    -999 not available

156. Left Arm Injection Sites
    0 – none
    1 – old
    2 – fresh
    3 - both

157. Right Arm Injection Sites
    0 – none
    1 – old
    2 – fresh
    3 - both

158. Blood Pressure – Systolic
    -enter the first number

159. Blood Pressure – Diastolic
    -enter the second number

160. Body Temperature
    -enter the number (with the decimal)

161. Blood Pressure – Systolic (recoded)
    0 – below range (< 120)
    1 – within range (120 – 140)
    2 – above range (> 140)
    -999 not available

162. Blood Pressure – Diastolic (recoded)
    0 – below range (< 70)
    1 – within range (70 – 90)
    2 – above range (> 90)
    -999 not available

163. Body Temperature (recoded)
    0 – below range (< 97.6 degree)
    1 – within range (97.6 – 99.6 degrees)
    2 – above range (> 99.6 degree)
    -999 not available

164. Muscle Tone
    0 – normal
    1 – flaccid
    2 – rigid
    -999 not available

165. Type of Medication/Drug Taken
    -enter any text that is written in this section of the face sheet

166. Amount of Medication/Drug Taken
    -enter any text that is written in this section of the face sheet

167. Time of Medication/Drug use time
    -enter time without any spaces or colons according to the 24-hour clock

168. Date of Arrest
    -enter the date as is on the face sheet without any spaces or hyphens

169. Time of Arrest
    -enter time without any spaces or colons according to the 24-hour clock

170. Evaluation Start Time
    -enter time without any spaces or colons according to the 24-hour clock

171. Evaluation Completion Time
    -enter time without any spaces or colons according to the 24-hour clock

172. Opinion of Evaluator – Drug 1 *If more than one drug is selected, then code each one using a separate drug variable.

0 – rule out (no impairment)
1 – medical rule out
2 – alcohol
3 – CNS depressant
4 – CNS stimulant
5 – hallucinogen
6 – dissociative anesthetic (PCP)
7 – narcotic analgesic
8 – inhalant
9 – cannabis
-999 unknown
-if left blank on the face sheet, then leave blank in the database

173. Opinion of Evaluator – Drug 2

0 – rule out (no impairment)
1 – medical rule out
2 – alcohol
3 – CNS depressant
4 – CNS stimulant
5 – hallucinogen
6 – dissociative anesthetic (PCP)
7 – narcotic analgesic
8 – inhalant
9 – cannabis

174. Opinion of Evaluator – Drug 3

0 – rule out (no impairment)
1 – medical rule out
2 – alcohol
3 – CNS depressant
4 – CNS stimulant
5 – hallucinogen
6 – dissociative anesthetic (PCP)
7 – narcotic analgesic
8 – inhalant
9 – cannabis

175. Opinion of Evaluator – Drug 4

0 – rule out (no impairment)
1 – medical rule out
2 – alcohol
3 – CNS depressant
4 – CNS stimulant
5 – hallucinogen

6 – dissociative anesthetic (PCP)
7 – narcotic analgesic
8 – inhalant
9 – cannabis

176. Toxicology Results – Drug 1
0 – no drugs found
1 – medical
2 – alcohol
3 – CNS depressant
4 – CNS stimulant
5 – hallucinogen
6 – dissociative anesthetic
7 – narcotic analgesic
8 – inhalant
9 – cannabis

177. Toxicology Results – Drug 2
0 – no drugs found
1 – medical
2 – alcohol
3 – CNS depressant
4 – CNS stimulant
5 – hallucinogen
6 – dissociative anesthetic
7 – narcotic analgesic
8 – inhalant
9 – cannabis

178. Toxicology Results – Drug 3
0 – no drugs found
1 – medical
2 – alcohol
3 – CNS depressant
4 – CNS stimulant
5 – hallucinogen
6 – dissociative anesthetic
7 – narcotic analgesic
8 – inhalant
9 – cannabis

179. Toxicology Results – Drug 4
0 – no drugs found
1 – medical
2 – alcohol
3 – CNS depressant

4 – CNS stimulant
5 – hallucinogen
6 – dissociative anesthetic
7 – narcotic analgesic
8 – inhalant
9 – cannabis

180. Toxicology Results – Drug 5
0 – no drugs found
1 – medical
2 – alcohol
3 – CNS depressant
4 – CNS stimulant
5 – hallucinogen
6 – dissociative anesthetic
7 – narcotic analgesic
8 – inhalant
9 – cannabis

181. CNS depressant active drug (recoded). If DRE opinion is drug and toxicology confirms drug mark as active
0 – not active
1 – active

182. CNS stimulant active drug (recoded). If DRE opinion is drug and toxicology confirms drug mark as active
0 – not active
1 – active

183. Hallucinogens active drug (recoded). If DRE opinion is drug and toxicology confirms drug mark as active
0 – not active
1 – active

184. Dissociative Anesthetics active drug (recoded). If DRE opinion is drug and toxicology confirms drug mark as active
0 – not active
1 – active

185. Narcotic Analgesic active drug (recoded). If DRE opinion is drug and toxicology confirms drug mark as active
0 – not active
1 – active

186. Inhalants active drug (recoded). If DRE opinion is drug and toxicology confirms drug mark as active

0 – not active
1 – active

187. Cannabis active drug (recoded). If DRE opinion is drug and toxicology confirms drug mark as active
0 – not active
1 – active

188. Total Active Drug Categories- drug combinations (recoded)
0 – no drug found
1 – CNS depressant
2 – CNS stimulant
3 – Hallucinogen
4 – Dissociate Anesthetic
5 – Narcotic Analgesic
6 – Inhalant
7 – Cannabis
8 – CNS stimulant/Narcotic analgesic
9 – CNS depressant/Narcotic analgesic
10 – CNS depressant/CNS stimulant
11 – Narcotic analgesic/Cannabis
12 – CNS stimulant/Cannabis
13 – CNS depressant/Cannabis
14 – CNS depressant/CNS stimulant/Cannabis
15 – CNS depressant/CNS stimulant/Narcotic analgesic/Cannabis

189. Missed DRE opinion (recoded)**follow DECP guidelines for classification for DRE opinion.
0 – not missed
1 – missed