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An Analysis of a Pilot Program: Oral Fluid Testing of Drugged Drivers in Michigan

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This is to certify that the doctoral dissertation by

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has been found to be complete and satisfactory in all respects,
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Walden University
2024

Abstract

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Graduate Certificate, Central Michigan University, 2023.

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Law enforcement officers are charged with the responsibility of interpreting complicated social situations of the public every day. Adding difficulty is rapid cannabis legalization across the United States, including Michigan; encompassed in medicinal legalization in 2008 and recreational legalization in 2018, which has brought with it many changes, affecting economic, social, safety, and criminal elements. Michigan has seen an approximate 45% increase in traffic crashes with drivers who tested positive for cannabis over a five-year time frame (2013 – 2018). The purpose of this quantitative correlational study was to determine the accuracy of roadside oral fluid testing introduced in Michigan through the Oral Fluid Roadside Analysis Pilot Program initiated in 2017. Bases of social power theory and punctuated equilibrium theory were used as a framework, and secondary data were collected through the initial pilot counties by a large Midwestern state police agency and drug recognition experts (DREs) from various agencies. Quantitative data analysis was conducted using correlational testing to examine the predictive accuracy of oral fluid testing central to the implementation of the pilot program. These key findings indicate that accuracy relationships examined for these testing methods do not support a broad application of reliability for identified all substances / drug categories using oral fluid testing, The findings of this study support positive social change by supporting law enforcement through a substantiation of objective tools and training to confidently approach oral fluid testing as a vetted method for investigating drugged driving.

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Chapter 1: Introduction to the Study

Introduction

Landscape for law enforcement contact with the public in the United States has changed rapidly over time given changes in drug laws, police training, and evolving societal conduct. In Michigan, the beginning of the 2010s brought increased demand in policy for objectivity in law enforcement targeting and investigating cases of “drugged driving” (Moore et al., 2020). “Drugged driving” in reference to controlled substance use and positivity in people causing impairment in their operation of motor vehicles on public roadways (Liebenberg et al., 2019). The challenges associated with investigating and prosecuting operating under the influence of drugs and drugs combined with alcohol have forced law enforcement and prosecutors alike to conform traditional methods for detecting impairment, such as standard field sobriety tests (SFST), in conjunction with technology for instant detection of controlled substances through roadside oral fluid testing. Law enforcement organizations are charged with the responsibility of training and equipping police with tools and knowledge to fully investigate criminal activity, as well as exploring opportunities for increased objectivity and legality in law enforcement. Although oral fluid testing use by law enforcement is not new internationally, oral fluid testing pilot programs are being implemented throughout the United States and are being vetted for viability.

Background

Selected articles relating to impact of cannabis and alcohol use on driving skills and Standard Field Sobriety Testing assessments are described here. The keywords or phrases searched were “oral fluid,” “oral fluid test,” “oral fluid testing,” “oral fluid pilot program,” “intoxicating,” “controlled substances,” “Cannabis OR Marijuana OR Marihuana OR THC OR pot OR Delta-9-Tetrahydrocannabinol.” The databases searched were facilitated through the Walden University Library and include Political Science Complete & Business Source Complete Combined Search, ProQuest Central, EBSCO database, Political Science Complete, SAGE Knowledge Publications, published Walden dissertations from 2016–2020, and encyclopedias for reviewing literature on theoretical framework.

Problem Statement

Controlled substance use combined with operation of a motor vehicle is a social issue. Currently, in the State of Michigan, police officers do not have instruments available to use on the road to establish probable cause for drugged driving. Police officers may be unequipped and untrained for drugged driving investigations unless they have completed specialized drug detection training. In 2016, Michigan passed Public Act 242 and 243, which established a pilot program in five counties of Michigan for roadside oral fluid testing to determine whether an individual is operating under the influence of a controlled substance by detecting the presence of controlled substances in drivers through an oral fluid sample (Michigan State Police, 2019a). Concurrently, a legalization of

cannabis (THC), both medically and recreationally, has occurred in Michigan by citizen referendum in 2008 and 2018 (Hauck, 2019).

Oral fluid testing has not been standardized in Michigan as an accurate method for detecting cannabis use and/or other controlled substances in drivers who may be under the influence. This problem has been exacerbated by the rampant legalization of recreational and medicinal cannabis in Michigan which in turn has caused an increase in drivers driving under the influence, as well as a lack of objectivity without a per se level of cannabis intoxication in Michigan, when compared to alcohol. Michigan saw an approximate 45% increase in fatal traffic crashes with drivers who tested positive for cannabis over a 5-year time frame (2013–2018) (Berdine, 2019).

This problem has negatively impacted citizens of Michigan because of the risks associated with driving under the influence. The Impaired Driving Safety Commission Act was implemented in Michigan through Public Act No. 350 to research the level of ingestible marijuana (THC) that could affect safe driving (Michigan State Police, 2019b). In 2019, the Impaired Driving Safety Commission Report identified that cannabis has been shown to impair critical driving-related skills including psychomotor skills like reaction time, tracking ability, target detection, and cognitive functions like judgment, anticipation, and divided attention. Additionally, it is estimated that cannabis impairment can cause an increased risk of crash by 22% - 36% (Michigan State Police, 2019b, p. 7). Previous research related to these issues have focused on the effects of cannabis (THC) and/or a combination of cannabis and alcohol use on impairment in an individual's driving skills (Arkell et al., 2019; Bondallaz et al., 2016; Chihuri et al., 2017; Hartung et

al., 2016) while other research has focused on the reliability and variability of roadside investigation methods including SFST and oral fluid testing as well as literature comparing oral fluid testing devices (Beirness & Smith, 2017; Dobri et al., 2019; Doucette et al., 2018; Downey, 2016; Gjersing et al., 2019; Logan & Mohr, 2015).

I analyzed the gap in the research for whether roadside oral fluid testing is an accurate detection tool for drivers under the influence of cannabis or several other controlled substance drug categories, and whether oral fluid testing tools are an objective assessment correlated with law enforcement ideology about usefulness and accuracy in the implementation of these tools in Michigan. It was important to determine whether these standardized tools are translatable and reliable for law enforcement in a changing climate of drugged drivers and laws. Drivers who may be illegally operating a motor vehicle while under the influence of cannabis or other controlled substances provide an enhanced investigatory challenge for police.

Purpose

The purpose of this quantitative research study was to understand the use and accuracy of roadside oral fluid testing conducted in the five Michigan counties which implemented pilot instruments for testing and detecting controlled substances in the oral fluid of drivers (Berrien, Delta, Kent, St. Clair, and Washtenaw). Participating Michigan counties were selected for the oral fluid pilot program based on a number of criteria. The primary factors in selecting the test counties included: (a) number of serious injury and fatal traffic crashes involving impaired driving within the county, (b) trained DRE

officers and prosecutors in their county, (c) knowledge of the pilot program, and (d) willingness to participate.

To either refute or substantiate oral fluid testing as an accurate method of illegal intoxication detection, as stated, this researcher analyzed secondary data collected from the aforementioned counties before, and after, the implementation of the oral fluid test pilot program in 2017. The intention of this study serves as a connection between the lack of resources to adequately detect consumed drugs in a drug-related "operating while intoxicated" investigation and the oral fluid pilot program introducing a new tool and method for roadside drug detection. A review of whether oral fluid testing can withstand the changing legal climate to incorporate this test and its results as scientifically dependable would aid law enforcement agency determinations in utilizing this test on a broad scale for individual officers working to detect impairment in drivers under the influence of controlled substances.

The research methodology is a quantitative research design. Variables of interest include independent variables of cannabis use only and polydrug use results from oral fluid testing, as well as dependent variables of preliminary oral fluid testing results performed by certified drug recognition experts (DREs) over a period of time before and after intervention of the pilot program. This researcher analyzed proposed correlations between variables through a quasi-experimental (correlational) design and variables will be assessed for the strength of the relationship among them as related to the gap in the research as identified through the literature review.

Research Questions and Hypotheses

RQ1: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of central nervous system depressants?

$H_0$1 – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of central nervous system depressants and the use of oral fluid testing.

H_a1 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of central nervous system depressants and the use of oral fluid testing.

RQ2: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of central nervous system stimulants?

$H_0$2 – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of central nervous system stimulants and the use of oral fluid testing.

H_a2 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of central nervous system stimulants and the use of oral fluid testing.

RQ3: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of hallucinogens?

$H_0$3 – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of hallucinogens and the use of oral fluid testing.

*H*a3 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of hallucinogens and the use of oral fluid testing.

RQ4: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of phencyclidine (PCP)?

$H_0$4 – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of phencyclidine (PCP) and the use of oral fluid testing.

H_a4 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of phencyclidine (PCP) and the use of oral fluid testing.

RQ5: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of narcotic analgesics?

$H_0$5 – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of narcotic analgesics and the use of oral fluid testing.

*H*a5 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of narcotic analgesics and the use of oral fluid testing.

RQ6: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of inhalants?

$H_0$6 – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of inhalants and the use of oral fluid testing.

*H*a6 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of inhalants and the use of oral fluid testing.

RQ7: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of cannabis?

$H_0$7 – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of cannabis and the use of oral fluid testing.

*H*a7 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of cannabis and the use of oral fluid testing.

Theoretical Framework

The bases of social power theory provides that there are five types of power: referent power, expert power, reward power, coercive power, and legitimate power (Hinkin et al., 1989). The theory of social power provides that influence on the person (P) produced by a social agent (O) – wherein O can be another person, a role, a norm, a group, or a part of a group – can be exerted on P through a system that P operates within (Shafritz et al., 2016, p. 251). Psychological changes in P can be changed by the social influence of O, but only when the effects of other forces have been eliminated (p. 252). This researcher focused on the theory of legitimate power relationship between social agent change on people in reference to the problem.

Due to the nature of criminal law in the State of Michigan, all Michigan drivers must comport with traffic laws including but not limited to prohibitions on operating a motor vehicle while under the influence of controlled substances or other intoxicating substances. Laws in Michigan are derived and established from a social contract that people have with the government to create and enforce laws protecting society from unnecessary harm. The legalization of medicinal and recreational marijuana has created a shift in the norm where Marijuana was once a stigmatized and illegal controlled substance, but is now a legalized, common substance for use and possession in society. This shift has impacted the behavior of the person to use and possess controlled substances (i.e. Marijuana) in greater frequencies and volumes given newly lawful and legitimate status. The bases of power theory, referencing legitimate power, provides that the person now *has the right* to possess and use marijuana – even when they may become

under the influence by said substance and the individual has *the right* to operate a motor vehicle, which the motivations deriving a person's *ought to* or *have the right to* may be internalized values in the person and dictation that the social agent has a legitimate right to influence the person and the person has a right to accept the influence (Shafritz et al., 2016, p. 255). In response to a shift in societal norms, which have influenced people to make decisions about controlled substances and operating motor vehicles, there should be an examination of oral fluid testing as a tool for use in the adaptation of policy applicable to changes in drivers. Changes in the behavior of Michigan drivers are moving faster than the laws, making laws more reactive than proactive in this instance. The variances in what can influence citizens behavior helps to understand why scientific authority supporting (or not supporting) the use of a standardized tool such as oral fluid testing may also influence citizens understanding and behavior through legitimacy when they are seated as jurors or when they are deciding whether to use controlled substances and drive.

An additional theoretical framework is the punctuated equilibrium theory. This theory surmises that public policies mirror the tendencies of Darwin's theory of evolution when applied to governance in that public policies tend to be stable for a long time and then may be interrupted by sudden starts and stops, followed by long periods of relatively minor changes (Branch, 2007). In turn, policy images and institutional venues "are used by policy makers to manipulate the dominant understanding of the issues with which they deal and to influence the institutions that exert jurisdiction over them" (Kuhlmann & van der Heijden, 2018, p. 329). This theoretical framework is applicable to the dichotomy between long-standing legislative and institutional policies for investigating and

prosecuting drunk and drugged driving cases in Michigan, which have been called to course due to swift Marijuana legalization policy in the State of Michigan. Policy transformation and creation are being exhibited through pilot programs for new tools, such as oral fluid testing, for law enforcement to monitor and enforce laws against drugged driving.

Nature of Study

Quantitative research designs are a systematic and methodological process that places considerable value on rationality, objectivity, prediction, and control (Walker, 2005, p. 572). The nature of this study was quantitative research with a nonexperimental, correlational research design based on the research question and proposed analysis of secondary data and original survey data. A nonexperimental research design was used to observe and build on an understanding of a social phenomenon to explore events, people, or situations by testing correlations and relationships among variables at a point in time. A correlational research design was an applicable research design for this study because this researcher was interested in investigating an existing dataset for observations of participant demographics, results from Oral Fluid Testing Program secondary data and qualitative data from law enforcement.

In the current literature, controlled substance use impact on driving skills and oral fluid testing methods are discussed. The nature of this proposed quantitative research study is to collect and analyze secondary data to measure the accuracy of roadside oral fluid testing in five Michigan counties as well as collect new data from law enforcement

exposed to oral fluid testing during the Pilot Program initiative. The secondary dataset that this researcher will examine will be drugged driving investigation and arrest data from 36 months prior to intervention of the Oral Fluid Testing Pilot Program, at the point of intervention in 2017, and drugged driving investigation and arrest data from 36 months after intervention, to analyze an association of mean results in five participating Michigan counties.

The research questions drew out the problem that roadside oral fluid testing is a new method, but which has not been substantiated for detecting drivers under the influence from cannabis use and/or other controlled substances in Michigan; therefore, objective values on oral fluid testing results from the Oral Fluid Pilot Program in five Michigan counties will be evaluated. I accessed the proposed secondary datasets and set out new survey instruments in partnership with the large police agency given proper permissions and agreements are achieved with the understanding that no identifiable information about participants was be released about individual candidates.

Possible Types and Sources of Data

The Oral Fluid Pilot Program effectuated 92 oral fluid roadside tests using the Alere DDS2 test instrument and 62 secondary oral fluid tests using the Quantisal test instrument by drug recognition experts (DRE) at traffic stops between November 8, 2017 and November 8, 2018 in Berrien, Delta, Kent, St. Clair, and Washtenaw counties. Secondary data collected from the Oral Fluid Testing Program implementation in 2017-2018 through a large Midwestern statewide agency. I collected the data through an open

records request submitted to the records resource department of a large Midwestern statewide law enforcement agency. Additionally, secondary data was collected from each Pilot Program participating counties (Berrien, Delta, Kent, St. Clair, and Washtenaw counties) to review DRE drugged driving investigation and arrest data for 36 months before and 36 months after the intervention of the Pilot Program in 2016. Lastly, this researcher decided against developing a survey for participating DRE officers who implemented the pilot program in participating counties to assess for accuracy of oral fluid testing for drug detection in drugged driving investigations.

Limitations, Challenges, and/or Barriers

A potential barrier, due to the use of secondary data, is that data access may include a partner-site agreement for confidentiality, site masking, and possible fees for data access.

Significance

This study does contribute to social change for the societal benefits derived from a methodological prohibition of driving under the influence including but not limited to reduced fatalities and damages. Objectivity in intoxicated driving investigations is needed for law enforcement and prosecutors working every day to hold impaired drivers accountable. The concept of roadside oral fluid testing as an available tool for law enforcement during every encounter with drivers who may be under the influence moves these investigations towards neutrality. The results of this study do provide insight into the accuracy of these tools for detecting drugged driving intoxication. Law enforcement

and prosecutors need versatility in tools as every drunk driving scenario and driver is unique and presents distinct issues. A lack of objective investigation standards (i.e. no per se level of Marijuana for drugged driving intoxication in Michigan) could also increase subjectivity in drugged driving investigations which does not always align with operating while intoxicated laws in Michigan. Insights from this study do aid in the successful investigation and prosecution of driving under the influence, which may lead to the reduction of drugged driving in Michigan and increase successful conviction and public deterrence therein.

Problem Statement

Controlled substance use combined with the operation of a motor vehicle is a social issue. Currently, in the State of Michigan, police officers have limited instruments available to use on the road to establish probable cause for drugged driving. Police officers may be in the dark for drugged driving investigations unless they have completed specialized drug detection training. In 2016, the State of Michigan passed Public Act 242 and 243, which established a pilot program in five counties of Michigan for roadside oral fluid testing to determine whether an individual is operating under the influence of a controlled substance by detecting the presence of controlled substances in drivers through an oral fluid sample. Oral fluid testing has not been standardized in Michigan as accurate for detecting cannabis use and/or other controlled substances in drivers who may be under the influence. This problem has been exacerbated by the rampant legalization of recreational and medicinal cannabis in Michigan which in turn has caused an increase in

drivers driving under the influence, as well as a lack of objectivity without a per se level of cannabis intoxication in Michigan, when compared to alcohol. Michigan saw an approximate 45% increase in fatal traffic crashes with drivers who tested positive for cannabis over a five-year time frame (2013 – 2018) (Berdine, 2019). Legalization of cannabis (THC), both medically and recreationally, has occurred in Michigan by citizen referendum in 2008 and 2018 (Hauck, 2019).

This problem has negatively impacted citizens of Michigan because of the risks associated with driving under the influence. The Impaired Driving Safety Commission act was implemented in Michigan in 2017 through Public Act No. 350 to research the level of ingestible Marijuana (THC) that could affect safe driving (Michigan State Police, 2019b). In 2019, the Impaired Driving Safety Commission Report identified that cannabis has been shown to impair critical driving-related skills including psychomotor skills like reaction time, tracking ability, target detection, and cognitive functions like judgment, anticipation, and divided attention. Additionally, it is estimated that cannabis impairment can cause an increased risk of crash by 22% - 36% (Michigan State Police, 2019b, p. 7). Previous research related to these issues has focused on the effects of cannabis (THC) and/or a combination of cannabis and alcohol use on impairment in an individual's driving skills (Arkell et al., 2019; Bondallaz et al., 2016; Chihuri et al., 2017) while other research has focused on the reliability and variability of roadside investigation methods including SFSTs and oral fluid testing as well as literature comparing oral fluid testing devices (Beirness & Smith, 2017; Dobri et al., 2019; Doucette et al., 2018; Gjersing et al., 2019; Logan & Mohr, 2015).

This researcher analyzed the gap in the research for whether roadside oral fluid testing is an accurate detection tool for drivers under the influence of cannabis or other controlled substances, and whether these tools as objective assessments are correlated with law enforcement ideology about usefulness and accuracy in the implementation of these tools in Michigan. It is important to determine whether these standardized tools are translatable and reliable for law enforcement in a changing climate of drugged drivers and laws. Drivers who may be illegally operating a motor vehicle while under the influence of cannabis or other controlled substances provide an enhanced investigatory challenge for police.

Purpose of the Study

The purpose of this quantitative research study was to understand the use and accuracy of roadside oral fluid testing conducted in the five Michigan counties which implemented pilot instruments for testing and detecting controlled substances in the oral fluid of drivers (Berrien, Delta, Kent, St. Clair, and Washtenaw). Participating Michigan counties were selected for the oral fluid pilot program based on a number of criteria. The primary factors in selecting the test counties included: (a) number of serious injury and fatal traffic crashes involving impaired driving within the county, (b) trained DRE officers and prosecutors in their county, (c) knowledge of the pilot program, and (d) willingness to participate.

To either refute or substantiate oral fluid testing as an accurate method of illegal intoxication detection, as stated, this researcher analyzed secondary data collected from

the aforementioned counties before, and after, the implementation of the oral fluid test pilot program in 2017. The intention of this study was to serve as a connection between the lack of resources to adequately detect consumed drugs in a drug-related "operating while intoxicated" investigation and the oral fluid pilot program introducing a new tool and method for roadside drug detection. In other words, does oral fluid testing withstand the changing legal climate to incorporate this test as dependable and aid in impairment detection for drivers under the influence of controlled substances?

The research methodology is a quantitative research design. Variables of interest include independent variables of cannabis use only and poly-drug use results from oral fluid testing, as well as dependent variables of preliminary oral fluid testing results performed by certified DREs over a period of time before and after intervention of the pilot program. This researcher analyzed proposed correlations between independent and dependent variables under study through a quasi-experimental (correlational) design and variables were assessed for the strength of the relationship among them related to the gap.

Research Question(s) and Hypotheses

RQ1: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of central nervous system depressants?

H_{01} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of central nervous system depressants and the use of oral fluid testing.

H_1 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of central nervous system depressants and the use of oral fluid testing.

RQ2: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of central nervous system stimulants?

H_{02} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of central nervous system stimulants and the use of oral fluid testing.

H_2 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of central nervous system stimulants and the use of oral fluid testing.

RQ3: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of hallucinogens?

H_{03} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of hallucinogens and the use of oral fluid testing.

H_3 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of hallucinogens and the use of oral fluid testing.

RQ4: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of phencyclidine (PCP)?

H_{04} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of phencyclidine (PCP) and the use of oral fluid testing.

H_4 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of phencyclidine (PCP) and the use of oral fluid testing.

RQ5: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of narcotic analgesics?

H_{05} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of narcotic analgesics and the use of oral fluid testing.

H_5 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of narcotic analgesics and the use of oral fluid testing.

RQ6: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of inhalants?

H_{06} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of inhalants and the use of oral fluid testing.

H_6 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of inhalants and the use of oral fluid testing.

RQ7: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of cannabis?

H_{07} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of cannabis and the use of oral fluid testing.

H_7 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of cannabis and the use of oral fluid testing.

Theoretical Foundation

The Bases of Social Power theory provides that there are five types of power: referent power, expert power, reward power, coercive power, and legitimate power (Hinkin et al., 2019). The theory of social influence and power provides that influence on the person (P) produced by a social agent (O) – wherein O can be another person, a role, a norm, a group, or a part of a group – can be exerted on P through a system that P operates within (Shafritz et al., 2016, p. 251). Psychological changes in P can be changed by the social influence of O, but only when the effects of other forces have been eliminated (p. 252). This researcher will focus on the theory of legitimate power relationship between social agent change on people in reference to the problem.

Due to the nature of criminal law in the State of Michigan, all Michigan drivers must comport with traffic laws including but not limited to prohibitions on operating a motor vehicle while under the influence of controlled substances or other intoxicating substances. Laws in Michigan are derived and established from a social contract that people have with the government to create and enforce laws protecting society from unnecessary harm. The legalization of medicinal and recreational Marijuana has created a shift in the norm where Marijuana was once a stigmatized and illegal controlled substance, but is now a legalized, common substance for use and possession in society. This shift has impacted the behavior of the person to use and possess controlled substances (i.e. Marijuana) in greater frequencies and volumes given newly lawful and legitimate status. The Bases of Power Theory, referencing legitimate power, provides that the person now *has the right* to possess and use Marijuana – even when they may become under the influence by said substance and the individual has *the right* to operate a motor vehicle, which the *ought to* or *have the right to* may be internalized values in the person and dictates that social agent has a legitimate right to influence the person and the person has a right to accept the influence (Shafritz et al., 2016, p. 255). In response to a shift in societal norms, which have influenced people to make decisions about controlled substances and operating motor vehicles, there should be an examination of oral fluid testing as a tool for use in the adaptation of policy applicable to changes in drivers. Changes in the behavior of Michigan drivers is moving faster than the laws; making laws more reactive than proactive in this instance. The variances in what can influence citizens behavior helps to understand why scientific authority supporting (or not supporting) the

use of a standardized tool such as oral fluid testing may also influence citizens understanding and behavior through legitimacy when they are seated as jurors or when they are deciding whether to use controlled substances and drive.

An additional theoretical framework is the Punctuated Equilibrium Theory. This theory surmises that public policies mirror the tendencies of Darwin's Theory of Evolution applied to governance in that public policies tend to be stable for a long time and then may be interrupted by sudden starts and stops, followed by long periods of relatively minor changes (Branch, 2007). In turn, policy images and institutional venues "are used by policy makers to manipulate the dominant understanding of the issues with which they deal and to influence the institutions that exert jurisdiction over them" (Kuhlmann & van der Heijden, 2018, p. 329). This theoretical framework is applicable to the dichotomy between long-standing legislative and institutional policies for investigating and prosecuting drunk and drugged driving cases in Michigan which have been called to course due to swift Marijuana legalization policy in the State of Michigan. Policy transformation and creation are being exhibited through pilot programs for new tools, such as oral fluid testing, for law enforcement to monitor and enforce laws against drugged driving.

Nature of the Study

In the current literature, controlled substance use impact on driving skills and oral fluid testing methods are discussed. The nature of this quantitative research study was to collect and analyze secondary data to measure the accuracy of roadside oral fluid testing

in five Michigan counties as well as collect new data from law enforcement exposed to oral fluid testing during the Pilot Program initiative. The secondary dataset that this researcher examined will be drugged driving investigation and arrest data from 36 months prior to intervention of the Oral Fluid Testing Pilot Program, at the point of intervention in 2017, and drugged driving investigation and arrest data from 36 months after intervention, to analyze an association of mean results in five participating Michigan counties.

Quantitative research designs are a systematic and methodological process that places considerable value on rationality, objectivity, prediction, and control (Walker, 2005, p. 572). The nature of this study was quantitative research with a nonexperimental, correlational research design based on the research question and proposed analysis of secondary data and original survey data. A nonexperimental research design was used to observe and build on an understanding of a social phenomenon to explore events, people, or situations by testing correlations and relationships among variables at a point in time. A correlational research design was an applicable research design for this study because this researcher is interested in investigating an existing dataset for observations of participant demographics, results from Oral Fluid Testing Program secondary data and qualitative data from law enforcement.

The research question did draw out the problem that roadside oral fluid testing is a new method, but which has not been substantiated for detecting drivers under the influence from cannabis use and/or other controlled substances in Michigan; therefore,

objective values on oral fluid testing results from the Oral Fluid Pilot Program in five Michigan counties were evaluated. This researcher did access the proposed secondary datasets and decided against setting out new survey instruments in partnership with the large police agency given proper permissions and agreements are achieved with the understanding that no identifiable information about participants will be released about individual candidates.

Limitations

A potential barrier, due to the use of secondary data, is that data access may include a partner-site agreement for confidentiality, site masking, and possible fees for data access.

Significance of the Study

This study does contribute to social change for the societal benefits derived from a methodological prohibition of driving under the influence including but not limited to reduced fatalities and damages. Objectivity in intoxicated driving investigations is needed for law enforcement and prosecutors working every day to hold impaired drivers accountable. The concept of roadside oral fluid testing as an available tool for law enforcement during every encounter with drivers who may be under the influence moves these investigations towards neutrality. The results of this study do provide insight into the accuracy of these tools for detecting drugged driving intoxication. Law enforcement and prosecutors need versatility in tools as every drunk driving scenario and driver is unique and presents distinct issues. A lack of objective investigation standards (i.e. no per

se level of Marijuana for drugged driving intoxication in Michigan) could also increase subjectivity in drugged driving investigations which does not always align with operating while intoxicated laws in Michigan. Insights from this study do aid in the successful investigation and prosecution of driving under the influence, which could lead to the reduction of drugged driving in Michigan and increase successful conviction and public deterrence therein.

Summary

It is a consistency of human behavior to drive. A 2014 – 2015 survey indicates that individuals 16 years of age and older drove an average of 29.8 miles per day (Triplett et al., 2016). Roads in in the State of Michigan are highly utilized by drivers; on average, drivers in Michigan drive 95.1 billion miles per year (Michigan Department of Transportation, n.d.). In that way, vehicles, roadways, and drivers, are a flowing stream of life and productivity moving endlessly throughout the State. Simultaneously, those vehicles and drivers consistently pose a present, potential danger to other drivers and citizens occupying roads throughout the State. In 2021, there were 282,640 traffic crashes in the State of Michigan – a 15% increase from traffic crashes in 2020 (Michigan State Police, 2022). Law enforcement are trained to preventatively observe risky driving behaviors and actions on Michigan roadways. When warranted, law enforcement are also trained to initiate and complete investigations into criminal driving conduct, such as operating a motor vehicle under the influence of drugs and/or alcohol, and subsequently hold criminal drivers responsible.

Resources and tools to assist law enforcement investigations of operating while under the influence of alcohol and/or drugs have evolved over time and are often aimed to increase ease of use, decrease subjectivity of law enforcement discretion, and increase reliability of detection and result. The Michigan Oral Fluid Pilot Program was the implementation of novel resources to assist law enforcement roadside in the detection of controlled substance use by drivers and further their investigation into whether controlled substance use negatively influenced the divided attention task of driving. This research was targeted towards the accuracy and range of detection through the application of various oral fluid testing devices in roadside drugged driving investigations executed by DRE officers in Michigan in 2016 – 2018.

Chapter 2: Literature Review

The purpose of this study was to examine the relationship between accuracy and reliability of roadside oral fluid testing by law enforcement through the implementation of the Oral Fluid Roadside Analysis Pilot Program in Michigan. There has been an increase in the issue of drug-impaired driving as evidenced from data produced in the National Highway Traffic Safety Administration (NHTSA) sponsored National Roadside Surveys, which has shown the presence of drugs and alcohol in blood and oral fluid samples volunteered from drivers and establishes an increase from 16.3% to 20% and Marijuana detection rates increasing from 8.6% to 12% (Tara Kelley-Baker et al., 2017; Lacey et al., 2009). In Michigan, this pervasive issue is also present and attributable to a number of factors, including state-wide legalization of medical and recreational Marijuana in 2008 and 2018, as there was a 9% increase for the presence of Marijuana in drivers involved in fatal crashes, post-legalization, and the average number of Marijuana-positive drivers increased (Witsil, 2020).

Effectiveness of laws against drugged driving and prosecution of the same have been established for deterrence and prevention, but many individual law enforcement officers are not trained to identify the signs and symptoms of drivers impaired by drugs other than alcohol (Hedlund, 2016). Research on the uses and reliability of oral fluid testing is available and largely targeted towards the effectiveness of oral fluid testing devices and variations, both domestically to the United States and internationally, as to oral fluid testing result uses. The literature review covers the following topics: theoretical foundation as a basis for governmental decision making with regard to enforcement,

studies conducted on the use of oral fluid testing for traffic-related purposes and alternative uses of oral fluid testing, international review of oral fluid testing uses, a comparison of research on oral fluid testing instruments, Michigan's Oral fluid Pilot Program and related legislation, and research on the accurate detection of drug categories detectable by oral fluid testing devices, in general. This review demonstrates the associations between oral fluid testing as a testing method vetted for accuracy when compared to blood sampling and the importance of establishing accuracy of controlled substance detection for law enforcement officers that may not have specialized training for drug-impaired driving investigations.

Literature Search Strategy

Selected articles relating to roadside oral fluid testing, alternative uses of oral fluid testing, international uses of oral fluid testing, reliability and effectiveness of oral fluid testing on various drug categories, and impacts of cannabis, controlled substance, and intoxicating substance use on driving skills or under the influence are described here. The keywords or phrases searched were "oral fluid", "oral fluid test", "oral fluid testing", "oral fluid pilot program", "intoxicating, "controlled substances", "Cannabis OR Marijuana OR Marihuana OR THC OR pot OR Delta-9-Tetrahydrocannabinol", "roadside", "traffic", and "driving OR drive." The databases searched were facilitated through the Walden Library and include *Political Science Complete & Business Source Complete Combined Search*, *ProQuest Central*, *EBSCO database*, *Political Science*

Complete, *SAGE Knowledge Publications*, published Walden dissertations from 2014 – 2020, and encyclopedias for reviewing literature on theoretical framework.

Theoretical Foundation

The focus of this study was to examine the objectivity and accuracy of newly developing systems of investigation for law enforcement execution on traffic stops for drugged driving – particularly, an oral fluid testing pilot program implemented in the State of Michigan in 2017 – 2020. The punctuated equilibrium theory provides that the choices that governmental agents make are the manifestation of their currently held preferences; their resulting action (Koski & Workman, 2018). Law enforcement officers and prosecuting attorneys are responsible for effectuating drugged driving laws in the State of Michigan. Rapid changes in illicit substance possession and use have impacted law enforcement ability to detect substance use as a precursor to impaired driving and this has resulted in unlawful and dangerous driving tendencies to go unaddressed or difficult to address through the criminal justice system due to high burdens of proof. This theory is appropriately aligned with this research and serves as its theoretical framework.

The Punctuated Equilibrium Theory

Theoretical framework is the guide from which the study is built, supported, and structured through the philosophical, epistemological, methodological, and analytical lens of the researcher (Grant & Osanloo, 2014). The punctuated equilibrium theory is a theoretical framework which “seeks to explain long periods of stability, short periods of rapid change, and the lack of much in between – moderate change” (Koski & Workman,

2018, p. 296). This theory surmises that public policies mirror the tendencies of Darwin's Theory of Evolution when applied to governance (Kuhlmann & van der Heijden, 2018, p. 326). Public policies tend to be stable for a long time and then may be interrupted by sudden starts and stops, followed by long periods of relatively minor changes (Branch, 2007, p. 778). There is a dichotomy in drugged driving policy making: laws establishing criminality for being under the influence while operating a motor vehicle and the challenges to objectivity in the role of law enforcement in detecting drivers under the influence of substances. The Punctuated Equilibrium Theory, as a theoretical framework, is applicable to this dichotomy because it provides that governmental entities through its agents are charged with implementing policy and do so based on preferences and capacity to commit their attention and may also be influenced by external political forces of the institutions in which they are situated (Koski & Workman, 2018, p. 296).

Between long-standing legislative and institutional policies for investigating and prosecuting drunk and drugged driving cases in Michigan and a swift Marijuana legalization policy in the State of Michigan, law enforcement officers are being charged with a hefty responsibility of interpreting whether someone is a drugged driver under the influence of substances. In response, policy adaptation and creation of new tools, such as oral fluid testing, for law enforcement to rely on to proceed in their investigation and enforcement of laws against drugged driving offers a question of accuracy not posed before.

The Bases of Social Power Theory

Additionally, the bases of social power theory is derived from the power within organizations, which establishes sources of power as those within the cog with abilities or inherent beliefs categorized as coercive, reward, legitimate, expert, and referent (Ward, 2001; Hinkin et al., 2019). This Theory, derived by French and Raven (1959), is foundational for power research within organizations. Within organizational development, there is ubiquity of authority and commitment to the organization because the organization is a "collective bending of individual wills to a common purpose" and any goal can therein be attempted and/or achieved (Clegg et al., 2006). The notion that positive things can be achieved through the power of the organization drives the ability to bend the commitment of the governmental organization towards eliminating the harm the befalls those who risk drug-impaired driving behaviors. Power in the organization and the bases of social power theory is important to create an assumption that the organization has power to effectuate social policy and authority to create tangible or intangible desires for those who facilitate the will of the organization (Clegg et al., 2006). Law enforcement organizations are driven by general missions for policing and public safety. Law enforcement organizations may also impact the relationship between things and people to secure truth based on certain knowledge: drug-impaired driving is dangerous in a public space of shared roads and increased risks of harm associate with operating motor vehicles.

Literature Review

Use of Oral Fluid Testing for Traffic-Related Purposes

Drug-impaired driving is not new conduct, but the pervasiveness of it as a traffic safety and enforcement issue has come into the forefront for policymakers and the criminal justice system increasingly overtime (Jones et al., 2019). Driver impairment by individual drugs or drug combinations drugs have been associated with increased risks of traffic crashes and fatal crash involvement, specifically THC (Compton & Berning, 2015; Dahlgren et al., 2020; Jørgenrud et al., 2018; Talpins et al., 2015). States first began enacting laws making it illegal to drive under the influence of alcohol or drugs in the early 1900s (Jones et al., 2019). In 1906, New Jersey was the first state to enact a law against operating under the influence of alcohol and drugs (An Act Defining Motor Vehicles, 1906). In the 1930s, the popularity of driving increased and the United States also saw the beginning of the end of prohibition in 1933 with the 21st Constitutional Amendment repealing federal prohibition (Smentkowski, 2020). These movements also triggered attention to the problem of the "drinking driver" on roads and the usage of chemical testing to measure alcoholic influence (Donigan, 1966). In the 1950s, the growth of the pharmaceutical industry to develop a spectrum of medications for anxiety, sleep aids, and mental health problems – substances subject to causing impairment – drew attention to the dangers for traffic safety (Jones et al., 2019).

In 1970, the National Highway Traffic Safety Administration was established through the *Highway Safety Act of 1970* (23 U.S.C. § 401) with the purpose of addressing traffic deaths, injuries, and economic losses occurring on the nation's highways through

the implementation of programs, training, and research (Federal Register, n.d.). In 2012, the National Highway Traffic Safety Administration engaged in a response to public policy by shedding light on the problem of drug-impaired driving. The Moving Ahead for Progress in the 21st Century Act (2012) signed into law by President Barack Obama, which was a reauthorization of the Safe, Accountable, Flexible, Efficient Transportation Equity Act (2005), provided directives to help reduce crashes, injuries, and fatalities on U.S. roads through research on prevention, detection, and prosecution of driving under the influence of drugs. In response, the National Highway Traffic Safety Administration joined the conversation surrounding drug-impaired driving in several publications to both understand the problem and isolate methods of public awareness (Compton et al., 2009; U.S. Government Accountability Office [U.S. GAO], 2015). Compton et al. (2009) discussed that when compared to the effects of alcohol, there is a limited understanding of the behavioral effects of drugs and the ability to predict individual performance at specific dosages of drugs. Compton et al. highlighted a number of factors including limited testing of drug impacts on human behavior, poor correlation between effects of psychomotor, behavioral, and/or executive functions and blood levels of drugs, individual tolerance and absorption differences, and acute versus chronic ingestion. There is a strong relationship between a blood alcohol level (BAC) from alcohol consumption and level of impairment, which has been vetted over decades of testing and incorporated into criminal law throughout the United States. This is not the same position of realization for chemically complex drugs (Compton et al., 2009).

The U.S. GAO, founded in 1921, is a nonpartisan agency established to provide Congress and other federal agencies with objective information to inform policy and spending (U.S. GAO, n.d.). U.S. GAO (2015) also expounded on the challenges in detecting drug-impaired driving for federal, state, and local agencies, as well as what steps those jurisdictions have taken to address the issue of drug-impaired driving. Although data was available for the prevalence of drivers testing positive for at least one drug (20% of drivers based on *NHTSA 2013 – 2014 National Roadside Survey of Alcohol and Drug Use by Drivers*), but that data was limited as to *how* drivers are impaired by drugs. Additionally, that there is a lack of a relationship between impairment and drug concentrations in the body, which blurs what it means to be impaired by drugs. (U.S. GAO, 2015) analyzed surveys on drug use behavior, various state impaired-driving arrests and toxicology results, and federal and state crash data, to determine that there is clear difficulty in defining drug impairment and this is exacerbating challenges relating to enforcement and public awareness of drug-impaired driving.

The National Highway Traffic Safety Administration (NHTSA) conducted a national survey in 2013 – 2014 to estimate the prevalence of drugged driving in the United States by utilizing systems of oral fluid and blood testing to detect the presence of drugs in the body (Berning et al., 2015; Tara Kelley-Baker et al., 2017). This is the most recent survey of this caliber and data on impairing-drug use was collected directly from drivers on the road. Participants provided an oral fluid sample and/or a blood sample, and self-reported drug use information was also collected. Berning et al. (2015) isolated the differences in the patterns of drivers with alcohol use when compared to illegal and other

drug use, as well as furthering the establishment that there is a clear challenge in determining how drugs affect driving. This is attributable to the notion that specific drug concentration levels cannot be equated to a specific degree of driver impairment.

Drunk and drugged driving policies are built on evidence requirements for establishing impairment, which influence systems of enforcement and prosecution in these types of cases (Jin et al., 2019). Self-reported drug or alcohol use, testimony of the officer's observations of the driver and the driving conduct, preliminary breath or oral fluid testing of the driver, evidence of the presence of drugs and/or alcohol in the blood, prescription information, or a combination therein, may be required to secure whether a driver was operating a motor vehicle while impaired (Jones et al., 2019). Zero-tolerance laws and per se level laws create more objectivity for law enforcement and prosecution in securing impairment under the law whereas a law requiring a showing of a driver "under the influence" creates space for misinterpretation and investigatory issues for law enforcement and prosecution securing convictions (Gjerde et al., 2019; Jones et al., 2019; FMCSA, 2016).

In relation to both research and enforcement, methods for detecting and assessing drug use among drivers has be done through the use of oral fluid testing and blood testing, and also utilizing self-reported drug use data has proved common and is translatable information useful for enforcement purposes. Eichelberger (2019) discusses that there are challenges with purely biological evaluates posed for roadside detection of drug use due to the importance of detecting recent drug use when determining impairment. A weakness of self-reported drug use is its validity; legitimacy of the

information compromised with the fear of the driver to be forthcoming about recent use with law enforcement, minimizing drug use, or inaccuracies associated with driver confusion/lack of knowledge of drug types. Despite these limitations, self-reported drug use validity tested against biological assays has set out to provide that there are strong relationships between self-reported drug use within the past-24 hours and biologically testing positive for cannabis use, opioid use, cocaine use, antidepressant use, and benzodiazepine use. Additionally, a number of factors were isolated as predictors of accurately self-reporting drug use including higher percentages of males when compared to females, a higher percentage of 16 – 20-year-old drivers when compared to those 45 years old and older, higher percentage of drivers with a college degree, and higher percentage of accurate reporting in survey sites without police presence. Ultimately, the findings strengthened that accuracy is strongest with multiple types of data for determining drug use – oral fluid testing, blood testing, and/or securing self-reported drug use information (Eichelberger, 2019).

There are advantages in using oral fluid testing methods in drunk and/or drugged driving cases, including the ease of administration, quicker results, less invasive than a blood draw and the ability of law enforcement to glean information about recent drug use (Sobolesky, 2018). Talpins et al. (2015) provides that law enforcement asserted significant value in the practicalities of oral fluid testing roadside and that drugs are present in drivers who are above the BAC limit, even though there is generally not further testing done on subjects who are at or above the illegal BAC limit. According to Sobolesky (2018) there are also limitations prescribed to oral fluid testing options,

including no significant associations between oral fluid and whole blood concentrations of substances, lack of standardized collection protocols and devices between jurisdictions, internal validity standards of sample testing, and the overall inability to correlate drug concentration levels with impairment.

Oral fluid testing is a tool lending objectivity towards the main issue facing law enforcement and prosecutors regarding drugged driving: what is the relationship between alcohol/drug use and driving impairment. Doucette et al. (2018) sets out that oral fluid testing is a process by which law enforcement can swab a driver's mouth roadside and produce rapid results of any presence of drugs representing a positive in specific drug categories. This is a forensic testing strategy comparable to what is employed for detecting alcohol impairment through the use of preliminary breath testing devices (PBT) (Benoit et al., 2017). These preliminary measures would only be part of a whole drugged driving investigation, but would provide direction for law enforcement suspecting impaired driving as to how to further examine and test a driver for potential impairment through the use of questioning, behavioral observations, and field sobriety testing. Currently, law enforcement that may suspect a driver of operating while under the influence of drugs are relatively blind to what individual consumption of substances would be, unless there is self-reported drug use or sensory indications (i.e. scent of burnt Marijuana). Flannigan et al. (2017) provides that law enforcement that are Drug Recognition Experts (DRE) or Advanced Roadside Impaired Driving Enforcement (ARIDE) trained have enhanced methods of detecting drug-impairment in drivers, but that impairment can still go undetected when it is attributed to medical conditions or

drowsiness, for instance. Oral fluid testing tools can assist law enforcement in developing probable cause for an arrest by producing an objective and scientific result to them to rely on and tailor their investigation (Hartman, et al., 2016).

Alternative Uses of Oral Fluid Testing

Oral fluid testing practices for detecting substance use are broader than, and may even precede, traffic-targeted uses. Employment-related testing, nightclub patrons, inpatient drug treatment program testing, probationers, music festival attendees, and subsidized housing residents are a collection of groups that have been exposed to a practice of oral fluid testing for convenient and rapid substance response testing. Oral fluid testing as a vehicle for supplementing self-reported drug use has been valuable in quick determinations of drug presence in individuals associating with others in employment, recreational, and court-ordered settings.

Gjersing et al. (2019), Bretteville-Jensen et al. (2019), and Gripenberg-Abdon et al. (2012) addressed the prevalence of illegal drug use in populations typically suspected for drug use in music festival and nightlife settings by comparing self-reported drug use and oral fluid testing results. Gjersing et al. established that 12% of music festival attendees divulged illegal drug use within the last 30 days and 11% tested positive for illegal substances including cannabis, cocaine, and MDMA/ecstasy. Bretteville-Jensen et al. provided that 2/3 of consenting night club individuals reported lifetime use of cannabis and 1/4 reported lifetime cocaine and MDMA/ecstasy use, wherein 1/4 tested positive for any illicit substances and 1/3 had blood alcohol levels above 1.2g/L, also

suggesting poly substance use. Gripenberg-Abdon et al. (2012) sets out that there was a significant discrepancy between self-reported illicit drug use of approximately 3% of nightclub attendees compared to 10% tested positive for illicit drug use. Collectively, these studies confirmed the need for meaningful substance use bioindication provided through the use of oral fluid testing to confirm utility in the methodology of self-reported drug use data and inclusion of individuals who do not report drug use, but test positive, so as not to exclude individuals from drug treatment intervention and prevention. Additionally, poly drug use was a significant finding in these studies given participants testing positive for illegal substances had detectable alcohol levels. This indicates that oral fluid testing enhanced and uncovered a more accurate picture of individual drug use in settings where drug use is more dominant.

In medical-based treatment settings, oral fluid testing has been established as an accurate method of detection of illicit drugs, alongside self-reported use. Kork et al. (2012), MacCall et al. (2013), and Miller et al. (2017) researched the accuracy and patient preference for oral fluid testing in situations where there may be pre-surgical risks associated with illicit drug use and circumstances where detecting drug use is vital to successful inpatient treatment for substance abuse disorders. Miller et al. (2017) sets out that patients in long-term, medication-assisted substance abuse treatment programs; patients treating with methadone or buprenorphine, established a 98% agreement in results comparing urine and oral fluid testing, and generalizing the reliability of oral fluid testing as a vehicle for determining compliance. Wherein MacCall et al. (2013) assessed patient preference for oral fluid testing to secure presence of illicit drug use in psychiatric

patients as presence of illicit drugs are a trigger of risk of relapse of psychosis, increased hospitalization, decreased compliance with treatment, and risk of interpersonal violence between patients. Patients overwhelming preferred oral fluid testing over urine testing (85%) because it was quicker and easier, more dignified and private as a method for testing. The researchers also noted that there was increased expense to the organization for oral fluid testing. Kork et al. (2012) sets out that there are dangers presented to surgical patients who use illicit substances when anesthetists are tailoring anesthesia and oral fluid testing has value to secure accuracy of information when compared to self-reported drug use. Here, self-reported illicit drug use within the last 30 days was substantially more sensitive, but less specific, than oral fluid testing for overall illicit drug use – as noted, this could be due to the impending nature of medical procedure placing the participant at risk of health complications for false reported drug use and/or awareness of impending oral fluid testing.

There are also employment-based uses for oral fluid testing. Casolin (2016) provides position that oral fluid testing provides an important distinction from urine testing, which is evidence of recent use, as drugs of abuse are typically detected for 12 – 48 hours in oral fluid whereas drugs of abuse and metabolites may be detected for up to 4 days after use in urine. Common methods utilized by employers is random urine testing of employees, which may recover evidence of metabolites in the urine; an indication of past drug use by an employee, but oral fluid testing methods in conjunction with impairment testing (direct observations of a person's cognitive functions and skills) produces a more accurate picture of whether an employee is safely operating in their

employment, or rather, whether a driver is operating their vehicle impaired or intoxicated (Casolin, 2016). Concerning in both employment-related and traffic-related policy development for workplace and traffic safety is impairment or intoxication of employees or drivers. Drug use alone does not indicate impairment or intoxication of employees or drivers. Recent drug use, especially in reference to cannabis/THC use, is of primary concern in roadside detection due to the impairing effects of active THC that dissipate within hours of use. Hickox (2012) provides that as with employer use of drug testing to determine illegal activity or employee unsafe behavior while under the influence, an assessment of whether an employee is exhibited signs of being affected by their use of a controlled substance – such as impacts on memory, reaction times, motor coordination, judgment, mood – is determinative for impairment or intoxication.

Lastly, oral fluid testing has been confirmed as a viable method for toxicological confirmation when utilized against self-reported drug use in field settings – homeless populations in New York City, NY, probationers in Balimore City, Maryland, and subsidized housing residents with mental illness. Rendon et al. (2019), Wooditch et al. (2013), and Aikins et al. (2015) provide framework for the use of oral fluid testing in the field and on the streets where there has largely been reliance on information gleaned from self-reported illicit drug use and where determinations about drug use are important for maintaining stable housing and securing accurate information about at-risk populations commonly exposed to illicit drug use. Rendon et al. (2019) established an 84.2% - 94.3% agreement between oral fluid testing and self-reported drug use in subsidized housing population over time. Aikins et al. (2015) sets out that 55% of those who tested positive

for cocaine use admitted to using it within the last 30 days – a result that indicated true prevalence of the drug use for a homeless population when twice as many participants tested positive for cocaine use than admitted to using cocaine. Wooditch et al. (2013) sets out that testing probationers in Baltimore City, Maryland based on individual self-reports of drug use and biological drug test results through oral fluid testing for illicit substances, along with controlling for factors such as drug availability, created a model for securing accuracy of illicit drug use in this subset of potential substance abusers. Similar to a roadside analysis of drivers suspected for impairment by law enforcement, saliva testing has been satisfied as a reliable, non-intrusive and quick method for triangulating recent drug use in an uncontrolled, field setting and in testing a population, like probationers or subsidized housing residents or homeless individuals, that may be reluctant to self-report illicit drug use and influence accuracy of results.

International Uses of Oral Fluid Testing

Drugged driving is not exclusive to the United States. Laws against drugged driving are common throughout other countries, as well as an international identification and research of inefficiencies in determining impairment and intoxication from drug use, the use of oral fluid testing for roadside detection of drugs, and the investigatory issues created for law enforcement. Other countries have responded to the problem of drugged driving with mandatory roadside oral fluid testing, expansions of drugged driving policy, and zero tolerance drugged driving laws, for instance.

In South Africa, drugged driving is identified as a major threat to public safety and that there is a challenge in accurately demonstrating correlations between presence of

a drug or drugs in the body and an associated level of impairment . To increase success of prosecution and to assist law enforcement, proposed recommendations for South Africa include specifying the country's legislation on drugged driving for defining "drug," implementation of per se standards/non-zero thresholds of drug levels in the body, and more efficient and accurate drug testing through the use of oral fluid testing and field sobriety testing on the road as the standard for law enforcement investigation (Liebenberg et al., 2019).

In Spain, Fierro et al. (2017), and Herrera-Gómez et al. (2020) provide that there is mandatory roadside oral fluid testing of drivers suspected for impaired driving and oral fluid testing devices produce a matrix of drug categories that can indicate as positive for law enforcement. Both studies sought out to determine the prevalence of drug use in Spanish drivers – particularly use of opioids and benzodiazepines – and guided by the European Commission Project entitled, "Driving Under the Influence of Drugs, alcohol and medicines (DRUID), which sets out categories for medications based on influence on fitness to drive. Although the positive rates of opioids (1.8%) and benzodiazepines (4.3%) was low for the overall sample of drivers tested in these studies, those drivers who did test positive for opioids and for benzodiazepines, respectively, polydrug use detection was high (opioid positives produced 86% rate of polydrug detection (Fierro et al., 2017); benzodiazepine positives produced 97.1% rate of polydrug detection (Herrera-Gómez et al., 2020)). These results were synthesized with the DRUID project results that there is a distinct increase in risk of injury or death with multiple drug and/or alcohol combinations and that oral fluid testing results that are unable to detect benzodiazepines, as asserted by

Herrera-Gómez et al. (2020), are not securing a drug use result that is potentially impairing drivers.

In Australia, Quilter and McNamara (2017) provides that oral fluid testing is an appropriate method for preliminary testing of drivers who may have recently used drugs, but that it is not an accurate tool for confirmation testing or correlating the amount of a substance in a person's blood – just the presence of drug(s) in saliva. This is in line with other research outlined in this section. The distinction in Australia, as Quilter and McNamara outlines, is the attention drawn to the potential for oral fluid tests being subject to contamination or inaccurate results because of how drugs are metabolized in the mouth, like the psychoactive ingredient in Marijuana (THC), which can accumulate in the buccal cavity of the mouth and produce elevated results not on par with what THC may be in the blood and impacting the brain. In Australia, THC accounts for a significant portion of what drivers are using for illicit drugs and resulting drug driving charges (Quilter & McNamara, 2017).

In Norway, Gjerde et al. (2014), Furuhaugen et al. (2018), Jamt et al. (2017), and Jørgenrud et al. (2018) highlighted the notion that Norway is a progressive country with regards to palpable results in eradicating alcohol and drug related traffic crashes. Norway was the first country in the world to carve out a legal limit for alcohol in 1936 and has since created strict, per se legislative limits for 20 illegal and medicinal drugs (Gjerde et al., 2014). Oral fluid testing, as a roadside method for collecting samples from drivers, has been used in Norway for research regarding associations between self-reported risk-taking behavior, drug use, and increased road traffic crashes (Gjerde et al., 2014;

Jørgenrud et al., 2018). Oral fluid has also been used in research for surveying the landscape of drug use in drivers in Norway, which has revealed that while alcohol use has remained consistent in rates of detection, there has been a decrease for other drug categories, and is largely attributable to Norway's implementation of legal limits for 28 drug types in 2012-2016 (Furuhaugen et al., 2018; Jamt et al., 2017).

In Brazil, Yonamine et al. (2013) and Christophersen et al. (2016) established a substantial increase in road traffic crash fatalities from 1980 – 2012, and that commercial motor vehicles comprised nearly 28% of all road traffic crashes on federal highways. One issue identified in their research was a low level of public awareness about drunk driving laws and weak enforcement efforts, as well as the notability of Brazil's transportation industry operating along highways. Yonamine et al. (2013) found that oral fluid testing has been used in research to assess the extent of alcohol and drug use by regular truck drivers operating on state roads, and produced a result that 3% of random samples of these drivers tested positive for alcohol, amphetamines, cocaine, and THC. This study provides that operating under the influence of drugs and alcohol is a problem frequently observed in the trucking and transportation industry.

In Belgium, Van Der Linden et al. (2015) sets out the country's shift towards oral fluid testing as a primary method for police to screen drivers for illicit substance use. Through its governmental enforcement units, Belgium has asserted an aggressive position in taking action against driving under the influence of drugs and implemented on-site oral fluid screening. Van Der Linden asserts that the drug screening procedures of oral fluid

testing in Belgium are advantageous due to reliability of results, quickness, decreased risk of contamination, and ease of administering testing.

Oral Fluid Testing Instrument Comparisons

Oral fluid testing devices have been evaluated, compared and vetted for accuracy, user experience, and substance detection both domestically in the United States, and internationally. Research-based comparisons have isolated at least 13 different oral fluid testing devices for purposes of exposing strengths and weaknesses of these specific tools. Reliability and accuracy of oral fluid testing devices and results have been compared against the "gold standard" of blood sample analysis for substances with Gas Chromatography – Mass Spectrometry methodology (Bridge et al., 2019). The range of detection and accuracy of oral fluid testing device results against blood results is an important area of research for establishing the reliability of oral fluid testing methods. Accuracy is established when the oral fluid testing devices are able to correctly detect a drug/drug category when the drug/drug category is present in a sample and to correctly indicate the absence of a drug/drug category when none is present (Beirness & Smith, 2017).

Oral fluid testing as a roadside procedure begins with the device, the operator, and the oral fluid. Oral fluid itself is in reference to fluid in the mouth secreted from the parotid, submaxillary, and sublingual glands. It serves as a biomarker, which provides a confirmatory-type of sample of body toxicity for recent use of controlled substances active in the body and present in the blood (Logan et al., 2014). Controlled substances, such as cocaine, amphetamines, cannabis, and opioids, diffuse into body tissues and

mouth fluid and present as higher concentrations than blood plasma (Cohen et al., 2023; Mohamed & Bakdash, 2017). The oral fluid testing devices themselves are "point-of-collection" handheld tools, which are structured with a swab, pad, or sponge to absorb a participant's mouth fluid, a buffer to reduce oral fluid viscosity, stabilize any drugs present, and extract them for presentation as a detection reading after the testing period – usually several minutes (Anzillotti et al., 2014). Oral fluid testing also provide an option for quickly testing a driver closer in time to exposure to cannabis than whole blood testing (Sobolesky, 2018).

One oral fluid testing device that has been vetted in scientific research is the Draeger DrugTest 5000, manufactured in Germany. Logan et al. (2014), Pechansky et al. (2019), Scherer et al. (2020), Beirness and Smith (2017), and Huestis et al. (2013), have evaluated the Draeger DrugTest 5000, among other devices, and results have shown that the Draeger DrugTest 5000 is fixed as a reliable and accurate device for analyzing oral fluid. Specifically, the Draeger DrugTest 5000 was noted in several studies for ease of use, for having acceptable reliability measures due to a higher rate of sensitivity for detecting Cannabinoids, shorter processing time for results, and high operational success (regarding device/use errors), when compared to other oral fluid testing devices.

Another device, the DDS2, now known as SoToxa and manufactured in the United Kingdom, has also been vetted in research. Pechansky et al. (2019) and Scherer et al. (2020) examined the user experience and operational feasibility of the SoToxa device for the purpose of drug detection in drivers. Research resolved that the SoToxa device ("DDS2") had high rates of analytical accuracy and good reliability performance for

detecting cocaine, but low reliability for detecting cannabinoids. The SoToxa device ("DDS2") also has a detectable drug panel of amphetamines, benzodiazepines, cannabinoids, cocaine, opioids, and methamphetamine (Pechansky et al., 2019). The SoToxa device was selected on criteria and utilized in Michigan's Oral Fluid Pilot Program.

There are several other oral fluid testing instruments scientifically reviewed, including the Affiniton DrugWipe, SecureTec DrugWipe6S and Drugwipe 5S, Ora-Check, SalivaScreen, DrugWipe 5/5^{+}, DOA MultiScreen, Multi-Drug Multi-Line Twist Screen Device, Cozart DDS 801, and the Alere DDS 2 (Arroyo et al., 2014; Beirness & Smith, 2017; Desharnais et al., 2020; Huestis et al., 2013; Logan et al., 2014; Pechansky et al., 2019; Pehrsson et al., 2011; Richeval et al., 2019; Tang et al., 2018). Largely, studies referencing these devices have engaged in performance evaluations and comparisons of oral fluid detection panels, cutoff levels between devices, sensitivities, and overall accuracies for controlled substance detection. Various results are individualized to the devices and research purpose and procedure, but there are consistencies in the research with regard to oral fluid testing devices producing poor and/or less than satisfactory sensitivity results for cannabinoid, cocaine, benzodiazepine, and ketamine detection. Additionally, there are consistencies in the research as to the satisfactory results for overall specificity, accuracy of results, and reliability of oral fluid testing devices forming suitability for use by police during traffic stops that necessitate controlled substance detection.

Michigan's Oral Fluid Pilot Program

The Oral Fluid Roadside Pilot Program in Michigan was forged from legislation drafted as a result of a tragedy in Michigan's Upper Peninsula, Delta County. On March 20, 2013, Thomas and Barbara Swift's vehicle was struck by a logging truck operated by Harley Durocher. Durocher was under the influence of controlled substance (THC) at the time of the collision, and was prosecuted and sentenced to five years to 15 years in prison for violation of MCL 257.625(4)(a); operating a motor vehicle with presence of a controlled substance causing death, and five other convictions. At the time of the collision, Durocher had 2 ng/mL of active THC in his system ("Truck Driver Sentenced in Gladstone Fatal Crash," 2014).

In response to this tragedy, Brian Swift, the son of Thomas and Barbara Swift, worked with Michigan legislative representatives and the Prosecuting Attorney Association of Michigan (PAAM) to develop responsive public policy to address the inherent difficulties and impacts associated with drivers operating under the influence of drugs and/or alcohol. In turn, the Barbara J. and Thomas J. Swift Law, Public Act 242 and 243 of 2016, effective September 22, 2016, was signed into law. The "Swift Law" authorized the Michigan State Police (MSP) to establish a pilot program in five counties in Michigan for oral fluid roadside drug testing. Additionally, the Law authorized peace officers certified as Drug Recognition Experts (DRE) in said participating counties to require a person to submit to a preliminary oral fluid analysis under certain conditions (Michigan State Police, 2019a).

Michigan state provides statutory authority for law enforcement to arrest a person based in whole or in part upon the results of a preliminary chemical breath analysis (Michigan Vehicle Code Act, 1949/2016, (§257.625a). In turn, preliminary oral fluid testing may also be a basis in whole or in part for an arrest based on preliminary oral fluid analysis results (§257.625r). This is because preliminary oral fluid testing is a test for law enforcement to determine recent drug use and can support a DRE opinion as to driver impairment by drug use, and the roadside circumstances largely dictate the volume of information that can be collected in an investigation and the law secures discretionary authority for law enforcement to arrest a driver based on a preliminary positive drug use result.

The "Swift Law" also carves out that preliminary oral fluid results may have evidentiary posture to assist the court in determining a challenge to the validity of an arrest, to rebut the presence or nonpresence of a controlled substance in a defendant's blood, or if offered by the prosecution to rebut the presence or nonpresence of a controlled substance that was found to be present in a chemical test of the defendant's blood or urine (Michigan Vehicle Code Act, 1949/2016, §257.625r).

Additionally, the law correlated the legality of law enforcement request for a driver's submission to roadside oral fluid testing to an existing provision under the law set out for preliminary breath testing ("PBT"); a portable breath test, which analyzes lung air for those drivers suspected of operating under the influence of alcohol. Upon request to take a "PBT" test by a peace officer who has reasonable cause to believe that a driver is operating under the influence of alcohol on a highway, drivers who refuse a

preliminary breath test are responsible for a civil infraction (Michigan Vehicle Code Act, 1949/2016, §257.625a). This refusal provision was also adopted for drivers who refuse oral fluid testing under the "Swift Law."

Responses to the Law have been positive. Michigan is one of 18 states in the United States which have laws authorizing roadside oral fluid testing, but a majority of the other authorizing states do not have an active roadside oral fluid testing program implemented (Foundation for Advancing Alcohol Responsibility, n.d.). Notably, Alabama has established a permanent oral fluid program for roadside screening and evidence of recent substance use (Foundation for Advancing Alcohol Responsibility, 2020). This researcher acknowledges that previously reviewed literature has provided that roadside oral fluid testing is common place in some countries, international to the United States.

Due to the successes and responses of the first year of the Oral Fluid Roadside Pilot Program's implementation in Michigan, the Program was approved for legislative and funding expansion to avail the Program for DREs in the entire State in December 2018 (Michigan State Police, 2019a). There were successes supported before the legislature from the Pilot Program in Michigan from the results of initial Program implementation, including information that of the 92 samples collected, 88 samples were confirmed by independent laboratory testing (Foundation for Advancing Alcohol Responsibility, 2020). Some defense attorneys have been vocal to advise Michigan drivers not to participate with an oral fluid test, if requested by law enforcement, due to criticisms that the oral fluid testing methods and devices are not reliable and that the validity of the testing device has not been established (Burns, 2020).

Categories of impairing substances have been set out through the Drug Recognition Expert (DRE) Program, established and regulated through the National Highway Traffic Safety Administration (NHTSA) and International Association of Chiefs of Police (IACP) (International Association of Chiefs of Police [IACP], n.d.). Detection of whether an individual is impaired by a particular drug category, or combination therein, is reflected in oral fluid testing devices for producing results and practices for systematic and standardized methods of impairment detection used in the Drug Recognition Expert (DRE) Program. Research surrounding the accuracy and reliability for the detection of categories of drugs is mixed given some categories of drugs are established in various capacities, while others have not appeared as being a basis for impairment or recognized as impairing substances. The following categories of research are based on the model of drug categories set out by the Drug Recognition Expert (DRE) Program (IACP, n.d.).

Accurate Detection of Central Nervous System Depressants

Central nervous system depressants is a category of largely medicinal drugs that when consumed have a pattern of effects on the body including “reduced response to sensory input, depression of cognitive functions, reduced motor activity, drowsiness, amnesia, pain relief” (Bloor & Sgouros, 2020). Central nervous system depressants are a category of substances that tend to decrease body functions such as blood pressure and temperature. The medicinal purpose for central nervous system depressants is to slow brain activity for those with anxiety disorders or sleep disorders like insomnia or relieving muscle spasms (National Institute on Drug Abuse [NIDA], 2023).

Benzodiazepines, Gamma-hydroxybutyric acid (GHB), anti-anxiety tranquilizers, and alcohol are examples of central nervous system depressants. Central nervous system depressants purposed for medical treatment are generally prescribed and come in pill, liquid, or capsule form taken by mouth (NIDA, 2023). Central nervous system depressant drugs may also become abused through prescription misuse.

Research conducted on accuracy testing for central nervous system depressants presents that oral fluid testing for central nervous system depressants is generally accurate. A review of the literature provides that various oral fluid testing devices, including Quantisal (Aikins et al., 2015; Furuhaugen et al., 2018; Gjerde et al., 2014; Jamt et al., 2017; Jørgenrud et al., 2018; Miller et al., 2017), Drugwipe-5S (Pehrsson et al., 2011; Richeval et al., 2018), Intercept (Aikins et al., 2015; Gjersing et al., 2019; MacCall et al., 2013), Drager Drugtest 5000 (Kork et al., 2012). One study asserts increased sensitivity of central nervous system depressants by self-reporting than oral fluid testing in preanesthetic patients (Kork et al., 2012).

Accurate Detection of Central Nervous System Stimulants

Central nervous system stimulants or “analeptics” are a category of chemical agents that stimulate pathways throughout the brain and spinal cord through the increase of neurotransmitters in the brain such as dopamine, norepinephrine, or serotonin and the inhibition of neuronal reuptake (Pope, 2023). Central nervous system stimulants tend to increase body functions such as temperature and blood pressure. Central nervous system stimulants are medically prescribed to treat certain clinical conditions such as attention deficit disorder, attention deficit hyperactivity disorder, chronic lethargy, or narcolepsy.

Central nervous system stimulants can have psychoactive effects creating dissociation or euphoria for the user, which makes them highly subject to abuse and addiction (Couch et al., 2020). Examples of central nervous system stimulants include amphetamine, cocaine, and methylphenidate ("Ritalin") and are considered highly potent (Pope, 2023).

Central nervous system stimulants are some of the most common drugs that have been vetted throughout roadside oral fluid testing research (U.S. GAO, 2015). Research conducted on accuracy testing for central nervous system stimulants presents that oral fluid testing for central nervous system stimulants is generally accurate (Aikins et al., 2015; Bahmanabadi et al., 2017; Beck et al., 2019; Berning et al., 2015; Christophersen et al., 2016; Gjerde et al., 2014; Gjersing et al., 2019; Jamt et al., 2017; Jørgenrud et al., 2018; Mohamed & Bakdash, 2017; Pehrsson et al., 2011). A review of the literature provides that various oral fluid testing devices, including Quantisal (Aikins et al., 2015; Gjerde et al., 2014; Jamt et al., 2017; Jørgenrud et al., 2018; Miller et al., 2017), Drugwipe-5S (Pehrsson et al., 2011; Richeval et al., 2019), Intercept (Aikins et al., 2015; Gjersing et al., 2019; MacCall et al., 2013), Drager Drugtest 5000 (Jones et al., 2019; Kork et al., 2012) have been vetted for accuracy and reliability determinations. One study asserts oral fluid testing is superior for accuracy of testing central nervous system stimulants then urine screening for the same (Allen, 2011). Several studies assert that central nervous stimulants are statistically more common drug category result in oral fluid testing compared to other drug categories (Beck et al., 2019; Christophersen et al., 2016; Jones et al., 2019; Pehrsson et al., 2011). Another study sets out that oral fluid

testing for amphetamine-related stimulants is an inferior method for long-term use detection (Casolin, 2016).

Accurate Detection of Hallucinogens

Hallucinogens are a category of substances that include synthetic and naturally-occurring substances. Consumption of hallucinogens can create psychotropic hallucinations, alteration of perception and consciousness, and/or transposition of senses for the user. Examples of hallucinogens includes psylocibin, lysergic acid diethylamide (LSD), bufotenine, and peyote. Hallucinogens have been purposed for ceremonial usage or healing rituals and have limited introduction into clinical or medicinal usage as well in order to treat mood disorders, psychological distress, and treatment of other medical conditions (Garcia-Romeu et al., 2016). Hallucinogenic drugs have a high potential for abuse, lack of medical benefits, and lack information about appropriate safety measures, which is also why they are categorized by the Controlled Substances Act as a Schedule I drug (Jones et al., 2019).

Accurate detection of hallucinogenic drugs is limited throughout roadside oral fluid testing research. Some research has been conducted regarding drivers suspected of impairment near music festival, which has produced positive results for LSD while utilizing oral fluid testing methods (Richeval et al., 2019). Other research includes self-reported use of traditional psychedelics drugs in reference to correlations between age and specific drug use (Aikins et al., 2015) and drug driving laws applicable to LSD and psylocibin (Quilter & McNamara, 2017). Studies which included an accurate detection of hallucinogens produced results that indicate accuracy in general including use of

Quantisal or Intercept oral fluid collection devices for hallucinogens (Bretteville-Jensen et al., 2019; Furuhaugen et al., 2018; Jamt et al., 2017).

Accurate Detection of Disassociative Anesthetics

Dissociative anesthetics are a category of drugs that carry anesthetic properties for users, as well as a disassociation of pain from the body. These substances may have medicinal properties, medical application, and also may be illicit. Dissociative anesthetic drugs, in general, interject the actions of glutamate – a neurotransmitter important for cognition, pain perception, and emotion – at brain receptors and may inject the actions of dopamine; another important neurotransmitter for brain functions (NIDA, 2014). Drugs in this drug category typically inhibit pain by cutting off or disassociating a perception of pain and are typically administered orally in capsule or tablet form, by injection, or by insufflation (snorting). Disassociative anesthetics can have medicinal purposes as an effective anesthetic they create a state of sedation, immobility, amnesia, and marked analgesia in its users. These drugs can also be abused and have adverse effects including dissociated and catatonic state in users, as well as nausea, vomiting, and visual hallucinations. Common drugs categorized as disassociative anesthetics are phencyclidine (PCP), ketamine; an analog of PCP, and dextromethorphan (DXM); found in numerous cough and cold products.

Accurate detection of dissociative anesthetic drugs is present throughout roadside oral fluid testing research. Recent research indicates high reliability in oral fluid testing using the Quantisal collection device for PCP, in addition to correlation of high agreement between oral fluid presence of PCP and self-reported use, despite low rates of

PCP use overall in the sample (Rendon et al., 2019). Some research sets out oral fluid testing of PCP by the Intercept Oral Specimen Collection Device without a finding on specific oral fluid reliability for PCP (Aikins et al., 2015). Other research indicates generally high reliability of oral fluid testing for detecting PCP, such as the testing for PCP using the Securetec DrugWipe in preliminary testing and Drager DrugTest 5000 or Cozart Drug Detection System (DDS) for secondary testing (Jones et al., 2019; Logan & Mohr, 2015; Logan et al., 2014; Quilter & McNamara, 2017; White, 2017). Some research indicates ketamine, as an increasingly popular recreational drug with potential for therapeutic use and abuse, has overall satisfactory specificity, accuracy, and sensitivity in oral fluid testing utilizing the SalivaScreen, Securetec DrugWipe, Quantisal, and Intercept devices and simultaneously poor performance utilizing the DrugWipe 5A, DrugWipe 5S, DrugWipe 6S and Ora-Check (Bretteville-Jensen et al., 2019; Chow et al., 2015; Desharnais et al., 2020; Gentili et al., 2016; Jones et al., 2019; Richeval et al., 2019; Richeval et al., 2018; Tang et al., 2018). There was limited to no research indicating oral fluid testing accuracy or detection for DXM.

Accurate Detection of Narcotic Analgesics

Narcotic analgesics, or "opioid" analgesics, are a specialized category of drugs that act on the pain neuroreceptors of the brain and have medicinal, and elicit, applications by users for pain relief. This category of drugs is typically administered orally in pill form, liquid, and sublingual under the tongue (Cohen et al., 2023). There are two types of narcotic analgesics: opiates – both natural alkaloids and opium derivatives – and synthetics. Alkaloid narcotic analgesic is derived from opium, which is sap from seed

pods of a particular type of poppy plant (papaver somniferum). Opium derivatives are chemically treated opium. Synthetic narcotic analgesics are not derived from opium, but chemically mimic effects of opium alkaloids upon consumption. There are several characteristics common to all narcotic analgesics that includes relieving pain, create physical dependence through withdrawal signs and symptoms, and suppress withdrawal signs and symptoms with use. Narcotic analgesics are highly addictive as users are inclined to form dependence with chronic use and may be subject to abuse.

Accurate detection of dissociative anesthetic drugs is vetted throughout roadside oral fluid testing research. Research evaluating oral fluid devices detection of opiates has established generally accurate detection and varying sensitivity values. Some research indicates high rates of opioid sensitivity in oral fluid device detection on devices such as with the DrugWipe 6S, SalivaScreen, Drager Drugtest 5000, Intercept, Quantisal (Beirness & Smith, 2017; Gentili et al., 2016; Jamt et al., 2017; T. Kelley-Baker et al., 2014; Kork et al., 2012; Li & Chihuri, 2020; Logan & Mohr, 2015; Logan et al., 2014; MacCall et al., 2013). Research also includes poor sensitivities or insufficient positive results or high false positive results for opiate detection as with the Ora-Check oral fluid device (53% detection rate), the Cozart DDS 801 device, and the Intercept device (25% detection rate), DrugWipe 5^{+} (10% detection rate) (Aikins et al., 2015; Arroyo et al., 2014; Pehrsson et al., 2011; Tang et al., 2018; Van Der Linden et al., 2015). Other research includes accurate detection of opioids through urine testing (Casolin, 2016).

Accurate Detection of Inhalants

An inhalant is a volatile chemical solvent or aerosol in a vaporous or gaseous form, or can become a vapor or gas, that is then inhaled into the lungs and deposited into the bloodstream by a user for the purpose of psychoactive or euphoric effect (NIDA, 2012). Inhalants may include volatile solvents, aerosols, or anesthetic gases. Some inhalants may include medicinal uses such as nitrous oxide and other medical anesthetics, but in general, chemical solvents abused in this capacity as an inhalant typically do not carry alternative medicinal use such as a household or industrial chemical such as hairspray, spray paint, paint thinners, gasoline, propane, glues, degreaser, correction fluid, refrigerants/freon, and markers (NIDA, 2012). Signs of abuse replicate alcohol intoxication and can include an odor of substance, disorientation, slurred speech, residue of substance around nose/mouth, lack of muscle control, confusion, and bloodshot/watery eyes (*Characteristics of Drug Use*, n.d.). Inhalant use is highly toxic to the body and can have short-term and long-term physical and pharmacological effects and form into addiction and dependency (NIDA, 2012).

Accurate detection of inhalants is nonexistent throughout the body of roadside oral fluid testing research. Scientific research into oral fluid testing methods and devices is void regarding detectability for chemical inhalants. Inhalants are a category of drug classification that is implemented and identifiable by Drug Recognition Expert (DRE) law enforcement in drug use evaluations for roadside or closed environment impairment. Detection of inhalant use impairment by DRE comes then through a physiological examination of a suspect (i.e. pupil size, odor of substance) and the use of Standard Field

Sobriety Testing (i.e. gaze nystagmus) and the existence of paraphernalia indicating recent use (Jones et al., 2019). Research for accurate detection of inhalant use has been supported by near infrared (NIR) spectroscopy with chemometric models for detecting halogenated hydrocarbons; halogenated hydrocarbons are compounds frequently used as household and industrial chemical solvents. Accuracy and reliability of NIR spectroscopy is not a focus of this research. Accurate detection for inhalant use has also been examined through detection of halogenated hydrocarbons (main components of liquid inhalant drugs) with some positive results in Brazil using near-infrared spectroscopy combined with chemometric tools (Nogueira et al., 2021).

Accurate Detection of Cannabis

Cannabis, also known as "Marijuana" or "Marihuana," which contains the chemical compound Delta-9-Tetrahydrocannabinol (THC), is a plant and drug of abuse that is available to users recreationally, medically, clinically, and/or illicitly. Cannabis has psychoactive properties that directly impact the mesolimbic dopamine system in the brain (Cooper & Haney, 2009). Cannabis is a widely consumed illicit substance in people ages 12 – 49 despite perceived great risk by users from use and is a substance that is associated with the largest number of new users (2.6 million new users in 2016) (Lipari et al., 2017). Cannabis can be processed into different forms depending on use preferences. Most commonly, cannabis plant can be dried and inhaled, THC oil can be extracted and concentrated into a wax, which is then heated and inhaled (also known as "dabs" or "dabbing"), THC can be used as an ingredient in food products and consumed, and THC can be developed into pill form (also known as Marinol) and taken orally.

Accurate detection of THC / cannabis in oral fluid is widely acknowledged and varied throughout the body of roadside oral fluid testing research. Studies that have analyzed an accurate detection of THC / cannabis include device-specific accuracy reports and accuracy of oral fluid testing, in general. Specific oral fluid testing devices, including the Drager DrugTest (Anzillotti et al., 2014; Beirness & Smith, 2017; Dobri et al., 2019; Fierro et al., 2017; Huestis et al., 2013; Kork et al., 2012; Owusu-Bempah, 2014; Pechansky et al., 2019), Quantisal device (Bosker & Huestis, 2009; Desharnais et al., 2020; Dobri et al., 2019; Eichelberger, 2019; Furuhaugen et al., 2018; Jamt et al., 2017; Jørgenrud et al., 2018; T. Kelley-Baker et al., 2014; Lee et al., 2012; Miller et al., 2017; Romano et al., 2019), the Cozart DDS device (Arroyo et al., 2014; Bosker & Huestis, 2009; Turfus et al., 2014), the Intercept device (Aikins et al., 2015; Bretteville-Jensen et al., 2019; Gjersing et al., 2019; MacCall et al., 2013; Ramaekers et al., 2006), the Statsure Saliva System (Gjerde et al., 2014), the Salivette device (Yonamine et al., 2013), and the Multi-Drug Multi-Line Twist Screen Device (Pechansky et al., 2019; Scherer et al., 2020) were published as accurate for detecting THC / cannabis in oral fluid.

Specific oral fluid testing devices, including the DrugWipe 5/5 (Gentili et al., 2016; Pehrsson et al., 2011; Richeval et al., 2019; Richeval et al., 2018), the DOA Multi-Screen device (Pechansky et al., 2019; Scherer et al., 2020), the Securtec DrugWipe device (Beirness & Smith, 2017; Chow et al., 2015; Pehrsson et al., 2011; Turfus et al., 2014; Van Der Linden et al., 2015) have varying accuracy results for detecting THC/cannabis. Several studies have published both accurate and not accurate findings for

prescribed sensitivity and cut-off levels for detecting THC/cannabis. There is also published research as to the accuracy of lab testing detecting THC / cannabis in oral fluid using an enzyme-linked immunosorbent assay (ELISA) and liquid chromatography-mass spectrometry (LC – MS) methods (Casolin, 2016; Li & Chihuri, 2020). Research indicates that a limitation in screening oral fluid for cannabis is inconsistency with volume of oral fluid required for detection aggravated by dry-mouth from cannabis use, cold-weather constraints, device ability to detect lower THC concentration levels, and short detection times (Aikins et al., 2015; Bosker & Huestis, 2009; Casolin, 2016; Dobri et al., 2019; Pressley, 2019). High sensitivity rates are present in chronic smokers of cannabis (Huestis et al., 2013; Doroudgar, et al., 2018).

Summary and Conclusions

The research set out for oral fluid testing of substances capable of impairing individuals is vast. Largely of concern is the variability of drug category results when reliability and accuracy are put to the ultimate test – in the courtroom. In addition to variability concerns, the presence of controlled substances in a driver's system are not legally indicative of being under the influence of the same. The Michigan Oral Fluid Roadside Analysis Pilot Program is a synthesis between the presence of controlled or intoxicating substances and observationally-based divided attention tasks that can be performed by drivers who are roadside and tasks that can be objectively evaluated by law enforcement.

In Michigan, traffic fatalities are at an all-time high. The amount of traffic fatalities, injuries, and crashes increased 4% from 2020 to 2021 (Office of Highway

Safety Planning [OHSP], 2022). Drugged driving has been identified as a significant traffic safety and public health concern throughout the United States. The ability to address the issue of drugged driving response by law enforcement has been increasingly challenged by the expanse of drug use and user variability, synthetic drug manufacturing, individualized responses to controlled/intoxicating substance use, and increased densities and populations. Programs such as Michigan Oral Fluid Roadside Analysis Pilot Program and the Drug Evaluation and Classification Program (DEC) are aimed at providing objective tools for law enforcement to detect driver impairment by drugs and/or alcohol roadside. Literature has vetted driver impairment by alcohol and/or controlled substances and/or intoxicating substances is measurable and may be initially detected by oral fluid testing devices. The present study fills a gap in the literature by examining roadside detection programming and its application by law enforcement through drugged driving by drivers. This is because what is known in the discipline is that there is largely accurate detection of substances in major drug categories, but what is not known is the application of the oral fluid testing roadside as well as subsequent application in a court of law. The present study will extend knowledge in the discipline by correlating detection of controlled / intoxicating substances in oral fluid comparable with the presence of the same substances in the blood of impaired drivers. This will support future programming and detection through the efforts of the Drug Recognition Expert Program (DRE) and law enforcement who are trained to recognize roadside impairment when the presence of controlled / intoxicating substances are in addition to and an affirmation of palpable clues of intoxication.

Chapter 3: Research Method

The purpose of this quantitative research study is to understand the use and accuracy of roadside oral fluid testing conducted in several Michigan counties that implemented pilot instruments for testing and detecting controlled substances in the oral fluid of drivers. Participating Michigan counties (Berrien, Delta, Kent, St. Clair, and Washtenaw) were selected for the oral fluid pilot program based on traffic-related criteria. The primary factors in selecting the test counties included: (a) number of serious injury and fatal traffic crashes involving impaired driving within the county, (b) trained Drug Recognition Expert (DRE) officers and prosecutors in their county, (c) knowledge of the pilot program, and (d) willingness to participate.

To refute, substantiate, or inform oral fluid roadside testing as an accurate method of illegal intoxication detection, as stated, this researcher did analyze secondary data collected from the aforementioned counties before, and after, the implementation of the oral fluid test pilot program in 2017. The intent of this study is to investigate the implementation of resources to accurately detect consumed controlled substances by drivers in drug-related “operating while intoxicated” investigations and the introductory tools and methods for roadside drug detection through the Oral Fluid Pilot Program in Michigan. In other words, does oral fluid testing withstand a changing legal climate to incorporate oral fluid drug detection as dependable and aid in drug detection for drivers who may be under the influence of controlled substances?

The research methodology is a quantitative research design (O'Sullivan, 2017). Variables of interest include independent variables of cannabis use only and poly-drug use results from oral fluid testing, as well as dependent variables of preliminary oral fluid testing results performed by certified DREs over a period of time before and after intervention of the pilot program in Michigan. This researcher did analyze proposed correlations between independent and dependent variables under study through a quasi-experimental (correlational) design, and variables will be assessed for the strength of the relationship among them related to the gap.

Research Design and Rationale

The study variables in this research were nominal, categorical variables replicated over seven statistical tests. The first variable is a categorical variable, which is central nervous system depressants oral fluid testing results, and the second categorical variable is accurate detection of whether drivers in Michigan are under the influence of central nervous system depressant controlled substances. The next set of variables is a categorical variable of central nervous system stimulants oral fluid testing results and a categorical variable of accurate detection of whether drivers in Michigan are under the influence of central nervous system stimulant controlled substances. The next set of variables is a categorical variable of Hallucinogens oral fluid testing results, and a categorical variable of accurate detection of whether drivers in Michigan are under the influence of Hallucinogen controlled substance. The next set of variables is a categorical variable of Phencyclidine (PCP) oral fluid testing results, and a categorical variable of

accurate detection of whether drivers in Michigan are under the influence of PCP controlled substance. The next set of variables is a categorical variable of narcotic analgesics oral fluid testing results and a categorical variable of accurate detection of whether drivers in Michigan are under the influence of narcotic analgesics controlled substance. The next set of variables is a categorical variable of inhalants oral fluid testing results and a categorical variable of accurate detection of whether drivers in Michigan are under the influence of inhalants controlled substance. The next set of variables is a categorical variable of Cannabis oral fluid testing results and a categorical variable of accurate detection of whether drivers in Michigan are under the influence of Cannabis controlled substance.

This researcher did engage in a quantitative research design, specifically, a Chi-Square test of association statistical test. I did run seven separate Chi-Square tests of association for each set of categorical variables, one for each substance category. Additionally, this researcher did conduct a Bonferroni correction due to the replicated statistical testing to account for the multiple statistical tests escalating the Type I error rate (Gau, 2010).

A quantitative research method for data analysis was built using Chi-Squares analysis. This research design is based in correlation, which is "a measure of association used to determine the existence and strength of the relationship between variables and is similar to proportional reduction of error (PRE) measures." (Frankfort-Nachmias, 2015, p. 325). The purpose of this correlational model was to analyze data collected from Michigan's Oral Fluid Roadside Analysis Pilot Program, conduct a bivariate analysis of

the relationship between sets of categorical variables, and provide informative results useful for those in law enforcement, prosecution, and government, and ultimately to advance social change. The aforementioned correlational model repeated for multiple hypotheses may contain error, therefore, this researcher incorporated Bonferroni corrections in SPSS. This design is consistent with research designs needed to advance knowledge in this discipline because the use of categorical variables in quantitative social science research models allows for research question testing and tests for significant relationships. Depending on results, this technique allows a researcher to determine statistical significance of relationships and provide insight as to implications of statistically significant relationships and generalizability.

Quantitative research in the field of criminal justice necessitates a flexible and responsive methodology through statistical analysis. The nature of social science research calls for a review of the volatility of human constructs and relationships, as are present in the criminal justice system, and quantitative research is best suited for testing theories supporting research (Jacques, 2014). The punctuated equilibrium theory has been vetted in studies analyzing policy change and is built from statistical evidence distinguishing instances of punctuated policy changes and non-punctuated policy changes. The underpinnings for policy change is important for understanding how policymakers, as people in general, have “only limited, cognitive and temporal, resources” such as time and attention, and how a policy is understood and discussed, what institutions have the authority to make decisions, and political systems that may operate as a force of resistance (Kuhlmann & van der Heijden, 2018). This theory will serve as a descriptor for

policy changes in Michigan and support this researcher's rationale for correlational data analysis.

Additionally, the application of the bases of social power theory is relevant in this quantitative study because variability in types of influence (power) impacts how a system responds dependently or independently on the person upon whom power is exerted and the agent who exerts power (French & Raven, 1959; Hinkin et al., 2019). The data to be retrieved from the implementation of the Oral Fluid Roadside Pilot Program is to be examined for inferences of any relationships between variables, which would include accuracy determinations of contact between law enforcement and Michigan drivers at the point of a traffic stop. The bases of social power theory will serve as a basis for social influence phenomena in relationships between the State of Michigan and law enforcement, as well as the executive branch of government and the citizenry.

Secondary data analysis will be used to examine data collected throughout the implementation of the Oral Fluid Roadside Pilot Program. The variables of accuracy reflected the time frame of this study from the policy initiation of this Program in 2016 to its completion of Phase I in 2018 (Michigan State Police, 2019a) and to its evolution to Phase II state-wide implementation in 2020 (Michigan State Police, 2021). The number of points of collection from Michigan drivers is to be recorded in the IBM SPSS Statistics Version 25 (IBM, 2022) instrument using the nominal type of measurement. The oral fluid testing results of categories of controlled substances are to be recorded in the IBM SPSS Statistics Version 25 instrument using the nominal type of measurement. Lastly, positive or negative determination of whether drivers in Michigan are under the influence

of categories of controlled substances is to be recorded in the IBM SPSS Statistics Version 25 instrument using the nominal type of measurement. Researcher bias is to be minimized because secondary data sets are to be used for this study. Also, the data is to be evaluated using correlational statistical analysis.

Methodology

Filtering, identifying, and vetting data to be used for research is a necessity for research performance and durable results. This researcher did explore the effects and implementation of Michigan's Oral Fluid Pilot Program for potential generalizations of accuracy and reliability of oral fluid testing tools and processes for law enforcement and prosecution. A quantitative methodology provides proper alignment through secondary data analysis and correlational analysis for statistically significant relationships between data points. The primary purpose of correlation research is to explore bivariate relationships, multiple relationships, and prediction among variables (*X*, *Y*) (Martin & Bridgmon, 2012). Here, due to research purposes for considering the interplay between variables for relationships, a Pearson's Chi-Square inferential statistic will be employed to examine for associations between categorical variables.

Secondary Data

This study will be a quantitative analysis of secondary data collected through Michigan's Oral Fluid Roadside Analysis Pilot Program, Phase I and Phase II. The data was largely documented and configured during traffic stops by a law enforcement officer (Drug Recognition Experts) from November 8, 2017 – November 8, 2018 in Phase I

(Michigan State Police, 2019a). Phase II was implemented from October 1, 2019 – September 30, 2020 (Michigan State Police, 2021). The data is information from the traffic stops and traffic crashes resulting in impaired driving investigation results, which would include police reports, blood sample results, oral fluid testing results per drug category, prosecutorial outcomes for determinations that sample Michigan drivers were operating under the influence of controlled substances or other drugs.

Specifically, this researcher did collect data of both Phase I and Phase II of the Oral Fluid Roadside Analysis Pilot Program through record request platforms available through the Michigan State Police, which would be authorized access through the Act 442 of 1976 (Freedom of Information Act, 1976). This researcher did format the records request to include all available information associated with and resulting from Phase I and Phase II of the Oral Fluid Roadside Analysis Program for the purpose of academic research. This researcher did create an online account through the Michigan State Police records request portal (https://www.michigan.gov/msp/services/foia). Michigan State Police would be a reputable source of data for this research due to the direct contact between data collection and the agencies for Phase I and Phase II. Additionally, Michigan State Police is a state-wide law enforcement agency and maintains a current and historically positive, productive governmental reputation based on employee reviews (https://www.indeed.com/cmp/Michigan-State-Police/reviews).

Instrumentation and Operationalization of Constructs

The purpose of this quantitative research was to examine the accuracy and reliability of oral fluid testing devices and results against observations of specially trained law enforcement officers assessing potentially drug-intoxicated drivers at the point of a traffic stop in Michigan. A focus on the accuracy of the tools and the results is imperative in terms of acquiring and analyzing appropriate data in this case and the context of what data can also be translatable into use in traffic investigations and courts. DRE officers are a select group of police officers in the State of Michigan, and throughout the United States, who have standardized and specialized training for investigating instances of drug–impaired driving. DRE officers executed oral fluid roadside testing through the aforementioned Pilot Program. An analysis of DRE officer qualifications as well as State of Michigan laws regarding operating while intoxicated under the influence of drugs (Michigan Vehicle Code Act, 1949/2016, §257.625) and Michigan Regulation and Taxation of Marihuana Act (2018, §333.27954) and will be needed for clarification of how data was collected and what data was produced by the investigations. Additionally, this researcher did seek out information regarding drug categories, including central nervous system depressants, central nervous system stimulants, hallucinogens, PCP, narcotic analgesics, inhalants, and cannabis (marihuana). There are many individual drug substances that can be categorized into drug categories, and oral fluid testing devices vary on what drug categories can be accurately detected per device.

To retrieve data related to laws in the State of Michigan, this researcher did utilize Michigan Compiled Laws, which are maintained by the legislature and available online

(https://www.legislature.mi.gov/Laws/MCLSEARCH). To retrieve data related to DRE officer qualification and certification, this researcher did utilize information from the International Association of Chiefs of Police (IACP) (https://www.theiacp.org/about-iacp), which is available online, and Michigan State Police – Law Enforcement Resources for Drug Recognition Experts Program (DRE), which is also available online (https://www.michigan.gov/msp/0,4643,7-123-72297_64773_22719-383472--,00.html). To retrieve data regarding drug categories, this researcher did use the information compiled by information from the International Association of Chiefs of Police (IACP) (https://www.theiacp.org/7-drug-categories), which is available online, as well as information available through the National Institute on Drug Abuse (NIH), which is also available online and is an authority for drug use (https://www.drugabuse.gov/drug-topics/commonly-used-drugs-charts).

Data Analysis Plan

Data analysis in this research model is based in the research objective and correlation hypothesis testing; to draw out associations from a set of initial conditions (Campbell & Stanley, 1963). This research was a quantitative analysis of secondary data obtained from a state-wide law enforcement agency through Freedom of Information Act (FOIA) requests. This law enforcement agency garnered and houses data from Phase I and Phase II of the Oral Fluid Roadside Analysis Program. The data was collected through FOIA requests submitted through the agency's records request portal and coordinated through a designated FOIA coordinator for payment. This researcher did

categorize the data into a Microsoft Excel spreadsheet and determine variables. Data from the Microsoft Excel spreadsheet and variables was then be input into a data set for SPSS version 25 to perform correlational analysis. Descriptive statistics were generated for all study variables and Pearson correlational coefficients were calculated to identify associations among variables. Additionally, this researcher did run diagnostic tests to assess possible violations of regression assumptions for these models.

Research Questions and Hypotheses

RQ1: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of Central Nervous System Depressants?

H_{01} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of Central Nervous System Depressants and the use of oral fluid testing.

H_1 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of Central Nervous System Depressants and the use of oral fluid testing.

RQ2: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of Central Nervous System Stimulants?

H_{02} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of Central Nervous System Stimulants and the use of oral fluid testing.

H_2 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of Central Nervous System Stimulants and the use of oral fluid testing.

RQ3: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of Hallucinogens?

H_{03} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of Hallucinogens and the use of oral fluid testing.

H_3 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of Hallucinogens and the use of oral fluid testing.

RQ4: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of Phencyclidine (PCP)?

H_{04} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of Phencyclidine (PCP) and the use of oral fluid testing.

H_4 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of Phencyclidine (PCP) and the use of oral fluid testing.

RQ5: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of Narcotic Analgesics?

H_{05} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of Narcotic Analgesics and the use of oral fluid testing.

H_5 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of Narcotic Analgesics and the use of oral fluid testing.

RQ6: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of Inhalants?

H_{06} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of Inhalants and the use of oral fluid testing.

H_6 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of Inhalants and the use of oral fluid testing.

RQ7: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of Cannabis?

H_{07} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of Cannabis and the use of oral fluid testing.

H_7 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of Cannabis and the use of oral fluid testing.

The software to be used for analyses is a combination of Microsoft Excel for organizing secondary data and SPSS (2022) for data analysis. SPSS (2022) software (IBM, 2022) is to be used to categorize and analyze data received from the law enforcement agency. This researcher did conduct exploratory analysis using SPSS to test that assumptions for correlation are met for variables to be normally distributed. Tests for assumption include histogram for bell-shaped dataset, level of measurement for each variable, related pairs, absence of outliers, and linearity (Field, 2013; Frankfort-Nachmias & Leon-Guerrero, 2015; Warner, 2013). This research intends to review each assumption against corresponding research questions and determine whether the variables produce statistically significant results for subgroup differences, laboratory results, and oral fluid category results.

Threats to Validity

Threats to the validity of a study are factors impacting the reliability of the research and findings when reviewed for causality, correlation, and generalizability of the research. The strength of a correlational research design is a design aimed to contribute to an evidence-based understanding of the world (Walker, 2005, p. 579). This is based on the nature of quantitative research, in general. A correlational research design can provide information for whether there is a relationship, or even a strong association, between two variables and this is an important aspect of research design for this proposed research given the question is directed to understanding the association between oral fluid testing of drivers suspected of driving while intoxicated by substance(s). Study validity is also a consideration when determining research design. The validity of a study references external validity, internal validity, and construct validity.

External Validity

External validity factors may impact any generalization of statistically significant results in this research given changes in laws and societal climates surrounding law enforcement and investigation of drugged driving offenses given study participants, materials, and environment (Warner, 2013). Specifically, threats to external validity, or generalization, may be due to inferences developed from determinations of causal relationships that are not maintained over across populations, settings, treatments, or outcomes (Shadish et al., 2002). Experimental and Quasi-Experimental Designs for Generalized Inference. Houghton, Mifflin and Company). Potential threats to external

validity may be the use of different oral fluid testing devices than those used in Michigan's oral fluid pilot program across different populations and settings given variability in oral fluid testing results. It is anticipated that law enforcement agencies would widely vary for oral fluid testing devices employed for use by officers given the array of oral fluid devices currently manufactured and agency specific criteria for device selection (i.e. cost, drug detection spectrum, reliability, ease of use for law enforcement).

Additionally, a potential threat to external validity may be legal and society climates varying widely throughout United States regarding law enforcement. Replication may be thwarted in jurisdictions without laws for roadside oral fluid testing. Generalization of research results in jurisdictions without support for roadside investigations of drugged driving may be inapplicable. These potential threats to external validity will be addressed with research specificity as to oral fluid testing devices employed in this research for replication.

Internal Validity

An instance of threat to internal validity may be found in the answer to a question of whether the experimental treatment (i.e. Variable A; the cause) did have an effect (i.e. Variable B; the effect) (Mitchell, 1985). It is primary to rule out alternative explanation(s) for relationship(s) between variables to secure the results are internally valid by accounting for history, maturation, statistical regression, experimental mortality, and selection-maturation interaction, as appropriate to the study. This researcher did maintain a list of potential internal validity threats that can be accounted for, and hopefully rule

out, as not present in this research. This was in efforts to rule out the possibility that there is not an alternative explanation for any correlative relationship outcome.

Here, threats to internal validity were addressed in this correlational study through the use of randomized experimentation (McDavid et al., 2012). For randomized experimental control, this researcher removed the potential of selection bias through a balancing of comparable intervention groups per variable and utilizing equal statistical testing, generating reproducible randomization schedules (assigning random numbers from random number tables to treatment conditions or computer programming of randomization of the secondary data depending on sample size). Given the nature of secondary data acquired in this research through the Michigan State Police, subjects were to be assigned to randomized groupings via Microsoft Excel and SPSS, which addressed indistinguishable influence of effects and an unbiased result.

Construct Validity

This researcher did address any threats to construct validity by reviewing the design of test instruments in this case to be effectuate a measurement and results that the instrument was designed to evaluate (Flake et al., 2022). Construct validity, as an additional measure of validity of research conclusions, is tailored to provide support that an instrument utilized for research and measurement procedure is measuring the intended construct. This researcher did utilize secondary data, develop variables, and analyze them for correlational associations in SPSS. Construct validity has been addressed if the intended measures in this research are covaried in a predicable manner and has

theoretically related scales for comparison among other variables, which would be evidence of construct validity. To ensure the acceptability of data analysis procedures and address construct validity, this researcher did include a diverse and full sample of subject matter cases for roadside oral fluid testing results and to adhere to the correlational analysis and design process.

Additionally, this researcher did make inferences from percentages of sample statistics of oral fluid sample test reported positive percentages and reported negative results. Inferences for these percentages is reported using sample estimates of the measures and their 95% confidence interval using binomial proportions, with the 95% confidence interval calculated using the Agresti Approximation (Agresti & Coull, 1998).

A potential threat to construct validity in this research was the published measurements, performance, and substance detection expectations for the various oral fluid devices used throughout this pilot program. The published measurements and detectable substances of various oral fluid testing devices in this research are validated by the respected manufacturers. The inclusion of laboratory and peer-reviewed research review of various oral fluid testing devices is expected to demonstrate adequate sensitivities in order to determine any reported differences bore out in this proposed research. An additional potential threat to construct validity was invalid on-site test results in oral fluid test samples. This researcher quantified only valid and non-missing data when analyzing the results of this study. Invalid test results are to be quantified as "missing."

Ethical Procedures

Maintaining ethical research practices with data and analysis was high priority for this researcher. This researcher analyzed secondary data in this research. The data collection process did include oral fluid test results from roadside traffic stops of vehicle drivers by Drug Recognition Experts (DREs) law enforcement officials in the State of Michigan, as well as demographic information, confirmation lab results from post-traffic stop blood or urine testing, drug category indications, and forensic fluid lab results. All information was retrieved for the purpose of analysis is available for public consumption. Although there are no direct human sample interactions intended for this research, this researcher protected the anonymity of those who were selected to as sample participants for oral fluid testing results by excluding unique identifiers and names from being published in secondary examination and dissemination of the data. Human subjects were not interviewed or approached for obtaining information in this research and consent forms regarding criminal case information are not needed.

This researcher gained access to research data through the process of requesting documentation and results from regarding the roadside drug testing pilot program through the Freedom of Information Act (FOIA) public records request procedures of the public state agency. The pilot program was conducted by a public state agency and research data is accessible to the public. As to the treatment of data, confidential or criminal case related data is to be redacted by the state agency as is required by through FOIA procedures for issuing information. Additionally, this researcher maintains secondary data as confidential through private and locked, external data storage and utilized with a

password protected computer. This researcher is the only one with access to the data as it was requested that the state agency provide the data directly to this researcher. The data was secured in this researcher's possession. This researcher destroyed the data as research analysis has been completed.

Summary

A quantitative research design has been developed for this research to support an evidence-based review of secondary data from an Oral Fluid Roadside Analysis Pilot Program initiated in 2017. This researcher has developed methodology to analyze correlations between accurate detection of categorically identified controlled substances by oral fluid detection tools and drivers who were subject to roadside investigation for offenses of drugged driving in Michigan. This researcher did utilize secondary data from a pilot program in Michigan implementing processes of roadside oral fluid testing to measure aspects of law enforcement use of oral fluid testing devices and measure dependability of the results of an oral fluid test for substances as compared to confirmatory blood sampling records. The primary purpose of correlation research is to explore bivariate relationships, multiple relationships, and prediction among variables (*X*, *Y*) (Martin & Bridgmon, 2012). Here, due to research purposes for considering the interplay between variables for relationships, a Pearson's Chi-Square inferential statistic was employed to examine for associations between categorical variables.

As provided in this Chapter, this quantitative study aligned with theoretical principles, recognize and address threats to validity, and ethical guidelines to protect the

identity and justice system involvement of those drivers involved in secondary data collection. The results were examined using reliable SPSS instrumentation and provided evidence of the research questions. The results of data collection and analysis are to be presented in Chapter 4.

Chapter 4: Results

Introduction

This chapter sets out an analysis and explanation of results of this study that utilized secondary data from Michigan State Police – a statewide law enforcement agency – to analyze correlational relationships between selected factors. The purpose of this quantitative research study is to understand the use and accuracy of roadside oral fluid testing conducted in the five Michigan counties which implemented pilot instruments for testing and detecting controlled substances in the oral fluid of drivers (Berrien, Delta, Kent, St. Clair, and Washtenaw).

To either refute or substantiate oral fluid testing as an accurate method of illegal intoxication detection, as stated, this researcher analyzed secondary data collected from the aforementioned counties before, and after, the implementation of the oral fluid test pilot program in 2017. The intention of this study is to serve as a connection between the lack of resources to adequately detect consumed drugs in a drug-related "operating while intoxicated" investigations and the oral fluid pilot program initiated in Michigan introducing a new tool and method for roadside drug detection. A review of whether oral fluid testing can withstand the changing legal climate to incorporate this test and its results as scientifically dependable would aid law enforcement agency determinations in utilizing this test on a broad scale for individual officers working to detect impairment in drivers under the influence of controlled substances.

To understand the relationship between oral fluid devices and accuracy, correlational Chi-Square analysis was conducted using the most recent IBM SPSS

Statistics Program (SPSS 28). This researcher addressed the research questions and hypotheses using this measuring instrument. The analysis of the data collected in this research was based on secondary data collection from publicly accessible resources such as a statewide law enforcement agency and units of local government. This research chapter describes the data collection process and procedures and presents the results of the data analysis.

Data Collection

The Internal Review Board (IRB) of Walden University approved this research plan on April 10, 2023 (IRB Approval No. 04-10-23-0994608). Secondary data collection began once this researcher received IRB approval of the research plan. This researcher located the proper source for requesting records from the oral fluid pilot program initiated in Michigan in 2016 through a statewide law enforcement agency. A Freedom of Information Act (FOIA) request was prepared and submitted to the Michigan State Police Records Division. The records request was received. Requested data was distributed to this researcher via external disk drive in various file formats including pdf, word document, and excel files.

This researcher conducted a thorough literature review on oral fluid testing devices, variabilities between brands of oral fluid testing devices, oral fluid test use and application, as well as history of operating while intoxicated laws in the United States and internationally. To complete a correlational Chi-Square analysis, this researcher completed a two-by-two table examination of several nominal variables using SPSS

(Version 28). A sample size of 100 was determined appropriate with alpha = .05. The data was organized from case reports, lab reports, and extracted from pilot program excel documents and organized by this researcher into an excel document that would be compatible with SPSS dataset programming.

The content of data that was received by this researcher was case arrest reports from Drug Recognition Experts (DREs), which provided summary of selected traffic stops involved in the oral fluid testing device program, as well as release test certificates of passing certification for individually issued oral fluid testing devices. The goal of this research was to understand whether a relationship exists or does not exist between the use of various objective roadside tools at the disposal of law enforcement in order to make quick and non-invasive determinations about whether drivers are under the influence of a drug category or categories. This was achieved through the use of secondary data provided by a statewide law enforcement agency that employed the use of oral fluid testing devices in several counties in Michigan.

The research questions answered in this study were as follows:

RQ1: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of central nervous system depressants?

H_{01} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of central nervous system depressants and the use of oral fluid testing.

H_1 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of central nervous system depressants and the use of oral fluid testing.

RQ2: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of central nervous system stimulants?

H_{02} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of central nervous system stimulants and the use of oral fluid testing.

H_2 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of central nervous system stimulants and the use of oral fluid testing.

RQ3: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of hallucinogens?

H_{03} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of hallucinogens and the use of oral fluid testing.

H_3 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of hallucinogens and the use of oral fluid testing.

RQ4: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of phencyclidine (PCP)?

H_{04} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of phencyclidine (PCP) and the use of oral fluid testing.

H_4 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of phencyclidine (PCP) and the use of oral fluid testing.

RQ5: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of narcotic analgesics?

H_{05} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of narcotic analgesics and the use of oral fluid testing.

H_5 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of narcotic analgesics and the use of oral fluid testing.

RQ6: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of inhalants?

H_{06} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of inhalants and the use of oral fluid testing.

H_6 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of inhalants and the use of oral fluid testing.

RQ7: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of cannabis?

H_{07} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of cannabis and the use of oral fluid testing.

H_7 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of cannabis and the use of oral fluid testing.

Setting

The participants in this Pilot Program in Michigan were drivers subject to traffic stop in several counties in Michigan from 2016 – 2017. These traffic stops were executed by trained law enforcement officers employed by a statewide law enforcement agency and specially trained as Drug Recognition Experts (DREs). Each driver consented to the use of the oral fluid testing device by law enforcement, which is a comparable procedure already established in Michigan law through the use of Preliminary Breath Tests (PBTs).

All traffic stops where the oral fluid test device was deployed and utilized by the investigating officer was noted in the secondary data. No personally identifiable information was provided by the statewide law enforcement agency to this researcher during any part of the research process. Data regarding dates of traffic stops, date of oral fluid collection, data of blood sample test collection, and identification of DRE officer and associated county of traffic stop were provided with the dataset, in addition to oral fluid test results and blood sample test results.

Data Analysis

Using the most recent version of SPSS program, this researcher completed seven Chi-Square correlational analysis using nominal variables to determine the existence or non-existence of relationship between the variables. The first Chi-Square analysis focused on analyzing for a relationship between the nominal variable of oral fluid testing result for central nervous system depressants (“detected” or “not detected”) and nominal variable blood test result for central nervous system depressants (“detected” or “not detected”) for the entire dataset of participant traffic stops. The second Chi-Square analysis focused on analyzing for a relationship between the nominal variable of oral fluid testing result for central nervous system stimulants (“detected” or “not detected”) and nominal variable blood test result for central nervous system stimulants (“detected” or “not detected”) for the entire dataset of participant traffic stops. The third Chi-Square analysis focused on analyzing for a relationship between the nominal variable of oral fluid testing result for hallucinogens (“detected” or “not detected”) and nominal variable

blood test result for hallucinogens (“detected” or “not detected”) for the entire dataset of participant traffic stops. The fourth Chi-Square analysis focused on analyzing for a relationship between the nominal variable of oral fluid testing result for phencyclidine (PCP) (“detected” or “not detected”) and nominal variable blood test result for phencyclidine (PCP) (“detected” or “not detected”) for the entire dataset of participant traffic stops. The fifth Chi-Square analysis focused on analyzing for a relationship between the nominal variable of oral fluid testing result for narcotic analgesics (“detected” or “not detected”) and nominal variable blood test result for narcotic analgesics (“detected” or “not detected”) for the entire dataset of participant traffic stops. The sixth Chi-Square analysis focused on analyzing for a relationship between the nominal variable of oral fluid testing result for inhalants (“detected” or “not detected”) and nominal variable blood test result for inhalants (“detected” or “not detected”) for the entire dataset of participant traffic stops. Lastly, the seventh Chi-Square analysis focused on analyzing for a relationship between the nominal variable of oral fluid testing result for cannabis (“detected” or “not detected”) and nominal variable blood test result for cannabis (“detected” or “not detected”) for the entire dataset of participant traffic stops. This researcher elected to utilize correction in analysis for the number of tests that were being run in the dataset. Following these seven Chi-Square analyses, I reviewed the results using alpha = .05.

Results

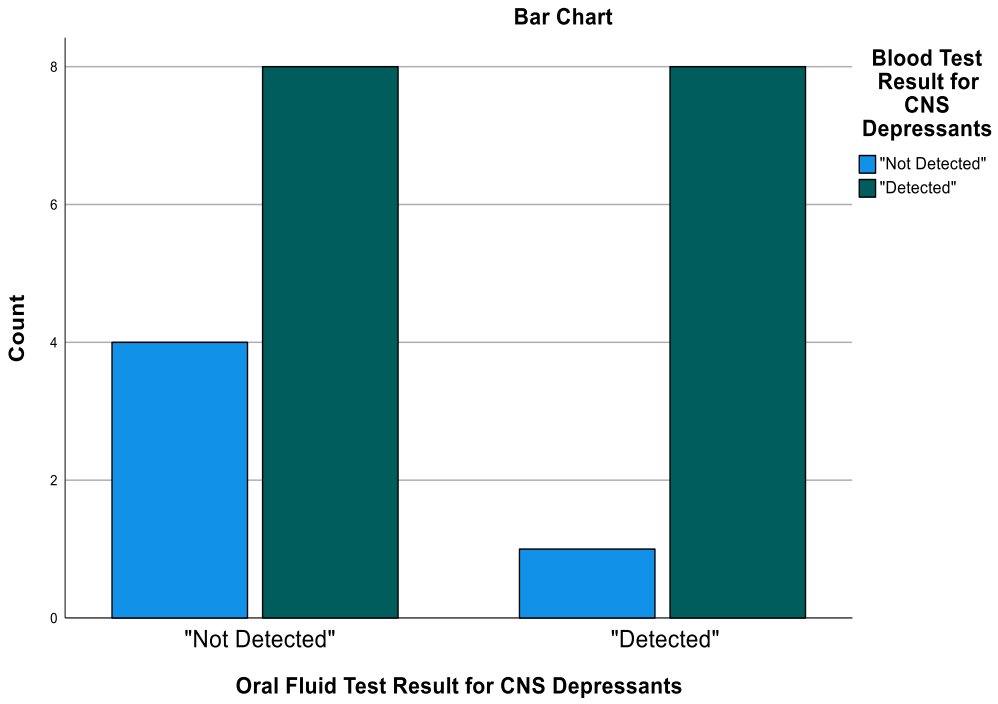
RQ1: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of central nervous system depressants?

A cross tabulation Chi-Square analysis was performed using SPSS (Version 28) on the data summary table that categorized secondary data into nominal, independent variables. Specifically, data was analyzed as to detection results ("detected" and "not detected") for central nervous system depressants category of drugs in both oral fluid test results produced via Alere DDS 2 devices employed by selected DRE officers and analyzed against detection results ("detected" and "not detected") for central nervous system depressants produced via blood sample test results examined by the Michigan State Police Crime Lab. This formed two-by-two table testing.

For the two-by-two table variable testing, assumptions were violated during analysis because not all expected counts exceeded a figure of 10. Based on the results, the null hypothesis is to be accepted (H_{01}). The results provide that there is no statistically significant relationship between the oral fluid test results for central nervous system depressants drug category and blood test results for central nervous system depressant drug category (Chi-Square; Alpha = .05, Fisher's = .237). The variables remain independent from each other.

As to percentage results impacting accuracy, 33% of the oral fluid results indicating central nervous system depressants were "not detected" were also "not detected" in the blood sample results, whereas 66.7% of the same oral fluid results were

detected in the blood sample results. Although there is no statistically significant relationship between these variables, the variables rates of detection indicate a deficit in the Alere DDS 2 function in detecting central nervous system depressants. For the oral fluid test results that did provide a “detected” result for central nervous system depressants, 88.9% of those results were also “detected” in blood sample results. There is also 11% of “detected” oral fluid test results that were “not detected” in the blood sample results. These results provide that each variable is independent and does not correlate with accurate detection of participant drivers who consumed central nervous system depressants and the detection results of oral fluid testing.



Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.400[a]	1	.237		
Continuity Correction[b]	.443	1	.506		
Likelihood Ratio	1.497	1	.221		
Fisher's Exact Test				.338	.258
Linear-by-Linear Association	1.333	1	.248		

H_{01}

Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of central nervous system depressants and the use of oral fluid testing.

RQ2: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of central nervous system stimulants?

A cross tabulation Chi-Square analysis was performed using SPSS (Version 28) on the data summary table that categorized secondary data into nominal, independent variables. Specifically, data was analyzed as to detection results (“detected” and “not detected”) for central nervous system stimulants category of drugs in both oral fluid test results produced via Alere DDS 2 devices employed by selected DRE officers and analyzed against detection results (“detected” and “not detected”) for central nervous

system depressants produced via blood sample test results examined by the Michigan State Police Crime Lab. This formed two-by-two table testing.

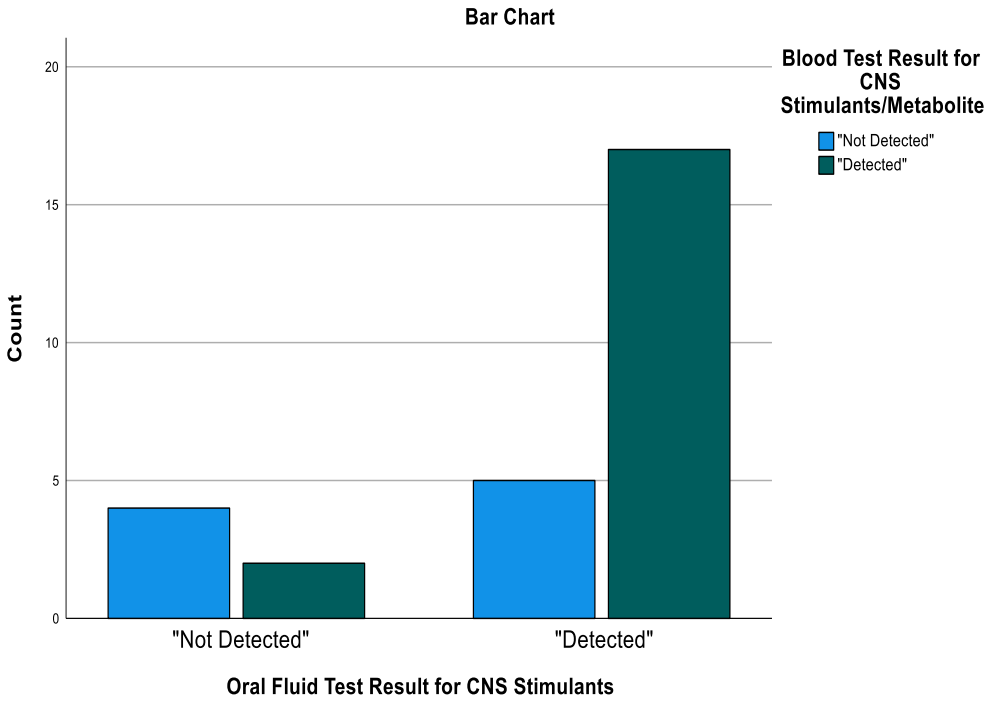
For the two-by-two table variable testing, assumptions were violated during analysis because not all expected counts exceeded a figure of 10. Based on the results, this researcher asserts that the null hypothesis is to be accepted (H_{01}). The results provide that there is no statistically significant relationship between the oral fluid test results for central nervous system stimulants drug category and blood test results for central nervous system stimulants drug category (Chi-Square; Alpha = .05, Fisher's = .064). The variables remain independent from each other.

As to percentage results impacting accuracy, 66.7% of the oral fluid results indicating central nervous system stimulants were "not detected" were also "not detected" in the blood sample results, whereas 33.3% of the same oral fluid results were detected in the blood sample results. Although there is no statistically significant relationship between these variables, the variables rates of detection indicate some deficit in the Alere DDS 2 function in detecting central nervous system stimulants. For the oral fluid test results that did provide a "detected" result for central nervous system stimulants, 77.3% of those results were also "detected" in blood sample results. There is also 22.7% of "detected" oral fluid test results that were "not detected" in the blood sample results. These results provide that each variable is independent and does not correlate with accurate detection of participant drivers who consumed central nervous system stimulants and the detection results of oral fluid testing.

H_{02} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of central nervous system stimulants and the use of oral fluid testing.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.173[a]	1	.041		
Continuity Correction[b]	2.402	1	.121		
Likelihood Ratio	3.944	1	.047		
Fisher's Exact Test				.064	.064
Linear-by-Linear Association	4.024	1	.045		
N of Valid Cases	28				



RQ3: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of hallucinogens?

Although data was requested for all available drug categories and drug categories of detection for oral fluid testing devices from the Michigan State Police, the data that was received by this researcher was void of any oral fluid testing results for hallucinogens in the aforementioned pilot program. This indicates that no participants provided a detectable result for hallucinogens either in oral fluid results or in blood sample results. The analytical results provide that no measures of association are computed for the cross tabulation of hallucinogens in oral fluid test results or blood test results. Therefore, no cross tabulation was performed for hallucinogenic substances in this pilot program. Research Question No. 3 was not analyzed.

RQ4: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of phencyclidine (PCP)?

Although data was requested for all available drug categories and drug categories of detection for oral fluid testing devices from the Michigan State Police, the data that was received by this researcher was void of any oral fluid testing results for phencyclidine (PCP) in the aforementioned pilot program. This indicates that no participants provided a detectable result for phencyclidine (PCP) either in oral fluid results or in blood sample results. The analytical results provide that no measures of association are computed for the cross tabulation of phencyclidine (PCP) in oral fluid test

results or blood test results. Therefore, no cross tabulation was performed for phencyclidine (PCP) substances in this pilot program. Research Question No. 4 was not analyzed.

RQ5: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of narcotic analgesics?

A cross tabulation Chi-Square analysis was performed using SPSS (Version 28) on the data summary table that categorized secondary data into nominal, independent variables. Specifically, data was analyzed as to detection results ("detected" and "not detected") for narcotic analgesics category of drugs in both oral fluid test results produced via Alere DDS 2 devices employed by selected DRE officers and analyzed against detection results ("detected" and "not detected") for narcotic analgesics produced via blood sample test results examined by the Michigan State Police Crime Lab. This formed two-by-two table testing.

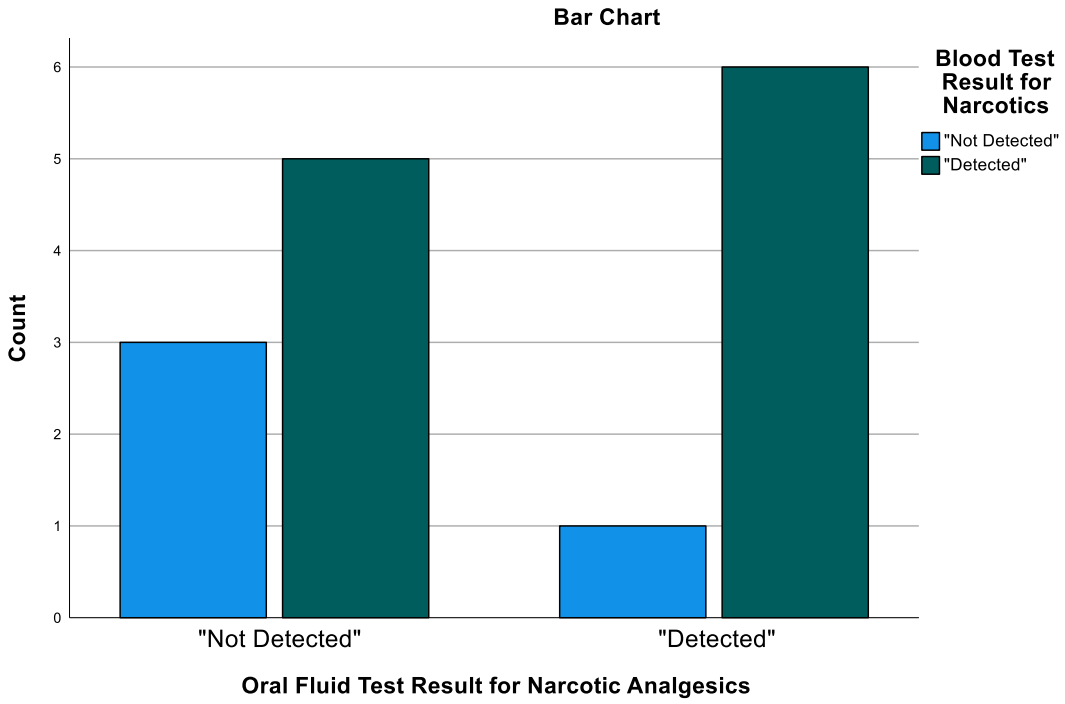
For the two-by-two table variable testing, assumptions were violated during analysis because not all expected counts exceeded a figure of 10. Based on the results, this researcher asserts that the null hypothesis is to be accepted (H_{01}). The results provide that there is no statistically significant relationship between the oral fluid test results for narcotic analgesics drug category and blood test results for narcotic analgesics drug category (Chi-Square; Alpha = .05, Fisher's = .569). The variables remain independent from each other.

As to percentage results impacting accuracy, 37.5% of the oral fluid results indicating narcotic analgesics were “not detected” were also “not detected” in the blood sample results, whereas 62.5% of the same oral fluid results were detected in the blood sample results. Although there is no statistically significant relationship between these variables, the variables rates of detection indicate a deficit in the Alere DDS 2 function in detecting narcotic analgesics. For the oral fluid test results that did provide a “detected” result for central nervous system depressants, 85.7% of those results were also “detected” in blood sample results. There is also 14.3% of “detected” oral fluid test results that were “not detected” in the blood sample results. These results provide that each variable is independent and does not correlate with accurate detection of participant drivers who consumed central nervous system depressants and the detection results of oral fluid testing.

H_{05} – Based on objective findings, there is no statistically significant relationship between accurate detection of drivers under the influence of narcotic analgesics and the use of oral fluid testing.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.029[a]	1	.310		
Continuity Correction[b]	.184	1	.668		
Likelihood Ratio	1.071	1	.301		
Fisher's Exact Test				.569	.338
Linear-by-Linear Association	.960	1	.327		
N of Valid Cases	15				



RQ6: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of inhalants?

Although data was requested for all available drug categories and drug categories of detection for oral fluid testing devices from the Michigan State Police, the data that was received by this researcher was void of any oral fluid testing results for inhalants in the aforementioned pilot program. This indicates that no participants provided a detectable result for inhalants either in oral fluid results or in blood sample results. The analytical results provide that no measures of association are computed for the cross tabulation of inhalants in oral fluid test results or blood test results. Therefore, no cross

tabulation was performed for inhalant substances in this pilot program. Research Question No. 5 was not analyzed.

RQ7: What is the relationship between oral fluid testing and the accurate detection of whether drivers in Michigan are under the influence of cannabis?

A cross tabulation Chi-Square analysis was performed using SPSS (Version 28) on the data summary table that categorized secondary data into nominal, independent variables. Specifically, data was analyzed as to detection results ("detected" and "not detected") for cannabis category of drugs in both oral fluid test results produced via Alere DDS 2 devices employed by selected DRE officers and analyzed against detection results ("detected" and "not detected") for narcotic analgesics produced via blood sample test results examined by the Michigan State Police Crime Lab. This formed two-by-two table testing.

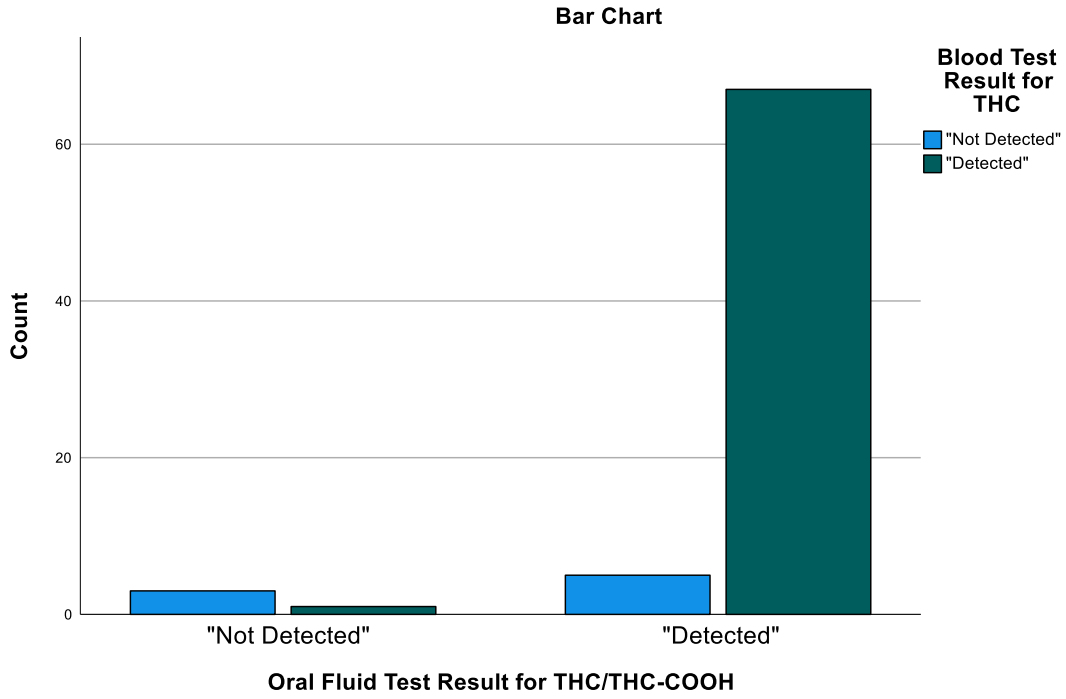
For the two-by-two table variable testing, assumptions were violated during analysis because not all expected counts exceeded a figure of 10. Based on the results, this researcher asserts that the alternative hypothesis is to be accepted, contrary to the null hypothesis (H_7). The results provide that there is a statistically significant relationship between the oral fluid test results for cannabis drug category and blood test results for narcotic analgesics drug category (Chi-Square; Alpha = .05, Fisher's = .003). The variables are not independent from each other and a strong relationship between the variables has been established through the Phi correlation co-efficient (Phi = .495).

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	18.635[a]	1	<.001		
Continuity Correction[b]	12.110	1	<.001		
Likelihood Ratio	10.332	1	.001		
Fisher's Exact Test				.003	.003
Linear-by-Linear Association	18.390	1	<.001		
N of Valid Cases	76				

As to percentage results impacting accuracy, 75% of the oral fluid results indicating narcotic analgesics were “not detected” were also “not detected” in the blood sample results, whereas 25% of the same oral fluid results were detected in the blood sample results. This indicates that the relationship between variables as to rates of detection have a 25% lack of detection in oral fluid testing where there is detection in blood sample testing for the same participant. For the oral fluid test results that did provide a “detected” result for cannabis, 93.1% of those results were also “detected” in blood sample results. There is also 6.9% of “detected” oral fluid test results that were “not detected” in the blood sample results. These results provide a reliable result as to positive oral fluid detection of cannabis and confirmatory detection in blood sample testing. Reliability in results where there is a statistically significant relationship between these nominal variables supports an accurate detection of drivers under the influence of cannabis and the use of oral fluid testing in this pilot program.

H_7 – Based on objective findings, a statistically significant relationship exists between an accurate detection of drivers under the influence of cannabis and the use of oral fluid testing.



Summary

This chapter has displayed the data collection, quantitative analysis process, and data output from performing analysis using SPSS. It was found that there was no statistically significant relationship between several drug categories, including central nervous system depressants, central nervous system stimulants, and narcotic analgesics, which would not account for the relationship between the Alere DDS 2 oral fluid testing device and confirmatory blood testing processes for establishing relatability in detecting a driver having consumed those drug categories and may be under the influence of the drug

while in the operation of a motor vehicle. Additionally, no data was recovered for the detection of several drug categories including hallucinogens, PCP, and inhalants in the entirety of the dataset.

It was also determined that there was a strong relationship between detection results of the Alere DDS 2 oral fluid testing device for the drug category of cannabis and the detection results in blood sample testing for the same category. A strong relationship was established for this drug category, which provides statistical significance for a relationship derived of accuracy and reliability. The following chapter provides interpretation of the research and data results with regard to limitations and future research considerations in the area of this study.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose and nature of this study was to gain an understanding of accuracy relationship between oral fluid tests administered roadside to drivers, and the results of said tests, to blood test results of those drivers. This is because detecting controlled substance use and intoxication in drivers is a nuanced area of traffic enforcement. Public policy is legitimizing the use of oral fluid testing by law enforcement in a criminal justice setting through pilot programs such as Michigan's Oral Fluid Pilot Program. Oral fluid testing provides a preliminary and noninvasive approach to initiate or further an operating while intoxicated traffic violation case for law enforcement in Michigan, but whether there is a legally sound and reliable relationship between a blood test result of a driver that creates legal enforceability of the substance(s) in their body may be impactful on the threshold of starting an investigation of this nature.

This study was conducted to analyze the secondary data produced by the oral fluid test program in Michigan in 2017 and measure for relationships between oral fluid and blood testing variables. Traffic law violations are fairly comparable and recognizable throughout states in the United States, as well as in many other countries, wherein it is unlawful for a driver to operate a motor vehicle while under the influence. A driver can be influenced by medical issues, intoxication by voluntary consumption of alcohol, or exhaustion and it may impact their driving. A driver that is under the influence due to the consumption of controlled substances, or other drug categories, also creates a risk to public safety and also poses a unique issue for detection by law enforcement of drug use.

Various drug substances can have significant impacts on cognitive performance, psychomotor performance, and create impairing effects on a person, such as fatigue (Strand, 2016). Tools, such as oral fluid testing devices that can indicate a detection of a specific drug category, would aid law enforcement to confidently detect drug substances at the outset of their investigations when it is initially suspected and justify proceeding with an investigation towards blood testing, or confirmation testing.

The key findings of this study are there was strong statistically significant relationship between positive and negative result indications in oral fluid test results and positive and negative result indication in blood test results for a specific drug category, and more outputs that indicate there was no relationship between the oral fluid test result – either negative indication or positive indication – and confirmatory blood test results. There were also several drug categories that were not detected at all in the participant drivers of the Pilot Program. These key findings indicate that accuracy relationships examined for these testing methods do not support a broad application of reliability for identified all substances / drug categories using oral fluid testing, especially regarding categories that were not detected at all, but a strong relationship for a specific drug category – cannabis and its metabolite (THC – COOH).

Interpretation of the Findings

The outcome of this research extends the knowledge of correlational relationships between oral fluid test results (positive or negative) and confirmation blood test results (positive or negative). Each research question was designed to bore out variables for each

drug category anticipated in the secondary dataset. The null hypothesis of each research question was addressed via two different nominal variables for each drug category. The current study demonstrated no significance in the relationship between oral fluid testing results for drug categories of central nervous system depressants, central nervous system stimulants, and narcotic analgesics with confirmation blood test results of drivers for the same drug categories in Research Question No. 1, Research Question No. 2, and Research Question No. 5, which may be as a result of the detection abilities of the Alere DDS 2 for these drug categories. Additionally, there was no data present in the dataset for analysis in SPSS of Research Question No. 3, Research Question No. 4, and Research Question No. 6 regarding drug categories of hallucinogens, inhalants, and PCP.

With respect to Research Question No. 7, there was a statistically significant relationship between the oral fluid test results regarding cannabis and the confirmation blood sample results for cannabis. Research indicates that an accurate detection of cannabis in oral fluid is widely acknowledged and varied throughout the body of roadside oral fluid testing research. Studies that have analyzed an accurate detection of cannabis include device-specific accuracy reports and accuracy of oral fluid testing, which include devices such as the Drager DrugTest (Owusu, 2014; Dobri, 2019; Moore, 2020; Scherer, 2020; Anzilloti, 2014; Pechansky, 2019; Kork, 2012; Fierro, 2017; Beirness, 2017; Huestis, ND), Quantisal device (Lee, 2012, Dobri, 2019, Bosker, 2009; Deshanais, 2020; Gierde, 2014; Jorgenrud, 2018; Romando, 2019; Eichelberger, 2019; Jamt, 2017; Furhaugen, 2017; Miller, 2017; Kelley, 2014), the Cozart DDS device (Bosker, 2009; Turfus, 2014; Arroyo, 2014), the Intercept device (Gjersing, 2019; MacCall, 2013;

Bretteville, 2019; Aikins, 2015; Ramekers, 2006), the Statsure Saliva System (Gjerde, 2014), the Salivette device (Yonamine, 2013), and the Multi-Drug Multi-Line Twist Screen Device (Pechansky, 2019; Scherer, 2020) were published as accurate for detecting cannabis in oral fluid. There is also oral fluid testing devices, including the DrugWipe 5/5 (Pehersson, 2011; Gentili, 2016; Richeval, 2018; Richeval, 2019), the DOA Multi-Screen device (Scherer, 2020; Pechansky, 2019), the Securtec DrugWipe device (Van Der Linden, 2015; Turfus, 2014; Chow, 2015; Pehersson, 2011; Beirness, 2017) have varying accuracy results for detecting cannabis. As to the Alere DDS 2 device, this research adds to a body of accuracy testing and supports accurate detection rates of cannabis due to a statistically significant relationship between positive and negative detection in both oral fluid results and blood sample results of cannabis.

Limitations of the Study

I identified several limitations in the proposal (Chapter 1) as barriers to research. Although anticipated, I did not encounter a limitation from requirement for partner-site agreement with the Michigan State Police because the secondary data was requested via public document access and there was no access to the site or participants. There were document fees paid to acquire the requested secondary data for the Michigan Oral Fluid Test Pilot Program, but it was not cost prohibitive and was not a limitation on this research.

There are limitations to generalizability and/or trustworthiness, validity, and reliability that arose from the execution of this study. One of the greatest limitations to

the examination of relationships between the identified nominal variables was the Pilot Program's use of one manufacturer oral fluid testing device – Alere DDS 2. From the literature review, it is established that positive and negative drug categories results can vary greatly between oral fluid test devices and manufacturers. The Michigan Oral Fluid Pilot Program utilized only one brand of oral fluid test device across all traffic stops in the test counties. The literature review in Chapter 2 provided that oral fluid results are varying across a spectrum of oral fluid test devices and there are consistencies in the research with regard to oral fluid testing devices producing poor and/or less than satisfactory sensitivity results for cannabinoid, cocaine, benzodiazepine, and ketamine detection. This effects generalizability of research results because there is a broad array of oral fluid test devices and manufacturers on the open market and only one type of device was examinable in the Michigan Oral Fluid Pilot Program.

Another limitation of this research was the reality of working with secondary data and a preclusion from collecting the data in real time. Although the data were comprehensive and easily accessible through public records requests, there were some aspects of the data provided to this researcher that was unclear, blacked out from public viewing, or missing altogether that may have been accessible during the traffic stops with drivers. This could include data on any self-reporting by drivers during traffic stops of drug use or possession on scene to analyze that aspect of detection in comparison to oral fluid test results. There are also due process concerns for drivers engaged in lawful traffic stops and subject to data collection for research purposes.

Specifically with limitations as to oral fluid testing for drug category of cannabis, research indicates that a limitation in screening oral fluid for cannabis is inconsistency with volume of oral fluid required for detection aggravated by dry-mouth from cannabis use, cold-weather constraints, device ability to detect lower THC concentration levels, and short detection times (Aikins, 2015; Bosker, 2009; Casolin, 2016; Dobri, 2019).

There is also a limitation inherent with oral fluid testing in a roadside capacity impacting drug metabolization and delays in testing, which certainly can effect the results. The Michigan Oral Fluid Pilot Program was structured for law enforcement to first offer to administer an oral fluid test to a driver for drug detection at the time of a traffic stop. If consented to by a driver suspected of operating under the influence, the oral test was administered, and results produced. If a positive drug result was indicated, law enforcement may have proceeded with an investigation involving standardized field sobriety testing, and subsequently made a determination about whether the driver was operating under the influence. If law enforcement makes a determination about arresting the driver, then a blood test would be subsequently administered in a controlled setting and away from the traffic stop. This process is important to understand from this Pilot Program because it creates a limitation from wide variability in how drugs metabolize. A positive drug detection on the oral fluid test device may also be detectable in a blood sample test within a certain timeframe, but any delays during a roadside traffic stop or travel time to the controlled blood sample test site, for instance, could cause a substance to become undetectable in the blood. Similarly, a substance may not appear to be detectable on an oral fluid device but may then appear in the blood sample result because

enough time has passed since the driver used it. From the dataset in this research, there was an average amount of time of 88.7 minutes and a range of 34 minutes to 173 minutes between when the roadside incident was initiated (near in time to when a law enforcement officer administered an oral fluid test to a driver) and when a blood sample was taken from the same driver.

Recommendations

This research guides the importance of future research in the area of roadside oral fluid testing and pilot programs created for public agencies to deploy oral fluid testing as an objective testing method. Evidence set out by the analysis in this research provides that there are strong relationships between results of preliminary oral fluid testing completed roadside and subsequent confirmation blood testing results. Additional research should be done to examine a wider range of oral fluid testing devices that have broader capacity for preliminary tests of drug categories such as inhalants, hallucinogens, and PCP as these substances can also have impairing effects.

Recommendations for future research in this area is grounded in the strengths and limitations of the current study as well as the literature review in Chapter 2. Future studies could focus on roadside study of participant drivers with use of varying oral fluid devices to test for additional correlations or to determine if any other correlations exist. The variables and output in this research were limited based on the use of one oral fluid testing device – Alere DDS 2. Additionally, there were no results in this study of a secondary dataset as to a detection of inhalant drug compounds, hallucinogenic drug

compounds, or PCP drug compounds. It is understood that these compounds are detectable in blood results (Richeval, 2019; Nogueira, 2021). Therefore, future research should be on the capacity and reliability detection of these specific drug compounds through preliminary oral fluid testing devices. Lastly, additional correlational research should be done on a larger population of drivers who provide roadside oral fluid samples in geographically dispersed regions of a state. This is recommended because drug category usage by drivers varies greatly based on regional positioning. For instance, as published by the National Library of Medicine, there are differences in opioid drug use based on rural or urban population and require region-specific intervention methods (Rigg, 2015). This could be significantly impactful on a region that employs the use of an oral fluid testing device or manufacturer of the same that does not have correlational relationships with detection of opioids, for example.

Implications

This research will contribute to positive social change for the societal benefits derived from objective and methodological prohibition on the carnage and preventability of driving under the influence on public roads. This is positive social change because examining reliability in criminal justice processes of identifying, investigating, prosecuting, and sentencing an individual for violation of a traffic law can benefit outcomes for individuals who are subject to law violations of this nature, or suspected of the same. This is because drivers should not be thwarted into the criminal justice system from subjective or unreliable methods of detection. Drivers putting themselves and others

at risk should be afforded objectivity in the detection methods of law enforcement training and tools.

Additionally, there are potential impacts for positive social change in communities because law enforcement engaging in roadside detection of drunk drivers is a reactive, legal approach to potentially unsafe drivers on the road. This is in contrast to preventative methods of drunk driving prevention such as law enforcement campaigns and advocacy groups such as MADD ("Mothers Against Drunk Driving"). A reactive, legal response by law enforcement through the criminalization of drunk driving behaviors may result in arrest, incarceration, prosecution, and if sentenced, probationary and/or rehabilitative requirements for drivers. A successful law enforcement reaction to a driver under the influence using accurate methods of detection directly removes unsafe drivers from public roads.

There are also theoretical implications from this research. The theoretical frameworks proposed for this research were validated through the cross-sectional relationship testing of a secondary data set and provided understanding to the research questions. The theoretical frameworks for this research were the bases of social power theory (Shafritz) and the punctuated equilibrium theory (Kuhlmann). The bases of social power theory guided this research through the legitimate power relationship between social influence on people dictates their actions and legitimizes the choice and action to possess influential substances such as cannabis because the substances at issue may be lawful to possess and consume. A shift in societal norms dictates the need for policy to respond to this change in drivers conduct. This theory substantiates the research in this

circumstance through an analysis of variable accuracy relationships in methods of detection from policy to increase detection.

As to punctuated equilibrium theory, this theoretical framework was also reflected in the State of Michigan's response to this initial Pilot Program for institution-wide implementation of roadside oral fluid testing with renewal policy for an expansion of the Pilot Program to all counties in the State of Michigan in order to have public policy regarding operating under the influence cases mirror a sudden influx of drug-based driving tendencies, specifically with regard to cannabis use in Michigan. Both the social power theory and the punctuated equilibrium theory supported the policy response and resource allocation to examine the relationship between tools used by law enforcement in actual circumstances suspected of violation of traffic law. The nature of utilizing and analyzing secondary data in this case enhances a scientific understanding of objective and reliable reproach for law violation policy. This research does set out some relationship between oral fluid testing results and blood confirmation testing results, which is impactful on social change because for positive social change to occur and for public safety to be actualized, communities and individuals have to come into objective trust of the criminal justice process and its tools.

Conclusion

This study highlighted a gap in the research around a tool that is new to use by law enforcement for drug detection and roadside traffic enforcement, but not new to various objective and subjective uses around the world. To address a gap in the research,

this researcher utilized a quantitative research methodology to examine data produced by a policy first in the State of Michigan – the Michigan Oral Fluid Pilot Program. Data from the Pilot Program resulted in a comprehensive view of over 100 roadside traffic stops and encounters with Michigan drivers that consented to oral fluid testing and confirmation blood testing over a 12-month period.

The results from this research provide a strong, statistically significant relationship around cannabis detection in oral fluid and blood. These are contributory results in an emerging field for law enforcement and criminal justice in drugged driving detection methods. Drugged driving poses a risk to the public that is nuanced for detection and widespread, increasingly so with the recreational and medical legalization of cannabis across many states and countries. Enforcement against drugged driving requires specialization of training for law enforcement that may not necessarily be required or enforced for employment. Objective tools, such as oral fluid test devices, that are vetted as reliable and accurate in relation to legally recognized, confirmatory testing methods such as blood testing, levels the playing field for drivers, law enforcement, courts, attorneys, and the public at large.

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