OYA Nuisance Incident Risk Assessment (O-NIRA)

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 problematic 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 Nuisance Incident Risk Assessment (O-NIRA)[1] to predict the likelihood that a youth will engage in multiple incidents within the first six months in close custody settings. By determining which youth are likely to engage in problematic 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.[2]

Dependent Variable

The dependent variable (DV) for this analysis was at least four nuisance incidents that occurred within six months of admission to a Youth Correctional Facility (YCF). Nuisance incidents were classified as (a)

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] For the purpose of this assessment, nuisance incidents are defined as a class of problem behaviors that require OYA staff intervention and result in an OYA Youth Incident Report (see OYA procedure FAC I-E-1.0). Further definition is provided in the Dependent Variable section of this report.
[2] This selection process over represents youth that were committed to the YCF on their first admittance and under represents youth that were revoked.

contraband, (b) escape, (c) major group disturbance, (d) peer fights not resulting in isolation or segregation, (e) sexual behavior, (f) significant event, (g) suicidal behavior, and (h) youth misconduct. Nuisance incidents did not include incidents classified as (a) an assault or (b) a peer fight that resulted in isolation or segregation. Staff document youth incidents in the Juvenile Justice Information System (JJIS). An OYA procedure (FAC I-E-1.0) requires staff to complete a Youth Incident 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 include sex, 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 nuisance incidents. Appendix A – Selection Variables reports the variables and their correlations with the DV. In total, 94 variables were examined. Statistically significant variables ($p<.05$) that were correlated with the DV where $r => .1$ were selected for the logistic regression;[3] however, if the variables were highly correlated ($r<.4$) with similar variables,[4] only the variable with the highest correlation with the DV was selected.[5] Twenty-two 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 22 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 ($p<.1$, the default level of statistical significance provided by SPSS) remain in the equation. The equation in the final step of the BSLR process comprises eleven independent variables. O-NIRA predicts the probability that a youth would engage in at least 4 nuisance incidents within the first six months in OYA close custody. Associated with each of the predictor

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[3] One exception to this selection process occurred. Although the correlation for sex was .09, this variable was included to statistically control for sex.
[4] An example of two highly correlated variables was the mental health history protective score and the current mental health protective score.
[5] 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.

variables is a coefficient that represents the relative strength of the predictor variable on the DV. Two more variables[6] were eliminated from the model because they were highly correlated with similar variables. The variable with the lowest level of significance was selected of those variables that were highly correlated and similar. BSLR was repeated with the nine remaining variables. All of the nine variables remained in the model with p values <.05. This equation is the O-NIRA model.

The O-NIRA model calculates a score for each youth. This score can be interpreted as the probability that the youth will engage in four nuisance incidents within their first six months of close custody. For example, a youth whose score is .42 has a 42% likelihood of engaging in at least 4 nuisance incidents within the first six months.

Area Under the Curve (AUC) 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 at least four nuisance incidents within the first six months—or false negatives—low risk youth who did commit at least four nuisance incidents within the first six months.

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 .80, meaning that 80% of the cases were classified correctly. The O-NIRA model was also relatively accurate for all of the tested subpopulations. The lowest AUC for a subpopulation was .77 for females and the highest was .85 for the Other/Unknown race category.

Variables in the Equation

Table 3 details the component variables of the O-NIRA model. The O-NIRA model suggests that younger youth with the Special Education label of Seriously Emotionally Disturbed (SED) youth who scored high on the RNA prescreen social score, youth who had a high number of mental health risk factors, youth who lacked aggression protective factors, youth who consistently disobeyed parents, youth who were non-sex

Table 2

Area Under the Reciever Operator Characteristic Curve (AUC)	
	AUC
Overall	0.804
Gender	
Female	0.778
Male	0.801
Race Category	
African American	0.831
Hispanic	0.836
Other/Unknown	0.850
White	0.781
Sex Offender	
Not a Sex Offender	0.789
Sex Offender	0.826

*Other/Unknown includes Native American and Asian

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[6] Mental health protective score and aggression risk score.

offenders, youth who were high risk to recidivate (ORRA), and youth who were low risk to recidivate violently (ORRA-V), were more likely to engage in at least four nuisance acts within their first six month of close custody.

Table 3

<table>
<tr><td colspan="5">Logistic Regression: Variables in the Equation</td></tr>
<tr><td>PREDICTOR VARIABLES</td><td>VALUES</td><td>PARAMETER ESTIMATE (β)</td><td>ODDS RATIO</td><td>SIGNIFICANCE LEVEL</td></tr>
<tr><td>Age at Admission</td><td>Age at admission</td><td>-.321</td><td>.726</td><td>.000</td></tr>
<tr><td>SED</td><td>No = 0, Yes = 1</td><td>.871</td><td>2.389</td><td>.000</td></tr>
<tr><td>RNA Prescreen Social Score</td><td>Sum (maximum = 18)</td><td>-.116</td><td>.890</td><td>.007</td></tr>
<tr><td>Mental Health Risk Score</td><td>Sum (maximum = 11)</td><td>.248</td><td>1.281</td><td>.000</td></tr>
<tr><td>Aggression Protective Score</td><td>Sum (maximum = 8)</td><td>-.248</td><td>.781</td><td>.000</td></tr>
<tr><td>Parental Authority and Control</td><td>Sum (maximum = 2)</td><td>.404</td><td>1.497</td><td>.009</td></tr>
<tr><td>Sex Offender</td><td>No = 1, Yes = 0</td><td>-.677</td><td>.508</td><td>.012</td></tr>
<tr><td>ORRA</td><td>4 Decimals between 0 & 1</td><td>2.583</td><td>13.237</td><td>.010</td></tr>
<tr><td>ORRA-V</td><td>4 Decimals between 0 & 1</td><td>-3.015</td><td>.049</td><td>.034</td></tr>
<tr><td>Intercept</td><td>Constant</td><td>3.359</td><td>28.750</td><td>.003</td></tr>
</table>

Actual vs. Expected Analysis

To further test the validity of the O-NIRA actual vs. expected[7] rates were examined. Table 4 reports actual and expected rates of nuisance incidents within the first six months for the overall population and several subpopulations. Overall, the O-NIRA predicted as expected. The actual and expected rates were nearly identical. The O-NIRA also predicted well by criminal offense type. However, the O-NIRA underestimated the incident rates for females and African Americans, and slightly overestimated the rates for all other race categories.

Table 4

Actual vs. Expected Rates of Committing at Least Four Nuisance Incidents within the First 6-Month of Close Custody		
	Actual	**Expected**
Overall	15.4%	15.3%
Gender		
Female	25.4%	20.9%
Male	14.3%	14.7%
Race Category		
African American	25.5%	15.4%
Hispanic	10.7%	11.9%
Other/Unknown*	13.5%	15.4%
White	15.9%	17.2%
Sex Offender		
Not a Sex Offender	17.6%	17.5%
Sex Offender	8.9%	8.9%

*Other/Unknown includes Native American and Asian

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

Determining the Cut Point for High Risk Youth

In addition to AUC, Cohen's kappa (K) statistic was used to indicate extent to which the assessment classifies youth better than random chance. Table 5 presents a 2 x 2 matrix that classifies youth in the study population by their O-NIRA risk scores (at or above the 50th percentile versus below the 50th percentile) and by whether or not the youth engaged in at least four nuisance incidents in their first six months of close custody. Using .5 as the cut point, the O-NIRA correctly classifies youth at 20% better than random chance (K = .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

Classification Matrix: 50th Percentile High Risk Cut Point			
	Did not have at least four nuisance incidents in the first 6 months of close custody	Did have at least four nuisance incidents in the first 6 months of close custody	Total
O-MIRA Score			
Below 50th Percentile	602	27[b]	629
50th Percentile and Above	462[a]	167	629
Total	1064	194	1258

a) false positives (462/1,258) = 36.7%
b) false negatives (27/1,258) = 2.1%

(nearly 37% of the youth—462 out of 1,258—were in the high risk group and did not commit at least four nuisance incidents 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-NIRA classifies youth correctly.

Classification Matrix: 20% High Risk Cut Point			
	Did not have at least four nuisance incidents in the first 6 months of close custody	Did have at least four nuisance incidents in the first 6 months of close custody	Total
O-MIRA Score			
Below 80th Percentile	917	89[b]	1006
80th Percentile and Above	147[a]	105	252
Total	1064	194	1258

a) false positives (147/1,258) = 11.7%
b) false negatives (89/1,258) = 7.1%

Table 6 presents the same 2 x 2 classification matrix as shown in Table 5 except that the cut point for identifying youth at high-risk of engaging in at least 4 nuisance incidents within their first 6 months of close custody was increased to the 80th percentile. At this cut point, the O-NIRA now correctly classifies 34% of the youth (K=.34) better than random chance.
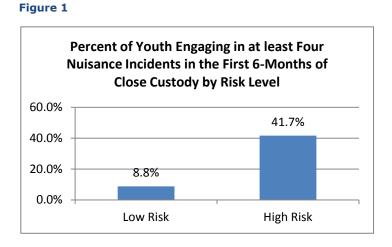
Using the 80th percentile as the cut point for high risk provides an assessment tool that will be useful for managing youth. In addition, this cut point divides the youth into risk

levels that clearly separate youth who are more likely to engage in at least four nuisance incidents 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 at least four nuisance incidents in their first six months of close custody at a much high rate than youth in the low risk category ($\chi^2 = 166.42$, $p<.000$).

Discussion

O-NIRA was designed to predict the likelihood that a youth will engage in at least four nuisance incidents within the first six months in close custody settings. Determining

which youth are likely to engage in numerous problem behaviors 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-NIRA and reported on the validity assessment of the instrument. The following discussion suggests possible applications for the tool, cautions against using the O-NIRA inappropriately, and recommends future research on this instrument.

Safe Environments. Staff often have little information about the likelihood that a youth will engage in nuisance behaviors when youth are first admitted to OYA. Knowing that a youth is likely to be involved in those types of behaviors will provide information to assist in placing youth accordingly and alerts staff that extra supervision/intervention may be required for certain youth.

Efficient Resource Allocation. Knowing that a youth is not likely to be involved in numerous nuisance problem behaviors will provide enough information to place the youth accordingly in a setting that requires less supervision. Thus, using the O-NIRA should allow managers to manage staff resources 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 treatment goals.[8]

Foundation for Future Work in Predicting Risk of Nuisance Incidents. The O-NIRA was not designed to indicate which youth are likely to continue to be involved in nuisance behaviors. Using the O-NIRA with youth that have been in close custody for more than six months would not be appropriate. Follow-up tools are necessary to indicate a youth's

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[8] 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

likelihood for continued 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-NIRA. Although the current study provides sufficient evidence concerning the tool's validity to begin utilization, the estimates of validity (AUC, Actual vs. Expected Analysis, etc.) may be inflated because this analysis only included youth that were involved in the development of the instrument. Replicating these analyses on a future set of youth will be important in demonstrating the overall validity and effectiveness of the O-NIRA.

Appendix A – Selection Variables

Correlations Between Possible Independent Variables and At Least Three Incidents within 6 months from Admission		
Variable	***r***	**Included in Logistic Regression**
Accepts responsibility for anti-social behavior	-.021	
Against person felony referrals	-.027	
Against person misdemeanor referrals	.141 **	
Age at admission	-.176 **	☑
Age at first offense	.109 **	
Aggression protective score	-.277 **	☑
Aggression risk score	.260 **	☑
Alcohol drug current protective score	.015	
Alcohol drug current risk score	.006	
Alcohol drug history protective score	.045	
Alcohol drug history risk score	-.012	
Attitude toward pro-social rules & amp; conventions in society	.054	
Attitudes behavior protective score	-.212 **	☑
Attitudes behavior risk score	.210 **	
Belief in control over anti-social behavior	-.089 **	
Belief in fighting and physical aggression to resolve a disagreement or conflict	.101 **	
Belief in yelling and verbal aggression to resolve a disagreement or conflict	-.013	
Consequential thinking	-.046	
Control of aggression	-.100 **	
Control of impulsive behaviors that get youth into trouble	-.029	
Current alcohol/drug use	-.031	
Current parental authority and control	.165 **	☑
Dealing with difficult situations	.078 **	
Dealing with feelings/emotions	.070 *	
Dealing with others	-.095 **	
Disposition orders with admission to detention or adult jail	.085 **	
Disposition orders with YCF admission	.060 *	
DOC	-.126 **	☑
Empathy, remorse, sympathy, or feelings for victim(s) of criminal behavior	.064 *	
Employment current protective score	-.156 **	☑
Employment current risk score	-.032	
Employment history protective score	-.126 **	☑

* $p < .05$
** $p < .01$
*** Insufficient observations to calculate *r*

Variable	r	Included in Logistic Regression
Employment history risk score	.018	
Family history protective score	-.166 **	
Family history risk score	.187 **	
Felony referrals	-.037	
Goal setting	.007	
History of being victim of emotional abuse or neglect	.151 **	☑
History of abuse	.131 **	
History of mental health problems	.212 **	☑
History of out of home placement exceeding 30 days prior to OYA close custody commitment	.112 **	
History of prior interventions: prior to current commitment to or placement with OYA	***	
History of running away or getting kicked out of home	.120 **	
Hostile interpretation of actions and intentions of others in a common, non-confrontational setting	.122 **	
Impulsive; acts before thinking	.002	
Jail/imprisonment history of persons currently involved with the household	.016	
Learning disibility indicated	.072 *	
Living arrangement protective score	-.104 **	
Living arrangement risk score	.132 **	
Mental health current protective score	.214 **	
Mental health current risk score	.130 **	
Mental health history protective score	-.251 **	☑
Mental health history risk score	.237 **	☑
Mental health no problems indicated	-.213 **	☑
Misdemeanor referrals	.132 **	
Monitoring of external triggers, events or situations, that can lead to trouble	-.027	
Monitoring of internal triggers, distorted thoughts, that can lead to trouble	.010	
Not special ed indicated	-.182 **	☑
Optimism	-.040	
ORRA	.068 *	
ORRA-V	.047	
Primary emotion when committing crime(s) (within the last 6 months)	-.026	
Primary purpose for committing crime(s) (within the last 6 months)	***	

* p < .05

** p < .01

*** Insufficient observations to calculate *r*

Variable	r	Included in Logistic Regression
Problem solving	-.032	
Relationship current protective score	-.114 **	
Relationship current risk score	.114 **	☑
Relationship history protective score	-.064 *	
Relationship history risk score	.044	
Reports of problem with sexual aggression not included in criminal history	.002	
Respect for authority figures	-.053	
Respect for property of others	.032	
Revoked	-.004	
RNA prescreen criminal risk score	.100 **	☑
RNA prescreen social risk score	.197 **	☑
Rports or evidence of violence not included in criminal history	.175 **	
School current protective score	-.011	
School current risk score	.112 **	
School history protective score	-.058 *	
School history risk score	.135 **	☑
School scoring	.063 *	
SED behavioral indicated	.230 **	☑
Sex	-.094 **	☑
Sex offender	-.103 **	☑
Situational perception	-.062 *	
Skills protective score	-.170 **	☑
Skills risk score	.137 **	☑
Tolerance for frustration	.020	
Use of time current protective score	-.016	
Use of time current risk score	.010	
Use of time history protective score	-.060 *	
Use of time history risk score	***	
Weapon referrals	-.032	
YCF	.117 **	☑
Youth's belief in successfully meeting conditions of court supervision	-.005	

* p < .05

** p < .01

*** Insufficient observations to calculate *r*