Volume 75 Number 3

Federal PROBATION
a journal of correctional philosophy and practice

Testing the Validity of Pupillometer Technology Against Traditional Drug Screening Instruments

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THE PURPOSE OF this study was to assess the validity of a pupillometer drug screening technology against two conventional measurements, urinalysis and oral swab, in screening probationers that were being monitored by a large urban court. Pupillometer screening is a relatively new procedure in retina technology and involves a self-administered computerized test that examines the probationer's eye to detect recent drug and alcohol abuse. The monitoring device is approximately the size of an Automated Teller Machine. When the probationer reports for drug screening, he or she enters an identification number into the system. The subject's eye is then scanned while following a series of flashing lights. During this 30-second procedure, the eye is given a controlled amount of light to measure the involuntary reflexes of the eye's reaction. The instrument collects four ocular measurements (saccadic velocity, latency, diameter, and amplitude) and compares the individual's current reaction to their baseline reaction (an established negative reading) to test for impairment. Proponents of the technology indicate that each drug affects the eye's reaction in a different way; as such, the instrument is able to pinpoint the specific drug, including marijuana, opiates, cocaine, amphetamines, methamphetamines, depressants, and inhalants, from which the subject is currently recovering.

The technology boasts several benefits (noted in figure 1), yet its effectiveness vis-à-vis its validity has not yet been corroborated given the dearth of published, peer-reviewed data supporting the marketed advantages. Figure 2 shows a comparison of alternative drug-testing methodologies. Urinalysis and saliva testing can typically detect the presence of drugs in the subject's system for up to three days and in some instances a week. Comparatively, pupillometer technology (PT) has a narrow window of detection (up to 48 hours). Thus, research is needed to assess false-negative rates (sensitivity) to determine to what extent the technology is appropriate for screening probationer drug use. Equally important, analysis is warranted in examining the rate of difference in unconfirmed positives (specificity).

The Probation Division of the subject court used PT during a 36-month timeframe to screen probationers for substance abuse. Before it became a staple procedure for screening probationers, the court sought a two-fold analysis to determine if the technology should continue to be used as an alternative to the foregoing modalities. First, what differences in identifying drug usage among probationers exist between pupillometer technology findings and

other conventional measurements? Second, if any disparity does exist, is it statistically significant, necessitating an abandonment of the practice? This research was guided by the following general null hypothesis: There is no significant difference between the test results of PT and other drug-screening modalities administered to probationers; that is, test results (Y) are not dependent upon drug screening instruments (X). The hypothesis is derivative of the need to test the efficacy of PT. Together, this analysis will demonstrate the most cost-effective procedure relative to court objectives.

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Methodology

Participants were selected using a simple random sampling method, a probability-type sampling procedure. Simple random samples are groups in which each individual, in this case baselined probationers, have an equal probability of being selected (Hagan 2003). Probationers were randomly chosen from a complete list of the court's baselined population, using a table of random numbers (Frankfort-Nachmias 1999). The utility of random sampling is that the variance should allow for a diverse sample so as to evaluate whether the instrument's validity is impacted by characteristics inherent in the probation population; that is, how different persons metabolize drugs that PT is attempting to identify. Assuming that conditions have not changed, findings should not vary significantly on repeated measurement. With a given degree of error, the court can assume that what is true of the sample is also true of the baselined population.

At the time of this study, the baselined population comprised 5,252 probationers. The court sought a target sample of 646 (12.3 percent of the baselined population), anticipating a response rate of 5 percent (262 probationers). A total of 188 probationers (approximately 3.6 percent of the probation population) were included in this study. Table 1 enumerates the disposition totals of the sample. The breakdown shows that almost 72 percent of the sample was tested. Five of these probationers were unable to be tested with PT at the time of the screening due to eye ailments. A total of 183 probationers were tested in whole (screened with each of the 3 modalities) while 188 probationers were tested in part (screened with urinalysis and oral swab). The remaining 28 percent of the sample (N = 74) were not screened for the reasons noted.

For the purposes of this study, the term "baselined" referred to those probationers that have been confirmed in having a negative PT reading. This measurement serves as the benchmark to which subsequent readings are compared. All probationers, unless otherwise prohibited by a verified medical problem, are required to partake in the PT procedure in order to establish the standard reading. As a condition of probation, subjects consented to the periodic testing for drug use. Consequently, their participation in this study was not voluntary. According to the Probation Division, the process takes approximately 35 minutes and involves the following two-step procedure. First, probationers submit a urine sample. If the sample is negative, the subject completes three consecutive satisfactory PT screenings. If the specimen is positive, the probationer cannot be baselined and is scheduled to return on a day when he or she is free of prohibited toxins.

The data collection method was principally employed to test the validity of PT by comparing the results to the instruments. In this context, validity exists when there is an insignificant difference between the positive and negative results of PT and the findings of the urinalysis and other drug screening methods, thereby supporting the null hypothesis. More simply, does PT measure that which it purports to measure? Validity differs from reliability (which was not measured) in that a study of reliability would repeatedly test the same subjects using each of the instruments to determine the stability of the measurement's results over time. This of course assumes that rival causal factors have not changed. Data collected from PT was analyzed for sensitivity (false-negative rate) and specificity (unconfirmed positive rate).

The design procedure for the study was as follows:

1. Approximately 12 percent of the baselined population was randomly selected from an alphabetical list identifying each probationer by last name.
2. The selected probationers were scheduled for an appointment to be tested by the Probation Division during a three-month period.

3. Upon arrival, all baselined probationers were administered the following tests in the noted order:
    a. Urine collected and screened by the NJ Department of Health
    b. Oral swab sample collected and analyzed by the Bendinger and Schlesinger Laboratories
    c. PT reading recorded by the kiosk located in the Probation Division facility.

4. An assigned Probation Officer recorded the demographic information and the results of each test on the data collection form (figure 3). The data was subsequently entered into a database for eventual analysis. The frequencies of the positive and negative results of the tests were compared for significance using the Nonparametric Chi-Square Test.

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Results

This research sought to examine the difference in results between PT and two traditional screening methods (urinalysis and saliva). The data was described using the cross-tabulation and chi-square methods demonstrating which aspects of the null hypothesis are supported and rejected. Chi-Square was utilized to test for significant relationships between screening instruments and test results. The .05 alpha level of significance was the benchmark value in rejecting the null hypothesis. Conclusions were extrapolated from these findings to formulate policy recommendations regarding the continued use of PT in monitoring drug usage among probationers.

Table 2 shows the makeup of the probationer sample by race, gender, and age. The vast majority of probationers were African-American and male. African-Americans comprised almost three-quarters of those sampled, followed by Hispanics, who included less than 17 percent of the total. Males outnumbered females by more than four to one. The average participant was 31 years of age, with the youngest being 12 and the oldest 71 at the time of screening.

Table 3 illustrates the drug test results by screening modality and racial background. Table 4 depicts the data by gender. The results of the urinalysis—considered the most reliable of the three measurements—demonstrate that 25 percent of the sample tested positive for drugs. This finding mirrors the current trend data of the probation population, where approximately 25 to 28 percent of probationers routinely test positive for substance abuse. Given the proportion of African-Americans and males to their counterparts in the sample, the fact that these groups had the largest number of positive results was expected. The rates, however, were not evenly distributed when the three modalities were compared. With the exception of those identifying themselves as "other," Caucasians were the only group whose saliva positive rate exceeded the urinalysis positive rate. The data shows that African-Americans account for most of the PT false-positives noted in tables 6 and 8. The positive rate for African-Americans tested with PT decreased by 11.5 percent when compared with urinalysis results and by 16.8 percent when compared to saliva findings. Caucasians, on the other hand, showed a negligible difference in the tests' results. Similarly, the number of Hispanics testing positive with PT decreased by less than one percent when compared to urinalysis results and declined by 2.2 percent when measured against saliva findings.

The results for males, analogous to racial background differences, were also disproportionate when compared to females. There was approximately a 15-percentage point difference between the positive results of PT and urinalysis. The difference was more pronounced with saliva results, where the number of males testing positive with PT decreased by more than 18 percent. Conversely, females testing positive showed only a one percent increase when tested against urinalysis and slightly more than a one percent decrease when compared to saliva results.

The results noted in tables 3 and 4 suggest that African-Americans and males have a greater propensity for testing positive with PT than their counterparts; however, data which isolates PT false-positives and false-negatives show that these groups comprised the largest percentage for *both* error types. Therefore, differences in the distribution of test responses are likely to be based on the proportion of specific groups within the population. Tables 5 and 6 illustrate the

demographic distribution of PT false-positives and false-negatives, respectively, when measured against urinalysis findings. With respect to racial background, African-Americans comprised approximately three-quarters of the false readings. Males, too, made up most of the false readings, yet there was almost a 12 percent difference between the two error types.

Tables 7 and 8 show PT false readings when compared against oral swab results. The data demonstrated that males generally make up 90 percent of the errors. The results for African-Americans deviated slightly for false-negatives, indicative of nearly a 10-percent difference compared to false-positives.

Research Hypothesis A—There is no significant difference between the PT and urinalysis screening methods and their test results for probationers

The following tables illustrate the cross-tabulation and chi-square test results of the PT and urinalysis screening instruments. There were 23 false-negative results registered by urinalysis, indicating that for every five probationers that were rendered negative by PT, one of them was determined to be positive by urinalysis. With respect to the false-positive rate, the results were more remarkable. The data showed that more than 70 percent of probationers who tested positive with PT were determined to be negative by urinalysis. The chi-square test demonstrates that the false readings were statistically significant at the .000 level.

Table 10 shows that given the expectation that the PT positive results should parallel urinalysis positive results, the PT false-positive rate was statistically significant at the .000 level. The observed number of negatives registered by urinalysis was 51 while the expected count was 0. The residual was thus 51 false-positive readings, an estimated 72 percent of those testing positive with PT. Table 10a is a hypothetical chi-square result, which was calculated using the same observations, but which reduces the expectation to the point where the difference is no longer significant. This model shows that given these observations, a minimum expected count of 28.1 is needed—roughly 40 percent—in order for the difference to be insignificant.

Table 11 depicts the results after applying the same methodological principles to the PT/Urinalysis false-negative readings. The data indicates a residual of 23, which was also significant at the .000 probability level. Table 11a shows that if these observations remained constant, the chi-square result would begin to decline in significance at the expected count of 96.1 or assuming a level of accuracy not exceeding 85.8 percent.

Research Hypothesis B—There is no significant difference between the PT and oral swab screening methods and their test results for probationers

Table 12 shows the cross-tabulation and chi-square test results of the PT and oral swab modalities. Similar to the results of the PT/urinalysis cross-tabulation, the PT false-negative rate when cross-tabulated with oral swab was relatively the same, stipulating a 2 in 10 ratio. The false-positive rate for PT, however, increased to more than 83 percent. The chi-square test showed that the level of significance was unchanged at the .000 level.

The data noted in the following tables show the chi-square results for the PT/Oral Swab false-positive rate. The residual count of 59 in table 13 shows the resulting chi-square significant at .000. The hypothetical model reduces the residual to 7.3, at which point the differences are no longer significant. Therefore, given these observations, the positive results noted by PT would require a minimum accuracy of 27.2 percent when paired against oral swab in order for the chi-square to be statistically insignificant.

Tables 14 and 14a show the false-negative results for the PT/Oral Swab relationship. The chi-square value of 483964.6 indicated a result significant at the .000 probability level. The chi-square was reduced to 3.772 after the minimum expected cell frequency was reduced from 112 (100 percent accuracy) to 97 (86.6 percent accuracy).

The study's findings provide two conclusions for discussion. With respect to the PT false negative rate, the data suggests that the 48-hour window for PT screens allows approximately 20 percent of probationers to evade detection. Depending on the court's expectation of accuracy, the differences vary in statistical significance. Nonetheless, the court should be cognizant of the implications posed by the narrow timeframe, including the inherent consequences of supervising probationers who continue to have substance abuse problems without being formally sanctioned.

This finding requires that testing be frequent and random, which should mitigate the probationer's ability to conceal his or her drug addiction. If probationers cannot calculate the frequency and timing of screenings, then officers can be confident that those who continue to abuse drugs will *eventually* be detected. Incidentally, the high rate of false positives will also bolster this effect by lessening the probationer's ability to predict with certainty the test's outcome. This is not to discount the psychological impact that a false-negative result can have on a drug-addicted probationer. One assumes that the effect will be exacerbated with each screening the probationer passes while still addicted to drugs. The probationer is likely to gain confidence in his or her ability to dupe PT when undergoing false negatives, and without formal penalties, rehabilitation becomes less appealing, especially for those not motivated by other intrinsic factors.

The second conclusion relates to the PT false-positive rate. The test statistics show that when the minimum cell frequency was 0, both the urinalysis and oral swab results were statistically significant when paired against PT data. In light of these findings, PT should not be used exclusively in determining whether a probationer is in violation. Rather, a positive result must be corroborated through other, more accurate measurements. The significant number of false-positives suggests that PT is detecting physiological variables that, according to urinalysis and oral swab results, are not drug-induced. PT results may be impacted by a number of factors not yet thoroughly examined, such as fatigue or diet. Alternatively, the false-positive rate may be due to drug elements not identified by these traditional measurements. The prohibitive nature of the substance may underlie the differences. For instance, if a probationer took allergy medication, rendering the probationer drowsy, this could have had an adverse effect on the eye, yet not affect the urinalysis or oral swab reading. This study also showed that the false-positive rate was most prevalent among African-Americans and males. This was shown, however, to be symptomatic of the proportion of these groups within the probation population that was studied, indicating the demographic distribution of false-negatives.

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Conclusions

This study showed that the general null hypothesis, whereby H0 predicted that test results (Y) drawn from selected drug screening instruments (X) would not differ significantly, was rejected due to the false-positive and false-negative rates. This hypothesis is rejected due to the supposition that the court's expectation exceeds the level of accuracy stipulated in the chi-square models that note it as statistically insignificant. Table 15 depicts the cost differences of integrating PT into the probation operations of the court. The screening cost rates were applied to the total number of probationers included in the study's sample. This research illustrated that PT is effective only when it is used in tandem with other instruments; therefore, assuming that all probationers are initially screened with PT and that those testing positive (38.8 percent; N = 73) are subsequently screened by either urinalysis or oral swab to validate these results, the total cost savings for this sample would have been $753.30 for the former and $429.00 for the latter.

In view of the large volume of probationers within the select court, PT is a sound option economically, despite the significant rate of false readings. Judges and court administrators must consider their expectations of PT accuracy and then balance pecuniary benefits against the social effects, if any, of both the false-positives and false-negatives. The continued use of PT warrants that probationers be advised by their supervising officers that PT is only a preliminary screening for those testing positive and is not conclusive until the results are matched by another measurement. A policy and procedure in which probation officers are regularly trained in handling false-positive instances with their clients is therefore strongly suggested. This research concludes that the intangibles of false readings are not terribly distressing at this point, so long as the following three standards are maintained:

1. PT is not used exclusively to test probationers.
2. Probation officers are trained on an ongoing basis in managing the dynamics of false readings.
3. The PT false-negative results are statistically insignificant after matching the court's expected level of accuracy.

4. Future research should more thoroughly examine whether drug-screening results (sensitivity and specificity) are significantly impacted by probationer demographics such as race, gender, and age. Physiology may play a role in how individuals metabolize drugs, which in turn can affect sensitivity and specificity results of a given screening method. More in-depth analysis is also warranted regarding the psychological impact of false readings on probationer behavior. This study has offered some policy recommendations in mitigating the possible effects; however, empirical evidence is needed to determine whether new screening technologies such as PT influence recidivism rates among recovering probationers.

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Figures

Figure 1.
Pupillometer Technology—Drug Screening Marketed Benefits

1. 30-second self-administered screen—no operator required
2. Fully automated, and self-actuated
3. Easy-to-learn for subject
4. Runs 24/7, 365 days a year without an operator
5. Non-invasive—No body fluids involved in screening
6. Immediate results—within 15 seconds after screen subject has a print out
7. Detects alcohol within a 6-8 hour window
8. Detects current impairment and past impairment
9. Screens 8 (plus rave/designer drugs) commonly abused substances on every scan
10. Computerized assessment and reporting
11. Emails Officer/Counselor with results—instant notification
12. Individualized
13. Fixed cost—unlimited screening
14. Non-gender specific screening
15. Results cannot be faked or adulterated
16. Can monitor all age groups.... from juvenile to geriatric (Will not screen the legally blind)

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Figure 2.
Comparison of Alternative Drug Testing Methodologies

Source Sample	Invasiveness of Sample Collection	Detection Time	Cutoff Levels	Advantages	Disadvantages	Cost
Urine	Intrusion of privacy	Hours to days	Yes	High drug concentrations; established methodologies; quality control and certification	Cannot indicate blood levels; easy to adulterate	Low to moderate
Blood	Highly invasive	Hours to days	Variable limits of detection	Correlates with impairment	Limited sample availability; infectious agent	Medium to high
Hair	Noninvasive	Weeks to months	Variable limits of detection	Permits long-term detection of drug exposure; difficult to adulterate	Potential racial bias and external contamination	Moderate to high
Sweat	Noninvasive	Days to weeks	Screening cutoffs	Longer timeframe for detection than urine; difficult to adulterate	High inter-individual differences in sweating	Moderate to high
Saliva	Noninvasive	Hours to days	Variable limits of detection	Results correlate with impairment; provides estimates of blood levels	Contamination from smoke; pH changes may alter sample	Moderate to high
Breath	Noninvasive	Hours	No, except for ethanol	Ethanol concentrations correlate with impairment	Very short timeframe for detection; only detects volatile compounds	Low to moderate

Note: From Drug Testing in a Drug Court Environment: Common Issues to Address, by U.S. Department of Justice, 2000.

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Figure 3.
Data Collection Form

Demographic Characteristic	Notation
Race Check one	☐ Caucasian ☐ African-American ☐ Hispanic ☐ Asian ☐ Other
Gender	☐ Male

Check one	☐ Female
Age	The probationer's age at the time of the screening is _____.
Screening Method	**Results**
Urinalysis Check one	☐ Positive ☐ Negative
Oral Swab Check one	☐ Positive ☐ Negative
Pupillometer Screening Check one	☐ Positive ☐ Negative

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Tables

Table 1.

Disposition Totals of the Probation Sample

Disposition	Percent	N
Tested in part or in whole	71.8	188
Out of state	1.9	5
Incarcerated	4.6	12
Bench warrant issued	3.4	9
Violation of probation	12.6	33
Enrolled in probation program	1.5	4
Medically cited	.8	2
Discharged	3.1	8
Deceased	.4	1
Total	100	262

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Table 2.

Probation Sample by Race, Gender, and Age

Racial background	Percent
Caucasian	8.7
African-American	72.7
Hispanic	16.4
Asian	1.1
Other	1.1

Note: N = 188

Gender	Percent
Male	82.4
Female	17.6

Note: N = 188

Age	
Minimum	12
Maximum	71
Mean	31

Note: N = 188

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Table 3.

Drug Test Results by Screening Instrument and Race

	Pupillometer Technology		Oral Swab		Urinalysis	
Race	**Positive**	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**
Caucasian	2.7%	6%	2.7%	5.9%	2.1%	6.4%
African-American	30.1	42.6	13.3	59	18.6	53.7
Hispanic	4.9	11.5	2.7	14.4	4.3	12.8
Asian	.5	.5	—	1.1	—	1.1
Other	.5	.5	.5	.5	—	1.1
Total	38.8	61.2	19.1	80.9	25	75

Note: PT N = 183. Oral Swab N = 188. Urinalysis N = 188.

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Table 4.

Drug Test Results by Screening Instrument and Gender

Gender	Pupillometer Technology		Oral Swab		Urinalysis	
	Positive	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**
Male	35%	48.1%	16.5%	66%	20.2%	62.2%
Female	3.8	13.1	2.7	14.9	4.8	12.8
Total	38.8	61.2	19.1	80.9	25	75

Note: PT N = 183. Oral Swab N = 188. Urinalysis N = 188.

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Table 5.

Frequency Distribution of PT/Urinalysis False-Positive Rate by Race and Gender

	Frequency	Valid Percent
Race		
Caucasian	4	7.8
African-American	39	76.5
Hispanic	6	11.8
Asian	1	2
Other	1	2
Gender		
Male	46	90.2
Female	5	9.8

Note: N = 51.

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Table 6.

Frequency Distribution of PT/Urinalysis False-Negative Rate by Race and Gender

	Frequency	Valid Percent
Race		
Caucasian	3	13
African-American	17	73.9
Hispanic	3	13
Gender		
Male	18	78.3
Female	5	21.7

Note: N = 23.

Table 7.

Frequency Distribution of PT/Oral Swab False-Positive Rate by Race and Gender

	Frequency	Valid Percent
Race		
Caucasian	3	5.1
African-American	46	78
Hispanic	8	13.6
Asian	1	1.7
Other	1	1.7
Gender		
Male	54	91.5
Female	5	8.5

Note: N = 59.

Table 8.

Frequency Distribution of PT/Oral Swab False-Negative Rate by Race and Gender

	Frequency	Valid Percent
Race		
Caucasian	3	13.6
African-American	15	68.2
Hispanic	3	13.6
Other	1	4.5
Gender		
Male	20	90.9
Female	2	9.1

Note: N = 22.

Table 9.

Cross-Tabulation for PT and Urinalysis Results

			PT		
			Positive	Negative	Total
Urinalysis	Positive	Count	20	23	43
		% within PT	28.2	20.5	23.5
	Negative	Count	51	89	140
		% within PT	71.8	79.5	76.5
Total		Count	71	112	183
		% within PT	100	100	100

Table 10.

Chi-Square for PT and Urinalysis False-Positive Rate

	Observed N	Expected N	Residual
Positive	20	71	-51
Negative	51	0	51
Total	71		
Test Statistics			
Chi-Square	2630278		
df	1		
Asymp. Sig.	.000		

Note: 1 cells (50.0%) have expected frequencies less than 5. The minimum expected cell frequency is .0.

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Table 10A.

Chi-Square Model Depicting an Insignificant Finding for the PT/Urinalysis False-Positive Rate

	Observed N	Expected N	Residual
Positive	20	28.1	-8.1
Negative	51	42.9	8.1
Total	71		
Test Statistics			
Chi-Square	3.819		
df	1		
Asymp. Sig.	.051		

Note: 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 28.1.

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Table 11.

Chi-Square for PT and Urinalysis False-Negative Rate

	Observed N	Expected N	Residual
Positive	23	0	23
Negative	89	112	-23
Total	112		
Test Statistics			
Chi-Square	528963.5		
df	1		
Asymp. Sig.	.000		

Note: 1 cells (50.0%) have expected frequencies less than 5. The minimum expected cell frequency is .0.

Table 11A.

Chi-Square Model Depicting an Insignificant Finding for the PT/Urinalysis False-Negative Rate

	Observed N	Expected N	Residual
Positive	23	15.9	7.1
Negative	89	96.1	-7.1
Total	112		
Test Statistics			
Chi-Square	3.695		
df	1		
Asymp. Sig.	.051		

Note: 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 15.9.

Table 12.

Cross-Tabulation for PT and Oral Swab Results

			PT		Total
			Positive	Negative	
Oral Swab	Positive	Count	12	22	34
		% within PT	16.9	19.6	18.6
	Negative	Count	59	90	149
		% within PT	83.1	80.4	81.4
Total		Count	71	112	183
		% within PT	100	100	100

Table 13.

Chi-Square for PT and Oral Swab False-Positive Rate

	Observed N	Expected N	Residual
Positive	12	71	-59
Negative	59	0	59
Total	71		
Test Statistics			
Chi-Square	3480980		
df	1		
Asymp. Sig.	.000		

Note: 1 cells (50.0%) have expected frequencies less than 5. The minimum expected cell frequency is .0.

Table 13A.

Chi-Square Model Depicting an Insignificant Finding for the PT/Oral Swab False-Positive Rate

	Observed N	Expected N	Residual
Positive	12	19.3	-7.3
Negative	59	51.7	7.3
Total	71		
Test Statistics			
Chi-Square	3.810		
df	1		
Asymp. Sig.	.051		

Note: 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 19.3.

Table 14.

Chi-Square for PT and Oral Swab False-Negative Rate

	Observed N	Expected N	Residual
Positive	22	0	22
Negative	90	112	-22
Total	112		
Test Statistics			
Chi-Square	483964.6		
df	1		
Asymp. Sig.	.000		

Note: 1 cells (50.0%) have expected frequencies less than 5. The minimum expected cell frequency is .0.

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Table 14A.

Chi-Square Model Depicting an Insignificant Finding for the PT/Oral Swab False-Negative Rate

	Observed N	Expected N	Residual
Positive	22	15	7
Negative	90	97	-7
Total	112		
Test Statistics			
Chi-Square	3.772		
df	1		
Asymp. Sig.	.052		

Note: 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 15.0.

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Table 15.

Cost Integration of PT in Screening Probationers for Drug Usage

Screening Instrument	Cost per Probationer	Total Cost without Integrating PT	Total Cost with PT Integrated	Cost Difference
Urinalysis	$9.82	$1,846.16	$1,092.86	$753.30
Oral Swab	7.00	1,316.00	887.00	429.00
PT	2.00	—	—	—

Note: Total costs based on sample size (N = 188). PT cost per probationer based on an average number of probationers screened on an annual basis.

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