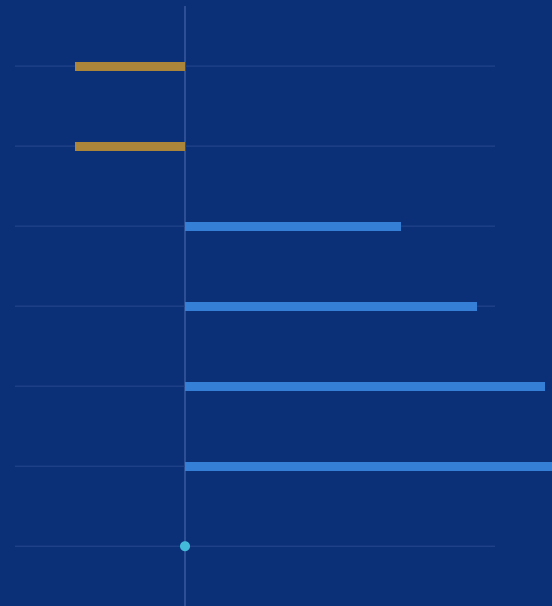


ORAL FLUID — VS. — URINE

What If the Gold Standard Isn't the Gold Standard?

Examining real-world performance—
and the assumptions behind it.



WHY START AN ORAL FLUID DISCUSSION WITH A HAIR STUDY?

Because if urine is the gold standard, it should hold up against more than one alternative.

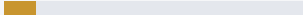
Commercial-driver pre-employment testing · 2017–2025 · >1.22 million hair and urine drug screens

HAIR
5.55%
POSITIVITY



9×
HIGHER OBSERVED
POSITIVITY

URINE
0.59%
POSITIVITY



THE AUTHORS IDENTIFY THREE ADVANTAGES OF HAIR TESTING

01 LONGER DETECTION WINDOW

Greater historical reach

02 RESISTANCE TO SHORT-TERM ABSTINENCE

Less vulnerability to attempts to alter detection through timing

03 RESISTANCE TO SAMPLE ADULTERATION

Less ability to fraudulently alter the submitted specimen

DETECTION WINDOW MATTERS.

But is it the only variable driving detection differences?

WHAT HAPPENS WHEN THE DETECTION WINDOW GETS SHORTER?



Source: Voss, Li & Bolumole, Hair v. Urine Testing Efficacy for Commercial Motor Vehicle Driver Pre-Employment Drug Screens (2024–2025), June 16, 2026.

Study funded and sponsored by the Alliance for Driver Safety & Security (The Trucking Alliance).

ARE WE ASKING THE RIGHT QUESTION?

THE QUESTION WE ROUTINELY ANSWER

Can this test accurately detect drugs in the *specimen provided*?



THE QUESTION THAT ULTIMATELY MATTERS

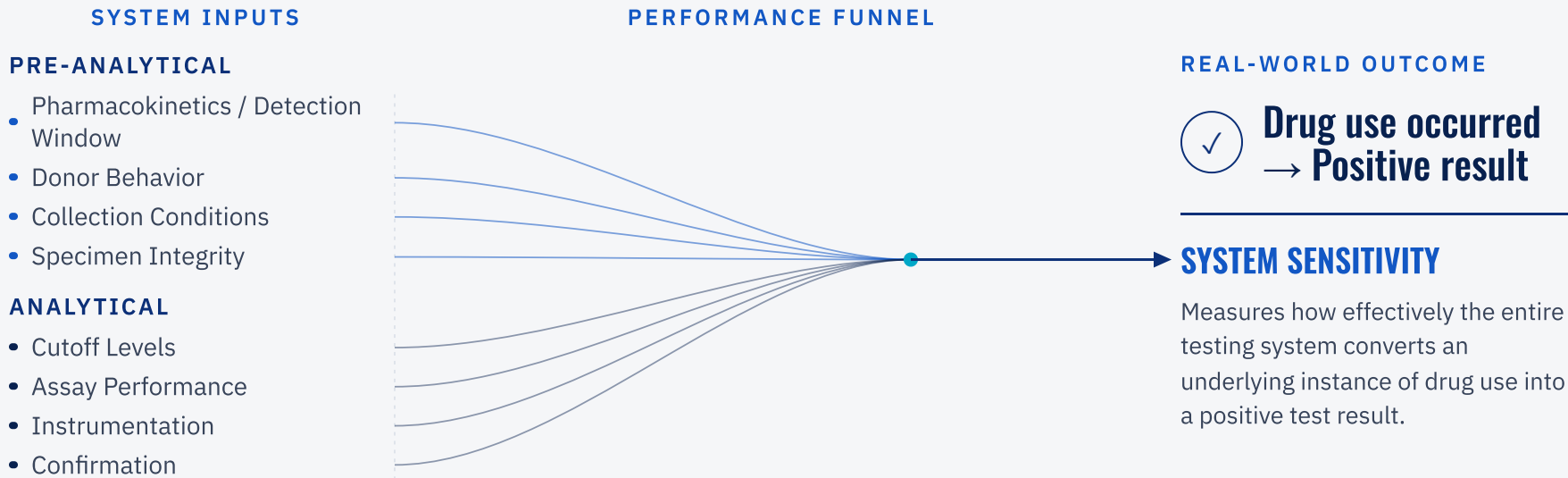
Does this testing system reliably identify drug use in the *population being tested*?



Analytical sensitivity *is not* the same as **System sensitivity**.

SYSTEM SENSITIVITY

Performance measured against the underlying reality.



**System sensitivity reflects the performance of the entire testing system—
*not simply the analytical performance.***

THREE DIFFERENT LENSES. ONE QUESTION.

Do different testing systems produce different real-world outcomes?

01

REAL-WORLD TRANSITIONS

Two non-DOT workforce populations

Urine → Oral Fluid

CRG Laboratories

02

CONTROLLED COMPARISON

196 donors · SAME DONORS · SAME TIME

DOT Urine + Non-DOT Oral Fluid

CRG transportation dataset

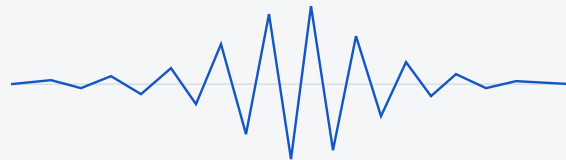
03

NATIONAL DATA

Millions of workplace drug tests

2025 Quest Drug Testing Index

Reporting period: 2020–2024



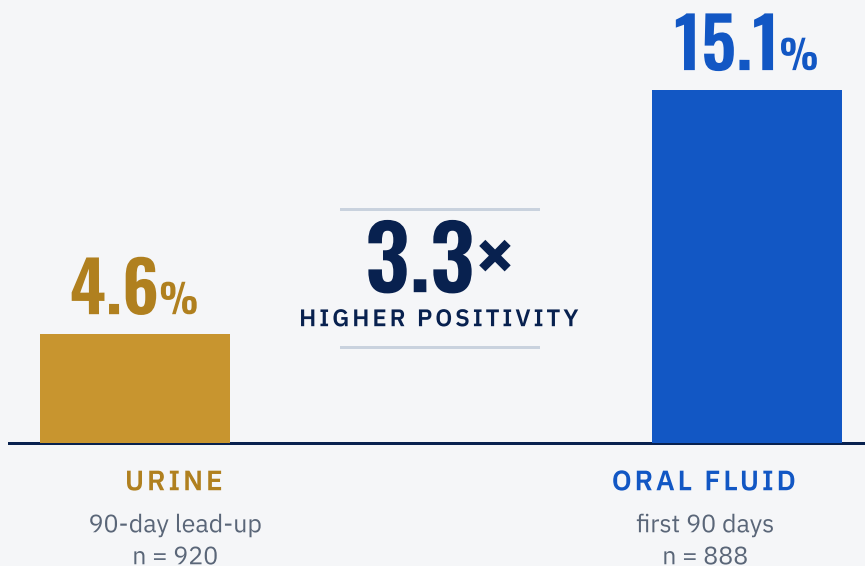
Does the same signal appear?

All reported positive results reflect laboratory-confirmed findings, including confirmatory testing in accordance with standard workplace drug-testing protocols.

No definitive biological gold standard exists for comparative evaluation of “true” system performance.

WAREHOUSE WORKFORCE

Pre-employment testing · Urine → Oral Fluid



The difference was largest immediately after transition.

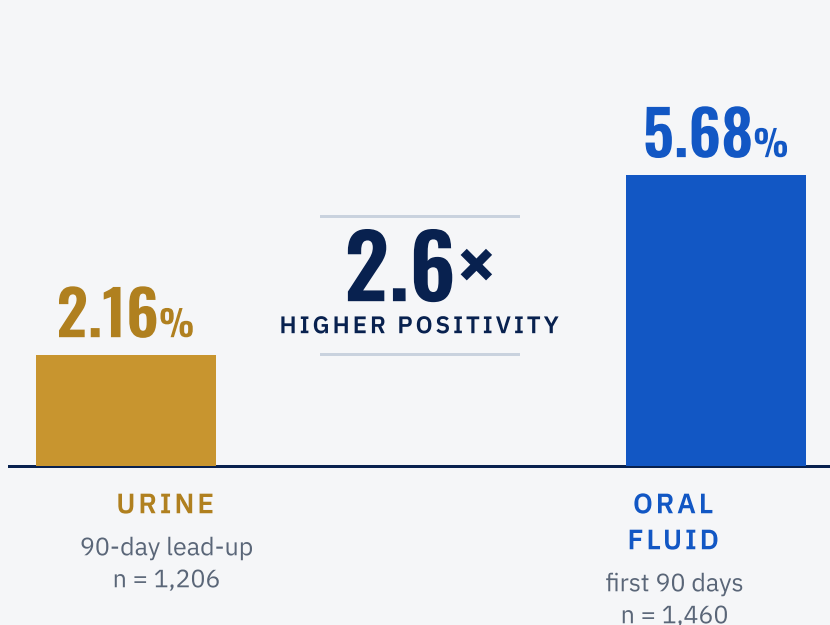


Pre-employment positivity rates after confirmatory testing and MRO Review.

The **15.1% 90-day average** may understate the magnitude of the initial observed difference: positivity reached **21.4% during the first 15 days** after transition.

HOSPITAL WORKFORCE

Pre-employment testing · Urine → Oral Fluid



THE SIGNAL APPEARED AGAIN

WAREHOUSE

3.3×

higher positivity

HOSPITAL

2.6×

higher positivity

**Different workforce. Different baseline.
Same signal.**



But what happens when we remove the population difference?

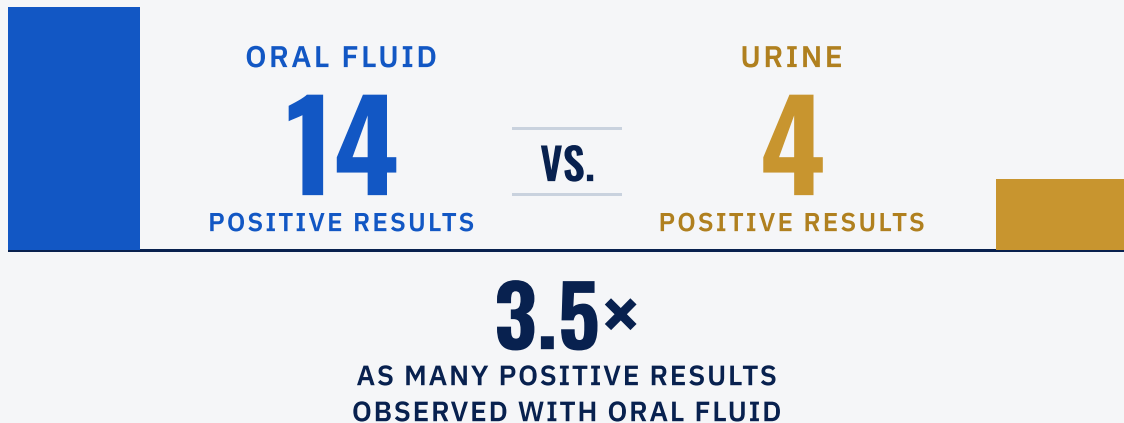
Same donors. Same time. Two testing systems.

Pre-employment positivity rates after confirmatory testing and MRO Review

SAME DONORS. SAME TIME.

196 contemporaneous paired collections · DOT transportation workforce

DOT Urine + *Non-DOT Oral Fluid*



Same donors. Same collection timing. Different observed outcomes.

The paired design controls for population differences and collection timing by comparing both testing systems within the same donors.

196 paired specimens. Pre-employment positivity after confirmatory testing and MRO review

All oral fluid positive results fell within drug classes included on the standard DOT drug panel.

DISCORDANT RESULTS



DISCORDANT SUMMARY



THE DIFFERENCE PERSISTED. WHY?

Same donors and same time narrow the field of possible explanations.

1 WHAT THE PAIRED DESIGN HOLDS CONSTANT

✓ POPULATION

Same 196 donors

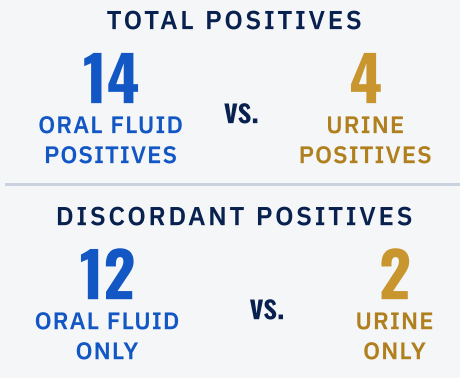
✓ COLLECTION TIMING

Contemporaneous collections

Population and timing differences cannot explain the between-system difference in these paired results.



2 YET THE OUTCOMES DIVERGED



Same donors. Same time.
Different observed outcomes.



3 WHERE SHOULD WE LOOK NEXT?

PHARMACOKINETICS / DETECTION WINDOW

ANALYTICAL PERFORMANCE

DONOR BEHAVIOR

COLLECTION CONDITIONS

SPECIMEN INTEGRITY



REAL-WORLD OUTCOME

Collection conditions and donor behavior can influence the integrity of the specimen entering the analytical process.

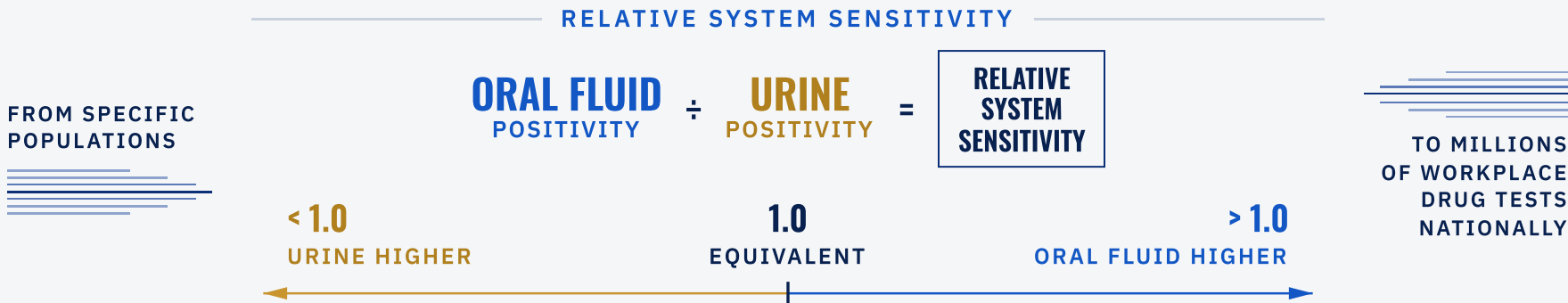
Could this be where the observed outcomes begin to diverge?

If the donors were the same and the timing was the same — what in the testing system was different?

The discordance requires explanation. *The evidence ahead will begin narrowing the possibilities.*

DOES THE SIGNAL SCALE?

2025 Quest Drug Testing Index · Non-DOT workforce data · Reporting years 2020–2024



Rather than asking which specimen has the higher overall positivity rate...

DOES DRUG-CLASS DETECTION REVEAL A *HIDDEN PATTERN*?

Millions of tests. Multiple drug classes.

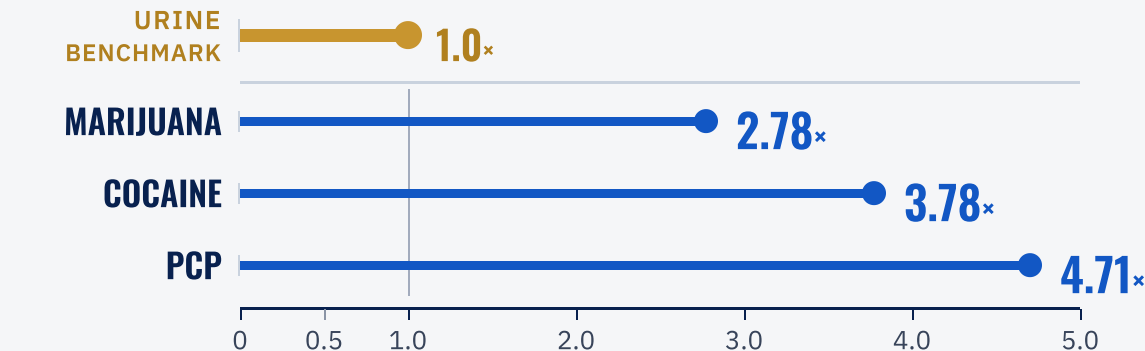
LET'S LOOK AT THE PATTERN.

Independent secondary analysis of publicly reported Quest Diagnostics Drug Testing Index (DTI) data; does not reflect the views or conclusions of Quest Diagnostics.

THE PATTERN EMERGES.

Illicit drug classes · 2025 Quest Drug Testing Index · Non-DOT workforce data

Relative System Sensitivity: Oral Fluid Positivity ÷ Urine Positivity



THREE DRUG CLASSES. SAME DIRECTION.

MARIJUANA

2.78× relative system sensitivity

COCAINE

3.78× relative system sensitivity

PCP

4.71× relative system sensitivity

THE DETECTION-WINDOW PARADOX

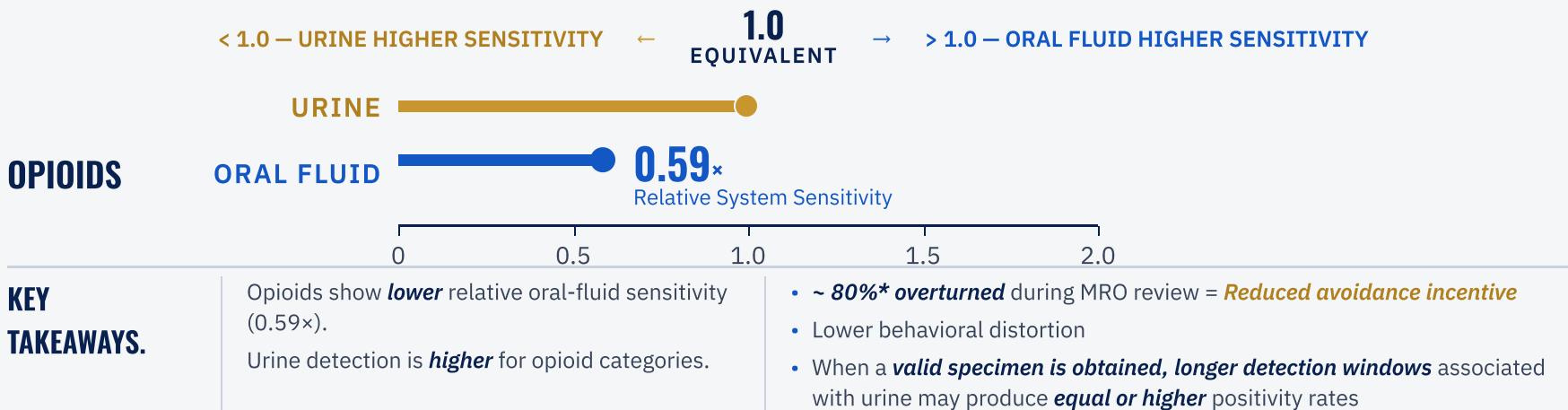
Oral fluid generally has the **shorter** detection window — yet substantially **higher observed positivity** appears across all three illicit drug classes.

**IF DETECTION WINDOW WERE THE DOMINANT EXPLANATION,
THIS IS NOT THE PATTERN WE WOULD EXPECT.**

So what else in the testing system could be influencing the observed outcome?

THE OPIOID PATTERN MOVES LEFT.

Relative System Sensitivity: Oral Fluid Positivity ÷ Urine Positivity



THE SYSTEM DOESN'T FAVOR ONE SPECIMEN THE SAME WAY ACROSS EVERY DRUG CLASS.

Something about the drug class — and the testing environment surrounding it — appears to matter.

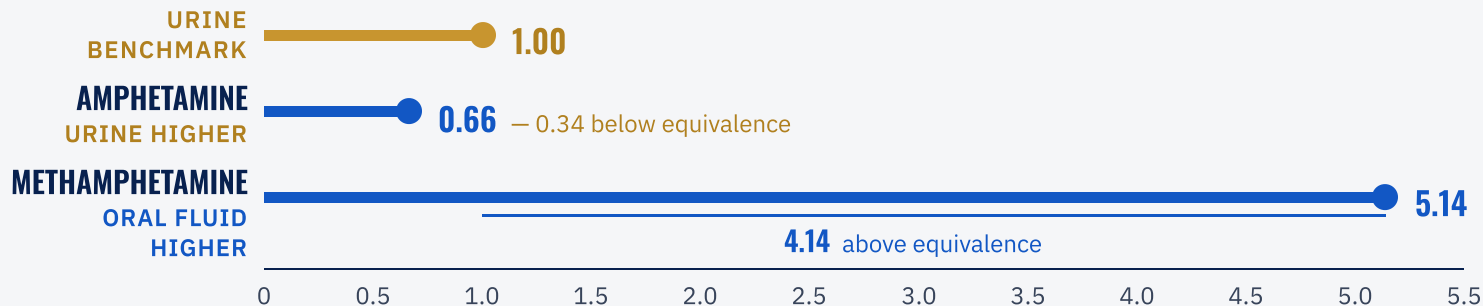
*Opioid sensitivity reflects combined Quest DTI categories for codeine/morphine, hydrocodone/hydromorphone, oxycodone/oxymorphone, and 6-acetylmorphine. Fentanyl is excluded because comparable oral-fluid reporting was not available in the analyzed DTI data.

*CRG non-DOT MRO Review data — 2025.

*Independent secondary analysis of publicly reported Quest Diagnostics Drug Testing Index (DTI) data; does not reflect the views or conclusions of Quest Diagnostics.

DIVERGENCE WITHIN THE AMPHETAMINES CATEGORY.

INSIDE THE AMPHETAMINES CATEGORY



PRESCRIPTION-TOLERANT Opioids **0.59** Amphetamine **0.66** → URINE HIGHER

ILLICIT-ONLY Marijuana **2.78** Cocaine **3.78** PCP **4.71** Methamphetamine **5.14** → ORAL FLUID HIGHER

ONE CATEGORY. TWO VERY DIFFERENT SIGNALS.

AMPHETAMINE 0.66

Observed positivity favors Urine

A pattern similar to the opioid categories. Prescription use can provide a legitimate medical explanation during MRO review.

METHAMPHETAMINE 5.14

More than 5× the relative observed positivity in Oral Fluid

A pattern similar to the illicit-only drug classes.

NOW THE HIDDEN PATTERN BECOMES HARDER TO IGNORE.

Drug classes with different consequence and prescription contexts show strikingly different relative detection patterns.

**Independent secondary analysis of publicly reported Quest Diagnostics Drug Testing Index (DTI) data; does not reflect the views or conclusions of Quest Diagnostics. Amphetamine and methamphetamine subcategories were isolated from the reported aggregate categories in the 2025 DTI Annual Summary.*

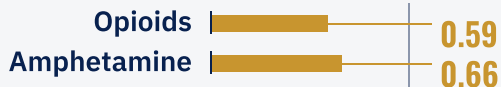
NOW THE PATTERN IS VISIBLE.

Relative System Sensitivity across drug classes · 2025 Quest Drug Testing Index · Non-DOT workforce data · Reporting years 2020–2024

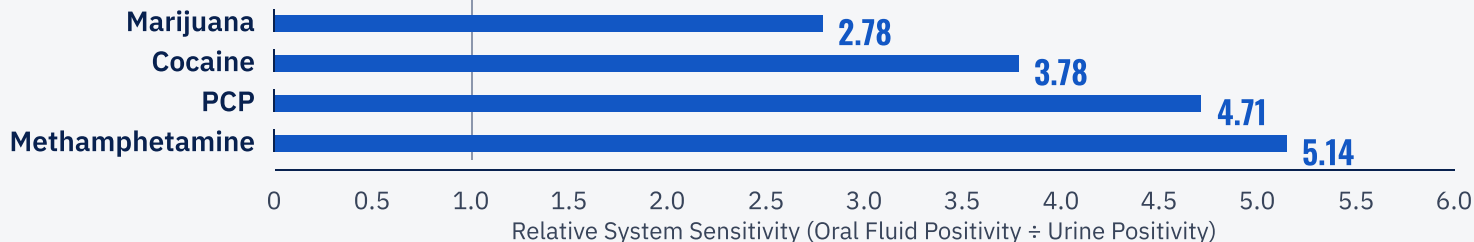
Oral Fluid Positivity ÷ Urine Positivity

PRESCRIPTION-TOLERANT CATEGORIES

URINE HIGHER ← 1.0 → ORAL FLUID HIGHER



ILLICIT-ONLY CATEGORIES



THE DIFFERENCE TRACKS WITH DRUG CLASS — NOT SIMPLY SPECIMEN TYPE.

Prescription-tolerant categories
0.59–0.66
Observed positivity favors Urine

2.78–5.14 Illicit-only categories
Observed positivity strongly favors Oral Fluid

Oral Fluid does not uniformly produce higher positivity — the direction and magnitude change systematically across drug classes.

WHAT CHANGES ACROSS THESE CATEGORIES?

Consequence of detection

Availability of a legitimate medical explanation

Incentive to influence the outcome

Those differences point us back toward the collection process — and the integrity of the specimen entering the analytical system.

THE SIGNAL ISN'T RANDOM.

The question is what feature of the testing system best explains the divide.

**Independent secondary analysis of publicly reported Quest Diagnostics Drug Testing Index (DTI) data; does not reflect the views or conclusions of Quest Diagnostics.*

THE PATTERN NARROWS THE EXPLANATION.

Across the evidence, one relationship keeps coming into focus.

WHAT THE EVIDENCE SHOWS

REAL-WORLD TRANSITIONS

Signal appeared across two different workforce transitions.

Higher observed positivity followed urine → oral fluid adoption.

PAIRED COLLECTIONS

Signal persisted with the same donors at the same time.

Population and collection timing were controlled within the paired study.

DRUG-CLASS PATTERN

The pattern changed with the consequence associated with detection.

Illicit-only, prescription-tolerant, and mixed categories did not behave alike.

THE BEHAVIORAL INCENTIVE THESIS

CONSEQUENCE OF DETECTION

creates or reduces

MOTIVATION



+



COLLECTION DESIGN

creates or limits

OPPORTUNITY

*potential
to influence*



**INFLUENCE
OUTCOMES**

THE PATTERN IS CONSISTENT WITH MOTIVATION AND OPPORTUNITY INFLUENCING THE SPECIMEN BEFORE ANALYSIS BEGINS.

= The test system cannot control **motivation**, but it can control **opportunity**.

THREE MATRICES. THREE DIFFERENT SYSTEM DESIGNS.

Each offers different strengths and tradeoffs. The question is which characteristics matter most to the intended outcome of the test.

	HAIR	URINE	ORAL FLUID
01 DETECTION WINDOW	LONGEST Extended historical reach	INTERMEDIATE Moderate historical reach	SHORTEST More recent-use focused
02 COLLECTION CONTROL Degree to which specimen acquisition is controlled by the collection process	HIGH	VARIABLE Collection control varies by collection protocol	HIGH
03 COLLECTION COMPLEXITY	HIGHER Specimen availability and characteristics can vary	MODERATE Facility and collection requirements add complexity	LOWER Direct, rapid collection
04 RELATIVE COST	HIGHER	LOWER	MODERATE

RECENT STUDY OUTCOMES

HAIR

9× higher observed positivity

Transportation pre-employment study

Hair 5.55% | Urine 0.59%

ORAL FLUID

3.3× CRG Warehouse transition

2.6× CRG Hospital transition

3.5× DOT contemporaneous paired collections

2.78–5.14× Quest DTI — illicit-use drug classes

URINE

?

ACROSS THE EVIDENCE REVIEWED HERE, URINE DOES NOT EMERGE AS THE SUPERIOR SYSTEM FOR DETECTING ILLICIT DRUG USE.

These findings come from different populations, study designs, time periods, and testing programs and should not be interpreted as direct Hair vs. Oral Fluid comparisons.

LET'S GO BACK TO WHERE WE STARTED.

THE 9× RESULT IS REAL. BUT RATIOS HAVE TWO SIDES.

Two alternative matrices. Two very different testing systems. One common comparator.

HAIR STUDY

Transportation pre-employment

$$\begin{array}{ccccc} 5.55\% & \div & 0.59\% & = & 9.4\times \\ \text{HAIR} & & \text{URINE} & & \text{RELATIVE} \\ & & & & \text{POSITIVITY} \end{array}$$

PUBLISHED STUDY RESULT

BUT LOOK AT THE URINE COMPARATOR.

$$\begin{array}{ccc} \text{STUDY URINE} & & \text{FMCSA CONTEXT} \\ 0.59\% & \rightarrow & \approx 1.3\% \end{array}$$

CONTEXTUAL SENSITIVITY CHECK

$\approx 4.1\times$

ILLUSTRATIVE ONLY — NOT A
RECALCULATION OF THE STUDY

Study urine positivity was $\approx 44\%$ of the
broader FMCSA pre-employment rate.

ORAL FLUID PAIRED STUDY

Contemporaneous DOT collections

$$\begin{array}{ccccc} 7.14\% & \div & 2.04\% & = & 3.5\times \\ \text{ORAL} & & \text{URINE} & & \text{RELATIVE} \\ \text{FLUID} & & & & \text{POSITIVITY} \end{array}$$

196
DONORS

Same donors. Same collection
event.

TWO VERY DIFFERENT DETECTION WINDOWS.

A SURPRISINGLY SIMILAR RELATIVE SIGNAL.

Different studies, populations, and designs. The $\approx 4.1\times$ figure is an illustrative sensitivity check — not a recalculation or direct Hair vs. Oral Fluid comparison.

IF DETECTION WINDOW ALONE WERE DRIVING THE OUTCOMES, WOULD WE EXPECT THESE TWO SIGNALS TO LOOK THIS SIMILAR?

Sources: Voss, Li & Bolumole, Hair v. Urine Testing Efficacy for Commercial Motor Vehicle Driver Pre-Employment Drug Screens (2024–2025) · FMCSA Drug and Alcohol Clearinghouse / MIS pre-employment reporting (contextual national benchmark; not a substitute for the urine result observed in the Hair study) · CRG contemporaneous DOT paired oral fluid and urine collections.

THE TEST MAY COST MORE. DOES THE INTELLIGENCE?

Price per test measures spending. It does not necessarily measure value.

REAL-WORLD EMPLOYER TRANSITION

+42%

HIGHER COST PER TEST

Urine = **100%** Oral fluid = **142%**

÷

~3.7×

MORE POSITIVE FINDINGS

Relative cost ÷ relative findings

142%

Oral fluid cost **42% more per test**

÷

3.7

=

38%

RELATIVE COST PER
ACTIONABLE FINDING

≈62% LOWER
INTELLIGENCE COST

HIGHER PRICE PER TEST ≠ HIGHER COST OF INTELLIGENCE

When testing systems produce different amounts of actionable information, price per test alone is an incomplete measure of value.

THE STANDARD SHOULDN'T BE THE STANDARD SIMPLY BECAUSE IT'S **WHAT WE'RE USED TO.**

**STANDARDS SHOULD BE CONTINUALLY CHALLENGED AGAINST ALTERNATIVE METHODS
— NOT SIMPLY PRESERVED BY FAMILIARITY.**

01 PURPOSE

WHAT ARE WE TRYING TO LEARN?

Does the testing system reliably produce the information the test is intended to provide?

02 SYSTEM DESIGN

WHAT CAN INFLUENCE THE OUTCOME?

Does collection design constrain or create opportunity to hide the truth?

03 VALUE

HOW SHOULD WE MEASURE VALUE?

Are we measuring only what the test costs
— or what we learn from the spend?

**THE STANDARD SHOULD BE THE SYSTEM
THAT **MOST RELIABLY SERVES THE PURPOSE OF THE TEST.****

THANK YOU

QUESTIONS & DISCUSSION

JIM TEDROW, MT(ASCP)

DIRECTOR, CRG LABORATORIES • FOUNDER, FLUIDPATH

jtedrow@thecrginc.com

FLUIDPATH.NET