Research Summary

OYA Violent Incident Risk Assessment (O-VIRA)

Critical parts of the mission of OYA are to "protect the public" and to provide youth "opportunities for reformation in safe environments." These can be daunting tasks given two important facts: (1) Many of the youth committed to OYA close custody facilities have long histories of engaging in violent behavior; and (2) OYA currently posts from one to three direct supervision staff—depending on the shift or setting—for every 25 youth in close custody. To increase the probability that the agency protects the public, including staff and youth in OYA's care, and provides safe environments, OYA has developed the OYA Violent Incident Risk Assessment (O-VIRA) to predict the likelihood that a youth will engage in a violent incident within the first six months in close custody settings. By determining which youth are likely to engage in violent behavior during incarceration, staff will be in a better position to anticipate problems and reduce the likelihood that they will occur. This research summary outlines the methods used to develop the assessment and discusses possible applications of the tool.

Methods

Participants

Participants included all youth admitted to an OYA Youth Correctional Facility (YCF) from November 2007 through December 2009 (N=1,258). The demographic and crime type breakdowns are provided in Table 1. For those youth admitted more than once, the first admittance was used to ensure each youth was represented only once.[1]

Dependent Variable

The dependent variable (DV) for this analysis was a violent incident that occurred within six months of admission to a YCF. A violent incident was defined as any incident classified as (a) an assault, or (b) a peer fight that resulted in isolation or segregation. Staff document these incidents in the Juvenile Justice Information System (JJIS). An OYA procedure (FAC I-E-1.0) requires staff to complete a Youth Incident

Table 1: Sample Demographics and Crime Types

All youth Admitted to OYA YCF from November 2007 through December 2009 by Demographic and Crime Type Variables			
		Frequency	Percent
Total		1,258	
Sex			
	Female	130	10.3%
	Male	1128	89.7%
Race/Ethnicity			
	African American	149	11.8%
	Asian	21	1.7%
	Hispanic	355	28.2%
	Native American	44	3.5%
	Other/Unknown	9	0.7%
	White	680	54.1%
Crime Type			
	Arson	20	1.6%
	Criminal Other	47	3.7%
	Person to Person	292	23.2%
	Property	341	27.1%
	Public Order	16	1.3%
	Robbery	108	8.6%
	Sex Offense	313	24.9%
	Substance Related	57	4.5%
	Weapons	64	5.1%
Legal Status			
	YCF	808	64.2%
	DOC	138	11.0%
	Revoked	133	10.6%

[1] This selection process over represents youth that were committed to the YCF on their first admittance and under represents youth that were revoked.

Report (YIR) for all major behavior violations, which are defined as offender behaviors that are "immediately threatening to life, health, or facility safety, security, or good order." FAC I-E-1.0 clearly states the steps required for documenting YIRs in the JJIS. FAC I-E-1.0 further requires input from all involved staff and review by a manager or officer of the day prior to locking the incident in JJIS

Independent Variables

Independent variables (IVs) used in this analysis were extracted from JJIS and the OYA Risk/Needs Assessment (RNA), also found in JJIS. Demographic variables included sex and age, and crime type. To avoid the possibility of creating a model that might be discriminatory, race/ethnicity was excluded as an IV. Crime type variables included only the most serious crimes for the committing dispositions. The RNA provided the majority of the IVs for this analysis.

The variable selection process required some preliminary examination of the correlation between the variables in question and violent incidents. Appendix A reports the variables and their correlations with the DV. In total, 81 variables were examined. Variables that were statistically significant at $p < .05$ were selected for the logistic regression if their correlation with the DV was $r=>.09$ and they were not highly correlated ($r<.4$) with similar variables[2], in which case the variable having the highest correlation with the DV was selected.[3] Thirty variables were included in the logistic regression.

Analysis

Backwards Stepwise Logistic Regression (BSLR) was used with the SPSS Statistics software to develop the model for predicting the DV. All of the 27 variables selected for the logistic regression were included in the first step of the analysis. As the BSLR process runs, it automatically removes the variable with the least amount of statistical significance at each step. The process is terminated when only statistically significant variables remain in the equation ($p<.1$ is the default level of statistical significance provided by SPSS). The equation in the final step of the BSLR process comprises the independent variables that predicted the probability that a youth would engage in a violent incident within the first six months in OYA close custody. Associated with each of the predictor variables is a coefficient that represents the relative strength of the predictor variable on the DV. This equation is the O-VIRA model.

The O-VIRA model calculates a score for each youth. This score can be interpreted as the probability that the youth will act violently within their first six months of close custody. For example, a youth whose score is .42 has a 42% likelihood of engaging in violence within the first six months.

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[2] An example of two highly correlated variables was the mental health history protective score and the current mental health protective score.

[3] One exception to the selection process occurred. Both the current and history relationship variables where included because the correlations were nearly equal and history may be a more reliable indicator for the type of social relationships.

Area Under the Curve (AUC) and Cohen's kappa metrics gauge the accuracy of the equation. AUC measures the extent to which the risk indicator correctly classifies youth. For this analysis, the AUC indicates the proportion of the youth that are not false positives—high risk youth who did not commit a violent incident within the first six months—or false negatives—low risk youth who did commit a violent incident within the first six months. Cohen's kappa measures the extent to which the assessment improves classification above chance when the distribution of scores is divided into equal halves (high risk = 50% and low risk = 50%), and similar to the AUC, indicates the proportion of youth that are classified correctly.

Results

Model Accuracy

Table 2 provides the results of the AUC analysis for the overall population and key subpopulations. The model was relatively accurate, overall, with an AUC of .71, meaning that 71% of the cases were classified correctly. The O-VIRA model was also relatively accurate for all of the tested subpopulations. The lowest AUC for a subpopulation was .67 for females and the highest was .73 for African Americans.

Table 2

Area Under the Reciever Operator Characteristic Curve (AUC)	
	AUC
Overall	0.707
Gender	
Female	0.671
Male	0.706
Race_Category	
African American	0.728
Hispanic	0.675
Other/Unknown	0.689
White	0.720
Sex_Offender	
Not a Sex Offender	0.679
Sex Offender	0.717

*Other/Unknown includes Native American and Asian

Variables in the Equation

Table 3 details the component variables of the O-VIRA model. In sum, out of the 30 variables entered into the model at step one, 8 variables remained in the equation at step 22, the final step. One variable—Animal Cruelty—was removed from the final equation because less than 5% of the youth were identified as cruel to animals, and the presence of this variable in the equation did not add to the AUC.

Table 3

Logistic Regression: Variables in the Equation				
PREDICTOR VARIABLES*	**VALUES**	**PARAMETER ESTIMATE (β)**	**ODDS RATIO**	**SIGNIFICANCE LEVEL**
Age at Admission	Age at admission	-.224	.800	.000
Gender	Female = 0, Male = 1	-.411	.663	.066
SED	No = 0, Yes = 1	.438	1.549	.015
Sex Offender	No = 0, Yes = 1	-.605	.546	.005
Mental Health Protective	Sum (maximum = 20)	-.098	.907	.000
Full Relationship Risk	Sum (maximum = 3)	.252	1.286	.004
Belief in Fighting/Aggression	Sum (maximum = 3)	.399	1.490	.000
Intercept	Constant	2.630	13.874	.004

*Although Animal Cruelty remained in the stepwise equation it was excluded from the final equation because (a) less than 5% of the youth were identified as cruel to animals, and (b) it did not add to the AUC.

The O-VIRA model suggests that younger youth, females, youth with the Special Education label of Seriously Emotionally Disturbed (SED), non-sex offenders, youth with the lack of protective factors for mental health, youth whose relationships tend to involve antisocial or gang associated youth, and youth that believe that fighting and aggression solve problems are more likely to engage in a violent act within their first six months of close custody.

Table 4

Actual vs. Expected Rates of Committing a Violent Act within the First 6-Month of Close Custody		
	Actual	**Expected**
Overall	20.9%	20.7%
Gender		
Female	32.3%	32.2%
Male	19.6%	19.5%
Race_Category		
African American	27.5%	24.0%
Hispanic	22.8%	21.9%
Other/Unknown*	21.6%	19.1%
White	18.4%	19.7%
Sex_Offender		
Not a Sex Offender	24.1%	23.9%
Sex Offender	11.2%	11.1%

*Other/Unknown includes Native American and Asian

Actual vs. Expected Analysis

To further test the validity of the O-VIRA actual vs. expected[4] rates were examined. Table 4 reports actual and expected rates of violent incidents within the first six months for the overall population and several subpopulations. Overall, the O-VIRA predicted as expected with actual and expected rates nearly identical. The O-VIRA also predicted well by gender and by criminal offense type. However, the O-VIRA slightly underestimated the incident rates for minorities and slightly overestimated the rates for white youth.

[4] Expected rates were determined by calculating the mean O-VIRA for the overall population and each of the subpopulations.

Determining the Cut Point for High Risk Youth

In addition to AUC, when the distribution is divided into equal halves, Cohen's kappa (K) is a statistic that indicates extent to which the assessment classifies youth better than random chance. Table 6 presents a 2 x 2 matrix that classifies youth in the study population by their O-VIRA risk scores (at or above the 50th percentile vs. below the 50th percentile) and by whether or not the youth engaged in a violent incident in their first six months of close custody. At this cut point, the O-VIRA correctly classifies youth at 20% better than random chance (κ = .20). However, for at least two related reasons, 50% may not be the optimal cut point for classifying youth as either low or high risk. First, the agency may not have the resources to keep half of the youth in secure settings after intake; and second, using 50% as the cut point creates too many false positives (nearly 35% of the youth—437 out of 1,258—were in the high risk group and did not commit a violent incident in the first six months). Compared to a cut point for high risk youth at the 50th percentile, increasing the cut-point percentile for high risk youth will (a) decrease the amount of resources needed to secure high risk youth, (b) decrease the number of false positives, and (c) consequently, increase the extent to which O-VIRA classifies youth correctly.

Table 6

Classification Matrix: 50th Percentile High Risk Cut Point			
	Did not have a violent incident in the first 6 months of close custody	**Did have a violent incident in the first 6 months of close custody**	**Total**
Non-VIRA Score			
Below 50th Percentile	558	71[b]	629
50th Percentile and Above	437[a]	192	629
Total	995	263	1258

a) false positives (437/1,258) = 34.7%
b) false negatives (71/1,258) = 5.6%

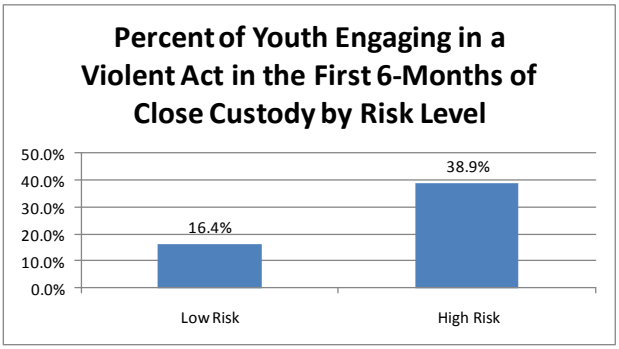
Table 5

Classification Matrix: 80th Percentile High Risk Cut Point			
	Did not have a violent incident in the first 6 months of close custody	**Did have a violent incident in the first 6 months of close custody**	**Total**
O-VIRA Score			
Below 80th Percentile	841	165[b]	1006
80th Percentile and Above	154[a]	98	252
Total	995	263	1258

a) false positives (154/1,258) = 12.2%
b) false negatives (165/1,258) = 13.1%

Table 5 presents the same 2 x 2 classification matrix as shown in Table 6 except that the cut point for identifying youth at high-risk of engaging in a violent incident was increased to the 80th percentile. At this cut point, the O-VIRA now correctly classifies 24% of the youth better than random chance (κ=.24). Using the 80th percentile as the cut point for high risk provides an assessment tool that will be useful for

Figure 1



managing youth. In addition, this cut point divides the youth into risk levels that clearly separate youth who are more likely to engage in a violent act in their first six months of close custody from those who are less likely. Figure 1 illustrates that youth in the high risk category engaged in a violent act in their first six months of close custody at a much high rate than youth in the low risk category ($\chi^2 = 61.63$, $p<.001$).

Discussion

O-VIRA was designed to predict the likelihood that a youth will engage in a violent incident within the first six months in close custody settings. Determining which youth are likely to engage in violent behavior during the early incarceration period should assist in anticipating problems and reduce the likelihood that they will occur. This research summary outlined the methods used to develop the O-VIRA and reported on the validity assessment of the instrument. The following discussion suggests possible applications for the tool, cautions against using the O-VIRA inappropriately, and makes recommendations for future research on this instrument.

Safe environments. When youth are first admitted to OYA, staff often have little information about the likelihood that a youth will be violent. Placing youth in the presence of other youth that may be violent or with youth who are likely to be victims of violence puts all of those youth at risk. Knowing that a youth is likely to be violent will provide enough information to place the youth accordingly and alerts to staff that extra supervision/intervention may be required for certain youth.

Efficient resource allocation. Knowing that a youth is not likely to be violent will provide enough information to place the youth accordingly a setting that requires less supervision. Thus, using the O-VIRA should allow managers to manage staff more efficiently while protecting youth at the same time. Supervising youth according to their risk level is consistent with OYA's current practice of placing adjudicated juveniles in the least restrictive environment possible so they can achieve their treatement goals.[5]

[5] Oregon Youth Authority (2009). The Oregon Youth Authority (IB 1 7/21/2009 4:29 PM). Retrieved May 12, 2011, from http://www.oregon.gov/OYA/docs/IB1_AboutOYA_072109.pdf

Foundation for future work in predicting risk of violent incidents. The O-VIRA was not designed to indicate which youth are likely to continue to be violent. Using the O-VIRA with youth that have been in close custody for more than six months would not be appropriate. Follow-up tools will be necessary to indicate a youth's likelihood for continue behavior problems. Tools that track their most recent behavior patterns also will be necessary.

In addition, follow-up analysis will be required to continue to determine the predictive validity of the O-VIRA. Although the current study provided sufficient evidence concerning the tool's validity to begin utilization, because this analysis only included youth that were involved in the development of the instrument, the estimates of validity (AUC, Actual vs. Expected Analysis, etc.) may be inflated. Replicating these analyses on a future set of youth will be important in demonstrating the overall validity and effectiveness of the O-VIRA.

Appendix A – Selection Variables

Correlations Between Possible Independent Variables and At Least One Violent Incident within 6 months from Admission		
Variable	***r***	**Included in Logistic Regression**
Age at admission	-.149 **	☑
Sex	-.095 **	☑
Current parental authority and control	.110 **	☑
Not Special Education (IEP)	-.092 **	☑
Learning disability	.022	
Seriously emotionally disturbed	.135 **	☑
First-time YCF commitment	.086 **	☑
DOC commitment	-.055 *	
Revoked	-.024	
Sex offender	-.138 **	☑
ORRA	.03	
ORRA-V	.049	
Aggression protective score	-.162 **	☑
Aggression risk score	.188 **	☑
Alcohol drug history protective score	-.026	
Alcohol drug history risk score	.055	
Attitudes behavior protective score	-.154 **	☑
Attitudes behavior risk score	.149 **	☑
Criminal risk score	.074 **	
Current alcohol drug protective score	.016	
Current alcohol drug risk score	.046	
Current employment protective score	-.117 **	☑
Current employment risk score	.014	
Current living arrangement protective score	-.095 **	☑
Current living arrangement risk score	.095 **	☑
Current mental health protective score	.115 **	
Current mental health risk score	.098 **	
Current relationship protective score	-.132 **	☑
Current relationship risk score	.136 **	☑

* $p < .05$

** $p < .01$

*** insufficient observations to calculate *r*

Variable	*r*	Included in Logistic Regression
Current school protective score	-.026	
Current school risk score	.110 **	☑
Current use time protective score	-.017	
Current use time risk score	.017	
Employment history protective score	-.109 **	☑
Employment history risk score	-.027	
Family history protective score	-.132 **	
Family history risk score	.151 **	☑
History use time protective score	-.066 *	
Mental health history protective score	-.141 **	☑
Mental health history risk score	.115 **	
Relationship history protective score	-.084 **	
Relationship history risk score	.134 **	☑
School history protective score	-.042	
School history risk score	.092 **	☑
Skills protective score	-.102 **	☑
Skills risk score	.065 *	
Prescreen criminal total score	.078 **	
Prescreen social total score	.168 **	☑
History of Mental Health Problems	.124 **	
History of Being Victim of Emotional Abuse or Neglect	.06 *	
Physically Abused by Someone Outside Family	.087 **	
Crime Intensity Ranking	-.084 *	
Total committing charges count	0.033	
Primary Emotion when Committing Crime(s)	-0.050	
Primary Purpose for Committing Crime(s)	- ***	
Optimism	0.016	

* $p < .05$

** $p < .01$

*** insufficient observations to calculate *r*

Variable	*r*	Included in Logistic Regression
Impulsive; Acts Before Thinking	0.021	
Belief in Control Over Anti-Social Behavior	-0.075 **	
Empathy, Remorse, Sympathy, or Feelings for Victim(s) of Criminal Behavior	0.004	
Respect for Property of Others	-0.012	
Respect for Authority Figures	-0.007	
Attitude Toward Pro-Social Rules & Conventions in Society	0.022	
Accepts Responsibility for Anti-Social Behavior	0.018	
Youth's Belief in Successfully Meeting Conditions of Court Supervision	-0.029	
Tolerance for Frustration	0.020	
Hostile Interpretation of Actions and Intentions of Others	-0.087 **	
Belief in Yelling and Verbal Aggression to Resolve a Disagreement or Conflict	-0.025	
Belief in Fighting and Physical Aggression to Resolve a Disagreement or Conflict	0.128 **	☑
Reports or Evidence of Violence Not Included in Criminal History	0.123 **	☑
Reports of Problem with Sexual Aggression Not Included in Criminal History	-0.036	
Consequential Thinking	-0.034	
Goal Setting	0.012	
Problem Solving	-0.022	
Situational Perception	-0.048	
Dealing with Others	-0.057 *	
Dealing with Difficult Situations	0.032	
Dealing with Feelings/Emotions	0.023	
Monitoring of Internal Triggers, Distorted Thoughts, that Can Lead to Trouble	0.019	
Monitoring of External Triggers, Events or Situations, That Can Lead to Trouble	-0.016	
Control of Impulsive Behaviors that Get Youth into Trouble	-0.026	
Violent Outbursts	0.085 **	☑
Deliberately Inflicting Physical Pain	0.094 **	☑
Using/Threatening with Weapon	0.074 **	
Animal Cruelty	0.085 **	☑
Control of Aggression	-0.135 **	☑

* $p < .05$

** $p < .01$

*** Insufficient observations to calculate *r*