A Study of Potential Accuracy Differences in Single and Dual-Purpose Narcotics Detection Canines

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Abstract

Law enforcement agencies have used police canines for many years to help combat the flow of illegal narcotics across the United States. In many cases, narcotics detection canines can give the necessary probable cause needed to perform a search without a warrant. Case law has repeatedly approved the use of canines for this purpose if they are properly trained and certified, but defense attorneys still attack the accuracy of canines in an attempt to win their cases. Only a few studies have been completed that address the accuracy of narcotics detection canines and the results have varied widely. Studies conducted with narcotics detection canines focused on factors such as breed, sex, level of training, type of narcotics to be searched, and the area to be searched. None of the studies looked at any possible accuracy differences between single-purpose and dual-purpose narcotics detection canines. Single purpose canines are only used for narcotics detection whereas dual-purpose canines are used for multiple tasks. This research involved the testing of 40 narcotics detection canines, 20 single-purpose and 20 dual-purpose, to determine if there were any differences in accuracy. This study looked at overall accuracy and false alert rates from canines during the testing procedure. The results indicated that there were no statistically significant differences in the accuracy rates or false alert rates of single-purpose and dual-purpose narcotics detection canines.

Keywords: detection canine accuracy, canine false alert rate, single-purpose canine, dual-purpose canine

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Glossary of Terms

Aggressive alert	A canine response to the presence of a target odor by scratching or barking
Alert	The taught behavior of a canine that indicates the presence of a target odor at a specific location, which can be a passive alert or an aggressive alert
Behavioral characteristics	A list of factors that researchers and canine trainers evaluate when determining which canines are suitable for detection work.
Cadaver detection canine	Detection canines that are used to search for human remains, including body parts, tissue, blood and bones
Canine handler	The human who is responsible for handling, working with, and caring for a particular detection canine
Canine team	An individual person and a detection canine selected to train and work together as an operational unit
Certification	A process that examines a canine team's skills and confirms its abilities and accuracy to detect the target odors it is trained to find
Confirmed alert	An alert for which the presence of a trained odor can be verified either by locating the target odor after the alert, or a statement by the offender that corroborates the alert
Criminal apprehension	Training of a canine to apprehend a suspect by biting and holding a part of the suspect's body until the handler arrives to take control of the suspect.
Cross-contamination	This occurs when different target odors are stored together and they no longer only consist of their unique odor.
Detection canine	A dog trained to detect a particular target odor such as narcotics, cancer, currency, or human remains.
Distracting odors	Odors that are placed within the testing site that are not the target odors on which the canines are trained to alert.

Double Blind Testing	An evaluation of a canine team where neither the handler nor the researcher is aware of the location of hidden odor.
Dual-purpose detection canine	A canine used for narcotics detection as well as tracking or criminal apprehension.
False alert	When a canine indicates that a target odor is present when it is not and the alert cannot be confirmed.
Handler error	Any action or cue given by a handler that can cause the canine to perform inaccurately or indicate a false alert at a location where no target odor is present.
Instructor	A person who is in a position of instructing or training canine teams.
Maintenance training	Training that is conducted after initial training that is done to maintain a certain level of proficiency.
Matching-to-sample task	Trained canines are required to compare a scent sample collected from an object at a crime scene to that of a potential suspect.
Miss	Occurs when a canine does not alert on a target odor that is present in a training area or in an actual search.
Off-leash	Occurs when the canine is not on a leash when conducting searches. The canine is free to move around to search as it pleases and is not directed by a handler.
On-leash	Occurs when the canine is on a leash while conducting searches.
Passive alert	A response by the canine that does not disturb the environment. The canine may sit, stand, or lie down at the presence of a target odor.
Reward	Refers to the object that a canine receives once it has correctly alerted to the presence of a target odor. This can be praise, a toy, or an article.
Search and rescue canine	A canine that has been trained to locate live victims who are lost or have been involved in an accident or disaster.

Single blind testing	An evaluation of a canine team where the researcher is aware of the locations of target odors but the handler does not.
Single-purpose detection canine	A canine used for narcotics detection only and has no other job tasks such as tracking or criminal apprehension.
Street drugs	Refers to actual narcotics that are sold and purchased on the street and not synthetic drugs that are sometimes used for detection canine training aids.
Target odor	The specific odor that a detection canine is trained to detect. Many detection canines can be trained to find multiple target odors.
Trainability	Refers to the overall ease of a detector canine's ability to learn new tasks.
Training log	A record completed after a training session has been done by a canine team.
Tracking canine	A canine that has been trained to follow the odor of an individual. This odor being followed can result from dead skin cells falling off of the individual or from ground disturbance of the crushed vegetation along the path that the person being tracked left behind.
Training facility	A business where canines are given their original training prior to being sold to an agency or a handler. This can also include other locations that allow canine teams to conduct maintenance training.
Unconfirmed alert	An alert that cannot be confirmed because there is no way to verify the presence of a target odor, which can be caused by a residual odor.
Vapor wake dog	Canines trained to alert to target odors in the aerodynamic wakes of moving persons, which includes the odors of small particles leaving persons that are body carrying or hand carrying explosives.
Washouts	Detection canines that failed to be placed in any type of detection service due to not meeting the quality standards that were necessary to enter the field.

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Dedication

This dissertation is dedicated to my parents, Tony Lee and Brenda G. Rice, my heroes and role models in life. You continue to teach me how to be a better person, spouse, father, and Christian. You have taught me so much in life, and both of you have always believed in me without fail. I have never taken your love for granted, and I hope to be the same kind of parent to my children that you have been to me. You both have sacrificed so much for our family throughout the years and it will never be forgotten.

Chapter I

Introduction

Study Overview

Law enforcement agencies across the country have historically used canine units to perform a wide variety of detection tasks, but narcotics detection and explosives detection remain the most common use of detection canines (Jezierski et al., 2014). Canine units can be very costly to start up, but they can also be a great source of income, for example with the asset forfeitures resulting from the arrests of drug dealers. For fiscal year 2017, the United States Department of Justice estimated $1.436 billion in revenue from recoveries, forfeiture deposits, and reimbursable earnings (Asset Forfeiture Program, 2017, p. 15).

When deciding to purchase a canine for narcotics detection, police agencies must decide if they want a single-purpose detection canine or a dual-purpose detection canine. A single-purpose narcotics detection canine is used for narcotics detection only, whereas a dual-purpose detection canine is used for tracking, criminal apprehension, and narcotics detection. Agencies sometimes purchase a single-purpose canine because they can get it at a lower cost, or they may have the fear of potential lawsuits from an accidental bite from a dual-purpose canine. Some agencies also purchase multiple canines and have different roles for each canine. A single agency may have a dual-purpose narcotics

detection canine, a single-purpose explosives detection canine, and a single-purpose tracking canine.

The major importance of this study revolves around ensuring that law enforcement agencies are not employing resources that are unnecessarily infringing upon a person's constitutional rights. The citizens of the United States are entitled to freedom from government intrusion and law enforcement officers must follow rules for search and seizure. Because a positive canine alert gives law enforcement officers probable cause to search in many situations, it is imperative that the process of using canine alerts to search an individual's property be ethical. If single-purpose narcotics detection canines are found to be significantly more accurate, then law enforcement leaders and the canine industry will need to determine what steps need to be taken in the future to improve the accuracy of dual-purpose narcotics detection canines to safeguard them from coming under attack.

Need for Study

While detection accuracies of canines have been researched, the studies have focused on overall accuracy rates and have only looked at variables such as breed, sex of the canine, and time in service (Jezierski et al., 2014). A study is needed to determine if there is a difference in the narcotics detection accuracy between a single-purpose narcotics detection canine and a dual-purpose narcotics detection canine. If there is no difference, which is what is hypothesized, an agency would provide itself with broader resources by choosing a dual-purpose canine. Research has concluded that canines can be very accurate (Johnen et al., 2017), but currently there has not been testing done to determine if single-purpose narcotics detection canines and dual-purpose narcotics

detection canines are equal in detection rates. Since a dual-purpose detection canine must spend time on other training activities, such as tracking and criminal apprehension, there is a real possibility that these tasks can take away much needed time for narcotics training, thus affecting accuracy rates.

This research was conducted to determine the overall narcotics detection accuracy of single-purpose and dual-purpose canines. The results cover differences with "misses" of target odors during searches and the frequency of false alerts by both single-purpose canines and dual-purpose canines. The results from this study could assist agencies in the decision-making process of determining which type of canine they need for their department. The results could also help determine if changes are needed related to the amount of time required for narcotics detection training for each canine team based on their single-purpose or dual-purpose status.

Summary

This study was conducted to determine accuracy of both single-purpose and dual-purpose narcotics detection canines and to establish if there are any major accuracy differences between the two. With the limited research that has been conducted regarding law enforcement narcotics detection canines, many areas still need to be addressed. Although breed, sex, handlers' level of experience, and a canine's total years in service have all been studied (Jezierski et al., 2014), no major study had been conducted to see if there is a difference in accuracy between single-purpose and dual-purpose narcotics detection canines. Of all the factors that could affect detection accuracy, the single-purpose and dual-purpose distinction is one that certainly needs to be researched. One potential cause of accuracy differences between the two could be that dual-purpose

canines must spend some of their allotted training time on other activities, such as tracking, obedience, article searches, and criminal apprehension. Single-purpose narcotics canines focus their training time solely on narcotics detection, which could make them more accurate. Another possible concern with dual-purpose canines is the fact that they can sometimes be trained too much on criminal apprehension, which can cause them to lose focus at the beginning of narcotics searches. When this occurs, canines enter the narcotics search area and immediately start looking for a person that they think may be a threat instead of being prepared to search for narcotics. Handlers are generally able to get their canine partners to refocus, but it is unknown if this initial distraction has any effect on narcotics detection accuracy.

Narcotics detection canines are a major asset to the communities they serve, and law enforcement leaders must do their part to ensure that these valuable tools are never taken away due to a lack of narcotics detection accuracy. Narcotics detection canines have proven to be monetarily beneficial through the large amounts of currency and property that is seized through asset forfeiture (Asset Forfeiture Program, 2017). Another major benefit is that narcotics detection canines help remove large amounts of narcotics from the streets of the United States. It is critical that research be conducted to ensure that these canines are accurate so that they can continue to operate in their current capacity.

The results from this study could help determine if steps need to be taken to address differences in accuracy rates between the single-purpose and dual-purpose narcotics detection canines in the field. This research used the best methods for data collection available, which were determined through an extensive review of literature available from canine studies that had been completed in the recent past.

Although some of the studies in the literature review were not directly related to narcotics detection canines, they were all very beneficial because they outlined some best practices to use for data collection, while also providing guidance on what not to do so bias and the collection of inaccurate data could be avoided during the testing process. The study may lead to training requirement changes that need to take place in order to improve narcotics detection rates for both groups of canine detection animals.

Chapter II

Literature Review

Problem Statement and Overview

Because defense attorneys have the right to challenge a police canine unit's reliability, it is important to improve the defensibility of detection canines in the courtroom if possible (*Florida v. Harris*, 2013). Studies regarding detection canine accuracy can go a long way in defeating any attacks against these valuable resources. Unfortunately, the studies pertaining to police narcotics detection canines are limited in nature. In their literature review, Johnen et al. (2017) only found 54 studies that could be evaluated. Of those 54 studies, none of them looked at differences between single-purpose and dual-purpose narcotics detection canines.

However, other studies that have been conducted on detection canines, although not related to law enforcement functions, are supportive of a canine's ability to accurately detect target odors in a search environment. Not only has the research substantiated the reliability of detection canines in most cases, but according to Johnen et al. (2017), it has also given researchers important knowledge regarding how testing should be set up in order to get accurate data, while avoiding bias in the process. This literature review also covers case law that has helped shape the use of narcotics canines at agencies across the country. The literature review of these detection canines is very important because it lays the foundation for proving accuracy in canine detection, determining best methods and

procedures for testing of detection canines, and identifying limitations and errors that occurred in previous testing that needs to be avoided in the future.

Social Contract, Legitimacy and Procedural Fairness

Law enforcement has a responsibility to fulfill its end of the social contract of protecting and serving the citizens of its communities. Under the social contract, citizens agree to not break laws and in exchange benefit from the security and other benefits that are allowed from this arrangement with law enforcement. In this agreement, laws are necessary to help prevent harm from actions that are deemed to be detrimental to society. One of the major concerns with the social contract is the fear that it gives government too much power to create laws under the premise that they are being enacted for the protection of the public. A government has the potential to implement laws that are intrusive under the guise of protection. A contract becomes invalid if a person has become a slave by having all of their rights taken away (Bërdufi & Dushi, 2015). Rousseau (2010) also believed that the ruling authority was obligated to create general and unbiased laws according to the common interests of the public that is being served.

Evans and MacMillan (2014) argued that the social contract is important for law enforcement because it helps justify the power that law enforcement agencies can exercise over a population. That power imbalance is a major part of the social contract to which citizens have agreed. When law enforcement agents violate the social contract, their legitimacy is drawn into question. A government is only legitimate if it has the consent of those being governed, because the government is given that power and authority by the people (Bërdufi & Dushi, 2015).

Legitimacy is a generalized perception that the actions of an organization are appropriate within some socially constructed system of norms or values (Suchman, 1995). Tankebe (2013) argued that perceived police legitimacy can lead to active public cooperation and long-term compliance with the law. He also found that this did not just apply to the general population but also to criminal offenders. Legitimacy helps police be more effective and empowers the relationship between law enforcement and the communities that they serve daily. Tankebe also asserted that the more legitimacy the police have, the more active cooperation can be expected from the public. Jackson and Gau (2015) defined institutional trust as the belief that law enforcement use their power appropriately and lawfully and as such it reflects the belief in the right of the police to possess power.

Agencies must justify their existence through legitimate actions that respect the moral values of society. Because current laws allow law enforcement officers to search based on a certified and well-trained canine's alert (*United States v. Kennedy*, 1997), it is imperative that agencies do not abuse this allowance by using less accurate canines. Doing so would be detrimental to public trust, which could also be detrimental to legitimacy. Unfair search and seizure incidents by narcotics detection canines can trigger public scrutiny and public debate, which can lead to public and political opposition to the continued practice of law enforcement detector canines. Law enforcement agents violate the social contract if they do not enforce the laws responsibly. If agencies choose to use narcotics detection canines, ensuring that the most accurate canines are being used by law enforcement agencies is the best way to keep the trust of the public.

When looking at police canines, procedural fairness is a concern that must be addressed so that citizens are not unjustly searched. Procedurally fair policing has been shown to help strengthen the legitimacy of the police (Jackson et al., 2016). Procedural fairness has also helped cushion against negative impacts of other police involuntary contacts which can sometime lower the public's trust in law enforcement (Tyler et al., 2014). Procedural fairness can then in turn help influence the willingness of the public to cooperate with other tasks (Blader & Tyler, 2009). The question is not if officers should be held liable for any unreasonable or unfair searches, but whether police actions are morally acceptable to the citizens who bear the burdens of searches and seizures (Re, 2018). Re (2018) stated that fairness is also not what just the police view as being fair, but also what a reasonable person would view as being a just and fair process.

Using narcotics detection canines for probable cause has the potential to create concerns with procedural fairness if the canines being used are not accurate. The Fourth Amendment of the Constitution is concerned with the security of one's privacy against arbitrary intrusion by the police. This is not a guarantee against all searches and seizures, but only those that are deemed to be unreasonable under the law. In order to search, law enforcement agents must have probable cause to do so. Officers can obtain probable cause to search with an alert by a trained narcotics detection canine. The Supreme Court ruled that a drug sniff that is conducted during a lawful traffic stop is not a search because an individual does not have a reasonable expectation of privacy in illegal contraband within an automobile. In *Illinois v. Caballes* (2005), the Supreme Court found that law enforcement did not need reasonable suspicion to use a narcotics detection canine to conduct a sniff of a vehicle when a legitimate traffic stop was being conducted.

This ruling gave the authority to police officers to search a legally stopped vehicle if the detection canine alerted to the presence of illegal narcotics. The alert by the detection canine served as the probable cause needed to search the vehicle. Warrants can help curb police discretion and potentially reduce innocent citizens being illegitimately charged for crimes. Circumventing the search warrant process with a canine alert can be a major concern if the canines being used are not accurate.

If a canine falsely alerts on an individual's car or property, then law enforcement officers have conducted a search that was improper and unfair. The Supreme Court has said the Fourth Amendment secures "at a minimum" those rights that were protected by law from the very beginning (Re, 2018). Citizens are protected from unreasonable searches and seizures, which must include searches that could be conducted after an inaccurate canine has falsely alerted on an individual's personal possessions. Police officers have the ability to use a narcotics detection canine to conduct a "sniff" to locate evidence without first involving an individual's Fourth Amendment rights. Law enforcement must not use inaccurate canines because the process will be unfair and violate the trust between the agency and the public.

Canine accuracy has the potential to continue to be questioned, so it is critical that everything is being done to make sure that the most accurate detection canines are being deployed in the field. If the data obtained from the current study suggest that changes need to be made, then law enforcement agencies must work diligently to make the necessary improvements to increase detection accuracy. Not doing so will violate the social contract and destroy any appearance of legitimacy that agencies may have. Law enforcement agencies have the responsibility to ensure that any practice they engage in

does not threaten public trust or legitimacy. Administrators must constantly review their practices and procedures to ensure that they are not involved in a process that is unfair to the people that they serve. Narcotics detection canines must constantly be evaluated to ensure accuracy so that the field can continue to improve. Agencies must engage safeguards with their narcotics detection canines that will ensure that they remain accurate in order to minimize the possibility of any unreasonable searches and seizures that may burden citizens. Not doing so is unfair to the public and also creates issues with legitimacy, negatively affecting the relationship between law enforcement and the citizenry. Research pertaining to narcotics canine detection accuracy has the potential to help law enforcement fulfill the responsibilities they have to the public they serve. Further research on canine detection accuracy, such as this study, can help determine deficiencies with detection canines and help supply possible solutions that can lead to improvements in training and deployment. Improvements in the canine field can lead to increased procedural fairness and a better perception of law enforcement from the citizens concerning search and seizure incidents

Case Law

In looking at police canine reliability, it is crucial to look at case law to understand the importance of accuracy in narcotics detection. The prosecution of many drug cases nationwide is dependent upon the positive alert from a trained and certified police canine. The canine alert, in many cases, is used for probable cause for officers to search instead of obtaining a warrant. In other cases the canine alert is used to help obtain warrants. For both situations, the canine alerts can be questioned by defense attorneys

during criminal trials. Narcotics detection canine alerts and accuracy will continue to be a point of emphasis for these cases.

Numerous cases have been tried relating to canine training records. Although there is no case law pertaining to how records should be maintained, there are several cases that deal with the importance of an agency keeping those types of records to help prove a canine team's reliability. The recent United States Supreme Court case *Florida v. Harris* (2013) established that if a bona fide organization has certified a narcotics detection canine in a controlled setting, or if that canine team has successfully completed a recent training program, then the court can presume that a positive alert to the presence of narcotics by the canine gives probable cause to search. The court determined that a defendant has the right to challenge a police canine's reliability. In fact, the court found that the defense counsel may cross examine the police canine handler and challenge the adequacy of the canine team's certification or training. Also, the defense attorney can question the canine's performance and the handler's performance in training and in the field. Next, the court found that the normal rules of criminal procedure still apply, including discovery rules. This is very important because a canine's reliability can be questioned without there being any evidence of training logs showing accuracy. Lastly, this case determined that canine reliability cannot be established in deployment, which is an uncontrolled setting or environment. Therefore, the reliability can only be established in a controlled training environment where records should be made (*Florida v Harris*, 2013).

However, the state does not need to, in every case, present a comprehensive set of records, including logs of a canine's performance in the field, in order to determine

reliability. Simple evidence of a narcotics detection canine's satisfactory performance in certification or training program can itself provide enough evidence to validate the alert. If an organization has certified a canine after testing for reliability in a controlled setting, then a court can presume that the canine's alert provides probable cause to search. This is the case even if the narcotic detection canine has not completed a formal certification program, as long as the canine has recently and successfully completed a training program that evaluated proficiency in finding drugs. Obviously, this would be much easier to prove with documented training logs of the canine's actions. However, the decision in *Florida v. Harris* (2013) also stated that a defendant must have the opportunity to challenge evidence of the narcotic detection canine's reliability by introducing their own evidence or expert witnesses, in addition to cross-examining the canine handler on the stand.

In *United States v. Bentley* (2015), the Court ruled in favor of a police canine that had less than a 60% accuracy rate in confirmed alerts. This particular canine was also found to have a 93% alert rate, which means the canine indicated the presence of narcotics 93% of the time it was deployed to conduct a sniff. Although no specific alert rate is required by the Court for a canine to be considered accurate, it is obviously an important factor because it continues to be a point of emphasis in court proceedings.

Several court cases looked at the importance of training records regarding canine reliability. In *United States v. Cedano-Arellano* (2003), the Court determined that the police canine's training and certification records are discoverable by the defense for cross-examination purposes. In *United States v. Kennedy* (1997), the Court found that even without the maintaining of an accurate account of a canine's training records, a

search warrant based on the canine's alert would still be valid. In this case, the canine's success rate of positive alerts was between 70% and 80% and the Court determined that if the search warrant affidavit states that the canine is trained and certified to detect narcotics, the search warrant will be valid.

Several other canine court cases dealt with the disclosures of training logs when the prosecution seeks to rely on a canine's alert as the evidentiary basis for a search (*United States v. Cortez-Rocha,* 2005). In *United States v. Thomas* (2013), the Court determined that it was wrong for the disclosed training logs to be heavily redacted. The defense argued in this case that since the records were highly redacted that they were not able to determine the reliability of the canine. Doubts were raised as to whether the redacted training logs would have questioned the reliability of the canine, thus defeating the probable cause that was used for the search.

In *United States v. Dicesare* (1985), the Court determined that the conviction of the defendants was correct due to the prosecution supplying the actual training records of the canines used in the searches. In another case, *United States v. Fernandez* (1985), it was affirmed that a narcotic detection canine's alert on an item without any supporting evidence of reliability is not enough to establish probable cause. In *State v. Foster* (2006), the Court determined that a canine with a 66% accuracy rate was still reliable because the canine team was documenting and maintaining training records. In *State v. Farmer* (1951), the Court found the canine alert inadmissible because they did not keep proper records of deployments, even though the canine was said to have a 100% accuracy rate in the field.

Florida v. Royer (1983) was a Supreme Court case that looked at issues with search and seizure and how it pertains to the Fourth Amendment. In this case, Mr. Royer was approached by two undercover officers at the Miami International Airport because they believed he fit the profile of a drug courier. Upon gaining consent to talk with Mr. Royer, the officers quickly noted that his driver's license did not match the name on his ticket and that he was extremely nervous. Officers took Mr. Royer to a private room and asked him for consent to search his luggage. Mr. Royer did not answer but simply handed them a key to his luggage. Upon opening the luggage, the officers discovered a large amount of marijuana. The Supreme Court held that the officers did not have probable cause to move Mr. Royer to the private room, but only had reasonable suspicion. The Court did state that the officers acted properly when approaching Mr. Royer, but that the officers had no concern for their own safety and should have returned Mr. Royer's ticket and identification before asking him to move to the private room. By not doing so, they essentially ended the consensual encounter. For these reasons, the Court ruled that the marijuana was discovered through an illegal search and should not be admitted into evidence. Although a narcotics detection canine was not used in this case, the Court brought the use of a canine into the conversation in their findings by concluding that a better option would have been to use a trained narcotics detection canine to detect the contents of Mr. Royer's suitcase. A negative response to the bag would have allowed Mr. Royer to go on about his business quickly, and a positive response would have given the necessary probable cause for a search and subsequent arrest. With this case, the Supreme Court voiced its opinion on its support and confidence in a well-trained narcotics detection canine for these types of situations.

In *Dillon v. United States* (2010), the Supreme Court reaffirmed its belief that canines are accurate and there is no need to discuss a canine's reliability. In this case, the Court stated that a canine's sniffing technique is well established and is all that is necessary to validate a canine alert for search warrant purposes. *United States v. Knox* (1988) is another early case in which the Court stated that a trained canine's reliability does not need to be further analyzed. The Court held that not only did a positive canine alert allow for the search of the luggage, but it also gave probable cause to arrest the suspect, Knox, immediately. Although these two cases show that the reliability of detection canines has not been questioned in several cases in the past, many other courts have been unwilling to affirm reliability without some type of supporting evidence such as training or certifications (Bird, 1996).

Doe v. Renfrow (1981) is another case that dealt with the use of narcotics detection canines in a school setting. Several issues surfaced with the searches in this case, but one issue raised centered on inadequate handler training with some of the participants. Many of the canine teams used for this search were not law enforcement officers, but rather civilian teams with little training. There were 50 alerts made by the canines that indicated the presence of illegal narcotics, however only 17 of the students were found to be in actual possession of drugs. To be fair, when looking at accuracy rates in real-life situations, it is hard to determine if an alert is false because lingering odors can be present that cannot be detected by human beings. People can have narcotics hidden on them that are not found, drugs could have recently been placed in the alert location but have since been removed, or there may be a lingering odor on an item in the alert location that is still detected by the canine. Regardless, this case is important

because training inadequacy and accuracy rates were both points of contention for the defense.

Case law pertaining to canine alerts has consistently held that as long as the canine in question has been trained and certified, then the accuracy rate can vary widely. However, law enforcement leaders must attempt to do all in their power to make certain that the best narcotic detection canines are being deployed in their communities. Studies on narcotics detection accuracy are vital for that process to be successful, and it is crucial that they are conducted in a proper manner.

Identifying Bias in Scent Detection Canine Testing

According to Johnen et al. (2017), numerous scientific studies have been conducted due to the importance of trained scent detection canines; however, the methods used to collect the data have varied widely and are at risk for potential bias. Johnen et al. performed a comprehensive literature review on scent detection canines and used the data to propose best practice standards for testing procedures of future studies. The best practice suggestions covered topics such as target odor, type of scent detection task and setting up the experiment, samples to be used for testing and training, test design, breeds to be used, and canine trainer and training procedures. After a thorough search in this meta-analysis, 54 studies were left for evaluation to be used for determining best practices when conducting canine detection studies.

Johnen et al. (2017) listed several factors that could influence the outcome of scent detection studies with trained canines. In regard to odor, it has been found that the degradation of the target odor can be severely impacted by temperature, humidity, and the presence of microorganisms (Goth et al., 2003). Many times, narcotics samples may

be used for a long period of time and can lose their odor. This can severely impact a detection canine's ability to locate a substance, especially if it is not used regularly in its training. Elliker et al. (2014) found that canines can memorize the odor of training samples instead of the actual target odor. For example, the training sample can take on the smell of the container in which it is being stored. Although the canine may still detect the target odor, it may be finding the substance based on the associated odor of the storage container. Cross contamination can also be a serious issue. Target odors stored together with negative samples can cause the canine to alert on those odors as well. If different target odors are stored together, then it is impossible to determine for certain that a canine is alerting on each individual sample since they will have the odor of the other sample present on them. Another concern for cross-contamination comes from the canine handlers or trainers leaving their personal odor on the sample during the handling of the item. Furton and Myers (2001) found that detection canines may alert to a substance based on the lingering scent of its handler on the sample.

Johnen et al. (2013) determined that further research is necessary in order to reach conclusive generalizations regarding the best breeds to be used for scent detection. The median and mean number of canines used in previous studies was found to be 4 and 4.6 respectively. It was also discovered that only 31.2% of all studies were conducted in a double-blind manner. Elliker et al. (2014) also suggested that future researchers should undoubtedly employ double-blind methods for any canine detection testing.

Johnen et al. (2017) outlined several suggestions that should be used to ensure that bias is not introduced into the detection testing process. It is crucial that the target odors used are familiar to the test canines and have not been contaminated from improper

storage or handling. Although there are no standard procedures for the collection of these items, researchers must do so in a manner that will not lead to cross-contamination. The same person should place the nontarget and target odors in the testing area. In order to avoid contamination, the nontarget odors should be placed in the area first prior to handling the target odors. It is also required that any samples to be used in testing be sent off to be tested for actual target odor. Researchers should describe in detail the process of hiding the target odors so that it can be reproduced in the future (Johnen et al., 2017). Furton and Myers (2001) also recommended placing nontarget odors in the testing environment so that it can be verified that the canines are not simply attempting to get their reward by falsely alerting when a target odor is not present. All test designs should use the double-blind method or there could be serious flaws with the research. The hiding of the target odors should also be randomized, especially in familiar search areas, so that canines cannot guess target areas based on previous searches (Furton & Myers, 2001). Johnen et al. (2017) also recommended that the handler be out of view from the canine during testing so that the handler's nervousness will not be transferred to the canine. For all studies, it is suggested that the researcher collect information such as breed, age, sex, experience, and overall training of handler and canine at every testing process (Johnen et al., 2017).

This meta-analysis research by Johnen et al. (2017) is very important because it does address several areas of bias concern that could develop if the canine detection testing methods are not set up properly. Numerous suggestions that were supplied by Johnen et al. will be very useful for future canine detection studies. The researchers did an excellent job of collecting the data from a large number of previous studies, and then

converting that into usable data for future studies. However, the study left out several important factors that need to be addressed. As in most canine detection research, variables such as breed, sex, drugs searched, and experience were looked at while the researchers ignored any possible differences related to the canine being trained as single-purpose or dual-purpose detection. Also, some of the suggestions mentioned do not work with narcotics detection canines. Johnen et al. recommended that the canines be allowed to search freely with the handler out of sight due to possible cueing. Most police canine teams perform their narcotics searches on-leash, while others allow the search off-leash with the handler nearby. Forcing handlers to be apart from their canine could potentially confuse the canine and lead to false alerts or misses. Although the Johnen et al. study focused heavily on the handling of the target odors to avoid contamination, there was no focus on the amounts of target odor that should be placed in the testing area. Overall, this study is very beneficial because it supplies future researchers with valuable ideas that can help avoid any major bias issues with their test design and any cross-contamination of odors during odor placement.

Study on New Training Aids

Degreeff, Weakley-Jones, and Furton (2011) conducted research on human-remains detection canines and the importance of having access to appropriate training aids for training purposes. Human-remains detector canines can be used to locate extremely small scent sources, including teeth and scattered remains that had indirect contact with remains materials. Although these detector canines are very good at locating these miniscule amounts of human remains, the canines performance can be greatly affected by the training aids and training environments that are being used by the canine

teams on a regular basis. Part of the problem is that in real scenarios, the canines may be searching for a wide variety of odors, such as whole bodies, body parts, tissue, or blood. Unfortunately, many agencies do not have access to all the various odors due to legal restrictions and potential biohazards. Using training aids that do not aptly represent real odors found in the field can significantly affect the accuracy of the scent detection canines. Detection canines can become inaccurate on real odors if they are consistently trained on a particular training sample that may have lost its odor over time (Degreeff et al., 2011). The canines can become comfortable with samples and locations that are repeatedly used during training sessions. When this happens, the detection canines may not perform up to standards in actual scenarios where the location and odors are different from their normal training scenarios. Canine teams must remain aware of this and train in a proper manner. Degreeff et al. were able to determine a unique approach of creating and maintaining training aids for human remains detection.

The canine trials used for testing by Degreeff et al. (2011) were simple yet effective. For each trial, the researchers placed 10 cement blocks in a row, 5 feet apart, with each block containing a target odor, a blank, or an untreated piece of gauze. The target odors were placed so that detector canines would not be able to make contact with the sample. Researchers collected data such as handler experience level, age of canine, years in the field for the canine, and breed. The alerts, no responses, and false alerts were all collected. Overall, 26 detection canines were used for the study. Eighty-six percent of the canine alerts were correct, while 14% of the alerts were false positives, or false alerts (Degreeff et al. 2011). It was also determined that 41% of the time when a canine did not alert, the nonresponse was correct.

One important discovery from the Degreeff et al. (2011) study was that there were no significant differences found between the responses of expert canines compared to the novice canines. The researchers surmised that this means a canine's responses to odor is possibly related to the type of training and training aids used by canine teams and not based on the amount of time in service and training. It was stated that further research needed to be conducted to help identify components of training methods, training aids and testing protocols on the reliability measured.

Furthermore, the Degreeff et al. (2011) study did determine what it proposed to do by recommending procedures to acquire and store STU-100 training aids for local police departments. One area of concern is that only 26 canines were used for this study. For a normal study that may be enough, but this study looked at training level of both the canine and the handler, suggesting that there is no difference in the results of the two. Although the experience levels are labeled as expert, intermediate, and novice, there was no discussion as to what put them in each category. In order to make determinations between accuracy and experience level, more canines need to be tested with a clear designation of how they are categorized. Even with following those guidelines, there would still be an issue of differences in type and quality of training being conducted by each team at its respective agency. The actual years of experience could prove to be a difficult factor to gauge because of potential differences in amount and quality of maintenance training completed by respective teams. This Degreeff et al. (2011) research is critical because it emphasizes the importance of using quality target samples for training and research testing. It will be important for future canine detection testing that

researchers ensure that the samples being used during testing are of the best quality and have been stored and handled appropriately so that the process is not compromised.

Study on Breeds and Accuracy

Although no known studies have been conducted regarding detection accuracy between single-purpose and dual-purpose canines, a few studies have been conducted with narcotics detection canines that can help with the design of testing procedures. Jezierski et al. (2014) researched the efficacy of drug detection by fully trained police canines and how it varied by breed, type of drug being searched for, training level, and search environment. The researchers clearly defined their research questions and hypotheses, while designing them in a way that was testable. This test was conducted in a controlled training and testing environment and Polish police canines were used for this experiment. Overall, 164 male and female canines were used of various breeds, including Labrador retrievers, German shepherds, terriers, and English cocker spaniels. Using police canines, 1219 experimental searching tests were conducted. Results indicated that the canines correctly indicated narcotics 87.7% of the time and falsely indicated 5.3%. Marijuana was the easiest drug to detect, while heroin was the hardest. German shepherds were the superior breed for accuracy and terriers performed rather poorly. Jezierski et al. (2014) determined that German shepherds were far superior in detection accuracy than Labrador retrievers. Table 1 shows the study results that German shepherds were more accurate, had fewer misses and false alerts, and were able to locate the odor more quickly.

Table 1

Detection Parameters Depending on Canine Breed

Breed	Mean time ±SD to correct indication (sec) (1)	% correct indications (2)	% misses (3)	% false alerts (4)	How many times the canine passed <1 m to hidden material before indication (mean ±*SD*) (5)
German Shepherds	61 ± 74[a]	86.8[aB]	5.0[a]	8.2[aB]	2.8 ± 3.3
English Cocker Spaniels	62 ± 56	82.0[d]	12.0[a]	6.0[D]	2.5 ± 1.9
Labrador Retrievers	66 ± 67	78.8[aC]	8.2	13.0[aC]	2.6 ± 2.2
Terriers	79 ± 90[a]	67.0[dBC]	8.4	24.6[BCD]	3.0 ± 3.0

Jezierski et al. (2014)

Further testing was proposed by Jerzierski et al. (2014) because their sample size was small. However, Wasser et al. (2009) found that selecting canines based on superior play drives and increased focus was more important than the type of breed. According to Jezierski et al., other studies conducted on breed have been faulty in research design.

Hickey et al. (2012) performed a study based on breed, but they gathered their data by interviewing frequent ecstasy users instead of actually testing canines. In this study, the drugs used were actual street narcotics and not synthetic or pharmaceutical grade. The drug samples used were 10 to 15 grams of hashish, marijuana, amphetamine, cocaine, and heroin. The drugs were hidden approximately one hour before the search in rooms and in cars. There were also "new" odors placed in these locations to recreate real world situations. For each test, only one drug sample was used and was placed in an unsealed plastic bag. The tests were conducted one month apart so that there would be no

residual odor left behind. Handlers were not aware of the narcotic locations and their canines searched the areas off leash. All tests conducted were video recorded by the experimenters who were aware of the drug locations.

The canines used in these experiments could indicate with a passive alert (sitting or lying down at point of odor) or an active alert (scratching or barking). If the canine made an alert, then the handler would have to confirm the alert to the experimenter before an affirmation of the positive alert would be given. If the canine correctly alerted, the handler would reward the canine with its toy. If the alert was false, the canine would be told "no" and move on with the search. If the odor was not located within 10 minutes, then it would be considered a "miss". Canines were limited to two searches in one day and, due to limited space, multiple canines were tested in the same room on the same day. Handlers and their canines waited in another building until it was their turn to search.

The research design used by Hickey et al. (2012) did supply good strategies for obtaining a large sample by conducting a high number of controlled tests with a large number of canines. The use of actual street drugs for the testing instead of other synthetic options was also an important testing decision. It is best to use confirmed "pure" street drugs for this type of drug detection testing since many canines may not have ever trained with synthetic drugs. Although this particular study did achieve the answers to the questions the researchers set out to find, there were several concerns with the research design that could be improved for future studies. First, even though the locations of the hidden narcotics were not known to the handlers prior to the search, the researchers confirmed the location to them once they called an alert for their canine. The researchers did have the handlers waiting in another building, but it does not appear that procedures

were put in place for the handlers to not communicate with each other after they completed their turn. Handlers could have easily communicated in person, by phone, or by text and relayed locations of the hidden drugs to those who had not performed their search yet. A knowledge of the location of the hidden drugs by the handlers could significantly increase the accuracy rates.

Another concern is that the canines were tested and then the researchers waited a month before testing them again out of the fear that lingering odors would cause false alerts. This could significantly affect the speed of the data collection and the researchers could have accomplished the same thing much quicker by simply using other testing locations. The researchers in the Hickey et al. (2012) study did an adequate job of exploring their research problem, and although they had some minor flaws, the overall contribution to this area of research is significant. The research design is very detailed and gives future researchers a foundation to begin with when conducting canine testing.

Behavioral Characteristics and Canine Selection

Even though sex and breed of the canine can play a role, behavioral characteristics of canines have proven to be crucial in the selection of canines that will eventually be used in the field. Jamieson et al. (2017) found that there has been an issue with consistency regarding what detection canine behavioral characteristics are desired during the screening process. Lazarowski et al. (2018) investigated behavioral characteristics of canines that were used to perform vapor wake detection. These canines targeted persons who are carrying or wearing explosives. The researchers used 146 detector canine candidates from a vapor wake breeding and training program for this study. All of the canines used were given the same initial training and were evaluated at

3, 6, 10, and 12 months of age. At the completion of the 12-month testing, the canines were labeled as vapor wake candidates, standard explosives detection, or washouts. The washouts were not placed into the field, while the canines in the other two categories were then sold for service. During testing, the canines were evaluated on search related behaviors such as performance, environmental factors, and trainability. During the study, it was found that some differences started to emerge as early as 3 months of age. Vapor Wake Dogs scored much higher on performance characteristics compared to the eventual standard explosive detection canines and the washouts (Lazarowski et al., 2018).

Lazarowski et al. (2018) determined that of the 146 canines used in the study, 63% were eventually used as Vapor Wake Dogs, 17% as explosive detection canines, and 20% were washouts. When looking at the canines that became washouts, 62.5% failed due to environmental factors, while 37.5% failed due to performance related issues. Also, there were no sex differences found in the washout group, but the research did find that 61% of the canines selected for Vapor Wake detection were male.

Lazarowski et al. (2018) realized the concern of behavioral characteristics affecting the future success of detection canines and used the three categories of performance, environmental and general in the assessment of potential Vapor Wake Dogs. Table 2 shows the descriptions and measures that were used during the evaluation of the potential Vapor Wake Dogs. The list gave a detailed explanation of what criteria would be used to score each canine during the research.

Table 2

Descriptions of Measures Assessed During Performance Evaluations

Domain	Measure	Definition
Performance	Retrieve	Dog enthusiastically retrieves any reward every time with full sprint outs and back
	Hunt	Dog constantly uses nose to search and investigate targets using closed-mouth search, not looking for handler guidance. Dog does not become overexcited when target odor is present and does not get discouraged when odor is not easily found
	Focus	Dog is able to focus on rewards/tasks. Dog notices environmental stimuli, but does not respond to distractions (e.g., urine, ambient noises
	Physical Possession	Dog holds reward in mouth, returns holding reward, and looks for engagement with handler
	Independence	Dog is willing to work at a distance from handler and spends a minimum amount of time looking back for assistance
	Work Effort	Dog gives 100% effort on every search/task every time. Dog is eager to find target to interact with handler
	Air Scenting	Dog is constantly using nose to find air currents, while consistently and efficiently searching air. Dog is not looking at specific targets/objects
Environmental	Surfaces	Dog transitions across any and all kinds of surfaces without hesitation
	People	Dog notices people but does not try to interact. Dog may sniff people but does not focus on people. Does not show fear, distraction, or excitement elicited by people
	Vehicles	Dog adapts to clutter and works normally without disruption in searching behavior. The urban clutter should elicit the dog's searching behavior
	Visual Startle	Dog notices new, unusual, or sudden stimuli but quickly resumes working. Dog may react by noticing stimuli but holds ground and recovers quickly and then goes forward to investigate area
	Acoustic Startle	Dog notices loud stimuli but holds ground and recovers quickly and then goes to investigate
	Excitability	Dog is very active, excited to work, but not erratic. Dog may run through odor, but can recover and return to scent cone without giving up on task
General	Trainability	Dog is easily trainable. Dog learns new tasks quickly and easily with few trials and little direction

Note. Scored on a 1–5 scale from least to most desirable performance source (Lazarowski et al., 2018).

This research and other similar studies are beneficial because they show that behavioral characteristics are important in regards to the success and sustainability of canines that enter the detection field. Maejima et al. (2007) found that only 30% of 197 Labrador retrievers entering working canine programs were successful. Wilsson and Sundgren (1997) also found that only 4.9 % of 2107 potential detection canines were successful in their detection endeavors. A major concern is that the traditional methods of procuring and training of detection canines is inadequate for all the specializations that are being demanded by today's detection canine needs.

A critical finding in the Wilsson and Sundgren (1997) study is that behavioral characteristics are important factors in determining which canines are suitable for detection work. They also found that performance characteristics appeared to be more crucial than environmental issues when determining which canines are better suited for Vapor Wake detection. This research agreed with results from later work conducted by Sinn et al. (2010), which found that object focus was a key component of measured success of military working canines.

Lazarowski et al. (2018) stated that one of the limitations of their study was that there was not always a second observer available during the evaluations, but that would have been greatly beneficial. There was a fear that the number of evaluators and their lack of knowledge of the canines could be a limiting factor of collecting accurate data. Further research was suggested that would focus on developing more objective measures of behavioral traits. Lazarowski et al. mentioned that canine MRIs could also be used to help predict canine suitability for detection purposes. One major consideration mentioned

was that a canine's inherited characteristics, maturation, and past experiences could be ruled out as important factors for performance.

The Lazarowski et al. (2018) study is important for the current study because it shows that canines selected for narcotics detection should be selected based on some of the same criteria. Many law enforcement canine training facilities do similar testing of canines prior to beginning initial training. If the canines fail some of the tests, they are considered washouts or repurposed. A concern is that canines that are purchased for dual-purpose tasks would be repurposed to single-purpose narcotics detection due to exhibiting a lower drive. If this is the case, then some canines that have been deployed as single-purpose narcotics detection canines could be less effective in the field. Unlike the study conducted by Lazarowski et al., the current study incorporated both fully trained canines before they have been sold to agencies and canines after they have been working in the field. Lazarowski et al. only looked at canines up to the point of their sale and did not include canines that were already working in the field for law enforcement agencies.

Match to Sample Human Scent Identification

Rigorous training of detection canines is an important indicator of high accuracy when it comes to human scent matching to sample performance. Schoon (1996) developed the task of matching to sample early on and it has continued to be refined over the years. Matching to sample occurs when detection canines are utilized to compare a scent sample that has been collected at a crime scene to an individual that is thought to be the suspect. Romanes (1887) was one of the first researchers to look at this topic and found conclusively that canines can identify and memorize the odor of a specific person with high accuracy. Locard (1934) determined that a person left odor at every location

they visited. Unfortunately, human scent identification has not gained complete support from the forensics community worldwide. In fact, human scent identification remains a highly contested form of legal evidence in courtrooms across the world (Taslitz, 1990).

Marchal et al. (2016) determined that matching-to-sample canines were 90% efficient with matching samples when the complexity of the scents presented during the task were similar to what was presented to them in the lineups. They also found that there were no false alerts in these tasks, which should give law enforcement confidence in using results from match to sample canines as official forensic evidence. Of course, these results can only be trusted if the canine teams conduct adequate and appropriate training.

The study by Marchal et al. (2016) is important because it shows the importance of meticulous planning when setting up research of detection canines. For their study, 13 German shepherds—two female and eleven males—were used over a period of 10.5 years. All of the canines were selected from breeders in Hungary based on their olfactory abilities. The canines were fed and exercised at set times and had specialized living quarters. The age of the canines ranged from 10 months to 3 years old at the beginning of the research. The canines were trained in a temperature-controlled environment and the training area was washed daily to keep residual odor out of the location.

Scent collection was done by a trained technician, wearing nitrile examination gloves and sterile suits when handling the target samples. Subjects were asked to hold a cotton ball in their hand for 10 minutes and the sample was placed in a sterile glass jar. The jars were then labeled and stored in a particular room until they were ready to be used. All of these steps were taken to ensure that the target odors did not become contaminated.

The canines used by Marchal et al. (2016) were initially trained and then moved into continual training that lasted throughout the research study. The number of trials needed to successfully complete stages in initial training significantly increased over each successive step as shown in Figure 1. At the end of the training, the canines entered the judicial case program.

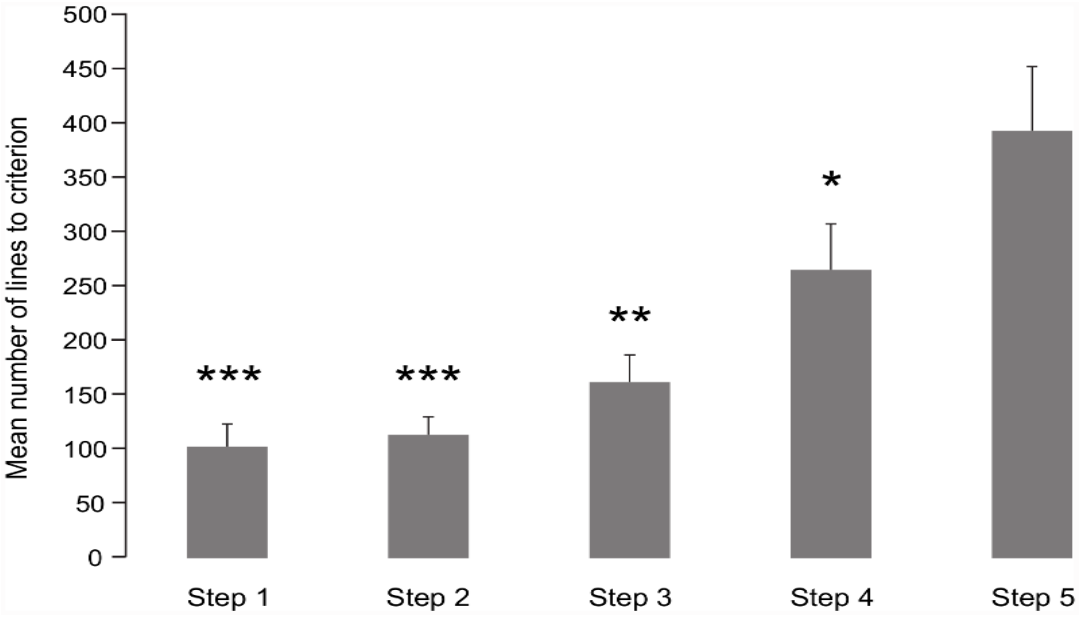

Figure 1. Mean number of trials to reach criterion at each step of initial training. (Marchal et al., 2016)

Individual canines then performed six to eight searches per day and were rewarded by game or food for correct responses. The jars were opened and contained either a cotton ball with the target odor or a clean cotton ball. The testing began with the handler presenting an open jar without the target odor to the canine with the reward sitting next to the jar. The handler encouraged the canine to sniff for 5 seconds before directing the canine to sniff the other jars. The canines progressed to various steps throughout their training, upon successful completion of earlier stages. The scores at the

end of step five confirmed that the detection canines had fully acquired the matching to sample task with no false alerts in the last 100 trials during initial training.

Marchal et al. (2016) is important to the current study because one of the lessons learned was that testing can be set up to reduce handler error as a major factor. Zubedat et al. (2014) also warned of handler error influence. In the final judicial case study of Marchal et al., the canines performed the matching-to-sample task without their handlers, which eliminated any chance of external influence by the handler during searches. This is important information but will be hard to apply in all testing situations. In this scenario, the canines used for the research were given initial training with the fact that handlers would not be with the canines during the trials. This allowed the canines to become comfortable with searching on their own. Narcotics detection canines are all trained differently, so not all canines would perform a search accurately without direction from their handler. For that reason, the majority of canine research has to deal with handler error since handlers are part of the process

Another important finding by Marchal et al. (2016) was that canines were able to better identify two samples of the same kind than two samples of different kinds. This is important to current research because narcotics samples can vary widely, so it is important during testing that pure, certified narcotics are used in the testing process. Narcotics that have aged significantly can lose odor, which may affect the results of the current study.

Overall, the study by Marchal et al. (2016) is helpful because it demonstrates the necessity of proper handling of target odors and steps that can be taken to ensure accurate testing and storage of target samples. One area of concern is the sample size since only

13 canines were used for testing. This study also covered a very long period of time, which could prove to be problematic as age, disease, and other contributing factors could appear during the course of the study. The major importance of this study to the field is that it supports that, with proper training, a canine used for matching to sample tasks is accurate and the results can be relied on as forensic evidence. Even though canines used for this purpose have not been readily accepted by the forensic community, studies such as this will help with validating the practice for law enforcement agencies. Future studies will be needed to further prove accuracy of these canines.

Effect of Handler's Beliefs on Canine Accuracy

An important aspect of police canine studies is determining how the scenarios are set up, specifically who is aware of where the narcotics are hidden. Reid (2009) focused on determining how the canine handler's beliefs affect a detection canine's alert patterns. Reid used 18 drug and explosive detection canines, completing two sets of four brief searches. The entire experiment was completed in a 2-day period. For all searches, there was no target scent present, so any alert by a canine was a false alert. The handler was influenced by being told that a marker was present to indicate a certain area as a scent location. Decoy scents were also placed in areas so that canines could show interest in those locations, along with the visual marker being present to influence handler behavior. The search was conducted in a four-room area of a church that had not been previously used for purposes of police canine training. Experimenters placed the paper markers in the room first and then placed the decoy scents so that no contamination was possible. In addition, in order to make the handlers believe that scents were being placed in the room, the experimenter went into the rooms carrying sealed boxes of narcotics and explosives.

The samples were never taken out of the sealed boxes, which were placed at the door as soon as the experimenter entered the room. When given instructions prior to the search, the handlers were told that two locations with scent would be marked with a red piece of construction paper. The handlers were also required to call the alerts for their canines during the searches.

The Reid (2009) study was a double-blind study where the observers and canine teams did not know where or what was hidden. The experimenter was the only individual aware of the search conditions until after the testing was completed on the second day when all participants were notified of the study conditions and results. Eighty-five percent of the searches resulted with at least one false alert. The study showed that handler belief does influence canine alerts. Reid stated that this influence could be caused by the handler erroneously calling alerts at locations they thought would have the target odor or could be due to canines falsely alerting at locations where they are influenced by their handler's actions to think the odor was present.

Reid (2009) set out to determine if canine handlers' beliefs affect their canine partner's alert patterns, and the study supported this hypothesis. The study was not about determining a canine's search ability; therefore, it was set up properly by not having any target scents present in the search area. The researchers did an excellent job at ensuring that no target odors lingered in the area that would cause alerts by the canines during testing. The scenarios were set up to prevent false alerts that were not related to handler error. Reid found that handlers could cause a canine to alert by pointing, nodding, staring, saying certain words, or stopping at a specific location. Unfortunately, handler cueing can be present from initial training, and it is possible that canines can become conditioned to

respond to additional unintentional cues by the handler (Wasser et al., 2004). Sometimes cueing can be caused by poor training of the canine, but typically the handlers cause the false alert (Hunter, 2002). Although Reid determined the answers to the research questions that were sought, no data were collected regarding single-purpose and dual-purpose detection canines. Anonymous data were collected from the participants to include sex of the canine, spaying or neutering status, breed of canine, age of the canine, handler experience, and canine experience. Reid could have easily included single-purpose and dual-purpose status but failed to do so. Also, because Reid did not focus on canine scent accuracy but handlers' beliefs causing false alerts, the study does not supply the data needed to look at accuracy rates of single-purpose and dual-purpose canines.

Regardless, this study by Reid (2009) is very important because it shows that canine alerts are greatly affected by handler error, so future studies need to take this into account when setting up testing procedures so that data are not unnecessarily affected by handler error. Handler error can be very detrimental to canine accuracy and must be accounted for if possible. Handler error is part of the testing process and will always occur, but researchers must not set up testing in a manner that promotes handler error.

Bed Bug Detection Study

Cooper et al. (2014) looked at the accuracy of canines trained to detect bed bugs. Bed bugs have become a major problem and there are few tools available to detect them in the early stages before a major infestation occurs. In recent years, canines have begun to be trained to help detect low levels of bed bugs, but no data are available to show how accurate the canines were in their alerts. Cooper et al. used 11 canine detection teams in naturally infested apartments. Prior to the testing, the handlers were very confident in the

reliability of their canines (95%). Cooper et al. revealed that the canines found the bed bugs only 44% of the time and had a false alert rate of 15%.

Cooper et al. (2014) conducted four different experimental scenarios. The first experiment was a blind evaluation in preselected apartments. Canines were hired from private firms to conduct a scent inspection of 24 apartments. The firms were not made aware that the canines would be evaluated by a team of researchers. A total of 48 apartments were used for this experiment, 24 with bed bugs and 24 without.

Cooper et al. (2014) conducted the second experiment a month later with four canine firms participating. Two of the teams from the first experiment, the highest rated and lowest rated, were included in that experiment again to examine their consistency. Two new highly regarded firms were selected to participate. Cooper et al.'s third experiment differed from the first two because they examined how the results changed during a large-scale building-wide inspection, which allowed the two canine teams to move from each apartment much quicker, which is a more realistic simulation of a real bed bug search. The fourth experiment was conducted to determine if a higher detection rate could be achieved if the experiment was done in a controlled environment. One of the teams with a low detection rate from the first two experiments was included to see if there was any change under the new conditions. This experiment was conducted in four 2-bedroom apartments where no bed bug activity had ever been reported. Three live bed bug samples and three control samples were hidden in each apartment. The team detected 83% of the live samples and falsely alerted on 25% of the control samples. This same team only found 15% of the live bed bug samples in experiments 1 and 2 and had a false alert rate of 14%.

Overall, this series of studies by Cooper et al. (2014) is important as it shows how a progression of experiments can be done to gain further insight after initial results are obtained. Another important outcome is that the data revealed that there was no significant relationship between detection rates and the team's experience or certification status. Although the detection rates and false alert rates varied greatly among the canine teams used in the research, there was a positive correlation found between detection rate and the false alert rate (Cooper et al., 2014). Table 3 shows false-positive rates are clearly defined, showing that rates varied widely among the teams. Several concerns were mentioned regarding potential accuracy issues based on testing conditions. According to Smith et al. (2003), heat can influence canine detection accuracy because it can cause increased panting in order to cool down the body, which interferes with proper sniffing and leads to inaccurate detection. In the bed bug testing study by Cooper et al., several of the canines exhibited signs of fatigue due to the heat and lack of air conditioning in the testing facilities. It was also found that some of the searches lasted much longer than some of the canine team's normal training practices. Other research has demonstrated that a canine's attention span can greatly diminish in scenarios lasting over 30 minutes (Waggoner et al., 1998). Many of the false alerts in the study by Cooper et al. that occurred during the testing were caused by the handlers. The handlers suspected certain areas of having bed bugs from prior experience, thus cueing the canines to alert.

Table 3

Canine Inspection Results in Experiment I

Team	Group	Apts	Time (min)	Time break (min)	Infested	# detected	# apts with false alerts	Accuracy rate (%)	False alert rate (%)
1	1	14	3.5	5	8	7	1	88	17
2	1	10	5.4	3	4	3	3	73	50
3	1	24	2.7	24	12	6	2	50	17
4	1	24	4.0	0	12	6	0	50	0
5	1	24	2.5	0	10	5	4	50	29
6	2	23	2.7	0	10	3	2	30	15
7	2	23	6.0	41	12	3	2	25	18
8	2	24	1.2	7	10	1	1	10	7

Note. The number of infestations is based upon a combination of interceptor trap catch and visual inspection (Cooper et al., 2014).

Ultimately, Cooper et al. (2014) raised more questions regarding the accuracy of bed bug detection canines, but there were several important lessons learned. First, researchers need to make sure that the testing environment is set up so that detection canines are not hampered by issues like excessive heat, which can drastically affect their ability to search for target odors. Researchers generally focus on other causes of potential bias, but weather and testing facility conditions can be crucial in canine testing. This concept applies to any type of detection canine, including narcotics detection canines. Second, it is best to work with testing scenarios that can be verified, which eliminates natural environments in some cases. Third, it was determined that better training needs to be developed as well as better methods for maintaining the target samples. Again, although this research did not directly relate to single-purpose and dual-purpose canines, the methods and lessons learned from Cooper et al. could help prevent bias during data collection of future studies.

Cadaver Canine Accuracy Study

Cadaver canines have been vital tools for crime scene investigations for many years (Oesterhelweg et al., 2008). Cadaver canines can help locate both deceased and live individuals. Most research involving cadaver canines, which is somewhat limited, involves the detection of artificial scents or contaminated items that are dated.

Oesterhelweg et al. (2008) used the bodies of a 60-year-old man and a 63-year-old woman who had died within 2 hours of the start of the trial. Brand new carpet squares measuring 20 by 20 centimeters were purchased and placed in airtight containers. The bodies were each placed on top of a new table and wrapped completely in a cotton blanket. Thirty-two carpet squares were placed underneath the bodies. Twenty-four of the

carpet squares were contaminated for 10 minutes and eight carpet squares were contaminated for 2 minutes. Six glass jars containing a single carpet square were placed in a line for the cadaver canines to search. Every sixth search contained no contaminated carpet squares. Neither the canine nor the handler knew where the suspected contaminated carpet squares were located during the experiment. After the initial experiment, the contaminated carpet squares were placed on an open air-drying rack and were used 35 days later and 65 days later to compare the accuracy of the canines. Overall, 354 searches were performed by the three canine teams. Figure 2 summarizes the results from the research pertaining to false negatives, false positives, and correct alerts from all three canines. The canines located the squares that were contaminated for 10 minutes 98% of the time, whereas the rate for the samples contaminated for just 2 minutes was 86%. Three cadaver canines from the State Police of Hamburg were used for this study. Oesterhelweg et al. determined that the searches conducted of the contaminated carpet squares at later dates had no false alerts.

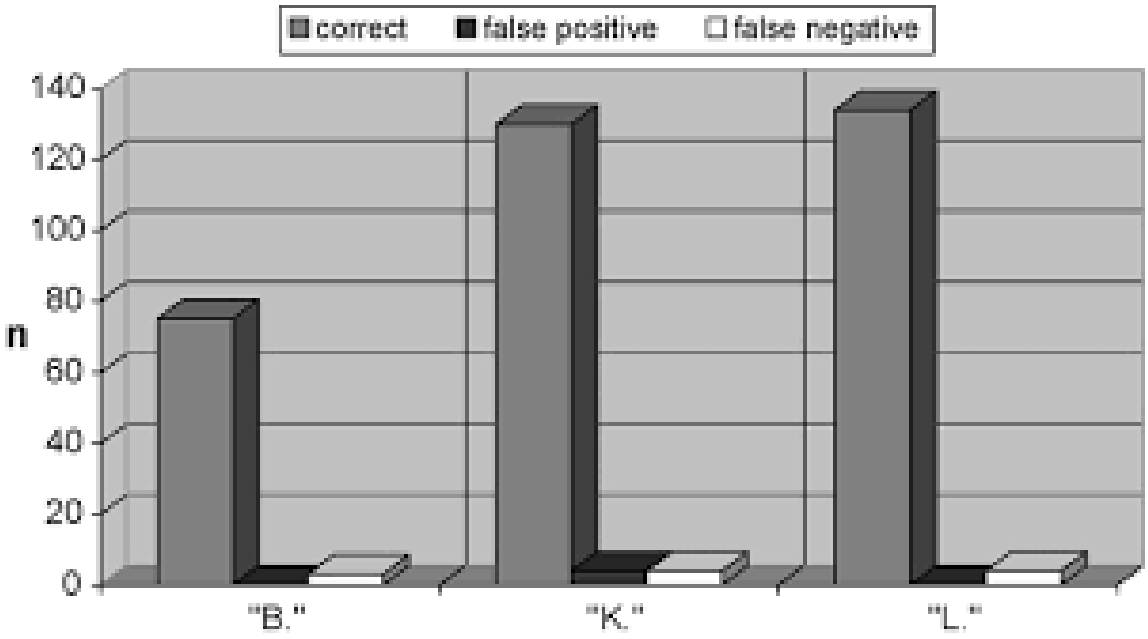

Figure 2. Results of cadaver dogs of Hamburg State Police. (Oesterhelweg et al., 2008)

Oesterhelweg et al. (2008) was important in that it used real, fresh odors instead of artificial scents. The study was also valuable because it showed the positive effects of an aged odor. The researchers suggested using two cadaver canines on a crime scene so that a comparison of the two canines' signaling behaviors could be evaluated, which could also help in the presentation of findings in a court if two cadaver canines alerted on the same location independently. Another important finding from this study is that only a very few searches by the trained canines resulted in a false alert, thus showing their importance for usage in homicide investigations. The findings confirm Schoon's (1994, 1998, 2005) determination that cadaver canines are reliable enough to be a forensic tool. One question that was not addressed that still needs to be answered is how long an individual needs to be deceased for their scent to be detected by a trained cadaver canine.

Although Oesterhelweg et al. (2008) were able to answer the questions they set out to investigate, several aspects of their research design pertaining to the testing procedures could have been improved upon. Three cadaver canines is not a large enough sample to draw any trustworthy conclusions, and all the canines came from the Hamburg State Police. The Hamburg State Police canine unit more than likely has its own training requirements, which may be more or less than other agencies. Training practices can vary widely between departments, so it is important to get a mixture of participants from different locations. The study could have been more useful if it had been conducted on a larger scale. However, some of the methods used in the Oesterhelweg et al. study could be used in a larger study addressing time frames for the early detection of cadaver scents.

Study of Canine Detection of Prostate Cancer

Canines can serve a variety of purposes, not always law enforcement related. Canines have recently been used in the detection of cancer in humans. Canines first began to be used for cancer detection after an owner's canine alerted to a melanoma on his leg (Williams & Pembroke, 1989). Cornu et al. (2010) used a single Belgian malinois to conduct sniffs of urine samples for early diagnosis of prostate cancer. The canine underwent a training period of 24 months prior to the study. Urine for the study was obtained from a urologist who had 66 patients with elevated prostate specific antigen or an abnormal digital rectal examination. Thirty-three patients had been diagnosed with cancer and 33 controls had negative biopsies. The test was set up with six samples, one of which was a cancer sample and the other five were random. The canine correctly identified 30 of the 33 cancer samples. Three of the samples were falsely identified as

cancer by the canine, but one of those patients was biopsied again and was found to have prostate cancer.

The Cornu et al. (2010) study shows the importance of canine accuracy as it can lead to life saving interventions if detected at an early stage. As with many other canine detection testing studies, this research was conducted in a double-blind scenario. The samples were anonymized so that the researchers conducting the test would not be able to determine the cancer samples from the control samples. The researchers did note several limitations from their study. The data collected were based on a single detection canine. Obviously, with using one canine the data could be very inaccurate as most canines have different training backgrounds and abilities. Using multiple canines would provide more data. The researchers did not explore potential biases of odor detection, including associated diseases and food and drink consumption. Although that study Cornu et al. did have some design issues, the study does open the door to future studies regarding detection canines sniffing urine for the presence of cancer.

Detection Canines and Effects of Exhaustion

Although detection canines have been used extensively and proven to be very beneficial at times, few studies have been conducted to examine various environmental and physiological factors that can impact a canine's detection abilities. Gazit and Terkel (2003) tested explosive detection canines and the effects that strenuous physical activity prior to searching has on scent detection accuracy. Canines pant in order to cool their body since they do not possess sweat glands. The issue is that canines cannot sniff and pant at the same time, so panting can severely decrease their ability to sniff for odors when they are overheated. Gazit and Terkel tested canines while relaxed and after being

heavily exercised on a treadmill. The results confirmed that increased panting resulted in a significant decrease in the detection of the explosives and also found that numbers were even lower for searches that lasted longer. The results showed a large difference in average breathing rate, body temperature, and pulse before and after a 20-minute exercise session on a treadmill (Table 4).

Table 4

Physiological Parameters Measured Before and After Physical Activity

	Before activity	After activity	*p* value
Breathing (per 1 min)	212.94 ± 6.68	337.65 ± 9.95	<0.01
Body temperature (C^{o})	38.11 ± 0.02	39.62 ± 0.11	<0.01
Pulse (per 1 min)	103.45 ± 1.6	130.74 ± 3.56	<0.01

Gazit and Terkel (2003)

The major result of Gazit and Terkel (2003) was that training canines under these extreme physical conditions led to improved detection capabilities once they become accustomed to it. Steen and Wilson (1990) also found that under normal circumstances canines were 90–100% accurate, but were only 68% accurate after brief exercise.

This research by Gazit and Terkel (2003) is important because it shows how a canine's accuracy and ability to sniff for a target odor can be greatly affected by physical condition at the time of the search. The study was somewhat limited because only six canines were used in the research. Another concern is that target odors were moved during the searches and there is no mention that a separate room was used for subsequent testing. If the samples were moved within the same room, there is a possibility of lingering odors in those areas. Gazit and Terkel confirmed that testing needs to be

conducted when canines are not physically exhausted so researchers must ensure that other activities are not conducted prior to the testing that will cause the canines to be fatigued. This research by Gazit and Terkel has shown that canine fatigue can greatly influence the accuracy of canines in testing and real detection scenarios.

Summary

Law enforcement has a critical role in the social contract. Agencies must make sure they operate in a manner that does not improperly infringe upon a citizen's constitutional rights. The use of detection canines has the potential of doing just that, so it is imperative that steps be taken to determine if certain canines are more accurate than others. Canine accuracy has the potential to come under attack and if a difference in accuracy detection between single-purpose and dual-purpose canines is determined, then steps must be taken to remedy that situation. Without conducting research on this topic, there will be no way of knowing if there is a problem that needs to be addressed with accuracy differences between single-purpose and dual-purpose narcotics detection canines. Detection canine trainers and law enforcement administrators have the responsibility to make sure that the canines being released to patrol the streets are accurate and the best option available.

The case laws reported in the literature review are important because they show how inaccuracy of detection canine alerts is a major defense in criminal cases. Canine alerts are many times used to justify search and seizure of an individual's property, so it is important that they be accurate, as inaccurate searches may lead to the incorrect confiscation of the property. Case law is constantly being made, so it is important to improve narcotics detection by canines. Although previous case law has not continually

questioned canine accuracy, there have been rulings that required some type of training or certification evidence (*Florida v. Harris*, 2013). Proper research should be conducted so that future case law that may limit the usage of narcotics detection canines due to inaccuracy can be avoided

The other research studies discussed in this chapter are important because they show the reasoning and data collection methods used in detection canines and the accuracy of canine alerts. A review of the existing literature has provided proper procedures to follow, in canine detection testing, so that any potential causes of bias can be avoided in the process. Issues such as contamination of odors, whether to use a single-blind or double-blind method, number of canines to use for testing, and effects of fatigue of canines during testing are all areas of concern addressed in the previous literature that was reviewed. The literature provides a good basis for how future studies should be conducted and what further research needs to be done. Many of the suggestions found in the extensive literature review will not be beneficial to this current study. However, the literature review did assist the researcher in identifying other potential issues that may arise in the canine detection testing and data collection process.

Although existing research is not an exact match to the current study, the information obtained from the studies reviewed could help guide the data collection methods for future research. Studies on detection canine accuracy involving bed bug detection (Cooper et al., 2014), cadaver detection (Oesterhelweg et al., 2008), and prostate cancer detection (Williams & Pembroke, 1989) are also relevant because they helped shape the methodology for the current study. Important issues regarding target sample collection and storage were addressed (Degreeff et al., 2011; Johnen et al., 2017).

The improper handling and placement of samples for testing purposes is one of the most important issues discovered reviewing previous research. For this reason, future detection canine research must ensure that samples are handled in an appropriate manner for credible, trustworthy, and accurate research results

Another important discovery from the review of literature is that training plays a major role in the accuracy of canine detection. Proper training of canines from various fields is an indicator of successful detection rates. Many of the studies (e.g. Marchal et al., 2016) reviewed included initial training of the canines, which gave the researchers assurance that the canines being tested were given proper foundational training. For the current study, the detection accuracy of canines already in the field and the detection rates of fully trained canines at training facilities that have not yet been purchased by an agency were analyzed, regardless of the quality of their initial or continued training. This research design element was chosen to determine if there were major issues that needed to be addressed with narcotics detection canines due to inaccuracy.

The major gap in the previous research reviewed in this study was the potential accuracy differences between single-purpose and dual-purpose narcotics detection canines. This could be a very important distinction that would lead to future studies and significant changes in the training and usage of both single-purpose and dual-purpose canines for narcotics detection in law enforcement agencies across the world. The studies in the literature review are very beneficial as several of them help lay out procedures that can be used for larger studies and longer lasting research. Many of the ideas used by previous researchers can be implemented to expand this current study in the future if needed. This study will hopefully lead to improved interest in the field of law

enforcement detection canines and will allow for future testing in various areas that will help improve the field. The ultimate goal of this study is to help determine any deficiencies in detection canines and assist with implementing new strategies that will help eliminate any potential issues in narcotics canine detection.

Chapter III

Methodology

Case Study

Police canines have undoubtedly helped agencies generate funding through the assets seized from drug investigations and arrests (Asset Forfeiture Program, 2017, p. 15). It is important for an agency to properly utilize the resources that it has available to it. However, if a particular resource is inaccurate, such as a narcotics detection canine, then steps must be taken to resolve that issue. Because this issue has not been researched extensively, this study aimed to determine if there were any differences in detection accuracy between a single-purpose and dual-purpose narcotics detection canine. Ultimately, this research could help police departments determine if they should purchase a single-purpose narcotics detection canine or a dual-purpose narcotics detection canine.

From a public administration perspective, if there is no accuracy difference between the two in regard to narcotics detection, then an agency would get more for their money by choosing a dual-purpose narcotics canine. However, if there are accuracy differences between the two, then law enforcement agencies need to evaluate what steps need to be taken to ensure that the most accurate police canines are being deployed on the streets. If there are meaningful differences, then a shift to single-purpose narcotics detection canines may need to be made. Other options include increasing training requirements for dual-purpose canines so that more time can be spent on narcotics

training. Currently, the industry standard is that police canines train a minimum of four hours a week, regardless if the canine is used in a single-purpose or dual-purpose capacity. Search and seizure laws continue to tighten so it is critical that law enforcement agencies do their part in protecting the rights of those that they serve in their daily operations. This study will help agencies make the important decision of which type of police canine is best for their department and community

Handler/Canine Teams

The current study was conducted by testing single-purpose and dual-purpose narcotics detection canines from several states. Canines were tested at several testing sites until 40 individual canines, 20 single-purpose and 20 dual-purpose, had been observed. The researcher tested canines at local police departments and training facilities in Arkansas, Indiana, Louisiana, and Oklahoma. Contact had already been made with training facilities in these states and they had agreed to participate in the study. Canines that were tested had completed their initial training and were either already deployed out in the field to work on the streets in a law enforcement capacity or were fully trained at a training facility but had not yet been purchased by an agency. Canines that had not yet completed their initial training were not used for this experiment. The training facilities were used as a site for testing since many agencies allow their canine teams to return for weekly or monthly training, which is necessary to maintain proficiency. Training days for local law enforcement canine teams at these facilities are great opportunities for data to be collected on a larger sample of canines. Using canine teams from multiple regions helped ensure that a wide range of canines with differing training backgrounds and abilities were used, so that a proper sample was tested

Demographic details of teams were collected to ensure that the handler and canine team will remain anonymous once the data are released. Information collected for each team included the state they were located in, if they belonged to an agency or a training center, single-purpose or dual-purpose status, breed of canine, sex of canine, age of canine, and years of detection experience for both handler and canine. Some of this information was collected in case further studies are conducted that could use the data. All canine teams used for this study that were already in the field were currently certified by a national canine certifying agency or by the state within which they operated. Some states have adopted a state certification that must be passed annually, while other states allow any national certification to show that a canine is accurate. Both passive alert canines and aggressive alert canines were allowed for this study. Passive alert canines generally sit at the location where they believe the target odor is present, whereas aggressive alert canines scratch at the same location.

Materials and Methods

The design of the testing procedures is critical for the successful collection of accurate data when it comes to canine testing. Many of the testing methods used by Jezierski et al. (2014) were utilized in this study of single-purpose and dual-purpose narcotics detection canines. However, some of the procedures from that study were slightly modified in the hope of obtaining more accurate results.

The types of testing sites being used varied, but steps were taken to safeguard the testing from any scenarios that would threaten the integrity of the data. A total of eight testing sites were used in this multi-state study, with two each in Arkansas, Oklahoma, Indiana, and Louisiana. The testing was conducted at training facilities that had not been

used for narcotics detection training within the last seven days. This information was verified with the canine trainer at each location. These safeguards should have prevented issues with false alerts related to residual odors in the testing area. The testing areas also contained distracting odors, as is customary for most narcotics detection training scenarios. The researcher selected rooms that were approximately 2000 square feet or larger so that the four target odors would not overlap in the area. Rooms for testing were selected that had storage items such as lockers, desks, and chairs so that the target odors could be hidden where the canines would not come into direct contact with them during testing. It was important that the testing be set up this way so that no canines could possibly ingest the drug samples. The researcher was present to set up the testing facility, give the instructions to the canine teams, observe the canine teams perform their searches, and collect the data.

The drug samples were actual street drugs that were confirmed as such through drug sample testing. Some of these drug samples were tested by their respective state crime labs, while other samples were supplied to the testing facilities from the Drug Enforcement Agency (DEA), which ensured that all narcotics used in the testing had been verified as containing the actual target odor. Marijuana, cocaine, methamphetamine, and heroin were hidden for the testing. There was one of each drug type hidden in the room, for a total of four hides in each search. The researcher labeled the marijuana as Odor 1, cocaine as Odor 2, methamphetamine as Odor 3, and heroin as Odor 4 for all testing for ease of data collection throughout the process.

When setting up the testing scenario, the researcher was the only individual who handled the decoy scents and the target odors. Handlers were not allowed to be in a

position to view the researcher placing the target odors in the search area. The researcher also placed the decoy scents in the room first prior to touching any target odors. The researcher ensured that there was no cross-contamination of target odors when placing the items in the area by wearing gloves when touching the items and not placing the different target odors in the same location. The drug samples were in a plastic bag that remained opened during the search. The drug amounts used in this study were between 10 grams and 20 grams. After the drugs were placed in hidden locations, the odor was allowed to sit for at least 15 minutes prior to the beginning of searches so that the odor could build. Each canine and handler team was only allowed one opportunity to conduct a search in the testing area. Allowing canines to search twice could affect the results since they may remember their previous alert locations and alert based on memory alone.

This quantitative study was set up in a single-blind fashion. The researcher was the only individual who was aware of the locations of the hidden drugs. In some situations, there was a trainer on site, but they were not involved with the testing process. Previous studies have shown that using double-blind testing is important (Johnen et al., 2017) so that participants are not cued by another individual's knowledge of the hidden drug locations. However, for this study, the researcher needed to be aware of the location of the hidden drugs because many times canines do not alert at the exact location due to wind or air current pushing the odor slightly from the odor source. The researcher needed to know the location of the hides due to the responsibility of placing the target and nontarget odors in the testing area. Allowing someone else to place the target odors in the room could have risked my ability to keep the locations of the hidden target odors from the canine handler before they were tested.

The researcher did not interact with the handlers during the testing other than giving them instructions prior to the beginning of the testing and verifying that they understood the testing process. The participants were given an informed consent form prior to participating in the research. Written consent was gained from agencies involved and from the training facilities prior to testing. Each organization supplied a signed letter of cooperation that will be maintained.

Because the researcher was responsible for placing the target odors and nontarget odors in the testing area, there were no issues with improper handling of the substances and no concerns about the locations of the hidden drugs being released to participants. The handlers remained in another location where they were unable to observe any testing area activity prior to the testing. Handlers were given instructions to call out the alerts as they occurred during the search so the researcher could document the results. Instructions were given to each canine team and each team was given the opportunity to ask any questions for clarification purposes. Once the handler acknowledged that they understood the instructions, the researcher told them to begin the search when ready. The handlers were not given confirmation when they called out each alert. They continued with their search and notified the researcher of any other alerts until they felt the search was complete. The handler was instructed to call out each alert as they believed the canine was indicating the presence of a target odor or it would not be counted. In order to make sure information on possible target odor locations was not shared, upon finishing their search, handlers were separated from the other handlers until all participants had completed their testing. Once all handlers had completed their searches, all participants

were advised of the locations where target odors were placed and the weights so that they could properly document their search on a training log.

The accuracy of both single-purpose and dual-purpose narcotics detection canine teams was measured by detection rate and total number of false alerts. Both factors are equally critical when determining overall accuracy of detection canines. The detection rate for this study was defined as the total number of target odors hidden (4) divided by the total number of target odors found by the canine. The false alert total is the number of false alerts made by each individual canine during the respective searches. The research question and hypotheses were analyzed using a nonparametric Mann Whitney U median test.

Hypotheses

Two hypotheses research questions were formulated to address the purpose of the study. Testing was conducted to determine if there were any significant differences in accuracy between single-purpose and dual-purpose narcotics detection canines. Listed below are the hypotheses that were addressed within the current research study.

Hypothesis 1: Single-purpose canines and dual-purpose canines have no significant differences of narcotics detection accuracy.

Null hypothesis: Single-purpose canines and dual-purpose canines do have significant differences of narcotics detection accuracy.

Hypothesis 2: Single-purpose canines and dual-purpose canines have no significant differences with the number of "false alerts" in narcotics searches.

Null hypothesis: Single-purpose canines and dual-purpose canines do have significant differences with the number of "false alerts" in narcotics searches.

Study Limitations

The limitations in this study are as follows. First, it has been proven that handlers can affect accuracy by cueing their canine partners to alert when there are no target odors hidden (Reid, 2009). With canine handlers being present during the searches, there is a real possibility that the canine was influenced by the handler's actions. However, handler's actions can influence alert patterns in real scenarios as well. Handler cueing was ignored for this study and the focus was entirely based upon the overall accuracy of the single-purpose and dual-purpose narcotics detection canine teams. The handler and canine were considered to be a team because the alert relies on the canine's ability to locate the odor and the handler's duty to properly read the canine's behavior. Unfortunately, handler error will always be a part of detection accuracy rates.

Another limitation of this study is that although data were collected on the number of years of service that the handler and canine had completed, there was no real way to measure the quality of training of the individual canine teams. Unfortunately, due to lack of funding, many canine teams never receive any formal training once they complete their initial training and certification. In many agencies, the handler may be the only canine handler for the entire department and lack any agency supervisors with canine experience. With no true guidance, they are left on their own to ensure adequate time is devoted to the suggested four hour per week maintenance training. There is a real possibility that a lack of weekly maintenance training by the teams could diminish their narcotics detection capabilities. However, the current study was conducted to determine the actual accuracy of narcotics detection canines and the difference in training levels of the canines was a known circumstance.

Dual-purpose narcotics detection canine teams may focus more on other areas of training instead of narcotics detection training. Handlers can be very detrimental to the accuracy of canines if they do not spend the proper amount of time training with them. Even if a handler does properly maintain training logs, there is no guarantee that the training was conducted properly. The amount of time spent in training would be very beneficial to examine because it has the potential to have a tremendous effect on accuracy of detection canines. However, the data would be hard to collect accurately because handlers might not be willing to give an honest answer for that particular question out of embarrassment or fear of punishment from their agency. Although the study set out to determine any accuracy differences between single-purpose and dual-purpose narcotics detection canines, it is impossible to determine in this study if any differences were due to training discrepancies among the canine teams.

Another possible limitation of this study revolved around the possibility of having a limited sample. At first glance, 40 canines may not seem like a large sample, but the researcher attempted to get a representative sample from a wider region. Canines from Arkansas, Oklahoma, Louisiana, and Indiana were tested for this research in an attempt to improve validity. A study conducted of only canines from a particular area could be problematic because many of the canines could have been purchased from the same canine training facility. The quality of canines can greatly vary from one training facility to the next, so it is important to get a sample of canines from different areas. This is also important because training practices can also vary significantly between regions. Taking a sample of canines from numerous states should help ensure that a proper sample of single and dual-purpose narcotics detection canines are used.

Although the sample of 40 canines was sufficient for this study, a larger sample would have allowed for more data to examine and analyze other variables. Unfortunately, budgetary constraints did not allow for a larger scale study to be conducted. The research methodology and testing protocol of this study allows for easy replication to conduct a larger study or to look at other variables and their effects.

Although participation in the research was originally a concern, ultimately that concern did not occur. Most agencies that were contacted agreed to participate; however, several were not used due to the COVID 19 pandemic and agency restrictions placed on outside attendance for canine training events. The data collection process was conducted during the time period of March to May, 2020.

Another potential limitation of the sample size could appear due to agencies and handlers refusing to participate for legal reasons. Some agencies and handlers could fear that participation in the testing could create problems with court cases if their canines do not perform exceptionally well. With the constant attack on narcotics canines and accuracy rates, this is a legitimate concern for canine teams. However, the researcher set up this study to prevent the identification of participants. Participants were notified of the means of protecting their anonymity so that the canine handlers would feel comfortable participating. The researcher made sure to advise the potential participants that only the testing location would be mentioned, and their names, agencies, and personal information would not be collected or distributed. Unfortunately, there was the possibility that handlers would not want to participate out of fear of failure. Handlers are tested annually for their certifications, and this testing is often a cause of stress. Much of the maintenance training that canine teams perform involves the handler knowing where the narcotics are

hidden prior to beginning the search. With the testing scenario for the current study, there was also the possibility that handlers would be unwilling to participate since it is something they are not required to perform in the line of agency or job responsibilities. In this process, it was crucial for the researcher to properly explain the purpose of the testing and the potential importance it holds for the field of narcotics detection canines so that training facilities were willing to assist with locating canine teams that would make themselves available for this important research.

Chapter IV

Results

Descriptive Statistics

Table 5 provides the frequencies for the different variables in the study. An equal percentage (50%) of canines that were trained for single purpose and dual purpose were tested. Approximately 57.5% of the canines were located at a training facility and not yet sold to an agency. Of the 40 canines that were tested, 14 of the canines tested were from Arkansas, 11 from Indiana, 10 from Louisiana, and five from Oklahoma. The majority (62.5%) of canines were Belgian malinois.

Half of the canines were under 4 years old, and one-eighth were over 5. Over three-fourths were male, and approximately 60% of the canines had been in service for less than 1 year.

Approximately 70% of handlers had been working with canines for less than 6 years. Table 5 presents the distribution of data for canine age and years of service and the years of experience of the canine handler. The average age of the canines in the study was about 4 years old, with the age distribution having large deviation (SD = 1.75). The age-of-canine data skewed significantly to the right (skewness ≈ 1.5).

Table 5

Frequency Distribution of Canine-Related Variables

Variable	Categories	Frequency	Percent	Cumulative Percentage
Canine Purpose	Single purpose	20	50.0	50.0
	Dual purpose	20	50.0	100.0
	Total	40	100.0	
Agency or Training Facility	Agency	17	42.5	42.5
	Training facility	23	57.5	100.0
	Total	40	100.0	
State Surveyed	Arkansas	14	35.0	35.0
	Louisiana	10	25.0	60.0
	Oklahoma	5	12.5	72.5
	Indiana	11	27.5	100.0
	Total	40	100.0	
Canine Breed	Malinois	25	62.5	62.5
	German shepherd	9	22.5	85.0
	Pitbull	3	7.5	92.5
	Labrador	2	5.0	97.5
	Terrier	1	2.5	100.0
	Total	40	100.0	
Canine Age	2	6	15.0	15.0
	3	14	35.0	50.0
	4	8	20.0	70.0
	5	7	17.5	87.5
	6	1	2.5	90.0
	7	2	5.0	95.0
	8	1	2.5	97.5
	10	1	2.5	100.0
	Total	40	100.0	
Canine Sex	Male	31	7.5	77.5
	Female	9	22.5	100.0
	Total	40	100.0	
Years in Service for Canine	<1	24	60.0	60.0
	1	3	7.5	67.5
	2	5	12.5	80.0

	3	3	7.5	87.5
	4	1	2.5	90.0
	5	3	7.5	97.5
	8	1	2.5	100.0
	Total	40	100.0	
Years of Experience as Handler	1	4	10.0	10.0
	2	8	20.0	30.0
	3	5	12.5	42.5
	4	4	10.0	52.5
	5	7	17.5	70.0
	6	3	7.5	77.5
	8	5	12.5	90.0
	10	2	5.0	95.0
	11	1	2.5	97.5
	15	1	2.5	100.0
	Total	40	100.0	

From Table 6, the average years of service of the canines was 1.2 years with a standard deviation of 1.9 years. The distribution of years of canine service was positively skewed (skewness ≈ 1.8). The mean number of years for the handler's experience was 4.75 with standard deviation of about 3.2. The distribution of handler experience also had an extreme skewness to the right (about 1.2).

Table 6

Descriptive Statistics: Canine Age, Years in Service, Experience of Handler

Statistic	Age	Canine Years in Service	Handler Years of Experience
N	40	40	40
Mean	3.98	1.23	4.75
Median	3.50	.00	4.00
Std. deviation	1.747	1.928	3.168
Variance	3.051	3.717	10.038
Skewness	1.499	1.765	1.173
Kurtosis	2.784	2.947	1.487
Range	8	8	14
Minimum	2	0	1
Maximum	10	8	15

Table 7 presents the accuracy of the narcotics detection by canines. Of the 40 canines, 37 detected 100% of the time, three had a 75% detection rate, and only four had false alerts. The canines detected at least 95% of the different drugs. Marijuana was detected every time, cocaine and methamphetamine missed only once each, and heroin was not detected twice.

Table 7

Frequency Distribution for Variables Related to Overall Rate of Detection

Variable	Categories	Frequency	%	Cumulative percentage
Narcotics detection accuracy				
	100%	37	92.5	92.5
	75%	3	7.5	100.0
	Total	40	100.0	
Number of false alerts in narcotics searches				
	0	36	90.0	90.0
	1	4	10.0	100.0
	Total	40	100.0	
Detect marijuana				
	YES	40	100.0	100.0
Detect cocaine				
	NO	1	2.5	2.5
	YES	39	97.5	100.0
	Total	40	100.0	
Detect methamphetamine				
	NO	1	2.5	2.5
	YES	39	97.5	100.0
	Total	40	100.0	
Detect heroin				
	NO	2	5.0	5.0
	YES	38	95.0	100.0
Total		40	100	100.0

One of the three canines that detected less than 100% of narcotics was a single purpose 5-year old, male pitbull from an agency. The canine had been in service for 3

years with the handler having 3 years of experience. The other two canines were both Belgian malinois breeds, both 3 years old, with one male and one female. The single-purpose female malinois had been in service less than 1 year with a handler with 1 year of experience. The male malinois was a dual-purpose canine at an agency and had been in service for 1 year and the handler had 1 year of experience.

Four canines had false alerts—two pitbulls, one Belgian malinois, and one German shepherd. The Belgian malinois was a dual-purpose, 3-year old male from an agency with 1 year of experience and whose handler had the same experience. The German shepherd was a dual-purpose, 4-year old male from an agency with 2 years of experience whose handler had the same experience level. Both pitbulls, one male and one female, were 5 years old. The male pitbull was a single-purpose canine from an agency, with 3 years in service and a handler with the same experience. The female pitbull was a single-purpose canine from a training facility, in service for 2 years, whose handler had 2 years of experience.

Testing of the Research Questions and Hypotheses

The data analysis results for the first research question and hypothesis tested are reported in Tables 8 through 10 and Figure 3. The research question and hypothesis were analyzed using a nonparametric Mann Whitney U median test, since the sample size was small, and the dependent variable was not normally distributed.

RQ 1. Is there a significant difference in narcotics detection accuracy between single-purpose and dual-purpose canines?

$H_0$1: Single-purpose canines and dual-purpose canines do not have a significant difference in narcotics detection accuracy.

H_a1: Single-purpose canines and dual-purpose canines have a significant difference in narcotics detection accuracy.

The null hypothesis was accepted [U(40) = 220.0, p = 0.598]. There was no statistically significant difference in narcotics detection accuracy between single-purpose (mean rank = 19.5, n = 20) and dual-purpose canines (mean rank = 21.5, n = 20).

Table 8

Independent-Samples Median Test: Overall Rate of Detection Accuracy

Hypothesis Test Summary

Null hypothesis	Test	p	Decision
The medians of overall rate of narcotics detection accuracy are the same across categories of canine purpose.	Independent-samples median test	.598[a]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .050.

a. Yates's Continuity Corrected Asymptotic Sig.

Table 9

Independent-Samples Median Test Summary

Statistic		Value
Total N		40
Median		1
Test statistic		1[a,b]
Degree of freedom		1
Asymptotic sig.(2-sided test)		.292
Yates's continuity correction	Chi-square	.278
	Degree of freedom	1
	Asymptotic sig.(2-sided test)	.598

Note. a. More than 20% of the cells have expected values less than 45. b. Multiple comparisons were not performed because the overall test did not show significant differences across samples.

Table 10

Independent-Samples Mann-Whitney U Test Summary

Statistic	Value
Total *N*	40
Mann-Whitney U	220
Wilcoxon W	430
Test Statistic	220
Standard Error	19.215
Standardized Test Statistic	1.041
Asymptotic Sig. (2-sided test)	.298
Exact Sig. (2-sided test)	.602

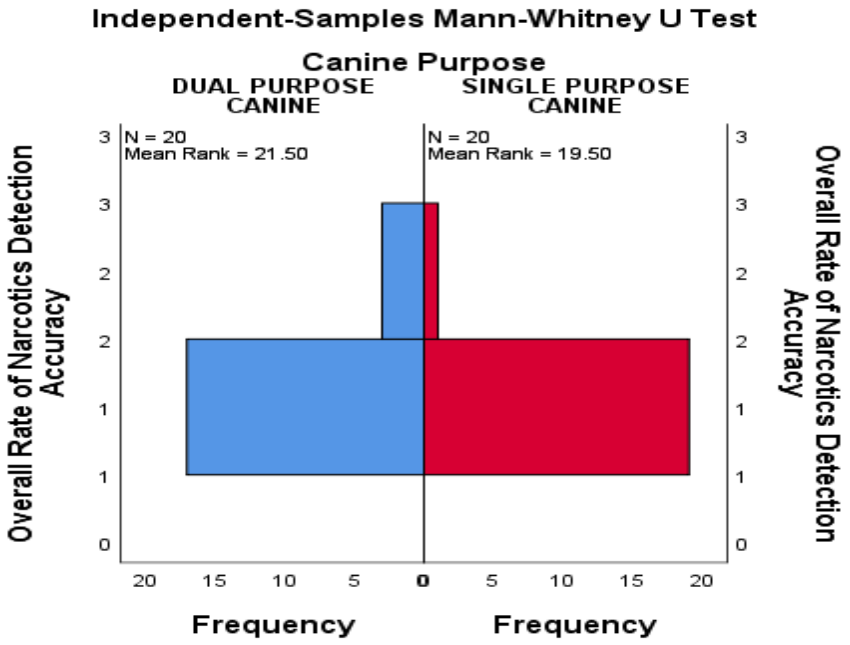

Figure 3. Results from Mann Whitney U test: Narcotics detection rate by purpose

RQ 2. Is there a significant difference in the number of "false alerts" in narcotics searches between single-purpose and dual-purpose canines?

$H_0$2: Single-purpose canines and dual-purpose canines do not have a significant difference in the number of "false alerts" in narcotics searches.

H_a2: Single-purpose canines and dual-purpose canines have a significant difference in the number of "false alerts" in narcotics searches.

Tables 11 to 13 and Figure 4 report data analysis results for the null hypothesis for Research Question 2. From the Mann Whitney U Median test, the null hypothesis was accepted [U(40) = 200.0, p = 0.598]. There was no statistically significant difference in the number of "false alerts" in narcotics searches between single-purpose (mean rank = 20.5, n = 20) and dual-purpose canines (mean rank = 20.5, n = 20).

Table 11

Independent-Samples Median Test: Number of False Alerts Across Purpose

Hypothesis Test Summary

Null hypothesis	Test	*p*	Decision
The medians of number of false alerts in narcotics searches are the same across categories of canine purpose.	Independent-samples median test	.598[a]	Retain the null hypothesis.

Note. Asymptotic significances are displayed. The significance level is .050. a. Yates's Continuity Corrected Asymptotic Sig.

Table 12

Independent-Samples Median Test Summary

Statistic		Value
Total *N*		40
Median		0
Test Statistic		0[a,b]
Degree of Freedom		1
Asymptotic Sig.(2-sided test)		1
Yates's Continuity Correction	Chi-Square	.278
	Degree of Freedom	1
	Asymptotic Sig.(2-sided test)	.598

Note. a. More than 20% of the cells have expected values less than 5. b. Multiple comparisons are not performed because the overall test does not show significant differences across samples.

Table 13

Independent-Samples Mann-Whitney U Test Summary

Statistic	Value
Total *N*	40
Mann-Whitney U	200
Wilcoxon W	410
Test statistic	200
Standard error	19.215
Standardized test statistic	0
Asymptotic sig. (2-sided test)	1
Exact sig. (2-sided test)	1

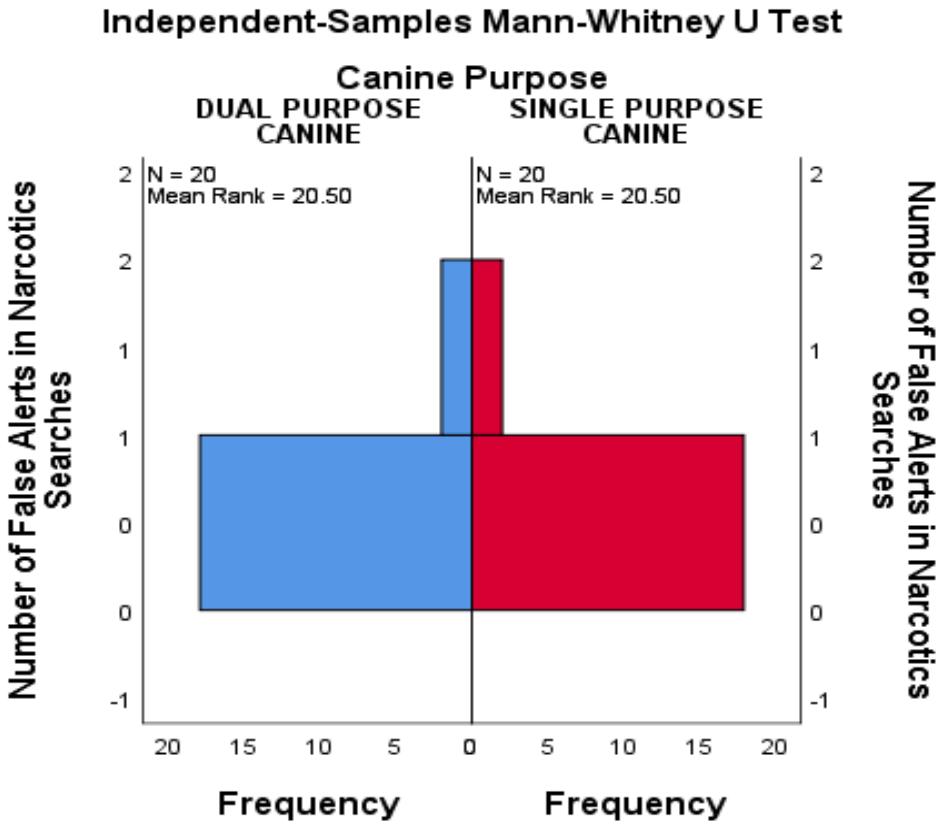

Figure 4. Results from Mann Whitney U test: False alerts by canine purpose

Chapter V

Discussion

Overview

This research study examined potential accuracy differences between single-purpose and dual-purpose narcotics detection canines. This chapter consists of an overview of the study, a summary of the findings, a discussion of the findings and how they relate to previous research, theoretical implications, and recommendations for future research. The discussion of findings presents the study results in a relationship to the empirical literature and case law reviewed in Chapter 2. The theory associated with the project will be addressed again to show how this study may affect the field going forward. The chapter concludes with a section that offers several recommendations and potential directions for future research.

Summary of Findings

This data analysis began by addressing the first research question of whether there was a difference in accuracy rates between single-purpose narcotics detection canines and dual-purpose narcotics detection canines. The null hypothesis was accepted [$U(40) = 220.0$, $p = 0.598$]. There was no statistically significant difference in narcotics detection accuracy between single-purpose canines (mean rank = 19.5, $n = 20$) and dual-purpose canines (mean rank = 21.5, $n = 20$).

The second research question tested was if there was a significant difference in the false alert rates between single-purpose and dual-purpose narcotics detection canines. The null hypothesis was accepted [U(40) = 200.0, p = 0.598]. There was no statistically significant difference in the number of "false alerts" in narcotics searches between single-purpose narcotics detection canines (mean rank = 20.5, n = 20) and dual-purpose narcotics detection canines (mean rank = 20.5, n = 20).

Discussion

As was discovered in previous canine detection research, the overall accuracy of the narcotics detection canines was impressive. In this study, the canines located the narcotics in 98% of the searches and 10% of the canines recorded a false alert during a search. This far exceeds the 60% success rate of confirmed alerts in *United States v. Bentley* (2015) where the Court ruled that the canine was to be considered accurate as long as it was adequately trained. The results of this study are very important for law enforcement agencies that continue to deploy narcotics detection canines in their communities. With a detection accuracy rate of 98% and only 10% of the tested canines having a false alert, the overall accuracy of narcotics detection canines continues to be impressive and a valuable tool for law enforcement agencies in the fight against illegal drug trafficking.

The accuracy rate also coincides with the results from the study conducted by Degreeff et al. (2011) where the detection canines were found to be 86% accurate. In the study conducted by Degreeff et al., the false alert rate of the canines was found to be 14%, which is slightly higher than the results from this study. False alert rates can be very hard to determine because of the usage of training areas with lingering odors and the

possibility of the odor being pushed further away from the source by air movement in the testing area.

These results from the current study differ greatly from the false alert data collected in the study conducted by Reid (2009). Reid determined that the canines had at least one false alert in 85% of the searches. However, the false alert rate was much higher in Reid's study due to the researcher setting up the testing scenario with markers that intentionally tried to make handlers think a target odor was present at that location. The current study was set up so that the participants were not aware of the locations of the hidden narcotics. The handlers were not influenced by the researcher setting up the testing in a manner that would try to trick the canine teams into believing an odor was present at certain locations. The teams were given simple instructions prior to beginning their respective searches so that there would be no confusion. With setting up the testing process in this manner, the scenario was as close to an actual narcotics detection deployment scenario as possible. By doing this, the data that was collected should be more representative of actual detection accuracy rates and false alerts.

The current results do agree with the false alert rate found in a study conducted by Cooper et al. (2014) where the bed bug detection canines had a false alert rate of 15%. However, there were some issues in that study with overall accuracy. The detection canines involved in their study had a mean detection rate of 44%. This rate is much lower than the 98% accuracy rate determined from the current narcotics detection accuracy study.

The results from the current study display that there was no significant difference found in detection accuracy between single-purpose and dual-purpose narcotics detection

canines. Approximately 90% of the single-purpose detection canines located all four narcotics samples during their searches. The dual-purpose canines were able to locate all four odors in 95% of the searches. The accuracy rates of both groups were very high, and no significant differences in regards to overall accuracy rates were determined from this study.

Out of the 40 canines used in this study, only four of them recorded a false alert in their search. Both the single-purpose narcotics detection canines and the dual-purpose narcotics detection canines had a false alert rate of 10% during the testing process. Therefore, there was no significant differences found in the false alert rates between the two groups of canines.

The importance of this study is that it adds to the previous research of detection canines by determining that there is no significant difference in accuracy rates and false alert rates of single-purpose canines and dual-purpose canines. This is also important to law enforcement agencies because it allows them to focus entirely on other factors when deciding what type of canine best suits the needs of their department and community. With accuracy not being a concern, they can then weigh the risks and benefits of having a dual-purpose canine.

In the current study, marijuana was the easiest sample to find and heroin was the hardest drug for the canines to find. Overall, there wasn't much difference in the detection of each of the types of narcotics. Marijuana was found on every search, while cocaine and methamphetamine were found by the canines in approximately 97% of the searches. Heroin was located in 95% of the searches. This is consistent with the results from the study conducted by Jezierski et al. (2014) where it was determined that

marijuana was the easiest drug for the participating canines to find, while heroin was the hardest. In that study, marijuana was located 92% of the time, while heroin was located by the detection canines in 70% of the searches. The importance of this data is that handlers need to monitor their canine's performance to determine if they are developing issues with detecting certain types of odor. If problems do develop, then handlers must design their training to reconcile those issues before they get worse.

The suitability of particular breeds for narcotics detection was also researched previously by Jezierski et al. (2014). In that study, German Shepherds proved to be the superior breed with a detection rate of approximately 87% and a false alert rate of 8%. The researchers did state that many times canines are selected due to breed preference, availability, and current opinions. In this current study, German Shepherds were also the superior breed with an accuracy rate of 100%, but it must be mentioned that only 9 of the 40 canines being tested were of this breed. Two of the Belgian malinois missed one target odor each, but they were the largest sample tested with a total of 25 canine teams. The accuracy rate of the Belgian malinois was approximately 98%. Three pitbulls participated in this study and they had the lowest accuracy rate of all breeds, which was approximately 92%. It should be noted that the pitbulls were all rescue canines from shelters that were later trained to be detection canines, but all of the other canines were trained from birth at training facilities. Also, the German Shepherds in this study had a false alert rate of 11%, which is very close to the 8% rate found by Jezierski et al. (2014). The Belgian malinois had a false alert rate of only 4%, while two out of the three pitbulls had a false alert. The pitbulls would need to be looked at further since it was such a small sample size. Ultimately, this current study revealed no major differences in accuracy rates

or false alert rates between the breeds. This is important for law enforcement agencies to know that a focus on individual breeds is not necessary when they are in the process of purchasing canines from facilities.

Another important component of this current research is the sex of canine variable that was evaluated. Overall, 31 male canines were tested and only nine female canines. Only one of the female canines missed an odor, so the accuracy rate was approximately 97%. Two of the male canines missed a single odor, so the accuracy rate was approximately 98% since they had a larger number tested. Three of the male canines had a false alert in their searches, which equates to a false alert rate of approximately 10%. Only one of the nine female canines had a false alert rate, so the female canine false alert rate was approximately 11%. With no significant difference in accuracy or false alert rates between male and female canines, this also eliminates the need for agencies to target a specific sex of canine due to accuracy concerns.

This study also focused on the importance of setting up the testing scenario in a manner that would allow for accurate data collection. Previous studies conducted by Jezierski et al. (2014) and Johnen et al. (2017) were instrumental in helping set up the testing scenario for this current study. Ultimately, focus was placed on both the setting up of the testing area and how the testing process was to be conducted with the participating canine teams. The use of verified actual narcotics, types of narcotics, amount of narcotics, testing locations, and the handling and placement of narcotics in the testing area were all important aspects that were covered in this research study. The importance of using clean testing areas where no residual odor would be present was crucial. One of the most important processes in the research was ensuring that all hidden locations of

target odor remained unknown to all participants until the testing process was over. The importance of this study is that the testing process is discussed in great detail and can serve as an example for a proper testing process for any future detection canine accuracy research. The testing process that was used can be easily replicated and can assist with obtaining accurate data in future research.

As mentioned previously, this research study was important because it added to previous canine studies by looking at the single-purpose or dual-purpose status of a detection canine. The results confirm that the single-purpose or dual-purpose status has no effect on accuracy or false alert rates. This study improves the literature on the subject by addressing a variable that had a legitimate potential of being a factor that affected overall accuracy and false alert rates of a canine. This research also improves the research topic by delving into other potential issues and suggesting future research centering on certification and documentation of deployments and training events. Focusing entirely on testing for accuracy rates of canines ignores other areas that need to be researched in order to make improvements in the canine detection industry. All aspects of detection canine usage must be continually evaluated to ensure fairness in the process.

Theoretical Implications

The theoretical positioning of this research involved the social contract, legitimacy, and procedural fairness. In order for the social contract between law enforcement and the citizens they serve to remain harmonious, practices being used must be procedurally fair or law enforcement risks losing their legitimacy (Tankebe, 2013). With the use of narcotics detection canines, accuracy is of extreme importance when discussing procedural fairness. With a positive alert of a trained and certified canine, law

enforcement can circumvent the search warrant requirement and legally search an individual's property without their consent (*Florida v. Harris*, 2013). Obviously, if an inaccurate canine is used for this process then a citizen can be unfairly searched if an alert is made from an inadequate detection canine. These types of incidents result in mistrust of the police and lead to fractured relationships between law enforcement agencies and the communities that they serve.

The responsibility of the training and release of accurate canines into the field is the responsibility of both the training facilities and the agencies that are utilizing the canines in their jurisdictions. Researchers must work with both in order to determine if there may be issues that need to be addressed in order to improve accuracy of detection canines. In this study, both groups were used to help collect the data to ascertain if there are accuracy differences between single-purpose and dual-purpose narcotics detection canines.

The results from this study verify that both single-purpose and dual-purpose narcotics detection canines are very accurate and the false alert rates for both are minimal. The data collected also helps strongly support that the use of detection canines is procedurally fair and should help with the legitimacy of law enforcement and the use of detection canines in the field. However, there are still many other aspects of canine detection that need to be researched. Potential enhancements with certification, training, and documentation efforts could help improve the canine detection industry, while also helping with legitimacy and the trust of the public.

Recommendations for Future Research

The field of law enforcement detection canines has an enormous potential for research that could be very beneficial to both law enforcement, public administration, and the public. This study was completed by a doctoral student with no defined research budget. With a limited budget, the sample size was not as large as it could have been due to budgetary constraints related to travel costs. In the future, it is recommended to conduct a replication on a larger scale with more canines from additional regions or states. More importantly, this current study has opened opportunities for future research to questions that have yet to be addressed. Several ideas were developed during the present research process that could be used to help facilitate future research of detection canines. While this study focused on potential accuracy differences between single-purpose narcotics detection canines and dual-purpose narcotics detection canines, future research could be focused on several different areas pertaining to law enforcement canines.

One future study could focus on testing accuracy differences between canines already in the field and fully trained canines at training facilities prior to their release to an agency. This type of study could help determine if there are issues with inadequate training conducted by handlers once they are released to their own agency with their canines. Another possible way to conduct this research is for researchers to test fully trained canines at the training facilities as they are released with their handler, and then test them again a year later to determine if there are any changes in detection accuracy. This type of study would be important to help determine if training practices at local agencies help or hurt a canine's accuracy over time. There is a possibility that accuracy

could improve as the canine continues to bond more with its assigned handler. Unfortunately, there is also the possibility that the canine's accuracy could decline if the teams are not allotted the same amount of training time each week that they received at the original training facility. This method would take longer, but it would allow the researcher to test the same canines in both phases, which would give a more accurate representation of any changes in narcotics detection accuracy.

Another possible area of research involves looking at dual-purpose detection canines being used for criminal apprehension and how their narcotics detection accuracy can be affected by their criminal apprehension training. Criminal apprehension canines can sometimes have issues with focusing on narcotics searches if they have just completed a training session for apprehension. Many times, the canines enter the search area and continue to look for a suspect instead of searching for narcotics. Research could be conducted to test the accuracy of detection canines that have not recently trained for criminal apprehension, and then compare it to the accuracy rates of canines trained for apprehension just prior to the narcotics search. Such a study could be very beneficial because it could help determine if there are concerns with using canines for narcotics detection purposes directly after apprehension training or when the canine has been deployed for an actual apprehension in the field.

The Need for National Canine Certification

Based upon the findings, it is evident that not all potential improvements to the field revolve around testing of canines. A wide variety of methods are used to certify narcotics detection canines. The United States Supreme Court case *Florida v. Harris* (2013) established that a certified canine's alert gives probable cause to search. However,

there is currently no specific certification or standards that are required nationally, leaving each state to decide what canines operating in their jurisdictions must do to qualify to serve as narcotics detection canines. In the state of Arkansas, law enforcement has transitioned to a statewide certification with certifying officials selected and trained to annually certify law enforcement canines being used in the field. In the state of Oklahoma, law enforcement has also adopted an annual statewide certification. Recently, in Arkansas, there has been discussion of turning the state canine certification into a simple qualification. If this were to happen, handlers would have to look to national certifying organizations to certify their canines each year. Louisiana has no statewide certification, and canine handlers continue to use national certifying organizations.

Over the past few decades, a requirement of a single, national canine certification has been discussed. With the current certification process, the many different types of certifications that vary widely in criteria can cause confusion, especially to an uninformed jury. These national certifications all have similar basic concepts but vary in standards and how they are evaluated. Some of the certifications are much easier to obtain due to lower certifying requirements. As a public administration policy concern, allowing a canine team to choose an easier certification could lead to a decline in the quality of canines working in the field. Implementing a national certification would not do away with the other certifications offered by these other organizations because canine teams could still get additional certifications if they choose to do so. A national canine certification would standardize performance requirements for working detection canines.

Based upon the findings of this study, it is recommended that a mandatory, national detection canine certification be developed. A single, recognized detection

certification will benefit the entire criminal justice system in a variety of ways. First, a nationally accepted certification will allow prosecutors to defend canine alerts more easily in the cases they handle. With an agreed upon certification where canines have met the determined specifications for a trusted and reliable detection canine, defense attorneys will have to attack other areas to create doubt in a canine team's performance. Also, ensuring that all canines are meeting the set standards for certification, law enforcement agencies can be assured that the canine teams they are deploying into their communities are accurate and are operating in a way that is procedurally fair to the public. An accepted national certification will also help agencies lower the risk of potential lawsuits if the canine teams remain certified annually.

In order to establish a national certification program, a representative group from the various stakeholders (i.e., handlers, certifying agencies, attorneys, etc.) should be formed to determine the standards that are acceptable for canines to be in the field, including what accuracy rates and false alert rates are necessary in the certification process. The certification process should be simple in nature and subjectivity should be removed from the process by implementing an objective minimum passing score. The specifics of certification requirements should be discussed by the stakeholder group so that a consensus can be reached.

From the information obtained from this study and previous detection canine literature, there are several recommendations that the stakeholder group should adhere to. It is proposed that if a canine fails their first certification attempt, they should be retested after a 24-hour waiting period. If the canine fails on the second attempt, they should return in 30 days to have one more opportunity at certification. If they are unsuccessful

on the third attempt, the canine team must wait an entire year before attempting certification. Individual agencies can decide to have stricter rules on repeated certification attempts if they choose to do so.

One of the current canine certifications used by the national canine organizations could potentially be the best method to certify canines in the field. The United States Police Canine Association, National Police Canine Association, and North American Working Dog Association organizations could assist in this effort to improve the quality of the process of certifying police canines. Not only do these organizations have a vast amount of knowledge that would help develop proper testing practices, they also have a unique opportunity to help promote and utilize the new certification process once it is developed. These organizations have the ability to incorporate the certification process into their trials and competitions, which are attended by large amounts of canine teams from across the world. Members of the organization could also help serve as knowledgeable certifying officials for the certification process. The pursuit of a single, national certification is necessary and will benefit the canine industry and the criminal justice system as a whole. Consistency in the certification process can ensure that agencies, citizens and the courts can have confidence in the abilities of the detection canines that are working on the streets in their communities.

Canine Records Management System Needed

During the testing process in this quantitative research study, another concern was mentioned by trainers at facilities. One important duty of law enforcement is to ensure accurate documentation of actions taken by an officer. Pursuits and uses of force are generally documented through an online database in most agencies so that they can be

tracked and readily available for court proceedings, if needed. However, when it comes to documentation of canine usage, no standard method is widely used. Just as there is no national canine certification requirement, there is no requirement on how records of canine usage should be maintained. Some agencies have their handlers simply handwrite a log each time a canine is used for a drug sniff, track, or apprehension and then store the form in a binder. Other agencies have a standardized form that is used and it is maintained in an electronic folder at the agency. A growing trend is for the handlers to enter the information into an online data management system such as KATS Police K9 Records Management System, PackTrack, KANINE Software, or some similar system.

It is important to determine the best method for documenting canine detection usage for several reasons. First, many important drug cases hinge on the use of a police canine at some point during the arrest procedure. Defendants sometimes try to get evidence suppressed in a case by attacking the canine's reliability. Quite frequently, the canine usage logs for that particular case, and any other case the canine team has been involved in, are requested by the defense attorney and must be supplied. Defense attorneys can even request copies of all training records and those must be provided by the handler if requested. In *Dawson v. State* (1999), although the court ruled that evidence of a narcotics detection canine being certified showed reliability, the defendant could still challenge that reliability and a handler's training records are still discoverable to be used in that process. Records showing that the canine has been properly trained and has continued to train as required can be very beneficial at trial. Inadequate training records can reverse a criminal conviction or change the outcome of a civil suit. For example, in *State v. Oliphant* (2009), the Louisiana Supreme Court found that a

successful track of a robbery suspect should not be admitted at trial because there were no "records" of the canines ever being used for successful tracking. Lastly, canine usage documents can obtain some very private and potentially confidential information about suspects or informants, so it is imperative that the information be retained in a secure location.

Moving to a state or nationally maintained canine records management system would be very beneficial to canine teams, law enforcement agencies, and attorneys and would lead to consistency in reporting practices for documenting training and actual canine deployments. Unit supervisors, handlers, and attorneys could all access the logs through the system with ease, which would help canine supervisors ensure that proper training was being conducted and documented on a daily basis. This would also give attorneys access to the files and could help avoid any delays in receiving the records from canine cases that are going to trial. Another advantage is that the system could be funded federally or through the state, thus eliminating any cost issues for individual agencies that may have budget constraints. With a national canine certification and an independent canine records management database, defense attorneys would have a much more difficult time of discrediting a narcotics detection canine team during a trial.

Summary

This study set out to determine if there were any accuracy differences between single-purpose and dual-purpose narcotics detection canines. The results from this study did reaffirm the accuracy of canines detailed in the previous detection canine research that has been discussed. The data shows that there are no meaningful differences in accuracy rates between single-purpose and dual-purpose narcotics detection canines. The

study can easily be replicated for future canine studies and serve as a guide for testing scenarios and overall data collection in detection canine research. Proper testing and data collection can ensure that bias and cross contamination can be avoided in the process. Although the main purpose of the research was to determine any accuracy differences between single-purpose and dual-purpose narcotics detection canines, this multi-state study evolved into much more throughout the process that could help lead to improvements in the canine industry.

Perhaps most importantly, this study demonstrates the need for a national detection canine certification, which would strengthen the practice of using narcotics detection canines in law enforcement. The certification will help with the prosecution of court cases involving police canines, assist with keeping inadequate canines out of the field, protect against potential lawsuits, and help improve the criminal justice system overall. Public administrators must continuously be looking at policies and procedures to determine if their organizations are operating in a manner that is fair to the people they serve. Law enforcement officers can use detection canines to gain probable cause to search, circumventing the search warrant process. Therefore, it is crucial that detection accuracy be proven through a standardized certification process so that institutional trust can be maintained with the public by showing that law enforcement uses their power appropriately and lawfully (Jackson & Gau, 2015). Moving forward with a national certification is prudent and necessary. This would be an important step to ensure that procedural fairness, public trust, and legitimacy all remain a major focus for law enforcement and the field of public administration.

Canine detection research is important because it allows law enforcement agencies and other public administrators to have more confidence in these tools. Research on law enforcement canines must continue in order to maintain public trust and legitimacy. Continued research will ensure that enhancements can be made before any major issues arise. Research, along with improvements to documentation efforts and certification requirements, will go a long way in improving detection canine defensibility in court, as well as maintaining legitimacy with the public in regards to the usage of detection canines in law enforcement.

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Appendix A: IRB Protocol Exemption Report

Institutional Review Board (IRB)
For the Protection of Human Research Participants

PROTOCOL EXEMPTION REPORT

Protocol Number: 04013-2020 **Responsible Researcher:** Brian Rice

Supervising Faculty: Dr. Leigh Stanford

Project Title: *A Study of Potential Accuracy Differences in Single and Dual-Purpose Narcotics Detection Canines.*

INSTITUTIONAL REVIEW BOARD DETERMINATION:

This research protocol is **Exempt** from Institutional Review Board (IRB) oversight under Exemption **Category 2**. Your research study may begin immediately. If the nature of the research project changes such that exemption criteria may no longer apply, please consult with the IRB Administrator (irb@valdosta.edu) before continuing your research.

ADDITIONAL COMMENTS:

- *Upon completion of this research study all data (email correspondence, survey data, participant lists, etc.) must be securely maintained (locked file cabinet, password protected computer, etc.) and accessible only by the researcher for a minimum of 3 years.*
- *This research study has been approved to begin at the following facilities:* ***U.S. K-9 Unlimited – Abbeville LA, Van Buren Police Dept. – Van Buren AR, Sequoyah County Sheriff's Office – Sallisaw OK, River Valley K-9 – Lavaca AR, Von Klein Stein Working Dogs – Sherwood AR, Mountainburg Police Dept. – Mountainburg AR, Irene Howcroft (owner) Ruidoso Malinois – Capitan NM, Roland Police Dept. – Roland OK, Sebastian County Sheriff's Office – Greenwood AR, Barling Police Dept. – Barling AR, Kaplan Police Dept. – Kaplan LA, Vohne Liche Kennels – Denver IN, Coal Hill Police Dept. – Coal Hill AR, City of Broken Arrow Police Dept. – Broken Arrow OK.***
- *Please forward additional permission letters to the IRB for review and approval. Research may not begin at a new facility prior to receipt of an updated Protocol Exemption Report from the IRB.*

☒ ***If this box is checked, please submit any documents you revise to the IRB Administrator at irb@valdosta.edu to ensure an updated record of your exemption.***

Elizabeth Ann Olphie *03.17.2020*
Elizabeth Ann Olphie, IRB Administrator

Thank you for submitting an IRB application.
Please direct questions to irb@valdosta.edu or 229-253-2947.

Revised: 06.02.16

Appendix B: Canine Handler Informed Consent Form

(Non-sensitive or identifying information/questions)

You are being asked to participate in a research study entitled "A Study of Potential Accuracy Differences in Single and Dual-Purpose Narcotics Detection Canines," which is being conducted by Brian Rice, a student at Valdosta State University. The purpose of the study is to determine if there are accuracy differences in narcotics detection between single-purpose canines (canines used for narcotics detection only) and dual-purpose canines (canines used for narcotics detection, tracking and criminal apprehension). You will receive no direct benefits from participating in this research study. However, your responses may help us learn more about potential accuracy differences in canines that can be used to improve training and accuracy rates of canines in the future. There are no foreseeable risks involved in participating in this study other than those encountered in day-to-day life. Participation should take approximately 10 minutes to complete. This research study is anonymous. No one, including the researcher, will be able to associate your responses with your identity. Your participation is voluntary. You may choose not to participate, to stop responding at any time, or to skip questions that you do not want to answer. You must be at least 18 years of age to participate in this study. Your participation serves as your voluntary agreement to participate in this research project and your certification that you are 18 or older.

Questions regarding the purpose or procedures of the research should be directed to Brian Rice at blrice@valdosta.edu. This study has been exempted from Institutional Review Board (IRB) review in accordance with Federal regulations. The IRB, a university committee established by Federal law, is responsible for protecting the rights and welfare of research participants. If you have concerns or questions about your rights

as a research participant, you may contact the IRB Administrator at 229-253-2947 or irb@valdosta.edu.

Appendix C: Canine Handler Questionnaire

Survey Form for Canine Study

"A Study of Potential Accuracy Differences in Single and Dual-Purpose Narcotics Detection Canines"

1. Is your canine single-purpose or dual-purpose? _____
2. What state is your canine from? _____
3. What is the breed of your canine? _____
4. What is the sex of your canine? _____
5. How many years has your K9 been in the field? _____
6. How many years of experience do you have as a handler? _____