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Research Article

Assessment on the Effectiveness of Pseudo-Narcotics Training Aids to Candidate Coast Guard Detection Dogs

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ABSTRACT

This study examined the effectiveness of pseudo-narcotic training aids in replicating the scent profiles of real narcotic substances, specifically marijuana and methamphetamine hydrochloride (shabu), for training Coast Guard K9 narcotics detection dogs. A mixed-methods approach was used, combining performance evaluations of ten handler-dog teams with focus group discussions involving instructors, evaluators, and handlers.

Findings revealed that dogs trained with pseudo-narcotics achieved perfect detection rates in most conditions and performed comparably to those trained with real substances, even in distraction-rich environments. However, real narcotics generally produced faster detection time and fewer false indications. Statistical analysis confirmed differences in detection speed without distractions, but no significant differences under distracting conditions. Thematic analysis highlighted six key factors: use in refresher training, the need for initial imprinting with real substances, legal and logistical benefits, environmental influences, scent differentiation challenges, and the role of evolving training technologies.

The study concludes that pseudo-narcotics are effective adjuncts for maintenance and broad deployment. However, they cannot fully substitute for real narcotics in foundational imprinting. This study provides evidence that pseudo-narcotics can complement, but not fully replace, real narcotics in Coast Guard K9 training.

Keywords: *Philippine Coast Guard K9 Training, K9 Narcotics Detection, K9 Scent Detection Accuracy, Pseudo-Narcotics, Real Narcotics*

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Introduction

Detection dogs are indispensable in law enforcement for identifying narcotics, explosives, and other contraband (Koech & Mulu, 2023). The Philippine Coast Guard (PCG) deploys K9 teams in ports, airports, and maritime checkpoints (Daily Tribune, 2024), yet narcotics detection training is hampered by limited access to real substances such as marijuana and methamphetamine hydrochloride (shabu). These materials are strictly controlled under the Comprehensive Dangerous Drugs Act of 2002 (Republic Act No. 9165), and subject to stringent storage and disposal protocols—constraints that complicate procurement, continuity of training, and standardization across sites.

Dogs have been used in detection roles globally since World War II, when their ability to serve in patrol and sentry duties was first formally recognized (Paltzer, n.d). Since 2004, the PCG trains and deploys dogs for narcotics and explosives detection (CGK9F Operations Manual, 2023). However, the training expansion of detection dogs remains constrained by restricted access to training substances, a shortage of centralized training facilities, and fragmented standards across agencies (Dela Cruz, 2024). Gesulgon (2019) has noted that the Philippines currently maintains only 16% of the K9 teams required, reflecting significant resource and capacity gaps.

To mitigate these challenges, pseudo- narcotics—synthetic training aids designed to mimic the odor profiles of real drugs without containing controlled compounds—have gained attention (Rice & Koziel (2015). These substances produce volatile organic compounds (VOCs) associated with narcotics, offering safer handling, easier transport, and more flexible training logistics. International studies present both advantages and limitations. Sokolenko et al. (2020) demonstrated that Ukrainian-developed pseudo-scents effectively replicated the odors of cocaine, heroin, and marijuana, proving useful for police and border patrol training. In contrast, Jantorno et al. (2020), citing Macias et al. (2008), reported that pseudo-scents used in Brazil failed to mimic VOC profiles accurately, leading to unreliable detection results. Commercial products such as those from Sigma and Scent Logix illustrate this trade-off: while they improve accessibility and safety, some lack complete odor components, contain harmful carrier particles, or present overly concentrated odors that may impair operational reliability.

In the Philippines, discussions of K9 training have largely emphasized shortages in capacity and inconsistent standards rather than the validation of training aids. With real narcotics controlled by the Philippine Drug Enforcement Agency (PDEA), access is severely restricted, creating bottlenecks in training schedules and expansion plans. This context underscores the potential value of pseudo-narcotics in sustaining training programs, yet there is limited evidence of their effectiveness in the PCG's operational settings, which include maritime environments, tropical climates, and distraction-rich scenarios.

Despite growing international attention, little research has examined how pseudo-narcotics perform in the Philippine Coast Guard context. This gap is significant, as the PCG faces unique logistical, legal, and operational challenges that shape K9 training outcomes. Therefore, the objective of this study is to assess the effectiveness of pseudo-narcotics compared to real narcotics in training PCG K9 detection dogs, focusing on detection accuracy, false indications, and detection times across distraction-free and distraction-rich conditions.

Methods

Research Design

A mixed-methods approach was employed, integrating both quantitative and qualitative research components. The quantitative strand followed an experimental repeated-measures design to evaluate the performance of K9 dogs trained with both real and pseudo-narcotic substances. The qualitative strand complemented this by incorporating focus group discussions (FGDs) with K9 handlers, instructors, and evaluators to capture experiential insights regarding the use of pseudo-narcotics in training.

Participants

The study involved 10 handler-dog teams from the Philippine Coast Guard (PCG) K9 Unit. This number was determined by the total

availability of operational teams within the unit during the study period, thereby representing the full accessible population. All handlers had prior experience in narcotics detection training using real narcotics and had completed the Coast Guard K9 Narcotics Detection Dog and Handler Course. Each team participated in two training phases: one with real narcotics (marijuana and methamphetamine hydrochloride) and another with pseudo- narcotics replicating the same substances.

Data Collection

Quantitative Data: Dog performance was evaluated on three variables:

1. Frequency of Positive Indications – correct identification of the target narcotic scent.
2. Frequency of False Indications – incorrect positive responses when no narcotic was present.
3. Detection Time – the duration between initial exposure and the signaling of detection.

Evaluations were conducted under two conditions: distraction-free and distraction-rich environments.

Qualitative Data: FGDs were conducted with handlers, instructors, and evaluators to explore their perceptions of pseudo- narcotics. Discussions focused on advantages, limitations, and practical implications for operational training.

Data Analysis

Quantitative Data: Descriptive statistics (means, standard deviations) were computed for each performance metric: frequency of positive indications, frequency of false indications, and detection time. Because the same handler-dog teams participated in both real and pseudo-narcotic conditions, the design was repeated-measures. Therefore, a paired samples t-test was employed to compare the two training conditions. This test was used to determine whether significant differences existed in detection performance between real and pseudo-narcotics under both distraction-free and distraction-rich environments.

Qualitative Data: Focus group transcripts were analyzed using Braun and Clarke's six-phase thematic analysis, which involved (1) familiarization with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the final report. Themes were derived inductively to capture recurring perspectives on the effectiveness, limitations, and operational implications of pseudo-narcotics.

Ethical Considerations

This study adhered to ethical standards for both human and animal participants.

Informed Consent: All human participants were briefed about the study's purpose, procedures, and potential risks, and provided voluntary informed consent. They were assured of the right to withdraw at any stage without penalty.

Confidentiality: No personal identifiers were collected. All data were anonymized, stored securely, and accessed only by the researcher.

Animal Welfare: The well-being of the K9s was prioritized. No harm occurred during training or evaluations. All procedures adhered to Coast Guard K9 Force guidelines, and only safe pseudo- narcotic substances were used.

Compliance with Standards: The research complied with institutional ethics protocols and review board requirements, ensuring transparency, respect, and accountability throughout the study.

Results

Detection Accuracy

Dogs trained with pseudo-narcotics achieved perfect detection rates in distraction-free environments for both marijuana and methamphetamine hydrochloride (shabu). In contrast, dogs trained with real narcotics achieved a slightly lower rate of 90% accuracy. This indicates that pseudo-narcotics can replicate the scent profiles of real narcotics effectively under controlled conditions.

False Indications

Neither group of dogs exhibited false indications during distraction-free trials. This finding demonstrates that both real and pseudo-narcotics supported accurate detection without misidentification in controlled settings.

Detection Time

Marijuana: Real marijuana was detected significantly faster (mean = 11.00 ± 3.43 sec) compared to pseudo- marijuana (mean = 27.22 ± 28.67 sec).

Methamphetamine (Shabu): Pseudo- methamphetamine was detected more quickly (mean = 20.50 ± 16.51 sec) than real methamphetamine (mean = 37.11 ± 30.06 sec).

These results suggest that detection speed varied by substance, with real marijuana providing faster recognition, while pseudo-methamphetamine yielded faster responses compared to its real counterpart.

Performance Under Distractions

When distractions were introduced, performance between the two groups was comparable. For marijuana, real-trained dogs had an average detection time of 18.67 ± 20.60 sec, while pseudo-trained dogs averaged 18.20 ± 10.21 sec. For methamphetamine, real-trained dogs took 21.22 ± 14.86 sec, and pseudo- trained dogs took 20.20 ± 16.46 sec. These findings suggest that distractions reduced differences in detection time, with both groups maintaining efficiency.

Statistical Comparison of Detection Time

To formally test differences in detection speed, a paired samples t-test was conducted (see Table 1).

Table 1. Comparison of Detection Time (Real vs. Pseudo-Narcotics)

Condition	Real Narcotics (sec)	Pseudo-Narcotics (sec)	t- value	p- value	Significance
Without Distraction	30	20	2.56	0.02	Significant
With Distraction	20	20	0.00	1.00	Not significant

As shown, under distraction-free conditions, pseudo-narcotics produced significantly faster detection time (p = 0.02). This may reflect the simplified and more consistent scent profile of synthetic substances, which are easier for dogs to recognize. However, under distraction-rich conditions, no significant difference was observed (p = 1.00), indicating that both real and pseudo-narcotic training yielded similar performance when environmental challenges were present.

Overall Detection Performance

To further illustrate accuracy and false indications, results were summarized by substance and condition (see Table 2).

Table 2. Detection Performance by Substance and Condition

Condition	Substance Type	Avg. Time to Detect (sec)	Positive Indications	False Indications	Notes
Without Distraction	Pseudo-Methamphetamine	25.67	8/9 (89%)	1/9 (11%)	One dog absent
Without Distraction	Real Methampheta mine	37.22	9/9 (100%)	0	One dog absent
Without istraction	Pseudo-Marijuana	27.22	9/9 (100%)	0	One dog absent
Without Distraction	Real Marijuana	11.00	9/9 (100%)	0	One dog absent
With Distractions	Pseudo-Methamphetamine	20.20	10/10 (100%)	0	All dogs detected
With Distractions	Real Methampheta mine	21.22	9/10 (90%)	1/10 (10%)	One dog distracted
With	Pseudo-Marijuana	18.20	10/10	0	All dogs

Condition	Substance Type	Avg. Time to Detect (sec)	Positive Indications	False Indications	Notes
Distractions			(100%)		detected
With Distractions	Real Marijuana	25.22	9/10 (90%)	1/10 (10%)	One dog distracted

These results demonstrate that pseudo-narcotics generally produced consistent performance, especially under distractions, while real narcotics yielded faster detection for marijuana under controlled conditions.

The findings align with Macias et al. (2008), who observed that dogs respond strongly to volatile organic compounds in narcotics, and Adebimpe (2014), who demonstrated that pseudo-narcotics can replicate such odors without containing narcotic compounds. A study by the Philippine Coast Guard Auxiliary (2023) supports this interpretation, noting that K9s exposed to real narcotics consistently demonstrated high accuracy across training domains. Meanwhile, Caldicott, L. et al. (2024) emphasized the critical role of associative learning and structured scent discrimination frameworks in shaping reliable detection behavior, whether through real or synthetic exposure.

These results indicate that while pseudo-narcotics may provide a practical advantage in terms of faster detection under controlled conditions, further research is needed to determine if these advantages persist in field applications. Despite the promising results with pseudo-narcotics, real narcotics continue to play an essential role in imprinting and developing deeper scent discrimination skills, which are crucial for operational reliability in real-world narcotics detection. Therefore, while pseudo-narcotics show potential as a supplemental tool, they should not fully replace real narcotics in foundational training.

Thematic Findings from Instructors, Evaluators, and Handlers

Focus group discussions revealed complementary insights:

Effectiveness: Pseudo-narcotics are useful for maintaining detection skills but cannot fully replace real narcotics, which remain essential for imprinting.

Training Adjustments: A combined approach—introducing pseudo- narcotics first, followed by real substances—was seen as effective for preparing dogs for operational conditions.

Legal and Safety Advantages: Pseudo-narcotics are easier and safer to handle, bypassing the regulatory burdens of real narcotics.

Environmental Factors: Both real and pseudo-narcotics are affected by temperature and terrain, suggesting training should progress from controlled to complex environments.

Accessibility and Sustainability: Pseudo-narcotics provide a practical solution for remote or resource-limited locations.

Handlers added two critical perspectives:

Need for Initial Exposure: Real narcotics are crucial for initial imprinting, with pseudo-narcotics better suited for refresher training.

Scent Differentiation Concerns: Prolonged reliance on pseudo-narcotics may confuse dogs and reduce their accuracy with real narcotics.

Overall, both groups emphasized a hybrid training strategy, where real narcotics are used for foundational imprinting and pseudo- narcotics for refresher and maintenance training.

Discussion

Interpretation of Findings

This study provides evidence that pseudo-narcotics can replicate many of the scent detection functions of real narcotics in Coast Guard K9 training. Quantitatively, dogs trained with pseudo-narcotics achieved perfect detection accuracy under controlled and distraction-rich conditions, with detection times in some cases faster than those using real narcotics. Qualitatively, handlers, instructors, and evaluators emphasized that pseudo- narcotics are practical, safer, and more accessible for refresher training and for sustaining detection readiness in geographically dispersed units.

However, real narcotics continue to hold a unique value for initial imprinting. Faster detection times for real marijuana, for example, suggest that the natural complexity of real substances provides a richer and more reliable scent signature. This aligns with international studies: Sokolenko et al. (2020) found pseudo-narcotics useful for training when real substances were scarce, while Macias et al., (2008) warned that poor formulations could limit reliability. Simon et al., (2020) similarly argued that pseudo-scents can simplify odor cues, but this may risk over-conditioning dogs to artificial profiles.

Theoretical Framing

The findings can be understood through behavioral learning theories. First, Pavlov's theory of classical conditioning explains how dogs associate a specific odor with the reward of successful detection; pseudo-narcotics appear capable of eliciting this conditioned response when used consistently. Second, Skinner's operant conditioning reinforces the role of reward structures—dogs continued to perform well with pseudo-narcotics because correct indications were paired with positive reinforcement. Third, Bandura's social learning theory highlights the influence of handler modelling and feedback during training: focus group insights confirm that handler expertise and structured training protocols help ensure dogs generalize skills to real-world conditions, even when pseudo-substances are used. Together, these theories support the conclusion that pseudo-narcotics can sustain conditioned detection behaviors, but strong foundational imprinting with real narcotics is still required to ensure scent fidelity.

Operational Implications for the PCG

For the Philippine Coast Guard, the results suggest that pseudo-narcotics should be integrated strategically, not as replacements but as supplements in the training cycle. A hybrid framework is recommended:

Initial Imprinting: Real narcotics should remain the foundation for new dogs, ensuring exposure to authentic odor complexity.

Maintenance and Refresher Training: Pseudo-narcotics can be used in regular drills to maintain proficiency, particularly in remote units where access to real substances is logistically difficult.

Distraction and Scenario Training: Since pseudo-narcotics yielded strong results under distraction-rich conditions, they are valuable for simulating operational environments where focus is critical.

Policy Integration: Updating PCG training SOPs to formalize pseudo- narcotics as complementary aids will reduce legal and logistical dependence on PDEA-supplied narcotics while maintaining high operational standards.

Limitations

This study was conducted in controlled training settings and may not fully reflect field complexities such as maritime weather, terrain, or concealment methods used by traffickers. Only two narcotics (marijuana and methamphetamine) were tested, limiting generalizability to other substances. The small sample size (10 handler-dog teams) also restricts statistical power, though results were consistent across both quantitative and qualitative data. Long-term effects of repeated pseudo-narcotics exposure were not evaluated, raising questions about potential scent differentiation challenges over time.

Recommendations

Adopt pseudo-narcotics as supplemental tools for refresher training, distraction-inclusive drills, and deployment readiness exercises, while reserving real narcotics for foundational imprinting.

Implement a hybrid training framework that combines both real and pseudo-narcotics to balance authenticity with accessibility.

Prioritize procurement of validated pseudo-narcotics formulations that closely replicate volatile organic compounds (VOCs) of real drugs.

Enable decentralized access to pseudo-narcotics for remote Coast Guard K9 stations to reduce reliance on PDEA supply chains.

Establish a monitoring system to evaluate detection accuracy, scent fidelity, and handler feedback regularly.

Update policies and SOPs to clearly define pseudo-narcotics as complementary, not replacement, tools.

Encourage future research on long- term effects, other synthetic formulations, and large-scale trials in operational maritime environments to strengthen evidence for institutional adoption.

Conclusion

This study is the first empirical research in the Philippines validating pseudo-narcotics as viable training aids for Coast Guard detection dogs. Findings demonstrate that pseudo- narcotics can replicate the detection performance of real narcotics under both controlled and distraction-rich conditions, offering advantages in safety, accessibility, and logistics. However, real narcotics remain essential for initial imprinting due to their complex odor fidelity.

The study was limited to 10 handler-dog teams and tested only two narcotics (marijuana and methamphetamine), which constrains generalizability.

Future research should investigate the long- term effects of continuous pseudo-narcotics use, assess their potential for cross-agency adoption across PNP, PDEA, and PCG, and extend validation to other targets such as explosives and agricultural contraband.

A hybrid training framework, real narcotics for foundational imprinting and pseudo-narcotics for refresher and maintenance remains the most practical pathway for enhancing the readiness and sustainability of the Philippine Coast Guard's K9 program.

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