

Development of the  
Charleston Pretrial Risk Assessment Instrument  
(CPRAI)

Final Report

James Austin, Ph.D.  
Wendy Naro-Ware  
Roger Ocker

August 2019

## Introduction

This document describes how the Charleston Pretrial Risk Assessment Instrument (CPRAI) was developed and tested for implementation by the Charleston County Criminal Justice Coordinating Council (CJCC). The CJCC is the lead agency for coordinating all aspects of the MacArthur Foundation's Safety and Justice Challenge (SJC) grant. The CJCC applied to the MacArthur Foundation and was awarded a multi-year grant to implement reforms that would safely lower its jail population. One of the key components of the SJC strategic plan was to implement a Pretrial Risk Assessment (PRA) instrument that would help guide judicial pretrial release decision-making. Currently all of the SJC sites have employed a pretrial risk instrument with most of them using the Arnold Foundation's Public Safety Assessment (PSA) instrument. However, several other sites have either developed their own customized PRAs or have adopted the Virginia Pretrial Risk Assessment Instrument (VPRAI).

In general, all of these PRAs use the same core risk factors to assess a defendant's risk to either be re-arrested and/or fail to appear (FTA) for a scheduled court hearing. But there are some important distinctions or key attributes.

In the area of prior criminal history very few if any PRA's rely on the number and type of prior arrests. Instead, these new instruments use the higher legal standard of prior convictions. Further some instruments put time limitations on the prior criminal record (e.g., FTAs in the past two years, convictions in the past ten years). The logic for this format is that more recent prior criminal activity is a better predictor of prior criminal activity with no time limitations. For example, if two defendants both have three prior convictions but one defendant's prior convictions occurred over 10 years ago while the other defendant's convictions occurred in the past two years, should their risk scores on prior criminal history be the same?

Second, PRAs increasingly are excluding so called "stability" factors such as employment status, education level, and marital status from the instruments. Such factors tend to be more reflective of socio-economic status rather than risk. More importantly, given the need to rapidly provide first appearance and bail setting courts a risk assessment score, it is very difficult to accurately score these items which typically are based on an interview with the defendant for which the data are unverifiable. As more "noise" is introduced to these stability factors, the scores are less reliable and valid.

Third, requiring an interview, while desirable, may not be feasible for certain jurisdictions. Increasingly, the PRAs are designed to only include limited demographic (age and gender), current charge(s), and prior criminal history risk factors that do not require an interview. These "automated" PRAs have the benefit of being applied to all detained defendants without jeopardizing its validity.

Finally, there is some evidence that risk instruments developed in a specific jurisdiction will perform better than a system that was developed in other locations. Often referred to as "the

need to norm” any instrument to the local population and information systems, one can expect significant improvement in the predictive capabilities of a locally tested risk instrument.

The CJCC first adopted the VPRAI-Revised in January 2018 and began using it on detained defendants at the initial Centralized Bond Court hearing. This is an eight-item PRA which has been shown in other jurisdictions to be both reliable and valid.

Prior to January 2018, the CJCC pilot tested the instrument over a seven-month time frame. A preliminary study by the Center for Court Innovation (CCI) found that instrument was performing satisfactorily for Charleston County, with higher risk scores associated with higher re-arrest and FTA rates.<sup>1</sup> However, some of the Bond Court Magistrates felt that the risk instrument score was inaccurate for some items and unnecessarily constrained their judicial flexibility. Further, because it required an interview to be completed less than half of the detained population was having a risk assessment completed.

## **Research Methods**

For these reasons, it was decided to conduct an assessment of the VPRAI-R to see if it could be modified so that an interview would not be required and to customize the scoring items based on follow-up data. To do this work, a cohort of defendants that were screened on the VPRAI-R and released from the jail was created. Specifically, the data file consisted of 2,090 General Sessions (more serious cases) and summary level defendants who had been screened on VPRAI-R and released between January 1, 2018 and December 31, 2018.

In PRA validation studies, one is attempting to narrowly determine if the defendant was re-arrested or had an FTA *during the time the defendant’s cases were still pending*. Ideally, this standard would have been applied to all of the cases screened and released in 2018. However, in this study we were able to only capture re-arrests and FTAs as of March 31, 2019. For this reason, the number of “failures” is under-estimated by some unknown amount.

Because the CJCC was able to date the re-arrests and FTAs one can calculate the average time to “failure”. For those re-arrested the average time was 91 days while the median time was 72 days. For FTAs, the average time to a bench warrant being issued was 122 days with a median of 91 days. By ensuring a follow-up period of at least 90 days, we are reasonably confident that we have a sufficient follow-up period to conduct this validation analysis. The number of cases in the cohort of pretrial releases is also sufficient to perform multivariate analysis.

---

<sup>1</sup> **Pretrial Risk Assessment in Charleston County: A Process Evaluation**, April 2019. Center for Court Intervention.

## Results

The first phase of analysis was to see how well the VPRA-R was performing. On general, all of the scoring items were working as designed in terms of being associated with pre-trial re-arrest and FTA rates. The overall failure rate was 28% with the majority being for a re-arrest (22.8%) and another 7.8% for an FTA. The overall rate (either a re-arrest or an FTA) is 28.1%. Another measure of predictive accuracy is a test called the AUC or area under the curve. Most instruments strive to reach the .70 level meaning that 70% of the tested cases were predictive of the actual result. For the VPRAI-R the AUC was only .617.

To improve on the VPRAI-R results we conducted a series of simulations using different weights and adding three new scoring items. Two demographic variables (age and gender) were added as well as one current charge descriptor (number of charges). In addition to the three new risk factors, the severity of the offense was significantly re-organized based on each charge's relationship to the failure rates. We also added the variable of "number of charges" which was also found to be predictive of pretrial failure. Factors in the VPRAI-R that were found to be predictive were retained but had the weights adjusted based on the strength of the statistical association. And in order to make the instrument work without the benefit of an interview, we deleted the drug use and employment status factors.

This process produced a nine-item instrument (Table 2). We then examined the distribution of the failure rates by the total points scored (Table 3). Four risk level designations (Highest, Higher, Moderate and Low) were established based on these results. Here again one can see a very strong statistical association between the overall failure rates and the four risk levels. The table also shows the percent of defendants who fall within each of the four risk levels.

The two largest risk levels are Low and Moderate risk defendants which together comprise 75% or the entire sample. Conversely, the Higher and Highest risk levels only account for 25% of the entire sample. The Highest group is only 7% but it has a 65% overall failure rate.

In terms of how these results compare with the VPRAI-R instrument, it's clear that the Charleston Pretrial Risk Assessment Instrument (CPRAI) performs much better than the VPRAI-R. There is a much greater separation of the defendant's failure rates by the four risk levels. For example, the CPRAI low risk group has a 10% failure rate while the VPRAI-R low group has a 19% failure rate. The moderate group for both instruments have virtually identical failure rates. But for the higher and highest risk groups, the CPRAI failures rates are significantly higher than for the VPRAI-R.

**Table 1. Re-Arrest and FTA Rates for VPRAI-R**

<b>Attribute</b>	<b>Number</b>	<b>Percent</b>	<b>Overall Failure</b>	<b>Re-Arrest</b>	<b>FTA</b>
<b>Total</b>	<b>2,090</b>	<b>100.0%</b>	<b>28.1%</b>	<b>22.8%</b>	<b>7.8%</b>
Risk Level					
1	401	19.2%	15.2%	10.5%	5.0%
2	367	17.6%	22.3%	16.3%	7.4%
3	446	21.3%	29.8%	25.3%	7.0%
4	420	20.1%	32.1%	26.2%	9.5%
5	331	15.8%	37.2%	31.4%	9.4%
6	125	6.0%	43.2%	37.6%	11.2%
Risk Category					
Low	768	36.7%	18.6%	13.3%	6.1%
Medium	866	41.4%	30.9%	25.8%	8.2%
High	456	21.8%	38.8%	33.1%	9.9%
Charge Type					
0	1,276	61.1%	26.7%	20.6%	8.3%
3	814	38.9%	30.3%	26.2%	7.0%
Criminal History					
0	561	26.8%	19.4%	15.2%	5.3%
2	1,529	73.2%	31.3%	25.6%	8.7%
Probation/Parole					
0	1,798	86.0%	25.8%	20.3%	7.7%
2	292	14.0%	42.8%	38.0%	8.2%
Employed or CG					
0	1,581	75.6%	27.1%	21.6%	7.8%
1	509	24.4%	31.2%	26.5%	7.7%
Failure to Appear					
0	1,586	75.9%	23.5%	19.4%	5.7%
1	504	24.1%	42.9%	33.5%	14.3%
History of Drug Use					
0	812	38.9%	22.7%	17.6%	6.2%
2	1,278	61.1%	31.6%	26.1%	8.8%
Pending Charges					
0	1,000	47.8%	21.4%	17.3%	5.2%
2	1,090	52.2%	34.3%	27.8%	10.2%
Violent Convictions					
0	2,046	97.9%	28.2%	22.7%	8.0%
1	44	2.1%	25.0%	25.0%	0.0%

These results are not surprising and should not be viewed as a negative assessment of VPRAI-R. Both instruments are predictive but the CPRAI performs significantly better largely because we have been able to fine-tune several of the VPRAI-R existing risk factors and added the two demographic factors of gender and age.

**Table 2. New Non-Interview CPRAI Simulation**

<b>Attribute</b>	<b>New Score Weight</b>	<b>Number</b>	<b>Percent</b>	<b>Overall Failure</b>	<b>Re-Arrest</b>	<b>FTA</b>
<b>Total</b>		<b>2,090</b>	<b>100.0%</b>	<b>28.1%</b>	<b>22.8%</b>	<b>7.8%</b>
<b>1. Gender</b>						
Female	-1	379	18.1%	23.5%	18.7%	6.9%
Male	0	1,711	81.9%	29.2%	23.7%	8.0%
<b>2. Age at Release</b>						
Under 25	3	542	25.9%	31.7%	27.5%	7.2%
25 to 34	2	770	36.9%	29.7%	22.7%	9.7%
35 – 44	1	408	19.5%	28.2%	23.0%	7.4%
45 and older	0	369	17.7%	19.5%	15.7%	5.1%
<b>3. Charge Type Severity</b>						
0	0	575	27.5%	6.1%	5.4%	1.2%
NA	1	1,112	53.2%	29.3%	24.0%	7.8%
3	3	403	19.3%	56.3%	44.2%	17.1%
<b>4. Criminal History</b>						
0	0	561	26.8%	19.4%	15.2%	5.3%
2	2	1,529	73.2%	31.3%	25.6%	8.7%
<b>5. Probation/Parole</b>						
0	0	1,798	86.0%	25.8%	20.3%	7.7%
2	3	292	14.0%	42.8%	38.0%	8.2%
<b>6. Failure to Appear</b>						
0	0	1,586	76.0%	23.5%	19.4%	5.7%
1	3	504	24.0%	42.9%	33.5%	14.3%
<b>7. Pending Charges</b>						
0	0	1,000	48.0%	21.1%	16.9%	5.3%
2	2	1,090	52.0%	34.2%	27.6%	10.2%
<b>8. Multiple Charges</b>						
No	0	1,149	55.0%	22.6%	18.5%	5.1%
2 or more	2	941	45.0%	34.9%	27.9%	11.1%
<b>9. Prior Violence Conviction</b>						
No	0	2,046	97.9%	28.2%	22.7%	8.0%
Yes	1	44	2.1%	25.0%	25.0%	0.0%

**Table 3. CPRAI Simulation Total Score and Risk Levels by Failure Rates**

Points	Success	Failure	Total	% Failure	Level	Overall Failure Rate	% of Cases
-1	5	0	5	0%	Low	10%	33%
0	19	1	20	5%			
1	48	5	53	9%			
2	73	2	75	3%			
3	134	17	151	11%			
4	162	23	185	12%			
5	183	22	205	11%			
6	182	51	233	22%	Moderate	29%	42%
7	163	55	218	25%			
8	154	91	245	37%			
9	123	55	178	31%			
10	93	63	156	40%	Higher	45%	18%
11	61	52	113	46%			
12	49	53	102	52%			
13	19	38	57	67%	Highest	65%	7%
14	18	27	45	60%			
15	12	22	34	65%			
16	3	2	5	40%			
17	1	7	8	88%			
18	0	2	2	100%			
Total	1,502	588	2,090				

**Table 4. Comparison Between New and Old Charleston Risk Assessment Instruments**

Risk Level	VPRAI-R		CPRAI	
	% of Defendants	Total Failure	% of Defendants	Total Failure
Low	37%	19%	33%	10%
Moderate	41%	31%	42%	29%
Higher	22%	39%	18%	45%
Highest	NA	NA	7%	65%

There has been a recent flurry of critiques of PRAs claiming that they are racially biased to Blacks and Hispanics. The scientific basis for this claim is based solely on a single study by ProPublica in 2016 of the COMPAS risk assessment instrument that is being used in Broward County, Florida.<sup>2</sup>

It should be emphasized at the outset that the COMPAS instrument a) is not being used in any SJC (or other) sites for pretrial risk assessment, b) was not designed to be a pretrial assessment instrument (it is used for assessing prisoners and supervising probationers and parolees) and c) is not being used by the court in Broward County for such purposes. COMPAS also consists of over 130 scoring items, many of which have been found to be of questionable value when tested for their reliability and validity.<sup>3</sup> Finally, the research conducted by ProPublica did not narrowly measure arrests that occurred while the released defendant's charges were pending nor did it measure FTAs that might have also occurred.

Nonetheless, all risk instruments need to be routinely examined to see if there is any direct bias with regard to race and gender. Unlike the ProPublica study of Broward County releases, there is little difference in failure rates by gender and race in Charleston County (Table 5). Both males and blacks have higher failure rates than females and whites but the differences are only for the re-arrest rate and not FTAs.

**Table 5. Overall FTA and Re-Arrest Rates by Gender and Race**

	FTA	Re-Arrest
Gender		
Male	8%	24%
Female	7%	19%
Race		
White	8%	20%
Black	7%	25%

When we control for risk levels, the differences in failure rates drop with no clear pattern or direction (see Tables 6 and 7). With respect to gender, males in the low and highest risk groups have higher failure rates but lower rates in the moderate and higher risk categories. One can also see that using median point scores, there is no difference in the median scores by gender or race with the exception of the low category where there is a one difference.

We also looked at the number of false positives (cases that were predicted to either be re-arrested or FTA but did not) for the high and highest risk groups. That analysis shows a higher

---

<sup>2</sup> Angwin, Julia, Jeff Larson, Surya Mattu and Lauren Kirchner. May 23, 2016. *Machine Bias. There's software used across the country to predict future criminals. And it's biased against blacks.* NY: ProPublica.

<sup>3</sup> Austin, James and Johnette Peyton. 2016. *Validation Evaluation of the San Francisco Adult Probation Department COMPAS Risk/Needs Assessment System.* Washington, DC: JFA Institute.



**Table 6. CPRAI Risk Level Failure Rate Controlling for Gender**

Risk Level	Gender	Median Risk Score	Average Risk Score	% Failure
Total	<b>Total</b>	<b>6.0</b>	<b>5.7</b>	<b>28%</b>
	Male	6.0	6.1	29%
	Female	4.0	4.1	24%
Low	<b>Total Low</b>	<b>3.0</b>	<b>2.6</b>	<b>10%</b>
	Male	3.0	2.9	14%
	Female	2.0	2.1	8%
Moderate	<b>Total Moderate</b>	<b>6.0</b>	<b>6.0</b>	<b>29%</b>
	Male	6.0	6.0	28%
	Female	6.0	5.9	33%
Higher	<b>Total Higher</b>	<b>9.0</b>	<b>9.2</b>	<b>45%</b>
	Male	9.0	9.2	40%
	Female	9.0	9.2	46%
Highest	<b>Total Highest</b>	<b>12.0</b>	<b>12.4</b>	<b>65%</b>
	Male	12.0	12.4	65%
	Female	12.0	11.8	62%

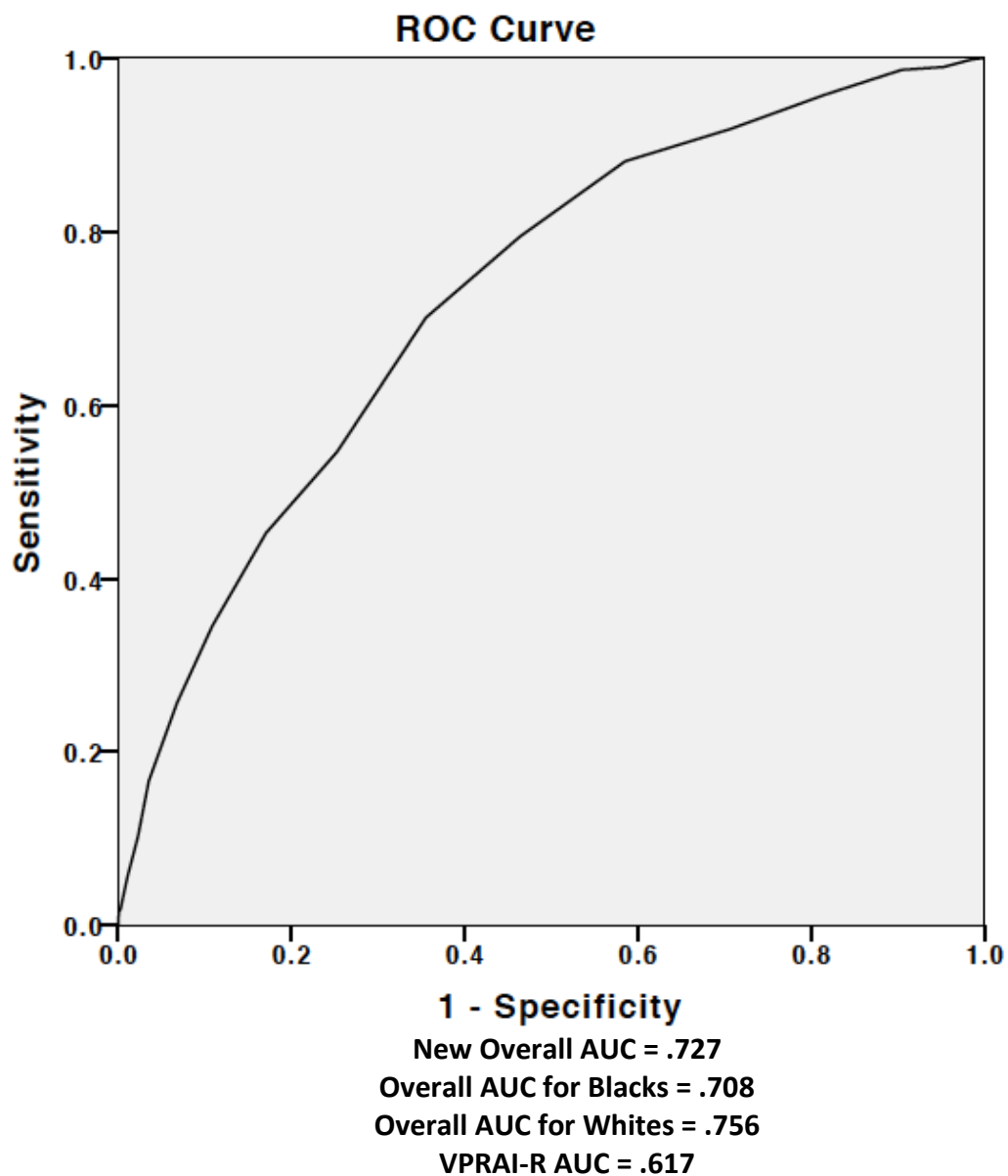
**Table 7. CPRAI Risk Level Failure Rate Controlling for Race (Black and White)**

Risk Level	Race	Median Risk Score	Average Risk Score	% Failure
Total	<b>Total</b>	<b>6.0</b>	<b>5.7</b>	<b>28%</b>
	Black	6.0	6.3	30%
	White	5.0	4.8	25%
Low	<b>Total Low</b>	<b>3.0</b>	<b>2.6</b>	<b>10%</b>
	Black	3.0	2.8	11%
	White	2.0	2.4	9%
Moderate	<b>Total Moderate</b>	<b>6.0</b>	<b>6.0</b>	<b>29%</b>
	Black	6.0	6.2	28%
	White	6.0	5.7	29%
Higher	<b>Total Higher</b>	<b>9.0</b>	<b>9.2</b>	<b>45%</b>
	Black	9.0	9.2	44%
	White	9.0	9.1	49%
Highest	<b>Total Highest</b>	<b>12.0</b>	<b>12.4</b>	<b>65%</b>
	Black	12.0	12.4	63%
	White	12.0	12.3	71%

**Table 8. CPRAI False Positives for Higher and Highest Risk Groups**

False Positives	Higher		Highest		Combined	
	Defendants	%	Defendants	%	Defendants	%
Black	279	35%	117	53%	396	41%
White	91	45%	34	44%	125	45%

**Figure 1. AUC Tests**



proportion of false positives for white defendants scored as higher while black had a higher percentage for defendants scored in the highest risk group (Table 8). Between the two groups there is very little difference (4) % in the overall proportion of false positives for blacks and whites in the two higher risk groups.

Finally, we compute an AUC statistic for the overall sample of defendants as well as for blacks and whites (Figure 1). The overall CPRAI is an acceptable .727 which compares favorably with the VPRAI-R AUC of .617. Both black and white AUC scores are well above the .700 acceptable level.

In summary, all of the relevant tests show that the CPRAI provides improved risk assessment than the VPRAI-R. We could not locate any persistent and sustained bias by gender or race. And, the CPRAI will allow for more coverage of the pretrial defendant population as it does not require an interview. In other words, by eliminating the need for pretrial interviews, the CPRAI will increase the reach of pretrial services and allow for consistent risk assessment of the pretrial defendant population. In terms of its use by the courts, the risk level is not intended to be the sole determinate of whether to release or not. Rather it will provide the court with objective, reliable and valid general risk assessment information that the court can use to make its decision to 1) release or detain and 2) what conditions of supervision are most appropriate for each released defendant.