Test Strip *Use, Accuracy & Mismatch* Analysis

Dataset: PA_Groundhogs_Lab_Reports_24

The purpose of this report is to evaluate real-world use of drug checking test strips among participants using the PA Groundhogs Drug Checking Service and compare participant-reported test strip results with laboratory-confirmed findings. These analyses are intended to improve public health practice, inform harm reduction education, and guide interpretation of field-based drug checking technologies.

EXECUTIVE SUMMARY

A new internal analysis of PA Groundhogs lab data finds that just 13.9% of submitted samples were accompanied by any test strip data — a striking figure given the tool's demonstrated accuracy and low cost. Of 1,434 samples analyzed between Nov. 2023 and April 2026, only 199 recorded any strip use, though those who did test were disproportionately engaged: nearly half used all three available strip types simultaneously. Until the first half of 2024 P.A.G. distributed one test strip each for fentanyl, xylazine and benzodiazepines. Benzo strips were discontinued unless requested in 2024, and medetomidine strips were added in 2025 through a reseller agreement with WiseBatch.

Where fentanyl test strips (FTS) were used, they performed exceptionally — achieving 100% sensitivity with zero confirmed false negatives across 193 samples. Every sample that tested negative was lab-confirmed fentanyl-free. A 7.1% false positive rate reflects known cross-reactivity and poses no safety concern: a false positive prompts caution, not harm.

Xylazine test strips (XTS) showed meaningfully lower performance, with a 6.5% false negative rate — roughly one missed detection per 15 xylazine-positive samples. More critically, the report identifies medetomidine cross-reactivity as a growing source of false positives: at least three confirmed XTS false positives were driven by medetomidine, not xylazine. As medetomidine increasingly displaces xylazine in the regional supply, this distinction will matter more, not less.

Strip use trended upward from near-zero pre-2024 to a sustained 15–25% monthly rate through 2025, likely reflecting the growing share of harm-reduction-engaged submitters in the Groundhogs user base. Geographically, use was heavily concentrated in Pennsylvania (68.8%), with meaningful presence in New Jersey and Maryland. Importantly, the 13.9% figure almost certainly undercounts actual use — submitters who tested but left the field blank are invisible here.

Bottom line: The data make a clear case for expanding test strip uptake. FTS remains one of the most reliable point-of-care harm reduction tools available; XTS works but requires informed interpretation — particularly as the alpha-2 agonist landscape shifts. Standardizing strip use documentation and educating field partners on medetomidine cross-reactivity are immediate priorities.

1. Overall Test Strip Adoption

Of the 1,434 samples submitted to the Groundhogs Drug Checking Service, only a minority of submitters reported using any test strip prior to submission. The most commonly used strip was the fentanyl test strip (FTS), followed by the xylazine test strip (XTS), with a smaller subset using a third-category strip (OTHER TS — primarily benzo or medetomidine strips).

1,434
Total samples in dataset

199
Samples with any test strip used
13.9% of total

193
FTS recorded
13.5% of total

156
XTS recorded
10.9% of total

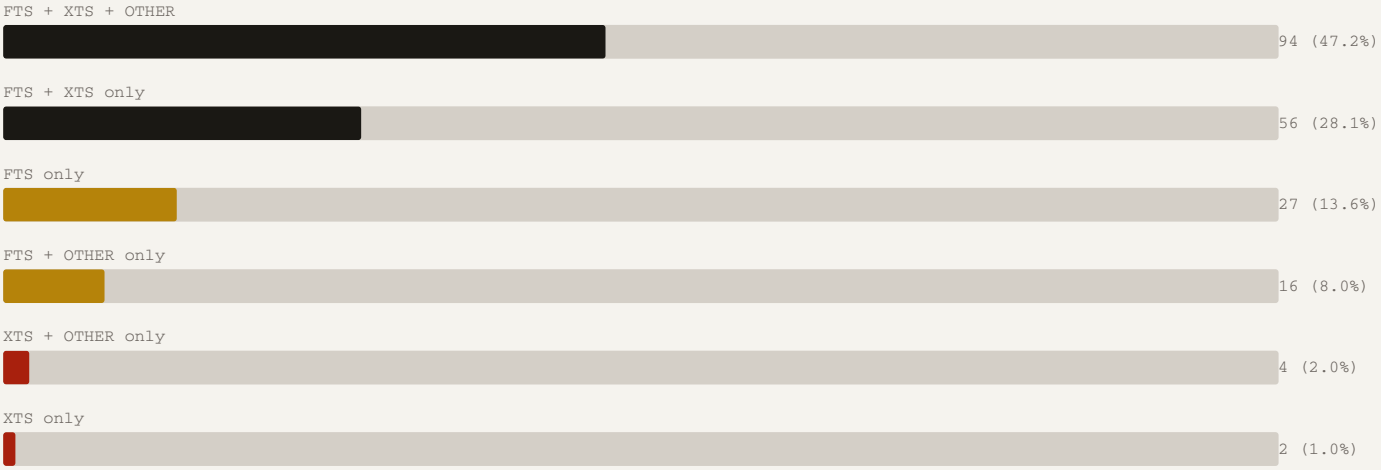
114
OTHER TS recorded
7.9% of total

27
FTS only (no other strip)
13.6% of TS users

94
All three strips used
47.2% of TS users

56
FTS + XTS only
28.1% of TS users

STRIP COMBINATION BREAKDOWN (AMONG 199 TS USERS)

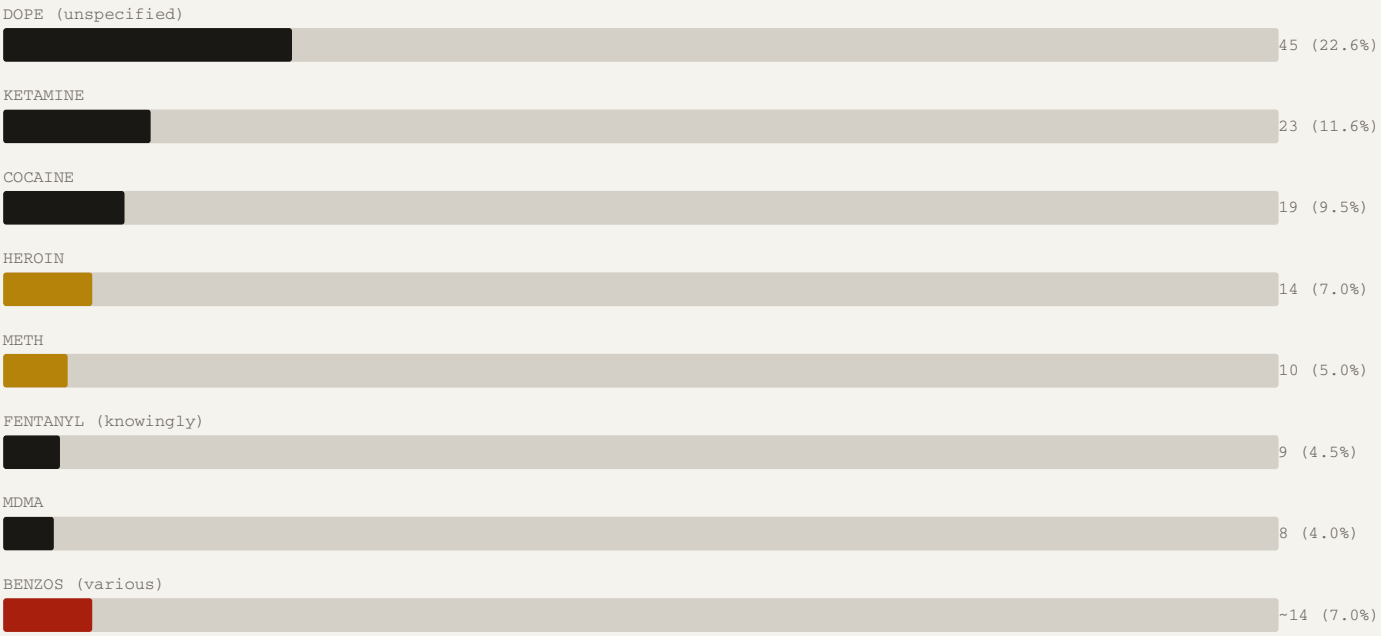


INTERPRETATION

Nearly half of TS users (47%) used all three available strip types, suggesting a subset of submitters with high harm reduction awareness or programmatic support. The majority of remaining TS users at least combined FTS and XTS. Standalone XTS or OTHER TS use without FTS was exceedingly rare (6 total cases), reinforcing FTS as the anchor strip in multi-strip protocols.

WHAT DRUG WERE THEY TESTING?

Test strips were not used exclusively on opioids. Submitters tested a wide array of substances, highlighting growing multi-drug harm reduction awareness — or anxiety — about contamination across supply chains.



NOTABLE

Ketamine is the second-most-tested drug (23 samples), reflecting genuine user concern about fentanyl contamination in recreational ketamine supply — a legitimate and documented public health issue in this dataset.

2. Fentanyl Test Strip (FTS) Accuracy

FTS results were compared against qualitative and LC-QTOF laboratory findings. A "true positive" was defined as FTS = POSITIVE with fentanyl confirmed by lab; a "false negative" as FTS = NEGATIVE with fentanyl found in lab; etc.

FTS vs. Lab — Confusion Matrix

65 True Positive FTS+ / Lab+	123 True Negative FTS− / Lab−
5 False Positive FTS+ / Lab−	0 False Negative FTS− / Lab+

Sensitivity (True Positive Rate)	100%
Specificity (True Negative Rate)	96.1%
False Negative Rate	0.0%
False Positive Rate	7.1%
Overall Accuracy (n=193)	97.4%

FTS — Key Findings

FTS performance in this dataset was **exceptional**. No false negatives were recorded — every sample that tested FTS-negative was confirmed by lab to contain no fentanyl or fentanyl analogues. The 5 false positives represent cross-reactivity or edge cases, not a systemic flaw.

False Positive Detail

SOLD AS	LAB FINDING
HEROIN	Heroin, acetylcodeine, morphine, meth, papaverine — no fentanyl
KETAMINE	Cocaine, ketamine — no fentanyl
DOPE	Xylazine primary — incomplete LC-QTOF
MARIJUANA (×2)	Delta-9 THC — no fentanyl (incomplete LC-QTOF)

Note: 3 of 5 false positives lack full LC-QTOF results; fentanyl presence cannot be entirely ruled out in those cases.

BOTTOM LINE: FTS WORKS

In 193 tested samples, FTS produced zero confirmed false negatives. Every fentanyl-positive sample was correctly flagged. The 7.1% false positive rate is consistent with known lateral flow strip cross-reactivity and does not represent a safety concern — a false positive prompts caution, not harm.

FTS RESULTS BY DRUG CATEGORY (LAB-CONFIRMED PRIMARY DRUG)

When FTS returned POSITIVE, the lab confirmed fentanyl in 65 of 70 cases. Notably, two samples sold as ketamine and two sold as marijuana triggered FTS positives — suggesting either trace fentanyl present below LC-QTOF detection thresholds, or lateral flow cross-reactivity. The 7 heroin samples that tested FTS-positive were confirmed to contain fentanyl alongside heroin.

3. Xylazine Test Strip (XTS) Accuracy

XTS results were compared against qualitative and LC-QTOF lab findings for xylazine. The XTS showed meaningfully lower performance than FTS, with both false positives and false negatives occurring.

XTS vs. Lab — Confusion Matrix

40 True Positive XTS+ / Lab+	100 True Negative XTS− / Lab−
9 False Positive XTS+ / Lab−	7 False Negative XTS− / Lab+

Sensitivity (True Positive Rate)	85.1%
Specificity (True Negative Rate)	91.7%
False Negative Rate	6.5%
False Positive Rate	18.4%
Overall Accuracy (n=156)	90.4%

XTS False Negatives — Missed Xylazine

7 samples tested XTS-negative but contained xylazine in lab analysis. All were opioid samples.

SOLD AS	PRIMARY DRUG	NOTES
DOPE (×5)	Fentanyl	Xylazine likely at trace/low level
HEROIN (×1)	Heroin	Xylazine present
PRESCOT HEROIN	Fentanyl	Complex adulterant profile

XTS False Positives — Flagged Without Xylazine

SOLD AS	LIKELY EXPLANATION
DOPE (×3)	Medetomidine present — likely alpha-2 cross-reactivity
PRESCOT HEROIN	Complex fentanyl analogue mix
METH	Unknown — methamphetamine only in lab
OXYCODONE, FENT/TRANQ, HEROIN, DOPE (×4)	Incomplete LC-QTOF (cannot rule out xylazine)

CRITICAL FINDING: MEDETOMIDINE CAUSING XTS FALSE POSITIVES

At least 3 confirmed XTS false positives involved samples containing medetomidine but not xylazine. Both medetomidine and xylazine are alpha-2 adrenergic agonists with similar chemical structures, and lateral flow strips designed for xylazine cross-react with medetomidine. As medetomidine increasingly displaces xylazine in the supply, this cross-reactivity will cause growing rates of XTS false positives — an important caveat for field testing interpretation.

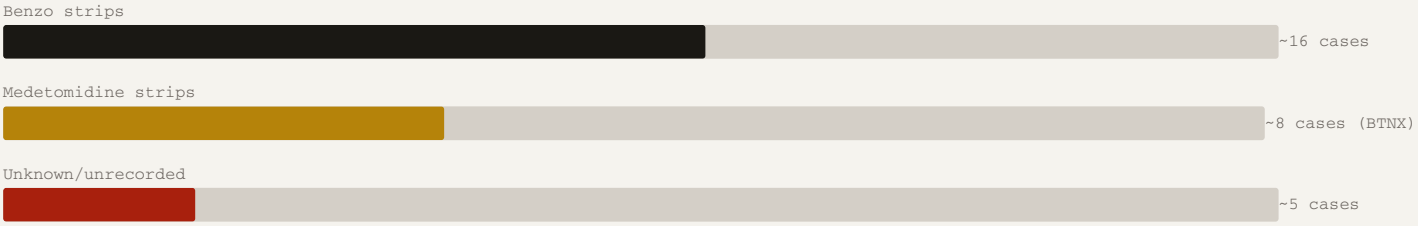
XTS FALSE NEGATIVE RISK

A 6.5% false negative rate means roughly 1 in 15 xylazine-positive opioid samples would pass XTS undetected. Given the clinical significance of xylazine (wound complications, atypical withdrawal), this miss rate is meaningful and argues for confirmatory lab checking when possible.

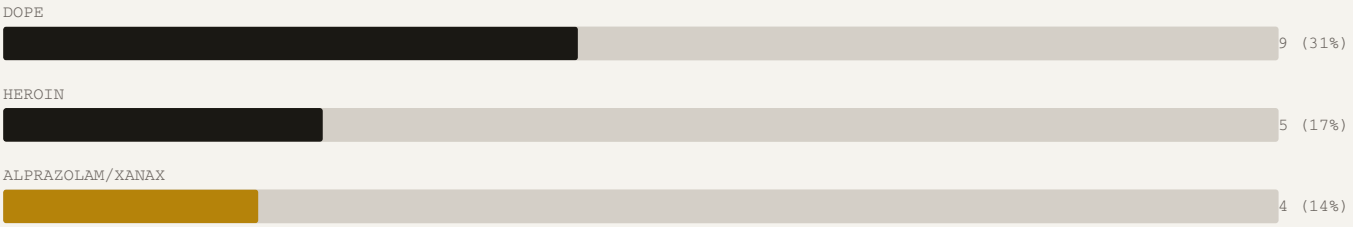
4. Other Test Strips (Benzo & Medetomidine)

The OTHER TS column captures a heterogeneous set of strip types, most commonly benzodiazepine test strips and medetomidine-specific strips (BTNX brand noted in several records). Of 114 OTHER TS records, 29 were positive and 85 were negative.

POSITIVE OTHER TS — WHAT WERE THEY TESTING FOR?



OTS+ BY SOLD-AS CATEGORY



BENZO STRIPS ON XANAX/FARMAPRAM: CONFIRMED BY LAB

Several submitters used benzo strips on what appeared to be pharmaceutical-style benzodiazepine products (Galenika Ksalol, Rivotril, Farmapram). In most cases with lab data, the benzo strip positive was confirmed — these were actual alprazolam or clonazepam samples. However, the strips were likely used to detect novel/illicit benzo contamination rather than the primary substance itself, suggesting a level of sophisticated harm reduction awareness among this subset of users.

NOTABLE CASE: BALTIMORE MASS OD EVENT

One OTHER TS+ sample is directly linked in the notes to a mass overdose event in Baltimore. The strip used was a benzo strip; the sample (sold as "Triple O," a tester pill) contained methylenedioxynitazene — a potent nitazene opioid — alongside fentanyl, para-fluorofentanyl, and several fentanyl precursors. The benzo strip positive likely reflected a false positive from the complex alkaloid mixture, rather than true benzo presence.

5. Test Strip Adoption Trend Over Time

The dataset spans samples from 2018 through early 2026, though the bulk of the data is concentrated in 2024–2026. Looking at monthly test strip adoption rates reveals a clear upward trend beginning in late 2024, with a sustained plateau in the 15–25% range through 2025–2026.

MONTHLY TS USAGE RATE (SIGNIFICANT MONTHS)

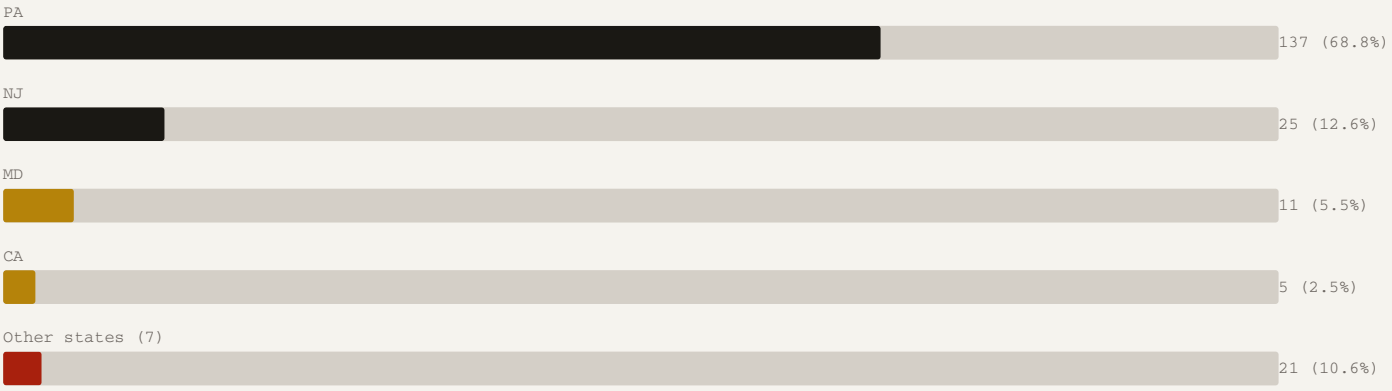
PERIOD	TOTAL SAMPLES	TS USERS	TS RATE
Jan 2024	27	6	22.2%
Mar 2024	17	7	41.2%
Nov 2024	63	15	**23.8%**
Feb 2025	33	20	**60.6% ⬆ peak**
Apr 2025	65	14	21.5%
May–Nov 2025	avg. 53	avg. 11	~20%
Jan 2026	72	11	15.3%
Feb 2026	40	9	22.5%

TREND SUMMARY

Before late 2023, test strip documentation was sporadic and near-zero. The sustained 15–25% range across 2025 likely reflects the growing Groundhogs user base overlapping with harm reduction-engaged submitters. The February 2025 spike to 60.6% may reflect a single partner organization that submitted heavily that month with consistent strip use. Importantly, test strip rate is almost certainly underreported — submitters who used strips but didn't record them would not appear here.

6. Geography of Test Strip Use

Test strip use was heavily concentrated in Pennsylvania, consistent with Groundhogs' geographic base, with meaningful presence in New Jersey and Maryland.



7. Summary of Key Findings

01 Test strip use is low overall but concentrated among harm-reduction engaged submitters

Only 13.9% of samples had any test strip data recorded. However, the majority of those who tested used multiple strip types simultaneously — suggesting a behavioral cluster of highly engaged users rather than casual, one-off testing.

02 FTS performance was near-perfect — zero false negatives in 193 samples

Every sample that tested FTS-negative was lab-confirmed to contain no fentanyl. The 7.1% false positive rate is clinically acceptable (a false positive prompts caution, not harm). FTS remains one of the most reliable point-of-care harm reduction tools available.

03 XTS is less reliable, with a 6.5% false negative rate and 18.4% false positive rate

Xylazine misses and phantom positives both occur. The high false positive rate is likely amplified by medetomidine cross-reactivity — a critical consideration as medetomidine gains market share in the fentanyl supply.

04 Medetomidine is triggering XTS false positives — a supply change with field testing consequences

At least 3 confirmed XTS false positives in this dataset were driven by medetomidine cross-reactivity. As medetomidine increasingly replaces xylazine, interpreting XTS positive results will require greater contextual caution. Field testers and harm reduction workers should be educated about this dynamic.

05 FTS positivity on non-opioid drugs (ketamine, cocaine, MDMA, marijuana) reflects real cross-contamination anxiety

Submitters routinely tested non-opioid drugs with FTS. In most FTS-negative cases among these categories, labs confirmed no fentanyl — suggesting the anxiety is larger than the confirmed risk for these specific samples, though the practice remains prudent.

06 OTHER TS use reveals an emerging medetomidine and benzo testing culture

BTNX medetomidine strips and benzo strips are entering field use among sophisticated submitters. Several cases link OTHER TS positives to confirmed medetomidine in lab results. One notable case involved a benzo strip triggering alongside a nitazene-containing sample linked to a Baltimore mass OD.

07 Test strip adoption appears to have stabilized at 15–25% among active submitters

After near-zero use prior to 2024, test strip documentation rose to a consistent 15–25% monthly rate through 2025. This may reflect the Groundhogs user base skewing toward harm-reduction-engaged individuals, or may undercount actual strip use due to incomplete form completion.

8. Limitations & Caveats

Underreporting: Test strip use is almost certainly more common than recorded here. Submitters who used strips but left those fields blank are invisible in this analysis. The 13.9% figure should be interpreted as a floor, not a ceiling.

Incomplete LC-QTOF: A meaningful number of samples with test strip data lack complete laboratory results, making full mismatch analysis impossible for those cases. Some apparent "false positives" may reflect analytes below detection threshold rather than true cross-reactivity.

Selection bias: Groundhogs submitters are not representative of all drug users. They are disproportionately harm-reduction engaged, which likely inflates test strip use compared to the broader population.

Strip type heterogeneity: The OTHER TS column captures multiple strip types (benzo, medetomidine, unspecified) under one field, limiting granular analysis. Standardizing this field in future data collection would substantially improve analytical value.

XTS / medetomidine cross-reactivity: The extent of cross-reactivity between medetomidine and XTS is not fully characterized in the literature. Prevalence estimates here are based on pattern matching and should be considered preliminary.

METHODS

Test strips are used in the field by the submitter, who then may or may not have marked the results on their sample survey. Both the sample and survey were sent to the CFSRE, where they were logged into the P.A.G. database. While we are confident in the findings, we have no way of knowing if all strips were properly administered and/or correctly interpreted in the field, which may affect the accuracy of participant-reported results.