



**RACE AND GENDER NEUTRAL
PRETRIAL RISK ASSESSMENT,
RELEASE RECOMMENDATIONS, AND
SUPERVISION:
VPRAI AND PRAXIS REVISED**

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INTRODUCTION

According to Code of Virginia § 19.2-152.4:3, Virginia Pretrial Services agencies have two primary responsibilities: (1) present pretrial investigation reports – including pretrial risk assessments – with recommendations to assist courts in discharging their duties related to granting or reconsidering bail, and (2) supervise and assist all defendants placed on pretrial supervision by any judicial officer to ensure compliance with the terms and conditions of bail. Consistent with these statutory responsibilities, the Virginia Pretrial Risk Assessment Instrument (VPRAI) is used to measure the risk of pretrial failure (failure to appear and new arrest). A structured decision making tool known as the Praxis incorporates the VPRAI results and the current charge to guide Pretrial Services agencies' recommendations for release and detention, as well as pretrial supervision dosage (i.e., levels of supervision with varying frequency and types of contacts). The pretrial release and detention recommendation is designed to manage the risk in the most effective manner. In short, the VPRAI is used to measure the risk of pretrial failure and the Praxis is used to manage that risk.

A study conducted between October 2012 and December 2014, which included agency random assignment in the research design, established empirical support for the use of the VPRAI and Praxis in Virginia. The results can be found in the report *Risk-Based Pretrial Release Recommendation and Supervision Guidelines: Exploring the Effect on Officer Recommendations, Judicial Decision-Making, and Pretrial Outcome*.¹

As previously reported in *Risk-Based Pretrial Release Recommendation and Supervision Guidelines*, the VPRAI reliably classifies cases into groups characterized by increasing risk of failure pending trial and the Praxis reliably manages risk. Judges were more likely to release defendants at first appearance when a Pretrial Services agency was using the Praxis to make pretrial release and detention recommendations. In addition, defendants in the Praxis group who received varying dosages of supervision matched to their risk of failure were less likely to fail to appear and experience a new arrest.

The Virginia Department of Criminal Justice Services (DCJS) requested further analysis to (1) determine if the VPRAI can be improved and, if so, to create a revised VPRAI (VPRAI-Revised) and (2) propose a revised Praxis using the VPRAI-Revised and the results of the research. The proposed revised Praxis was reviewed and finalized by the Praxis Committee, consisting of representatives of DCJS, Pretrial Services agencies, Court (judges and magistrates), Commonwealth's Attorney, Public Defender, and Criminal Sentencing Commission.

This report describes the results of further analysis of the supervision sample used in the original study. The supervision sample comprises cases supervised by Pretrial Services beginning July 2013 to July 2014 and followed through December 2014. Each case contains a VPRAI and data on charge category, demographics, supervision, and outcome (N=14,382). The majority of pretrial cases were successful; of the 14,382 supervision cases, 15.2% experienced at least one type of pretrial failure (Any Failure). Those

¹ Danner, M. J. E., VanNostrand, M., and Spruance, L. M. (2015). *Risk-Based Pretrial Release Recommendation and Supervision Guidelines: Exploring the Effect on Officer Recommendations, Judicial Decision-Making, and Pretrial Outcome*. St. Petersburg, Florida: Luminosity, Inc.



that failed did so because of Failure to Appear (FTA, 4.0%), New Arrest (NA, 5.2%), and/or Technical Violation that resulted in bail revocation (TV, 8.8%).²

The text and tables presented in the body of this report are primarily of analysis of Any Failure. Where appropriate, the Appendix contains additional tables reporting analysis of pretrial failures due to Failure to Appear (FTA), New Arrest (NA), and Technical Violations (TV); these are noted with lowercase letters following the corresponding Any Failure table number (e.g., Appendix table 1a).

The primary objectives of these analyses are to (1) determine if the VPRAI can be improved and, if so, (2) to create a VPRAI-Revised and propose a revised Praxis. To meet these objectives, seven steps were followed as shown below.

1. Test the statistical validity and practical utility of the current VPRAI using descriptive, bivariate, and multivariate analyses.
2. Test the race and gender neutrality of the current VPRAI.
3. Test the statistical validity and practical utility of potential new risk factors using descriptive and bivariate statistics and select risk factors for inclusion in the VPRAI-Revised.
4. Test the statistical validity and practical utility of the VPRAI-Revised using multivariate analyses.
5. Weight the risk factors and create VPRAI-Revised risk levels with the greatest dispersion.
6. Test the race and gender neutrality of the VPRAI-Revised.
7. Propose a revised Praxis that uses the VPRAI-Revised and the results of the previous research.

RESEARCH FINDINGS

Each of the seven steps is listed below followed by a description of the corresponding analysis conducted and the primary findings.

1. TEST THE STATISTICAL VALIDITY AND PRACTICAL UTILITY OF THE CURRENT VPRAI USING DESCRIPTIVE, BIVARIATE, AND MULTIVARIATE ANALYSES

Descriptive (univariate) statistics describe the population of interest and bivariate statistics examine the relationship between each of the eight risk factors and pretrial success or failure. Chi-Square, a statistical test used with categorical data, was used to test whether any observed differences are statistically

² Defendants may have more than one failure type; as a result, the FTA, NA, and TV rates do not total the Any Failure rate.



significant. To say that a VPRAI risk factor is statistically significant means that the differences observed between success and failure are reliable and not due to chance. This observation comes from the calculation of the “*p*-value” which refers to the probability of observing a difference if no real difference exists. A *p*-value of $p < .001$ means that fewer than 1 in 1,000 samples would present a meaningless (or random) difference. A *p*-value of .05 (5 cases in 100) is commonly accepted in social science research, and is used here, to indicate reliable, non-random results. When statistical software returns the value of $p = .000$ it should be interpreted as $p < .001$ since a probability cannot equal zero.

Table 1 shows that each of the eight VPRAI risk factors has a statistically significant ($p < .001$ ³) relationship with Any Failure pretrial. Individuals with the risk factors (e.g., *Pending charge* = yes) fail at higher rates than those who do not, and these relationships between risk factors and Any Failure meet the statistical threshold of not being due to chance or random occurrences. The efficacy of the risk factors is also apparent when Any Failure pretrial is deconstructed into measures of Failure to Appear (FTA), New Arrest (NA), and Technical Violations (TV) (see Appendix tables 1a, 1b, and 1c, respectively).

Having established that the current VPRAI risk factors individually relate to failure pretrial, the analysis moves to determine whether these risk factors, as a group, are able to distinguish between success and failure pretrial. Logistic regression analysis confirms that the VPRAI as a whole is statistically significant in predicting Any Failure, FTA, NA, and TV pretrial (Table 2, $p < .001$). In addition, seven of the eight risk factors are statistically significant; only *Two or more violent convictions* is not significant at the $p \leq .05$ level.

The analytical strategy includes the calculation of Area Under the Curve for the Receiver Operator Characteristics (AUC-ROC), a common measure of risk assessment performance. The AUC-ROC from these multivariate analyses gauges the performance of the combined VPRAI risk factors in differentiating between defendants who are successful pretrial from those who experience Any Failure pending case disposition. The AUC-ROC value of .666 is interpreted as 66.6% of the time, when taking into account the eight VPRAI risk factors together, a randomly selected defendant who fails pretrial will have more of the risk factor characteristics than a randomly selected defendant who is successful. The AUC-ROC value of .666 is in the good range; 1 indicates a perfect model while .50 suggests that the tool predicts no better than chance.⁴

³ Although the statistical software returned the value of $p = .000$ shown in Table 1, it is reported in the text as $p < .001$ since a probability cannot equal zero.

⁴ AUC-ROC values of .54 and below are poor, .55 to .63 are fair, .64 to .70 are good, and .71 to 1.00 are excellent. Values of 1.00 are not expected as this would suggest perfect prediction. Desmarais, S. L., & Singh, J P. (2013). *Risk assessment instruments validated and implemented in correctional settings in the United States*. Lexington, Kentucky: Council of State Governments.



Table 1. Descriptive and Bivariate Statistics for Eight VPRAI Risk Factors (Any Failure Outcome)

		Total		Any Failure		Chi-Square	P
		N	%	N	%		
Charge type	Felony	8510	59.2	1602	18.8	216.135	.000
	Misdemeanor	5872	40.8	580	9.9		
Pending charge	Yes	3224	22.4	671	20.8	102.743	.000
	No	11158	77.6	1511	13.5		
Criminal history	Yes	11060	76.9	1880	17.0	124.112	.000
	No	3322	23.1	302	9.1		
Two or more FTA	Yes	1702	11.8	375	22.0	70.612	.000
	No	12680	88.2	1807	14.3		
Two or more violent convictions	Yes	1883	13.1	365	19.4	70.612	.000
	No	12499	86.9	1817	14.5		
Lived at residence less than one year	Yes	5302	36.9	878	16.6	12.572	.000
	No	9080	63.1	1304	14.4		
Not employed for two years prior to arrest	Yes	8307	57.8	1371	16.5	27.128	.000
	No	6075	42.2	811	13.3		
History of drug abuse	Yes	7102	49.4	1425	20.1	261.004	.000
	No	7280	50.6	757	10.4		



Table 2. Predicting Failure Outcomes with VPRAI Risk Factors

	Any Failure		FTA Failure		NA Failure		TV Failure	
	Odds Ratio	P	Odds Ratio	P	Odds Ratio	P	Odds Ratio	P
Charge type (felony)	1.986	.000	1.193	.049	1.677	.000	2.408	.000
Pending charge	1.563	.000	1.344	.002	1.792	.000	1.572	.000
Criminal history	1.585	.000	1.618	.000	1.572	.000	1.495	.000
Two or more FTA	1.159	.000	1.340	.000	1.026	.639	1.146	.001
Two or more violent convictions	1.120	.092	1.245	.053	1.072	.508	1.121	.172
Lived at residence less than one year	1.159	.002	1.351	.000	1.100	.208	1.105	.104
Not employed for two years prior to arrest	1.170	.001	1.129	.171	1.232	.007	1.103	.112
History of drug abuse	1.763	.000	1.267	.008	1.481	.000	2.096	.000
Constant	.041	.000	.015	.000	.016	.000	.019	.000
Model Chi-Square	633.505	p=.000	119.018	p=.000	191.626	p=.000	514.031	p=.000
Nagelkerke R Square	.075		.029		.038		.078	
AUC-ROC	.666	p=.000	.630	p=.000	.642	p=.000	.688	p=.000
AUC-ROC Confidence Intervals	Lower=	Upper=	Lower=	Upper=	Lower=	Upper=	Lower=	Upper=
	.654	.678	.608	.653	.622	.661	.674	.703

The practical merit of establishing that the current VPRAI risk factors, individually and combined, relate to pretrial failure relies on how well the risk factors translate into a risk categorization tool by classifying defendants based on their risk of pretrial failure. The eight VPRAI risk factors are weighted and summed to calculate a VPRAI score. Each risk factor is scored at 1 point with the exception of *Two or more failures to appear* which is assigned 2 points. The points are totaled to create a score from 0 to 9. The VPRAI is then collapsed to create five risk levels.⁵ The risk levels represent the likelihood of pretrial failure, including failure to appear in court and danger to the community pending trial.

Table 3 summarizes the effectiveness of the current VPRAI, including key qualities such as the overall predictive ability of the instrument, distribution of defendants into risk levels, and failure rates associated with risk levels (see Appendix tables 3a, 3b, and 3c). Consistent with the examination of the combined VPRAI risk factors’ predictive ability via logistic regression presented above (see Table 2), the AUC-ROC of .645 for the VPRAI risk levels indicates good predictive ability. The Total % column shows that nearly a quarter of cases (23.2%) are classified as high risk. This finding raises the question of whether there is a subset of cases yet to be identified who, as a group, fail at a higher rate. The Any Failure rates move incrementally from those cases classified as low risk of failing at a rate of 4.6% to high risk of failing having a failure rate of 24.5%. Chi-Square analyses indicates that the differences in failure rates observed across risk levels are statistically significant and not due to chance.

⁵ VanNostrand, M. & Rose, K. J. (2009). *Pretrial Risk Assessment in Virginia*. Richmond, Virginia: Virginia Department of Criminal Justice Services.



Table 3. Any Failure Outcome by VPRAI Risk Level

Risk Level	Score	Total N	Total %	Any Failure N	Any Failure %
Low	(0-1)	1661	11.5	77	4.6
Below Average	(2)	2691	18.7	229	8.5
Average	(3)	3524	24.5	479	13.6
Above Average	(4)	3168	22.0	578	18.2
High	(5-9)	3338	23.2	819	24.5
Base Rate	15.2				
Chi-Square	493.558, $p=.000$				
Agg R	1.00				
AUC-ROC	.645	Lower = .633	Upper = .657		
DIFR	.610				
Pearson's r	.185				

2. TEST THE RACE AND GENDER NEUTRALITY OF THE CURRENT VPRAI.

...the analyses support the neutrality of the VPRAI in classifying People of Color and Whites by risk of pretrial failure.

The performance of the current VPRAI with consideration of race and gender is assessed to determine whether the instrument is race and gender neutral. Table 4 presents the distribution of the sample by race. Approximately half of the sample (51.5%) is White, followed by Black defendants (43.2%) with a very small percentage (5.2%) of Hispanic,

Asian, Native American, and other race. In order to explore race neutrality, minority ethnic and racial groups were collapsed into People of Color (48.5%). As shown in Table 5, when failure rates are combined to indicate Any Failure, People of Color fail at the same rate (15.3%) as do Whites (15.2%). The similar Any Failure rates across racial groups is a balance between People of Color having a higher FTA rate (4.5% compared to Whites 3.6%) and Whites having a higher NA rate (6.1% compared to People of Color 5.0%).

Table 6 presents the descriptive and bivariate statistics for the eight VPRAI risk factors by race for Any Failure. Only one risk factor is not statistically significant. Because *Lived at residence less than one year* is not statistically significant for People of Color, assigning weight to it may result in overclassifying the risk of pretrial failure for this group.

Table 4. Distribution of Race

	N	%
Asian	140	1.0
Black	6145	43.2
Hispanic	510	3.6
Native American	16	0.1
Other	77	0.5
<u>White</u>	<u>7321</u>	<u>51.5</u>
Total ^A	14209	99.9
People of Color	6888	48.5
<u>White</u>	<u>7321</u>	<u>51.5</u>
Total	14209	100.0

^A There are 173 defendants (1.2%) whose race is unknown. They are excluded from the analyses.



Table 5. Outcomes by Race

	People of Color		White		Chi-Square	P
	N	%	N	%		
Any Failure	1053	15.3	1110	15.2	.043	.852
FTA	312	4.5	260	3.6	8.789	.003
NA	341	5.0	444	6.1	8.440	.004
TV	616	8.9	644	8.8	.094	.391

Table 6. Descriptive and Bivariate Statistics for Eight VPRAI Risk Factors by Race (Any Failure Outcome)

		People of Color				White			
		Total		Any Failure		Total		Any Failure	
		N	%	N	%	N	%	N	%
Charge type	Felony	4265	61.9	781	18.3	4163	56.9	808	19.4
	Misd.	2623	38.1	272	10.4	3158	43.1	302	9.6
	Chi-Square	79.105, $p=.000$				.341, $p=.000$			
Pending charge	Yes	1442	20.9	290	20.1	1742	23.8	377	21.6
	No	5446	79.1	763	14.0	5579	76.2	733	13.1
	Chi-Square	32.766, $p=.000$				74.621, $p=.000$			
Criminal history	Yes	5413	78.6	917	16.9	5534	75.6	950	17.2
	No	1475	21.4	136	9.2	1787	24.4	160	9.0
	Chi-Square	53.349, $p=.000$				70.837, $p=.000$			
Two or more FTA	Yes	1145	16.6	244	21.3	551	7.5	131	23.8
	No	5743	83.4	809	14.1	6770	92.5	979	14.5
	Chi-Square	38.463, $p=.000$				34.364, $p=.000$			
Two or more violent convictions	Yes	1118	16.2	210	18.8	756	10.3	155	20.5
	No	5770	83.8	843	14.6	6565	89.7	955	14.5
	Chi-Square	12.596, $p=.000$				18.695, $p=.000$			
Lived at residence less than one year	Yes	2436	35.4	391	16.1	2797	38.2	476	17.0
	No	4452	64.6	662	14.9	4524	61.8	634	14.0
	Chi-Square	1.696, $p=.103$				12.126, $p=.000$			
Not employed for two years prior to arrest	Yes	4208	61.1	682	16.2	4028	55.0	677	16.8
	No	2680	38.9	371	13.8	3293	45.0	433	13.1
	Chi-Square	7.065, $p=.004$				18.580, $p=.000$			
History of drug abuse	Yes	3331	48.4	650	19.5	3697	50.5	763	20.6
	No	3557	51.6	403	11.3	3624	49.5	347	9.6
	Chi-Square	88.961, $p=.000$				174.138, $p=.000$			



Two multivariate logistic regression models lend insight into whether the current VPRAI is neutral with regard to race. The first logistic regression model indicates whether inclusion of race along with the current VPRAI risk factors negates the ability of the individual and or combined risk factors to predict failure outcomes, and whether “race” is a significant predictor of Any Failure when the predictive ability of the risk factors are taken into consideration. The second logistic regression model allows for a comparison of the predictive ability of the current VPRAI between the People of Color sample and the White sample.

As seen in the Any Failure (All) columns of Table 7, race is not a significant predictor of Any Failure in the multivariate model. Nor does race impact the relationship between individual or combined risk factors and Any Failure. In fact, the predictive ability of the model, as measured by AUC-ROC, is exactly the same as the logistic regression model that did not include race (see Table 3, above). There is, however, a difference in the predictive ability of the VPRAI risk factors for People of Color and for Whites, with the model performing better for Whites. The AUC-ROC for Whites (.686) is higher than the AUC-ROC for People of Color (.645) and the difference is statistically significant ($AUC_{DIFF} = -.041, p = .002$).

Yet, as can be seen in Table 8, when VPRAI risk factors are weighted, summed, and collapsed into risk levels, the difference in AUC-ROC values for People of Color compared to Whites evidenced in the logistic regression models is no longer statistically significant ($AUC_{DIFF} = -.017, p = .332$). Taken as a whole, the analyses support the neutrality of the VPRAI in classifying People of Color and Whites by risk of pretrial failure.

Table 7. Predicting Failure Outcomes with VPRAI Risk Factors - Race

	Any Failure (All)		Any Failure (People of Color)		Any Failure (White)	
	Odds Ratio	P	Odds Ratio	P	Odds Ratio	P
Race – People of Color	.953	.324				
Charge type (felony)	1.984	.000	1.859	.000	2.095	.000
Pending charge	1.568	.000	1.456	.000	1.667	.000
Criminal history	1.593	.000	1.581	.000	1.593	.000
Two or more FTA	1.165	.000	1.162	.000	1.180	.003
Two or more violent convictions	1.129	.072	1.077	.410	1.211	.062
Lived at residence less than one year	1.151	.004	1.120	.109	1.167	.024
Not employed for two years prior to arrest	1.161	.003	1.145	.057	1.167	.025
History of drug abuse	1.753	.000	1.580	.000	1.945	.000
Constant	.043	.000	.048	.000	.037	.000
Model Chi-Square	625.959	$p = .000$	235.055	$p = .000$	400.396	$p = .000$
Nagelkerke R Square	.075		.058		.093	
AUC-ROC	.666	$p = .000$	.645	$p = .000$	.686	$p = .000$
AUC_{DIFF}	-.041, $p = .002$					



Table 8. Any Failure Outcome by VPRAI Risk Level – Race

Risk Level	Score	People of Color				White			
		Total		Any Failure		Total		Any Failure	
		N	%	N	%	N	%	N	%
Low	(0-1)	676	9.8	32	4.7	956	13.1	45	4.7
Below Average	(2)	1198	17.4	115	9.6	1448	19.8	110	7.6
Average	(3)	1637	23.8	218	13.3	1836	25.1	255	13.9
Above Average	(4)	1548	22.5	273	17.6	1589	21.7	299	18.8
High	(5-9)	1829	26.6	415	22.7	1492	20.4	401	26.9
Base Rate		15.3				15.2			
Chi-Square		176.961, $p=.000$				323.659, $p=.000$			
Agg R		1.00				.99			
AUC-ROC		.625				.664			
Pearson's r		.160				.208			
AUC _{DIFF}		-.017, $p=.332$							

...VPRAI risk level classifications perform equally well for the female sample and the male sample...

With respect to gender, nearly three-quarters (74.4%) of the sample is male and 25.6% is female (Table 9). Table 10 presents the failure rates for males and females. Any Failure rates do not differ between males (15.4%) and females (14.6%), although males do have a significantly higher rate of NA (5.8%) compared to females (4.5%). Bivariate analysis (Table 11) reveals that two risk factors are not

statistically significant in predicting Any Failure for females: *Two or more violent convictions* and *Lived at residence less than one year*. Assigning weight to these risk factors may result in overclassifying pretrial failure risk for females.

Table 9. Distribution of Gender

	N	%
Female	3677	25.6
Male	10705	74.4
Total	14382	100.0

Table 10. Outcome Rates by Gender

	Female		Male		Chi-Square	P
	N	%	N	%		
Any Failure	537	14.6	1645	15.4	1.236	.275
FTA	161	4.4	418	3.9	1.590	.206
NA	167	4.5	623	5.8	8.610	.004
TV	317	8.6	952	8.9	.251	.320



The gender neutrality of the VPRAI is supported by logistic regression analyses and comparison of VPRAI risk levels across the female and male samples. Table 12 shows that gender is not a significant predictor of Any Failure when included in a model of risk factors. The relationship between risk factors and outcome are not affected by including gender in the model and the predictive ability of the combined risk factors for the female sample (AUC-ROC = .667) is essentially the same as that for the male sample (AUC-ROC = .666).

Similarly, VPRAI risk level classifications perform equally well for the female sample and the male sample, as can be seen in the non-significant AUC_{DIFF} value presented in Table 13.

Table 11. Descriptive and Bivariate Statistics for Eight VPRAI Risk Factors by Gender (Any Failure Outcome)

		Female				Male			
		Total		Any Failure		Total		Any Failure	
		N	%	N	%	N	%	N	%
Charge type	Felony	2223	60.5	401	18.0	6287	58.7	1201	19.1
	Misd.	1454	39.5	136	9.4	4418	41.3	444	10.0
	Chi-Square	53.168, $p=.000$				163.515, $p=.000$			
Pending charge	Yes	903	24.6	183	20.3	2321	21.7	488	21.0
	No	2774	75.4	354	12.8	8384	78.3	1157	13.8
	Chi-Square	30.762, $p=.000$				72.968, $p=.000$			
Criminal history	Yes	2629	71.5	442	16.8	8431	78.8	1438	17.1
	No	1048	28.5	95	9.1	2274	21.2	207	9.1
	Chi-Square	36.064, $p=.000$				87.106, $p=.000$			
Two or more FTA	Yes	398	10.8	87	21.9	1304	12.2	288	22.1
	No	3279	89.2	450	13.7	9401	87.8	1357	14.4
	Chi-Square	18.836, $p=.000$				51.548, $p=.000$			
Two or more violent convictions	Yes	260	7.1	44	16.9	1623	15.2	321	19.8
	No	3417	92.9	493	14.4	9082	84.8	1324	14.6
	Chi-Square	1.206, $p=.157$				28.627, $p=.000$			
Lived at residence less than one year	Yes	1564	42.5	245	15.7	3738	34.9	633	16.9
	No	2113	57.5	292	13.8	6967	65.1	1012	14.5
	Chi-Square	2.455, $p=.065$				10.852, $p=.001$			
Not employed for two years prior to arrest	Yes	2218	60.3	358	16.1	6089	56.9	1013	16.6
	No	1459	39.7	179	12.3	4616	43.1	632	13.7
	Chi-Square	10.580, $p=.001$				17.510, $p=.000$			
History of drug abuse	Yes	1608	43.7	320	19.9	5494	51.3	1105	20.1
	No	2069	56.3	217	10.5	5211	48.7	540	10.4
	Chi-Square	64.273, $p=.000$				195.490, $p=.000$			



Table 12. Predicting Failure Outcomes with VPRAI Risk Factors - Gender

	Any Failure (All)		Any Failure (Female)		Any Failure (Male)	
	Odds Ratio	P	Odds Ratio	P	Odds Ratio	P
Gender - female	.976	.666				
Charge type (felony)	1.988	.000	1.951	.000	2.000	.000
Pending charge	1.565	.000	1.558	.000	1.567	.000
Criminal history	1.583	.000	1.595	.000	1.579	.000
Two or more FTA	1.159	.000	1.200	.009	1.147	.000
Two or more violent convictions	1.117	.102	.935	.709	1.152	.054
Lived at residence less than one year	1.161	.002	1.149	.149	1.165	.007
Not employed for two years prior to arrest	1.171	.001	1.198	.075	1.165	.007
History of drug abuse	1.761	.000	1.681	.000	1.788	.000
Constant	.042	.000	.042	.000	.041	.000
Model X ²	633.692	p=.000	158.590	p=.000	475.588	p=.000
Nagelkerke R Square	.075		.075		.075	
AUC-ROC	.666	p=.000	.667	p=.000	.666	p=.000
AUC _{DIFF}	.001, p=.949					

Table 13. Any Failure Outcome by VPRAI Risk Level – Gender

Risk Level	Score	Female				Male			
		Total		Any Failure		Total		Any Failure	
		N	%	N	%	N	%	N	%
Low	(0-1)	481	13.1	18	3.7	1180	11.0	59	5.0
Below Average	(2)	694	18.9	61	8.8	1997	18.7	168	8.4
Average	(3)	876	23.8	123	14.0	2648	24.7	356	13.4
Above Average	(4)	797	21.7	135	16.9	2371	22.1	443	18.7
High	(5-9)	829	22.5	200	24.1	2509	23.4	619	24.7
Base Rate		14.6				15.4			
Chi-Square		128.282, p=.000				366.373, p=.000			
Agg R		.99				1.00			
AUC-ROC		.648				.645			
Pearson's r		.185				.184			
AUC _{DIFF}		.003, p=.849							



3. TEST THE STATISTICAL VALIDITY AND PRACTICAL UTILITY OF POTENTIAL NEW RISK FACTORS USING DESCRIPTIVE AND BIVARIATE STATISTICS AND SELECT RISK FACTORS FOR INCLUSION IN THE VPRAI-REVISED.

Risk factors Charge is felony drug, theft, or fraud is superior to Charge type ... Unemployed at time of arrest is superior to Not employed for two years prior to arrest.

To determine if the VPRAI can be improved, analyses begins by examining the bivariate relationships between Any Failure and (1) alternatives to existing risk factors, noting whether the alternative risk factors are better able to distinguish between success and failure than the current VPRAI risk factors, and (2) an additional risk factor that could potentially improve the VPRAI. The

alternative risk factors include six research factors as originally collected, 13 additional measures based on those research factors, and one new research factor.⁶ Table 14 presents descriptive and bivariate statistics for the five VPRAI risk factors and corresponding alternative risk factors that were most promising, one new research factor, and one existing VPRAI risk factor.

There are statistical and practical considerations in choosing an alternative to a current VPRAI risk factor. The first statistical step is to determine whether the potential risk factors have statistically significant relationships with Any Failure. A review of Chi-Square p -values reveals that all of the factors in Table 14 are statistically significant ($p < .001$). Next, the strength of the relationships between factors and Any Failure, summarized using the Cramer's V statistic, inform the selection process. Cramer's V measures the strength of relationship between two categorical variables. A V of zero indicates no association between the two variables and larger values indicate greater association with a V of one indicating perfect association. Thus, factors with larger values of V are desired. Finally, statistics alone must not drive decisions as numbers do not reveal the contexts in which individuals live and the criminal justice system operates.

As seen in Table 14, alternatives to the VPRAI risk factor *Charge type* (felony or misdemeanor) include (1) a measure with nine categories of charges (e.g., drug, firearm, etc.), (2) a measure that combines drug, theft, and fraud categories compared to all other charge categories, and (3) a measure of whether the charge is felony drug, theft, or fraud. The superior measure is *Charge is felony drug, theft, or fraud* based on its higher V value; this measure's V is .162 compared to the current VPRAI *Charge type* risk factor V of .123. The incorporation of the charge categories drug, theft, or fraud to the current measure that only distinguishes between felony or misdemeanor raises the Any Failure percent for the risk factor from 18.8% to 22.3%. While the nine-category measure has the highest V value (.170), its numerous categories limits the measure's utility in a parsimonious risk assessment instrument.

A choice is made between the current VPRAI unemployment related risk factor *Not employed for two years prior to arrest* and the alternative *Unemployed at time of arrest*. The alternative measure contrasts being unemployed at the time of arrest to being employed, a full-time student, a primary caregiver, or a

⁶ Specifically, bivariate analyses were conducted on 20 alternative risk factors and compared to the VPRAI risk factors as follows: *Charge type* (compared to three alternatives), *Two or more failure to appear* (two alternatives), *Two or more violent convictions* (three alternatives), *Not employed for two years prior to arrest* (one alternative), *History of drug abuse* (10 alternatives).



retiree. The VPRAI risk factor *Not employed for two years prior to arrest* has an Any Failure percent of 16.5 and V value of .043, compared to the measure *Unemployed at time of arrest* with a superior 17.8 Any Failure percent and superior V value of .087.

While two alternative measures are superior to current VPRAI risk factors, the VPRAI *History of drug abuse* risk factor proves to be a better choice over its alternatives: UNCOPE categories of dependence, abuse and none, UNCOPE combination of substance types “other drug” or “alcohol and other drug,” and the composite measure of UNCOPE dependency and “other drug.” The strength of the relationship between *History of drug abuse* and Any Failure ($V = .135$) is greater than those of the alternative measures.

A clearly superior measure of violent criminal history does not emerge. The VPRAI risk factor *Two or more violent convictions* ($V = .046$) is compared to the alternative violent arrest factors which categorize the counts of arrest in three ways: none to eight (nine categories), two or more, and four or more. All four factors have fairly similar V values, .041 to .048, providing no reason to replace the current risk factor.

Active community supervision is a new research factor and not comparable to an existing VPRAI risk factor. Twenty-two percent of cases under active community supervision at the time of arrest experienced Any Failure pretrial. The factor’s V value of .087 is in line with other measures selected for the VPRAI-Revised.

Practical considerations dictate the decision regarding the VPRAI *Two or more failure to appear*. Although the two alternative *FTA convictions* factors possess larger V values (.101 and .096 compared to .070), inconsistent practices across Virginia with regards to the disposition of FTA charges make replacing the VPRAI *Two or more failure to appear* unwise.

Table 14. Descriptive and Bivariate Statistics for Alternative VPRAI Risk Factors (Any Failure Outcome)

		Total		Any Failure		Chi-Square	P	Cramer’s V
		N	%	N	%			
Charge type (VPRAI Risk Factor)	Felony	8510	59.2	1602	18.8	216.135	.000	.123
	Misdemeanor	5872	40.8	580	9.9			
Charge category	Drug	3117	21.7	717	23.0	414.073	.000	.170
	Theft/fraud	2382	16.6	509	21.4			
	Firearm	428	3.0	72	16.8			
	FTA	774	5.4	121	15.6			
	Traffic: non-DUI	333	2.3	50	15.0			
	Non-violent misd.	801	5.6	106	13.2			
	Violent	3478	24.2	315	9.1			
	Traffic: DUI	2208	15.4	177	8.0			
	Other	861	6.0	115	13.4			
Charge category	Drug or theft/fraud	5499	38.2	1266	22.3	351.010	.000	.156
	All other categories	8883	61.8	956	10.8			
Charge category	Charge is felony drug, theft, or fraud	4793	33.3	1121	23.4	377.098	.000	.162
	All other categories	9589	66.7	1061	11.1			



Table 14. Descriptive and Bivariate Statistics for Alternative VPRAI Risk Factors (Any Failure Outcome), continued

		Total		Any Failure		Chi-Square	P	Cramer's V
		N	%	N	%			
Not employed for two years prior to arrest (VPRAI Risk Factor)	Yes	8307	57.8	1371	16.5	27.128	.000	.043
	No	6075	42.2	811	13.3			
Unemployed at time of arrest	Yes	6917	48.1	1234	17.8	73.726	.000	.072
	No	7465	51.9	948	12.7			
Active community supervision (Research Factor)	Yes	2578	17.9	564	21.9	109.745	.000	.087
	No	11804	82.1	1618	13.7			
Two or more violent convictions (VPRAI Risk Factor)	Yes	1883	13.1	365	19.4	70.612	.000	.046
	No	12499	86.9	1817	14.5			
Violent arrests	8 or more	416	2.9	86	20.7	33.252	.000	.048
	7	136	0.9	27	19.9			
	6	187	1.3	34	18.2			
	5	327	2.3	61	18.7			
	4	538	3.7	102	19.0			
	3	777	5.4	130	16.7			
	2	1338	9.3	219	16.4			
	1	2282	15.9	343	15.0			
	0	8381	58.3	1180	14.1			
	Violent arrests	2 or more violent arrests	3719	25.9	659				17.7	25.305	.000	.042
No		10663	74.1	1523	14.3			
Violent arrests	4 or more violent arrests	1604	11.2	310	19.3	24.217	.000	.041
	No	12778	88.8	1872	14.7			

Table 14. Descriptive and Bivariate Statistics for Alternative VPRAI Risk Factors (Any Failure Outcome), continued

		Total		Any Failure		Chi-Square	P	Cramer's V
		N	%	N	%			
History of drug abuse (VPRAI Risk Factor)	Yes	7102	49.4	1425	20.1	261.004	.000	.135
	No	7280	50.6	757	10.4			
UNCOPE categories	Dependence (4 to 6)	2195	15.3	448	20.4	58.438	.000	.064
	Abuse (2 to 3)	1913	13.3	298	15.6			
	None (0 to 1)	10274	71.4	1436	14.0			
UNCOPE substance type	Other drug or Alcohol & other drug	3516	24.4	761	21.6	151.469	.000	.103
	None or Alcohol	10866	75.6	1421	13.1			
UNCOPE depend. & other drug	UNCOPE Depend. & Other Drug	1563	10.9	372	23.7	99.745	.000	.083
	Other	12813	89.1	1810	14.1			
Two or more FTA (VPRAI Risk Factor)	Yes	1702	11.8	375	22.0	70.612	.000	.070
	No	12680	88.2	1807	14.3			
FTA convictions	8 or more	23	0.2	6	26.1	147.608	.000	.101
	7	25	0.2	6	24.0			
	6	31	0.2	6	19.4			
	5	46	0.3	17	37.0			
	4	114	0.8	34	29.8			
	3	247	1.7	60	24.3			
	2	589	4.1	124	21.1			
	1	1445	10.0	318	22.0			
	0	11862	82.5	1611	13.6			
	FTA convictions	Any FTA convictions	2520	17.5	571				22.7	133.076	.000	.096
No		11862	82.5	1611	13.6			
Lived at residence less than one year (VPRAI Risk Factor)	Yes	5302	36.9	878	16.6	12.572	.000	.030
	No	9080	63.1	1304	14.4			



Finally, whether to continue including the VPRAI *Lived at residence less than one year* risk factor is considered. As revealed in the neutrality analyses presented above, the risk factor is not statistically significant in analysis for People of Color (Table 6 above) and females (Table 11 above). Therefore, assigning weight to this risk factor may result in overclassifying pretrial failure risk for People of Color and females. As shown in Table 14, although the difference in Any Failure percentages for those who lived at a residence less than one year compared to others is statistically significant as measured by the Chi-Square, the V value for this risk factor is very low (.030), indicating that, the difference is very small. This is substantiated by the fact that there is only a 2.2 percentage point difference in Any Failure between the two categories.

...risk factor *Lived at residence less than one year* does not possess a sufficiently strong relationship to Any Failure to warrant remaining in the VPRAI.

Thus, there is insufficient justification for the risk factor to remain in the VPRAI as a predictor, and the quest for gender and race neutrality supports removing *Lived at residence less than one year* from the VPRAI.

In sum, two alternative research factors are superior to current VPRAI risk factors. *Charge is felony drug, theft, or fraud* is superior to VPRAI *Charge type*, and *Unemployed at time of arrest* is superior to VPRAI *Not employed for two years prior to arrest*. In addition, *Active community supervision* is a new research factor that is related significantly to Any Failure. VPRAI *Two or more failure to appear*, VPRAI *Two or more violent convictions*, and VPRAI *History of drug abuse* remain appropriate for inclusion in the risk instrument in lieu of the alternative factors. Finally, VPRAI *Lived at residence less than one year* does not possess a sufficiently strong relationship to Any Failure to warrant remaining in the VPRAI.

4. TEST THE STATISTICAL VALIDITY AND PRACTICAL UTILITY OF THE VPRAI-REVISED USING MULTIVARIATE ANALYSES.

...the VPRAI-Revised group of risk factors is a statistically significant improvement over the current VPRAI's group of risk factors.

Having selected risk factors to include in the VPRAI-Revised, a logistic regression model is built to examine the predictive validity of the combined risk factors and whether the individual factors maintain their relationships with Any Failure when other risk factors are considered. The efficacy of the VPRAI-Revised model is compared to the current VPRAI model.

Table 15 presents the logistic regression model of the risk factors that compose the VPRAI-Revised. The full model is statistically significant in predicting Any Failure, as can be seen by the p -value of the model Chi-Square ($p<.001$). The p -values of the individual risk factors (all $p<.01$) indicate that each risk factor independently predicts failure, even when the other risk factors are present to explain the occurrence of failure. Furthermore, all odds ratios are above 1, indicating that the presence of each risk factor increases the likelihood of pretrial failure.

To determine whether the predictive power of the combined VPRAI-Revised risk factors is an improvement over the combined current VPRAI risk factors, focus turns to the AUC-ROC values and their associated confidence intervals. If the AUC-ROC of the VPRAI-Revised logistic regression model is greater than the upper boundary of the current VPRAI's AUC-ROC, a true, significant improvement in predictive power exists and the difference in AUC-ROC values is not due to chance or a random occurrence. The current VPRAI model's AUC-ROC value is .666 with an upper boundary of .678 (Table 2 above). The VPRAI-Revised model's AUC-ROC of .678 is exactly on the limit for asserting that predictive power of the combined revised group of risk factors is a statistically significant improvement over the current VPRAI's combined group of risk factors.

Table 15. Predicting Failure Outcomes Using VPRAI-Revised Risk Factors

	Any Failure		FTA Failure		NA Failure		TV Failure	
	Odds Ratio	P	Odds Ratio	P	Odds Ratio	P	Odds Ratio	P
Active community supervision	1.387	.000	1.092	.406	1.250	.011	1.433	.000
Charge is felony drug, theft, or fraud	2.120	.000	1.550	.000	1.874	.000	2.307	.000
Pending charge	1.437	.000	1.315	.004	1.683	.000	1.424	.000
Criminal history	1.485	.000	1.571	.001	1.490	.000	1.391	.000
Two or more FTA	1.150	.000	1.327	.000	1.020	.714	1.137	.002
Two or more violent convictions	1.216	.004	1.307	.019	1.147	.193	1.227	.015
Unemployed at time of arrest	1.249	.000	1.228	.018	1.238	.005	1.233	.001
History of drug abuse	1.585	.000	1.169	.085	1.351	.000	1.871	.000
Constant	.052	.000	.016	.000	.020	.000	.025	.000
Model Chi-Square	734.445	$p=.000$	133.863	$p=.000$	226.534	$p=.000$	567.576	$p=.000$
Nagelkerke R Square	.087		.032		.045		.086	
AUC-ROC	.678	$p=.000$	.640	$p=.000$	.656	$p=.000$	.698	$p=.000$
AUC-ROC Confidence Intervals	Lower= .666	Upper= .690	Lower= .618	Upper= .663	Lower= .637	Upper= .676	Lower= .683	Upper= .713



5. WEIGHT RISK FACTORS AND CREATE VPRAI-REVISED RISK LEVELS WITH THE GREATEST DISPERSION.

The DIFR of the VPRAI-Revised is notably higher than that of the current VPRAI, indicating greater dispersion of failure rates across the risk levels of the VPRAI-Revised.

The predictive power of the combined VPRAI-Revised risk factors and their individual independent influence on Any Failure warrant moving forward with creating a composite VPRAI-Revised risk score to be collapsed into risk levels. The current VPRAI equally weights seven of the eight risk factors. The strategy of summing the current VPRAI risk factors and collapsing them into five risk levels achieves an acceptable AUC-ROC of .645 (Table 3 above), but the equal

weighting of seven of the risk factors may not be the most appropriate. Thus, differential weighting based on odds ratios of the VPRAI-Revised risk factors is explored to maximize the predictive value of the VPRAI-Revised.

Table 16 presents the weighting of the odds ratios of the VPRAI-Revised factors; the odds ratios are drawn from the logistic regression model presented in Table 15, above. Odds ratios are weighted as follows: odds ratios 1-1.33 are weighted as 1, odds ratios 1.34-1.66 are weighted as 2, and odds ratios 1.67 and higher are weighted as 3. When the weighted risk factors are summed, the VPRAI-Revised yields scores ranging from 0 to 14. Table 17 presents the distribution of cases across the range of scores.

The scores are collapsed into six risk levels in an effort to create groups with similar Any Failure rates and maximize the difference in Any Failure rates between groups. Table 18 illustrates how the scores transform into risk levels (Score column), the distribution of cases across the risk levels (Total % column), Any Failure rates for each risk level, and statistics describing the overall quality of the VPRAI-Revised in relation to Any Failure (also see Appendix tables 18a, 18b, and 18c). These facets of the VPRAI-Revised are compared to the VPRAI to establish whether the new version is an improvement over the current version.

To begin, like the current VPRAI, the overall VPRAI-Revised succeeds in classifying cases into groups with Any Failure rates that are significantly different from what one would expect to occur by chance, as evidenced by the statistically significant Chi-Square (742.537, $p = .000$).

The strength of a classification scheme, however, lies beyond mere statistically significant differences in failure rates. Optimally useful classification instruments create great dispersion in failure rates across groups or risk levels. The Dispersion Index for Risk⁷ (DIFR statistic) represents the distance from the whole sample base rate (15.2%) to the base rates for risk levels. There is no standard that defines what is considered an acceptable DIFR value. However, the statistic can be a useful tool in determining whether a classification scheme succeeds in achieving a wider dispersion of group or risk level outcomes (e.g., failure rates) compared to other classification approaches or cutoffs in a single sample.

⁷ Silver, E., & Banks, S. (1998). *Calibrating the potency of violence risk classification models: The Dispersion Index for Risk (DIFR)*. Washington, DC: American Society of Criminology.

The DIFR of the VPRAI-Revised (1.64) is notably higher than that of the current VPRAI (.61, Table 3), indicating greater dispersion of failure rates across the risk levels of the VPRAI-Revised.

The greater DIFR of the VPRAI-Revised comes as no surprise when examining the actual Any Failure rates of the two VPRAI versions. Where the current VPRAI could be considered top-heavy (i.e., nearly a quarter of cases are classified as high risk), the VPRAI-Revised succeeds in identifying and separating out

The predictive ability of the VPRAI-Revised is a statistically significant improvement over the current VPRAI.

groups of cases with Any Failure rates higher than the high risk level of the current VPRAI. The high risk level of the current VPRAI has an Any Failure rate of 24.5% (see Table 3), while the VPRAI-Revised risk levels 5 and 6 fail at rates of 29.3% and 37.1%, respectively.

The predictive ability of the VPRAI-Revised benefits from the improved dispersion of Any Failure rates. Whereas the current VPRAI has an AUC-ROC of .645 with an upper boundary of .657, the VPRAI-Revised has an AUC-ROC of .672. Because the VPRAI-Revised AUC-ROC falls outside of the confidence interval of the current VPRAI, the predictive ability of the VPRAI-Revised is considered a statistically significant improvement.

Table 16. VPRAI-Revised Risk Factor Weights - Based on Odds Ratio

	Odds Ratio	Weight
Active community supervision	1.387	2
Charge is felony drug, theft, or fraud	2.120	3
Pending charge	1.437	2
Criminal history	1.485	2
Two or more failure to appear	1.150	1
Two or more violent convictions	1.216	1
Unemployed at time of arrest	1.249	1
History of drug abuse	1.585	2
Total possible score		14

Table 17. Any Failure Outcome by VPRAI-Revised Risk Score

Score	Total N	Total %	Any Failure N	Any Failure %
0	965	6.7	48	5.0
1	533	3.7	35	6.6
2	1642	11.4	108	6.6
3	1589	11.0	145	9.1
4	1708	11.9	178	10.4
5	1800	12.5	246	13.7
6	1481	10.3	244	16.5
7	1412	9.8	281	19.9
8	1387	9.6	317	22.9
9	819	5.7	229	28.0
10	615	4.3	191	31.1
11	213	1.5	83	39.0
12	176	1.2	64	36.4
13	37	.3	12	32.4
14	5	.0	1	20.0
Base Rate	15.2			
Chi-Square	759.696, $p=.000$			
Agg R	.87			
AUC-ROC	.676	Lower = .664	Upper = .688	
Pearson's r	.224			

Table 18. Any Failure Outcome by VPRAI-Revised Risk Level

Risk Level	Score	Total N	Total %	Any Failure N	Any Failure %
1	(0-2)	3140	21.8	191	6.1
2	(3-4)	3297	22.9	323	9.8
3	(5-6)	3281	22.8	490	14.9
4	(7-8)	2799	19.5	598	21.4
5	(9-10)	1434	10.0	420	29.3
6	(11-14)	431	3.0	160	37.1
Base Rate	15.2				
Chi-Square	742.537, $p=.000$				
Agg R	.99				
DIFR	1.64				
AUC-ROC	.672	Lower = .660	Upper = .684		
Pearson's r	.224				



6. TEST THE RACE AND GENDER NEUTRALITY OF THE VPRAI-REVISED.

...the VPRAI-Revised is a good predictor of pretrial failure as measured by Any Failure, FTA, NA, and TV, and is free of race and gender predictive bias.

Investigating the neutrality of the VPRAI-Revised addresses concerns regarding predictive bias, also known as differential prediction; that is, it examines concerns regarding the likelihood of the instrument resulting in different predictions for different groups. If a particular risk assessment score predicts failure more accurately for one group than another, then the instrument may suffer from

predictive bias. A risk assessment instrument may be considered to be free of predictive bias when a given risk score predicts pretrial failure with similar accuracy across groups.⁸ When predictive bias is discovered, questions must be asked about the possible introduction of bias, intended and conscious or not, into the model and any resulting disparate treatment.

In order to confirm that the VPRAI-Revised is race and gender neutral in terms of predictive bias, statistical analysis is conducted by race and then by gender. Analyses begin with descriptive and bivariate relationships between VPRAI-Revised risk factors and Any Failure to see whether individual risk factors function well for the separate racial and gender samples. The neutrality of the combined risk factors are then analyzed through logistic regression models. Finally, the performance of the VPRAI-Revised risk level scheme is compared across the racial and gender samples.

Table 19 presents the descriptive and bivariate statistics for VPRAI-Revised risk factors by race. The presence of each risk factor is associated with higher Any Failure for both People of Color and Whites. The Chi-Square values for all risk factors are statistically significant.

Table 20 presents the logistic regression model that includes race for all cases, as well as the regressions for People of Color and Whites separately. All risk factors in the first model, for All, are statistically significant with the exception of race; that is, race is not a statistically significant predictor in the model. The statistically significant AUC_{DIFF} (-.041), however, indicates that the predictive power of the combined VPRAI-Revised risk factors is greater for Whites (AUC-ROC = .698) than for People of Color (AUC-ROC = .657). The relative effectiveness of the regression model for Whites over People of Color is due, in part, to *Two or more violent convictions* becoming not significantly related to Any Failure for People of Color when combined with the other VPRAI-Revised risk factors.

Table 21 presents two models of Any Failure outcome by VPRAI-Revised risk levels: one model for People of Color and one for Whites. Comparisons of the AUC-ROC values indicate that both are in the good range. The AUC-ROC for People of Color is .650 and for Whites is .693. The difference in AUC-ROC is statistically significant ($AUC_{DIFF} = -.043, p = .001$).

Chi-Square tests are conducted to compare Any Failure rates for People of Color to Whites for each individual VPRAI-Revised risk level. The results reveal that the rates of Any Failure for each risk level are

⁸ Skeem, J. L., & Lowenkamp, C. T. (2016, June) *Risk, Race, & Recidivism: Predictive Bias and Disparate Impact*. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2687339.



statistically the same for People of Color and Whites classified as risk level 1, 2, 3, 4, and 6. For risk level 5, People of Color fail at a lower rate (27.8%) than do Whites (31.0%); however, the failure rates for both groups are above risk level 4 and below risk level 6 (Table 22). This means that both People of Color and Whites are classified in the proper risk level 5, eliminating the potential for predictive bias to either group.

Table 19. Descriptive and Bivariate Statistics for VPRAI-Revised Risk Factors by Race (Any Failure Outcome)

		People of Color				White			
		Total		Any Failure		Total		Any Failure	
		N	%	N	%	N	%	N	%
Active community supervision	Yes	1156	16.8	246	21.3	1400	19.1	314	22.4
	No	5732	83.2	807	14.1	5921	80.9	796	13.4
	Chi-Square	38.523, $p=.000$				71.062, $p=.000$			
Charge is felony drug, theft, or fraud	Yes	2305	33.5	917	22.3	2441	33.3	597	24.5
	No	4583	66.5	136	11.8	4880	66.7	513	10.5
	Chi-Square	131.523, $p=.000$				245.982, $p=.000$			
Pending charge	Yes	1442	20.9	290	20.1	1742	23.8	377	21.6
	No	5446	79.1	763	14.0	5579	76.2	733	13.1
	Chi-Square	32.766, $p=.000$				74.621, $p=.000$			
Criminal history	Yes	5413	78.6	917	16.9	5534	75.6	950	17.2
	No	1475	21.4	136	9.2	1787	24.4	160	9.0
	Chi-Square	53.349, $p=.000$				70.837, $p=.000$			
Two or more FTA	Yes	1145	16.6	244	21.3	551	7.5	131	23.8
	No	5743	83.4	809	14.1	6770	92.5	979	14.5
	Chi-Square	38.463, $p=.000$				34.364, $p=.000$			
Two or more violent convictions	Yes	1118	16.2	210	18.8	756	10.3	155	20.5
	No	5770	83.8	843	14.6	6565	89.7	955	14.5
	Chi-Square	12.596, $p=.000$				18.695, $p=.000$			
Unemployed at time of arrest	Yes	3526	51.2	620	17.6	3304	45.1	602	18.2
	No	3362	48.8	433	12.9	4017	54.9	508	12.6
	Chi-Square	29.411, $p=.000$				43.760, $p=.000$			
History of drug abuse	Yes	3331	48.4	650	19.5	3697	50.5	763	20.6
	No	3557	51.6	403	11.3	3624	49.5	347	9.6
	Chi-Square	88.961, $p=.000$				174.138, $p=.000$			

Table 20. Predicting Failure Outcomes with VPRAI-Revised Risk Factors – Race

	Any Failure (All)		Any Failure (People of Color)		Any Failure (White)	
	Odds Ratio	P	Odds Ratio	P	Odds Ratio	P
Race – Persons of Color	.980	.677				
Active community supervision	1.176	.000	1.180	.000	1.165	.000
Charge is felony drug, theft, or fraud	1.283	.000	1.243	.000	1.323	.000
Pending charge	1.201	.000	1.168	.000	1.231	.000
Criminal history	1.222	.000	1.217	.000	1.227	.000
Two or more FTA	1.330	.000	1.305	.002	1.408	.002
Two or more violent convictions	1.222	.003	1.137	.154	1.354	.004
Unemployed at time of arrest	1.248	.000	1.252	.001	1.239	.002
History of drug abuse	1.256	.000	1.206	.000	1.307	.000
Constant	.053	.000	.059	.000	.047	.000
Model Chi-Square	726.233	p=.000	275.656	p=.000	461.506	p=.000
Nagelkerke R Square	.087		.068		.107	
AUC-ROC	.678	p=.000	.657	p=.000	.698	p=.000
AUC _{DIFF}	-.041, p=.002					



Table 21. Any Failure Outcome by VPRAI-Revised Risk Level – Race

Risk Level	Score	People of Color				White			
		Total		Any Failure		Total		Any Failure	
		N	%	N	%	N	%	N	%
1	(0-2)	1376	20.0	99	7.2	1717	23.5	90	5.2
2	(3-4)	1614	23.4	166	10.3	1635	22.3	151	9.2
3	(5-6)	1621	23.5	246	15.2	1613	22.0	239	14.8
4	(7-8)	1384	20.1	278	20.1	1397	19.1	317	22.7
5	(9-10)	695	10.1	193	27.8	728	9.9	226	31.0
6	(11-14)	198	2.9	71	35.9	231	3.2	87	37.7
Base Rate		15.3				15.2			
Chi-Square		273.720, $p=.000$				471.404, $p=.000$			
Agg R		.99				.99			
AUC-ROC		.65				.693			
Pearson's r		.196				.251			
AUC _{DIFF}		-.043, $p=.001$							

Table 22. Comparison of Risk Level Any Failure Rates across Racial Groups

Risk Level	People of Color	White	Chi-Square	P
	Any Failure %	Any Failure %		
1	7.2	5.2	.727	.427
2	10.3	9.2	.173	.198
3	15.2	14.8	.028	.883
4	20.1	22.7	.000	1.000
5	27.8	31.0	7.681	.006
6	35.9	37.7	.461	.501
Base Rate	15.3	15.2	.043	.852

The Any Failure rates for all risk levels are statistically the same for males and females.

Turning to gender, Table 23 presents the descriptive and bivariate statistics for VPRAI-Revised risk factors separately for females and males. All risk factors for

both groups are statistically significant in relation to Any Failure with one exception: *Two or more violent convictions* is not statistically significant for females.

Two approaches to multivariate analyses are employed and both support the gender neutrality of the combined risk factors. As seen in the Any Failure (All) columns of Table 24, not only do all of the VPRAI-Revised risk factors remain significant when gender is entered into the model, but gender itself is not significant. These results indicate that gender is not a predictor of Any Failure. The remaining columns



of Table 24 present separate models for females and for males. Both the female and male models are statistically significant, as are all risk factors with the exception of *Two or more violent convictions* for females. Furthermore, the combined VPRAI-Revised risk factors have similar predictive power for females (AUC-RUC = .690) and males (AUC-ROC = .675); the AUC_{DIFF} of .015 is not statistically significant ($p = .331$).

...the VPRAI-Revised risk levels have the same meaning for People of Color and Whites and for females and males.

Table 25 presents gender-specific models of Any Failure by VPRAI-Revised risk levels. Comparison of the Any Failure rates for risk level across the two genders indicates similarity; the Any Failure rates for all risk levels are statistically the same for males and females (Table 26). The AUC-ROCs for males and for females are both in

the good range. While the AUC-ROC for the female sample is higher than for the male sample (.682 compared to .669), the difference is not statistically significant. These results indicate that each model is good at differentiating between defendants who are successful pretrial from those who experience Any Failure pending case disposition.

In sum, the VPRAI-Revised is a good predictor of pretrial failure as measured by Any Failure, FTA, NA, and TV, and is free of race and gender predictive bias. Specifically, the VPRAI-Revised risk levels have the same meaning for People of Color and Whites and for females and males. Thus, concerns about predictive bias are successfully addressed and the VPRAI-Revised may be considered race and gender neutral.

Table 23. Descriptive and Bivariate Statistics for VPRAI-Revised Risk Factors by Gender (Any Failure Outcome)

		Female				Male			
		Total		Any Failure		Total		Any Failure	
		N	%	N	%	N	%	N	%
Active community supervision	Yes	622	16.9	137	22.0	1956	18.3	427	21.8
	No	3055	83.1	400	13.1	8749	81.7	1218	13.9
	Chi-Square	33.062, $p=.000$				76.882, $p=.000$			
Charge is felony drug, theft, or fraud	Yes	1427	38.8	314	22.0	3366	31.4	807	24.0
	No	2250	61.2	223	9.9	7339	68.6	838	11.4
	Chi-Square	102.393, $p=.000$				276.761, $p=.000$			
Pending charge	Yes	903	24.6	183	20.3	2321	21.7	488	21.0
	No	2774	75.4	354	12.8	8384	78.3	1157	13.8
	Chi-Square	30.762, $p=.000$				72.968, $p=.000$			
Criminal history	Yes	2629	71.5	442	16.8	8431	78.8	1438	17.1
	No	1048	28.5	95	9.1	2274	21.2	207	9.1
	Chi-Square	36.064, $p=.000$				87.106, $p=.000$			
Two or more FTA	Yes	398	10.8	87	21.9	1304	12.2	288	22.1
	No	3279	89.2	450	13.7	9401	87.8	1357	14.4
	Chi-Square	18.836, $p=.000$				51.548, $p=.000$			
Two or more violent convictions	Yes	260	7.1	44	16.9	1623	15.2	321	19.8
	No	3417	92.9	493	14.4	9082	84.8	1324	14.6
	Chi-Square	1.206, $p=.157$				28.627, $p=.000$			
Unemployed at time of arrest	Yes	2045	55.6	375	18.3	4872	45.5	859	17.6
	No	1632	44.4	162	9.9	5833	54.5	786	13.5
	Chi-Square	51.486, $p=.000$				35.262, $p=.000$			
History of drug abuse	Yes	1608	43.7	320	19.9	5494	51.3	1105	20.1
	No	2069	56.3	217	10.5	5211	48.7	540	10.4
	Chi-Square	64.273, $p=.000$				195.490, $p=.000$			

Table 24. Predicting Failure Outcomes with VPRAI-Revised Risk Factors - Gender

	Any Failure (All)		Any Failure (Female)		Any Failure (Male)	
	Odds Ratio	P	Odds Ratio	P	Odds Ratio	P
Gender – female	.921	.144				
Active community supervision	1.178	.000	1.178	.006	1.177	.000
Charge is felony drug, theft, or fraud	1.287	.000	1.282	.000	1.287	.000
Pending charge	1.201	.000	1.179	.002	1.208	.000
Criminal history	1.216	.000	1.216	.002	1.213	.000
Two or more FTA	1.324	.000	1.405	.015	1.303	.001
Two or more violent convictions	1.204	.007	1.030	.869	1.237	.004
Unemployed at time of arrest	1.259	.000	1.572	.000	1.183	.002
History of drug abuse	1.255	.000	1.208	.000	1.269	.000
Constant	.054	.000	.046	.000	.054	.000
Model Chi-Square	736.599	p=.000	205.001	p=.000	537.475	p=.000
Nagelkerke R Square	.087		.096		.085	
AUC-ROC	.678	p=.000	.690	p=.000	.675	p=.000
AUC _{DIFF}	.015, p=.331					

Table 25. Any Failure Outcome by VPRAI-Revised Risk Level – Gender

Risk Level	Score	Female				Male			
		Total		Any Failure		Total		Any Failure	
		N	%	N	%	N	%	N	%
1	(0-2)	845	23.0	44	5.2	2295	21.4	147	6.4
2	(3-4)	812	22.1	68	8.4	2485	23.2	255	10.3
3	(5-6)	854	23.2	138	16.2	2427	22.7	352	14.5
4	(7-8)	670	18.2	144	21.5	2129	19.9	454	21.3
5	(9-10)	364	9.9	96	26.4	1070	10.0	324	30.3
6	(11-14)	132	3.6	47	35.6	299	2.8	113	37.8
Base Rate		14.6				15.4			
Chi-Square		199.361, $p=.000$				549.631, $p=.000$			
Agg R		.99				.99			
AUC-ROC		.682				.669			
Pearson's r		.231				.222			
AUC _{DIFF}		.013, $p=.402$							

Table 26. Comparison of Risk Level Any Failure Rates across Gender Groups

Risk Level	Female	Male	Chi-Square	P
	Any Failure %	Any Failure %		
1	5.2	6.4	1.836	.207
2	8.4	10.3	2.434	.132
3	16.2	14.5	.266	.615
4	21.5	21.3	.729	.424
5	26.4	30.3	.059	.855
6	35.6	37.8	.717	.439
Base Rate	14.6	15.4	1.236	.275

7. PROPOSE A REVISED PRAXIS THAT USES THE VPRAI-REVISED AND THE RESULTS OF THE PREVIOUS RESEARCH.

To meet the need for a legal, ethical and effective pretrial release and detention strategy, the Praxis was founded on legal and research-based principles.

DCJS requested a proposed revised Praxis, which has been reviewed and finalized by the Praxis Committee. The Praxis Committee consists of representatives of DCJS, Pretrial Services agencies, Court (judges and magistrates), Commonwealth's Attorney, Public Defender, and Criminal Sentencing Commission.

Just as the original Praxis was founded on legal and research-

based principles, the revised Praxis was founded on these same principles. Similarly, the revised Praxis continues to take into consideration community resources and risk tolerance. However, the revised Praxis reflects alterations made to the VPRAI, results from the research, and a change in Virginia Pretrial Services agencies' policy.

Research used to develop the VPRAI-Revised impacts the revised Praxis. The original Praxis used the five VPRAI risk levels while the VPRAI-Revised contains six risk levels. As a result, the Praxis has been altered to account for the six risk levels. In addition, the original Praxis relied on eight charge categories including Violent, Firearm, Failure to Appear, Drug, Traffic: DUI, Theft/Fraud, Non-violent Misdemeanor, and Traffic: Non-DUI. The VPRAI-Revised includes a new risk factor that accounts for felony drug, theft, and fraud related charges, eliminating the need to distinguish the Drug and Theft/Fraud charge categories in the revised Praxis. It should also be noted that the original Praxis contained the same recommendation for Violent and Firearm charges and for Traffic: Non-DUI and Non-Violent Misdemeanor, indicating that these categories can be collapsed. Based on these research results the revised Praxis relies on the VPRAI-Revised six risk levels and five charge categories (i.e., Non-Violent Misdemeanor, DUI, Non-Violent Felony, Violent Misdemeanor, and Violent Felony/Firearm).

To meet the need for a legal, ethical and effective pretrial release and detention strategy, the Praxis was founded on legal and research-based principles. These principles, which also provide the foundation of the revised Praxis, include the following:

1. highest risk defendants, when legally allowable, should be detained;
2. moderate risk defendants should be released with supervision and conditions targeted to mitigate risk;
3. pretrial supervision dosage (frequency and types of contacts) should be commensurate with the risk posed;
4. low risk defendants should be released with minimal or no conditions;
5. defendants are presumed innocent and have the right to release on the least restrictive terms and conditions; and



6. pretrial incarceration of low and moderate risk defendants increases the likelihood of conviction, the likelihood of receiving a sentence to incarceration, the length of a sentence to incarceration, and post-disposition recidivism.⁹

...the Praxis considers the resources (supervision and conditions) available in the community to mitigate risk and the concept of risk tolerance.

In addition to legal and research-based principles, the Praxis considers the resources (supervision and conditions) available in the community to mitigate risk and the concept of risk tolerance. Put simply, in this context risk tolerance refers to the amount of risk that communities are willing to take when considering the current offense. The nature and circumstances of the offense is a legitimate pretrial release

and detention consideration. Based on this concept, one would expect that the release and detention recommendations made by the Praxis would be more restrictive for certain types of offenses even when the risk level is the same. For example, release and detention recommendations for risk level 3 defendants charged with Violent/Firearm offenses would be more restrictive (e.g., include a higher level of supervision and conditions) than for risk level 3 defendants charged with Non-Violent Misdemeanor offenses.

Consistent with the considerations informing the development of the Praxis, the release and detention recommendation by Pretrial Services should be driven primarily by risk, yet with legitimate consideration of the seriousness of the current offense, and with responsiveness to risk tolerance which dictates more restrictive recommendations for certain types of charges.

Previous research led to the development of the differential supervision strategy of the Praxis, which involved four levels of pretrial monitoring and supervision as shown below.

Pretrial Monitoring (note, less than supervision)

- Court date reminder for every court date
- Criminal history check before court date

Pretrial Supervision Level I

- Court date reminder for every court date
- Criminal history check before court date
- Face-to-face contact once a month
- Special conditions compliance verification

⁹Milgram, A., Holsinger, A. M., VanNostrand, M., & Alsdorf, M. (2015, April). *Pretrial Risk Assessment: Improving Public Safety and Fairness in Pretrial Decision Making*. *Federal Sentencing Reporter*, 27(4), 216-221.



Pretrial Supervision Level II

- Court date reminder for every court date
- Criminal history check before court date
- Face-to-face contact every other week
- Special conditions compliance verification

Pretrial Supervision Level III

- Court date reminder for every court date
- Criminal history check before court date
- Face-to-face contact every other week
- Alternative contact every other week (telephone, e-mail, text, or others as approved locally)
- Special condition compliance verification

The research indicated that defendants supervised under a differential supervision strategy (varying supervision dosages) based on risk as identified by the VPRAI were less likely to fail to appear or experience a new arrest. The pretrial monitoring and supervision levels above are used to populate the Praxis, with consideration of the Praxis' founding legal and research-based principles and recognition of risk tolerance. Finally, Virginia Pretrial Services agencies made a policy decision that bail status recommendation will either be release or detain, and that financial bonds will not be used. Based on all of these factors, a revised Praxis was proposed and finalized by the Praxis Committee – including 4 steps and the Praxis matrix shown below.

Step 1: Complete the VPRAI-Revised to identify the risk level.

Step 2: Examine all charges and identify the most serious charge category. The charge categories in priority order are Violent Felony/Firearm, Violent Misdemeanor, Non-Violent Felony, Driving under the Influence, and Non-Violent Misdemeanor.

Step 3: Use the most serious charge category and the VPRAI-Revised risk level to identify where they intersect in the Praxis matrix (see Table 27). The bail status, pretrial services, and special condition values represent the preliminary recommendation.



Step 4: Determine if any of the current charges are for Failure to Appear.

- If yes, increase the preliminary recommendation by one level to identify the final recommendation.
 - Release = Release with Monitoring
 - Release with Monitoring = Release with Pretrial Supervision Level I
 - Release with Pretrial Supervision Level I = Release with Pretrial Supervision Level II
 - Release with Pretrial Supervision Level II = Release with Pretrial Supervision Level III
 - Release with Pretrial Supervision Level III = Detain
- If no, the preliminary recommendation is the final recommendation.

Table 27. Praxis Matrix

Charge Category/ VPRAI-Revised	Non-Violent Misdemeanor	Driving Under the Influence	Non-Violent Felony	Violent Misdemeanor	Violent Felony/Firearm
Risk Level 1					
Bail Status	Release	Release	Release	Release	Release
Pretrial Services	No	No	No	No	Level II
Special Cond.	No	No	No	No	As needed
Risk Level 2					
Bail Status	Release	Release	Release	Release	Release
Pretrial Services	No	Monitoring	Monitoring	Monitoring	Level III
Special Cond.	No	No	No	No	As needed
Risk Level 3					
Bail Status	Release	Release	Release	Release	Detain
Pretrial Services	Monitoring	Monitoring	Level I	Level I	No
Special Cond.	No	No	No	As needed	NA
Risk Level 4					
Bail Status	Release	Release	Release	Release	Detain
Pretrial Services	Level I	Level I	Level II	Level II	No
Special Cond.	No	As needed	As needed	As needed	NA
Risk Level 5					
Bail Status	Release	Release	Release	Detain	Detain
Pretrial Services	Level II	Level II	Level III	No	No
Special Cond.	As needed	As needed	As needed	NA	NA
Risk Level 6					
Bail Status	Detain	Detain	Detain	Detain	Detain
Pretrial Services	No	No	No	No	No
Special Cond.	NA	NA	NA	NA	NA



APPENDIX. SUPPLEMENTARY TABLES

Table 1a. Descriptive and Bivariate Statistics for Eight VPRAI Risk Factors (FTA Failure Outcome)

		Total		FTA Failure N		Chi-Square	P
		N	%	N	%		
Charge type	Felony	8510	59.2	372	4.4	6.438	.006
	Misdemeanor	5872	40.8	207	3.5		
Pending charge	Yes	3224	22.4	171	5.3	17.569	.000
	No	11158	77.6	408	3.7		
Criminal history	Yes	11060	76.9	504	4.6	34.955	.000
	No	3322	23.1	75	2.3		
Two or more FTA	Yes	1702	11.8	128	7.5	61.019	.000
	No	12680	88.2	451	3.6		
Two or more violent convictions	Yes	1883	13.1	112	5.9	20.717	.000
	No	12499	86.9	467	3.7		
Lived at residence less than one year	Yes	5302	36.9	256	4.8	13.998	.000
	No	9080	63.1	323	3.6		
Not employed for two years prior to arrest	Yes	8307	57.8	362	4.4	5.607	.010
	No	6075	42.2	217	3.6		
History of drug abuse	Yes	7102	49.4	343	4.8	23.459	.000
	No	7280	50.6	236	3.2		



Table 1b. Descriptive and Bivariate Statistics for Eight VPRAI Risk Factors (NA Failure Outcome)

		Total		NA Failure		Chi-Square	P
		N	%	N	%		
Charge type	Felony	8510	59.2	563	6.6	50.614	.000
	Misdemeanor	5872	40.8	227	3.9		
Pending charge	Yes	3224	22.4	273	8.5	70.837	.000
	No	11158	77.6	517	4.6		
Criminal history	Yes	11060	76.9	679	6.1	38.523	.000
	No	3322	23.1	111	3.3		
Two or more FTA	Yes	1702	11.8	117	6.9	7.095	.005
	No	12680	88.2	673	5.3		
Two or more violent convictions	Yes	1883	13.1	125	6.6	5.475	.011
	No	12499	86.9	665	5.3		
Lived at residence less than one year	Yes	5302	36.9	314	5.9	2.982	.046
	No	9080	63.1	476	5.2		
Not employed for two years prior to arrest	Yes	8307	57.8	506	6.1	13.559	.000
	No	6075	42.2	284	4.7		
History of drug abuse	Yes	7102	49.4	497	7.0	61.221	.000
	No	7280	50.6	293	4.0		

Table 1c. Descriptive and Bivariate Statistics for Eight VPRAI Risk Factors (Technical Violation Failure Outcome)

		Total		TV Failure		Chi-Square	P
		N	%	N	%		
Charge type	Felony	8510	59.2	988	11.6	201.144	.000
	Misdemeanor	5872	40.8	281	4.8		
Pending charges	Yes	3224	22.4	402	12.5	68.645	.000
	No	11158	77.6	867	7.8		
Criminal history	Yes	11060	76.9	1098	9.9	72.560	.000
	No	3322	23.1	171	5.1		
Two or more FTA	Yes	1702	11.8	223	13.1	43.930	.000
	No	12680	88.2	1046	8.2		
Two or more violent convictions	Yes	1883	13.1	216	11.5	18.878	.000
	No	12499	86.9	1053	8.4		
Lived at residence less than one year	Yes	5302	36.9	501	9.4	4.087	.044
	No	9080	63.1	768	8.5		
Not employed for two years prior to arrest	Yes	8307	57.8	790	9.5	11.521	.001
	No	6075	42.2	479	7.9		
History of drug abuse	Yes	7102	49.4	888	12.5	236.177	.000
	No	7280	50.6	381	5.2		

Table 3a. FTA Failure Outcome by VPRAI Risk Level

Risk Level	Score	Total		FTA Failure	
		N	%	N	%
Low	(0-1)	1661	11.5	26	1.6
Below Average	(2)	2691	18.7	62	2.3
Average	(3)	3524	24.5	128	3.6
Above Average	(4)	3168	22.0	143	4.5
High	(5-9)	3338	23.2	220	6.6
Base Rate	4				
Chi-Square	106.877, $p=.000$				
Agg R	.98				
AUC-ROC	.622 Lower = .600 Upper = .644				
Pearson's r	.085				

Table 3b. NA Failure Outcome by VPRAI Risk Level

Risk Level	Score	Total		NA Failure	
		N	%	N	%
Low	(0-1)	1661	11.5	34	2.0
Below Average	(2)	2691	18.7	81	3.0
Average	(3)	3524	24.5	183	5.2
Above Average	(4)	3168	22.0	204	6.4
High	(5-9)	3338	23.2	288	8.6
Base Rate	5.5				
Chi-Square	139.224, $p=.000$				
Agg R	.990				
AUC-ROC	.621 Lower = .602 Upper = .640				
Pearson's r	.098				

Table 3c. TV Failure Outcome by VPRAI Risk Level

Risk Level	Score	Total		TV Failure	
		N	%	N	%
Low	(0-1)	1661	11.5	30	1.8
Below Average	(2)	2691	18.7	130	4.8
Average	(3)	3524	24.5	257	7.3
Above Average	(4)	3168	22.0	344	10.9
High	(5-9)	3338	23.2	508	15.2
Base Rate	8.8				
Chi-Square	351.257, $p=.000$				
Agg R	.99				
AUC-ROC	.655 Lower = .640 Upper = .669				
Pearson's r	.098				

Table 18a. FTA Failure Outcome by VPRAI-Revised Risk Level

Risk Level	Score	Total N	Total %	FTA Failure N	FTA Failure %
1	(0-2)	3140	21.8	61	1.9
2	(3-4)	3297	22.9	103	3.1
3	(5-6)	3281	22.8	134	4.1
4	(7-8)	2799	19.5	140	5.0
5	(9-10)	1434	10.0	104	7.3
6	(11-14)	431	3.0	37	8.6
Base Rate	4				
Chi-Square	110.957, $p=.000$				
Agg R	.99				
AUC-ROC	.621 Lower = .598 Upper = .644				
Pearson's <i>r</i>	.086				

Table 18b. NA Failure Outcome by VPRAI-Revised Risk Level

Risk Level	Score	Total N	Total %	NA Failure N	NA Failure %
1	(0-2)	3140	21.8	68	2.2
2	(3-4)	3297	22.9	120	3.6
3	(5-6)	3281	22.8	177	5.4
4	(7-8)	2799	19.5	226	8.1
5	(9-10)	1434	10.0	138	9.6
6	(11-14)	431	3.0	61	14.2
Base Rate	5.5				
Chi-Square	234.163, $p=.000$				
Agg R	.98				
AUC-ROC	.652 Lower = .633 Upper = .671				
Pearson's <i>r</i>	.126				

Table 18c. Technical Violation Failure Outcome by VPRAI-Revised Risk Level

Risk Level	Score	Total N	Total %	TV Failure N	TV Failure %
1	(0-2)	3140	21.8	86	2.7
2	(3-4)	3297	22.9	164	5.0
3	(5-6)	3281	22.8	282	8.6
4	(7-8)	2799	19.5	362	12.9
5	(9-10)	1434	10.0	271	18.9
6	(11-14)	431	3.0	104	24.1
Base Rate	8.8				
Chi-Square	570.637, $p=.000$				
Agg R	.99				
AUC-ROC	.691 Lower = .675 Upper = .704				
Pearson's <i>r</i>	.195				

