Assessing Risk of Disruptive Behaviors Among Juvenile Offenders: Development of a Prediction Tool

Technical Report

November 2014

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A S S O C I A T E S , I N C .

Acknowledgements

Background to the Study

The objective of the current study is to develop an instrument to help improve the overall safety of juvenile correctional facilities and provide guidance for professionals to identify high need youth that will require additional supportive services. Until more recently, the process of identifying high need youth was reliant on a subjective clinical assessment, which has overall proven to be an inconsistent method of identification (Lowenkamp, Holsinger, and Latessa, 2001; Van Voorhis and Brown, 1997). Based on the literature, it is clear that the development of a standardized predictive instrument that identifies which youth—and, importantly, under which conditions--are most likely to become involved in institutional violence can assist in prevention and rehabilitation efforts. Through careful analysis of individual and institutional level factors, justice professionals may gather meaningful insight into improving safety in juvenile detention facilities.

Within the literature there is a body of work that investigates factors related to the internal emotional state and beliefs of individual youth to account for differences in participation in institutional violence, particularly in regards to less clinically severe individuals. In a 2014 study of incarcerated youth, researchers found a correlation between low-self esteem, maladaptive perception biases, high levels of egoism and participation in institutional violence (Smith et al, 2014). This finding supports literature that demonstrates the effectiveness of cognitive and social skills training in reducing aggression and impulsive behavior in incarcerated youth (Glick & Goldstein, 1987). Exposure to violence is one of the greatest predictors of violence perpetration (Kimonis et al, 2011); however, individual traits such as anger and callused-unemotional (CU) traits can function as important mediators between exposure to violence and perpetration of violence. The trait of anger surfaces in the literature as particularly significant indicator (Cornell, Peterson & Richards, 1999; Kimonis et al, 2011). Utilizing a simple Anger scale, Cornell, Peterson and Richards successfully classified 66% of juvenile offenders into either high or low risk groups. After following participants for 3 months of incarceration researchers concluded that anger behavior presented clear predicative ability in identification of those at risk for institutional aggression (physical and verbal). It is important to note that boys and girls may have slightly different risk profiles in regards to the interplay between violence exposure, internal processes, and aggressive behavior. A Finnish study (Gammelgård et al, 2012) found that girls' risk was more strongly connected to past violent behavior and lifetime stress exposure, whereas violent outcome in boys was more strongly connected to anti-social behaviors and cognitions.

Carrizales (2013) investigated potential protective factors to counterbalance individual level risks. Strong social supports, strong attachment and bonds and school commitment were all protective factors against involvement in institutional violence, which may be suggestive of proactive intervention points that can be initiated. Particularly salient is the finding that the most significant factors for predicting violence were social support and positive attitude towards intervention and authority. This finding suggests it is well worth the effort of programs to help youth maintain connection to outside social supports and to dedicate effort to fostering positive staff-youth relationships.

In the body of literature on individual level assessment of risk, demographic data has also lead to correlations to likelihood of violence. In a study of 192 incarcerated youth McDougall, Campbell and Santor (2012) found a youth's interactional history with the criminal justice system was strongly predictive of involvement in institutional violence. In this study, detainees who were younger at the time of their first arrest, had more convictions, and had spent more time institutionalized were at highest risk. Additional studies have found that younger detainees are at greater risk for committing more severe institutional violence (Light, 1990). The literature suggests various possible causal linkages. Younger inmates, still developing neurological capacities for impulse control and problem solving have a more difficult time coping with social stress (Barton & Mackin, 2012) Additionally, there is strong evidence that younger inmates are targets of violence and initiation at higher rates than older inmates (Edgar & O'Donnell, 1998). Additional research finds that poor academic performance and a history of substance use—especially substances other than marijuana (Kimonis et al, 2011)--are important demographic indicators to identify high risk youth (Ellickson & McGuigan, 2000).

Within the population of incarcerated youth there are proportionally higher numbers of youth with pervasive and persistent mental illness, which is a significant contributing factor in violence participation (Teplin et. al 2002). The detainee's with the most severe mental illness, according to this Teplin's study, are non-Hispanic-whites, females, and older youth. Another study found that females in particular, but also for youth overall, those who rated highly for depression and anxiety were more likely to become involved in institutional misconduct (McDougall, Campbell & Santor, 2012). This finding, that smaller subsets of individuals who struggle with serious and persistent mental illness comprise a significant proportion of overall violence levels, indicates the importance of assessing the appropriateness of the setting and the effectiveness of the interventions for this high need subset of youth (Deitch et al, 2013).

In addition to individual level indicators, the literature is clear that institutional and organizational factors can either encourage or prevent violent incidents from occurring. Institutional factors are vital to examine, as they suggest tangible actions that our correctional institutions can take to significantly improve the safety of facilities. One limitation with individual level risk assessment tools is that some indicators are static and unable to change over time (ex. age of first arrest) whereas institutional level instruments are more sensitive to changes over time. Across the literature, overcrowding is consistently sited as a contributing factor to violence within correctional facilities (McCorkle, Miethe & Drass, 1995). Similarly, several studies have demonstrated that facilities that are poorly maintained can actually have a significant negative impact on youth behavior (Weren & Olsen, 1980; McCorkle, Miethe & Drass, 1995; Deitch et. al, 2013). Simple structural strategies, these studies have found, such as use of color, natural lighting, and outdoor spaces can improve facility safety overall.

Programmatic and staff responses to misbehavior appears to be absolutely critical in the prevention or escalation of violence in facilities. A special report conducted by University of Texas at Austin found that sites that relied more heavily on the use of security units, isolation, pepper spray and mechanical restraints actually increased violence overtime (Deitch et al, 2013). In contrast, sites that employed evidence-based disciplinary strategies such as swift, short-term and graduated consequences in conjunction with rewards consistently saw decreased incidents of violence, particularly incidents against staff. Providing staff training in descalation and proper restraint methods were particularly important in this study since the vast majority of staff injuries resulting from a youth-on-staff assault occurred when staff members were attempting to bodily restrain the youth.

Interestingly, the quality not the quantity of staff seems significant for decreasing violence levels. Deitch et al (2013) found that small staff-to-youth ratios were a protective factor in that it promoted positive attitudes towards authority. Smart placement of staff and video cameras is also significant. Vivian, Grimes & Vaquez (2007) found that assaults most commonly occur in dayrooms, lounges, and halls (36%) and youth rooms (21%), while recreation and dining area see far fewer incidents of violence. Research suggests increased supervision in housing and activity areas will promote safety (Deitch et al, 2013). Finally, across the literature, high staff turnover is correlated to increases in violence (Light, 1990; Vivian, Grimes & Vaquez , 2007; Deitch et al, 2013). The professional development, retention and supervision of staff are of paramount importance to safe facilities.

Programmatic structure also improves overall safety. The amount of time inmates spend participating in constructive activities was found to be a protective factor against violence. In contrast, facilities that allowed for long periods of unstructured time or television watching were correlated with institutional violence (Edgar & O'Donnell, 1998). Administration must also be cognizant that youth behavior follows predicable waxes and wanes, particularly linked to their sentences. Overall, juveniles tend to behave well at the beginnings and ends of their sentences but exhibited more aggressive behaviors during the middle of their incarceration. Vivian, Grimes and Vaquez (2007) indicate that youth who deviated from this typical pattern and demonstrated marked aggression within their first month are at higher risk for chronic aggressive incidents. Addressing aggressive behavior swiftly and effectively within the first month will help prevent the escalation of dangerous incidences.

Predictive instruments are increasingly being used in the criminal justice setting. The most accurate tools assess in two or more domains (such as offense history, psychological factors, family factors and peer factors) as well as minimize differences in validity across gender and race/ethnicity (Schwalbe et al, 2006). Unfortunately, the majority of high quality instruments have focused on recidivism. Very few tools have been developed to help correctional staff assess individual risk factors in order to take immediate preventative and rehabilitative steps.

The Current Study

The project purpose was to create an "actuarial risk tool" to help identify those children who are at highest risk for institutional violence. LeCroy & Milligan Associates conducted an analysis to identify what, if any, characteristics of the youth are related to violent incidences. The data source was juveniles committed to ADJC during 2012 through 2014, and used the number and types of juveniles assaulted by juveniles, juvenile on juvenile fights, and employees assaulted by juveniles that occurred. These dates were used for two reasons: First, to allow youths to have a sufficient time to develop and exhibit disruptive behaviors, in accordance with an average of 6.9 months in secure care. Second, Positive Behavior Interventions & Supports (PBIS) was rolled-out to the entire Adobe Mountain School (AMS) campus in February of 2014, thus we would expect to see changes in the incidence of violent behaviors due to PBIS and not the child characteristics.

The method followed five steps recommended in the literature as necessary to the successful development and implementation of any risk assessment instrument (Gottfredson & Snyder, 2005; Krysik & LeCroy, 2002):

1. Clearly defining the behavior to be predicted (the outcome measure)

2. Identifying a set of potentially predictive variables

3. Measuring relations between the predictor variables and outcome measure to construct the risk model

4. Testing the relations/model in an independent validation sample

5. Applying the model in situations for which it was developed (i.e., implementation of the risk tool)

Data

The data were provided by the research and development staff at the Arizona Department of Juvenile Corrections (ADJC).

Dependent Variable or Outcome Measure

Identifying and operationalizing the outcome measure defines the standard for selecting predictors and testing the validity of the results (Gottfredson & Snyder, 2005). The primary dependent variable or outcome measure was the incidence of violence, specifically juvenile fighting, juvenile assault, and juvenile on employee assault.

Independent Variables or Predictor Variables

The independent or predictor variables used in the final model were as follows:

Total Number of Referrals is the number of referrals. This ranged from 1 to 41.

School Grade is the juvenile's school grade last attended. This ranged from 3rd to 12th grade.

Manipulation indicates the degree of manipulation by the juvenile. Scores range from 0 (always honest and straightforward) to 4 (use veiled threats, power and deceit to control others and meet wants)

Runaway from Placement is the juvenile's history of running away from placement. Scores ranged from 0 (no history of running away from placement) to 3 (over 7 instances of running away from placement)

Involved in Gang is whether the juvenile is formally involved in a gang. This was coded as 1 (history of gang involvement) and 0 (no history of gang involvement).

Conduct Disorder is if a juvenile has a diagnosis of Conduct Disorder. This was coded as 0 (no diagnosis) and 1 (has a diagnosis).

ADD_ADHD is if the juvenile has a diagnosis of Attention Deficit (Hyperactive) Disorder (ADHD). This was coded 0 (no diagnosis) and 1 (has a diagnosis).

Psychotropic is if the juvenile was prescribed psychotropic medication(s). This was coded as 0 (no prescription) and 1 (has a prescription).

SL Level-Substance Issues is the degree of a substance use problem. This was coded 1(SL1) 2 (SL2), or 3 (SL3)

Dual Award-DCS is whether the juvenile was from CPS/DES. This was coded 0 (no) or 1 (is dual award)

Consequential Thinking Skills is the juvenile's ability to understand and incorporate that their actions have consequences that directly affect their life. This was scored on a range from 1 (does not understand there are consequences to actions) to 5 (acts to obtain positive & avoid negative consequences)

Control of Impulsive Anti-social Behaviors is the juvenile's ability to understand and respect other's perspectives. This was coded as 1 (unwilling to recognize there can be other points of view), 2 (has difficulty understanding there can be two points of view), 3 (can reason there are two sides to a situation), 4 (tried to understand others' points of view), 5 (can accept others' points of view without necessarily agreeing).

Respect for Authority Figures is the juvenile's perspective towards authority figures . Scores ranged from 1 (views all authority figures with contempt) to 5 (indicates respect for the role of authorities).

Attitude Toward Responsible Law-abiding Behavior is the juvenile's perspective toward law-abiding behavior. This was scored on a range from 1 (openly admits unwillingness to demonstrate law-abiding behavior) to 5 (clearly positive commitment towards law-abiding behavior)

Recidivism Risk Level is the risk for a juvenile to recidivate. Scores range from 0 to100.

Risk Level is the juvenile's risk of recidivism. This was scored on a range from 1 (low) to 5 (high).

Age of Youth in Years at Time of Commitment is the juvenile's age when committed. This ranged from 12 to 18.

Results

Empirical validation of the recidivism risk instrument followed six steps as recommended in the literature as necessary to the successful development and implementation of any prediction study:

1. The outcome variable "violence" was operationalized as any (at least one) violent incident report (i.e., juvenile fighting, juvenile assault, employee assault).

2. A set of potentially predictive items was specified to include all of those variables available in the CAPFA dataset (re-coded).

3. Tests for bivariate relationships between the outcome variable (violence) and the individual predictor variables were conducted using a random sample (i.e., an estimation sample) of all active juveniles in the ADJC system in 2012 – 2014 using the CAPFA. Individuals were randomly assigned to one of two groups: an estimation sample (60% of the population) and a validation sample (the remaining 40%). Random assignment was employed to produce two equivalent groups. The estimation sample is used to determine the predictive power of the variables. The validation sample, in contrast, was drawn for the purpose of testing the predictive efficacy of the assessment instrument, as predictions are always more accurate when tested on the samples from which they were constructed than when tested on independent samples. Table 1 compares the estimation and validation samples.

Table 1: Juveniles' Background Characteristics across Estimation and Validation Samples.

Characteristic	Estimation Sample n=667 (60%)	Validation Sample n=445 (40%)
Fights		
	339 (50.8%)	202 (45.4%)
Gender		
Male	579 (86.8%)	393 (88.3%)
Female	88 (13.2%)	52 (11.7%)
Ethnicity		
Caucasian	194 (29.1%)	117 (26.3%)
African American	82 (12.3%)	52 (11.7%)
Native American	39 (5.8%)	25 (5.6%)
Hispanic	301 (45.1%)	212 (47.6%)
Asian	3 (0.4%)	3 (0.7%)
Other	2 (0.3%)	5 (1.1%)
Mexican National	23 (3.4%)	16 (3.6%)
Bi-Racial	22(3.3%)	15 (3.4%)
Age		
At time of commitment	16.46 (*SD*=.93)	16.41 (*SD*=1.01)

Note. No significant differences across groups for age, gender, ethnicity, or fights.

4. Bivariate correlations were assessed using Pearson's Product Moment Correlation to determine the Point Biseral Correlation (given that the recidivism variable is a discrete dichotomy, r_{pb}). A Spearman's Rho Correlation was also conducted for when the assumption of normality was not met and when both predictors were ordinal.

Based on the extent of missing data and the results of the bivariate relationships, the number of predictor variables was reduced to include only those which were significantly related to the outcome ($p < .05$), and which were consistently reported (less than 10% of missing data) as per the recommendation of Jones (1996) because they were unreliable (see Table 2). Further, correlation matrices were examined to assess the likelihood of multicollinearity. Multicollinearity exists when predictor variables are highly correlated with one another. Ideally, predictor variables will be strongly correlated with the criterion (violent incidents), but largely independent of

each other, which means that each contributes uniquely to the overall risk score (Jones, 1996). In this case, we did not find evidence of multicollinearity.

Table 2: Bivariate Correlations of the Significant Predictor Variables with Violence in the Estimation Sample (n=667)

Variable	Pearson's r	P value	n
# of Referrals	.117	.002	667
School grade	-.135	.000	666
Manipulation	.148	.002	448
Runaway from placement	.104	.008	655
Involved in Gang	.212	.000	667
Conduct Disorder	.093	.017	655
ADD/ADHD	.131	.001	656
Psychotropic	.188	.000	655
SL level-substance issues	-.163	.000	532
Dual Award-DCS	.116	.003	667
Consequential Thinking Skills	-.094	.016	667
Control of Impulsive anti-social behaviors	-.180	.000	651
Respect for authority figures	-.205	.000	651
Attitude toward responsible law-abiding behavior	-.143	.000	650
Recidivism risk level scoring	.141	.000	667
Risk level	.195	.000	667
Age of Youth in years at time of commitment	-.219	.000	664

**Variables: Manipulation and SL level-substance issues dropped at the next step due to greater than 10% missing data.

5. This reduced set of variables was entered into a stepwise logistic regression equation, used to choose a reduced set of best predictors. The Log-likelihood statistic is analogous to the residual sum of squares in multiple regression. It is an indicator of how much unexplained information there is after the model has been fitted. Large values indicate poorly fitting statistical models.

$$\text{log} - \text{likelihood} \ = \ \sum_{i=1}^{N} [\, Y_i \ \ln \, (P \, (Y_i)) + (1 - \ Y_i) \ln\big(1 - P \, (Y_i)\big)]$$

Using the log-likelihood for different models we can compare models by looking at the difference between their log-likelihoods and testing for statistical significance.

$$X^2 = 2\left[\text{LL}(\textit{New}) - \text{LL}(\textit{Baseline})\right]$$
$$(df = k_{new} - k_{baseline})$$

The findings are presented in Table 3.

Table 3: Logistic Regression Model Using Simultaneous Entry Predicting Violence (Estimation Sample, n=667)

	B	SE	Wald	Df	Sig	Exp(B)	95% CI for Exp(B)
Psychotropic (0=no, 1=yes)	.862	.204	17.924	1	.000	2.368	1.589 – 3.530
Gang Involvement (0=not involved, 1=involved in a gang)	.660	.186	12.549	1	.000	1.934	1.343 – 2.786
Age of Youth in Years at Time of Commitment Range (12 to 18)	-.481	.100	23.108	1	.000	.618	.508 – .752
Recidivism Risk Level (1=Low, 2=Low-Moderate, 3=Medium, 4=Moderate-High, 5=High)	.177	.065	7.385	1	.007	1.193	1.051 – 1.356
Control of Impulsive Anti-Social Behaviors (1= unwilling to recognize there can be other points of view, 2= has difficulty understanding there can be two points of view, 3= can reason there are two sides to a situation, 4= tried to understand others points of view, 5= can accept others points of view without necessarily agreeing)	-.321	.157	4.172	1	.041	.725	.533 –.987
Respect for Authority Figures (1=views all authorities with contempt, 2=expresses resentment toward authorities, 3=expresses neutral attitude toward authorities, 4=appreciates the role of authorities, 5=indicates respect for the role of authorities)	-.314	.157	4.172	1	.041	.730	.550 –.970
Number of Referrals Range (1 to 41)	.026	.015	3.070	1	.080	1.026	.997 – 1.057
Constant	8.714	1.745	24.924	1	.000	6087.931	

Note. A forward-step wise regression yielded a model with a 7 variable solution
Model: -2 Log likelihood (df=7) = 776.905, Pseudo R² (Nagelkerke) = .217
X² (8)=4.242, *p* > .05 (Hosmer and Lemeshow Test)

6. The predicted probabilities using the maximum likelihood coefficients produced by the logistic regression equation were then used to predict violence in the validation sample (an independent random sample of juveniles, i.e., the remaining 40% of the sample). Using the estimation procedures developed on one sample (the estimation sample) with an independent sample (the validation sample) is referred to as cross-validation. Without it, there can be little confidence in the utility of the prediction method.

$$Y = \frac{\exp(b_0 + b_1X_1 + ...b_nX_nX_n)}{1 + \exp(b_0 + b_1X_1 + ...b_nX_nX_n)} \quad (100)$$

The maximum likelihood coefficients are used to predict the probability of violence, shown in Table 4.

Table 4: Fighting Using Predicted Probabilities (n=431, 14 missing)

Probability of Violence	Risk Classification	Number of Cases (%)	Violence (%)
0 - .3499	Low-Moderate	122 (28.3 %)	28 (23.0%) [a]
.35 - .4999	Moderate-High	137 (31.8 %)	63 (46.0%) [b]
.50 plus	High	172 (39.9 %)	109 (63.4%) [c]
Total		431	46.4%

Note. Differences between risk classification groups by fighting are significant based on z-tests of proportions at *p*<.05 High risk group fought at almost 3 times that of the low-moderate risk group.

7. Contextual issues that would affect implementation of a risk instrument such as perceptions around usefulness and utility were assessed in meeting with the research and development team at the Arizona Department of Juvenile Corrections.

Conclusions

The current system has facilitated the collection of a large amount of data on each juvenile that is easily accessible for purposes of validation research. Differences between risk classification groups by violence are significant based on z-tests of proportions at $p < .05$. The high risk group fought at almost 3 times that of the low-moderate risk group. Overall, the model correctly identified 64.3% of the cases as having violent (54.5% of cases) or non-violent incidents (72.7% of cases).

Subsequent analysis to determine a set of items that were most predictive of risk of institutional violence produced results that were consistent with the literature. This is not to imply that there are not other items, including remaining items on the dataset, but these 7 items provide the most efficient and effective avenue to predict institutional violence. It was notable that there were no significant gender differences in incidents of violence in the estimation sample.

The model identified by our analysis exhibited a degree of predictive validity that meets conventional standards of risk assessment research. Well-designed instruments are typically able to identify a group of high risk- offenders whose probability of selection is four to five times higher than low-risk offenders (Wagner, et al., 1994).

Gottfredson (1987) reported that in criminology, the generally poor quality of data, combined with the highly random nature of criminal behavior, ensures that prediction research rarely explains more than 15% to 20% of the outcome variance, and may never do much better than 30%. Outcome variance refers to the amount of variability in recidivism that can be explained by or attributed to predictor variables. That is, our best models on recidivism typically have small to moderate effect sizes, reaching a ceiling of approximately 30%. In our analysis, the model predicted 22% of incarcerated violence, which exceeds Gottfredson's prediction and approaches the maximum predictive ability in violence research.

Actuarial tools have been shown to consistently outperform practitioner and professional clinical assessments (Lowenkamp, Holsinger, and Latessa, 2001; Van Voorhis and Brown, 1997). These tools are able to account for a wide variety of background factors that subjective or professional assessments cannot capture. For this reason, agencies are able to employ these tools with a great deal of confidence knowing they can efficiently and validly identify high-risk youth.

Recommendations

1. Adopt the recommended procedure for assessing juveniles' risk for violence throughout the course of treatment. This would require programming into the current information system the predicted probability equations using the maximum likelihood coefficients corresponding to the variables that were determined to be the most predictive for male and female juveniles. This would produce a percentage of risk for subsequent offense for each juvenile. The programming must include a differentiation between missing data and scores of zero. The score should not be interpreted if there is 80% or more of the data on the risk assessment items missing (i.e., more than 1 out of 5 items).

2. Establish a classification protocol whereby juveniles deemed at risk for violence can be offered a set of procedures to prevent the likelihood of violence, deescalate aggression when it occurs, and address infractions with evidence-based consequence strategies to decrease future incidences.

3. Institutional factors can also be related to violence such as in overcrowded situations, poorly maintained facilities, in day rooms during unstructured times, facilities where there is high staff turnover, and in the middle of incarceration as opposed to the beginning and ending periods. These additional factors should be considered in attempting a plan to reduce fighting incidents.

4. Plan for and carry out subsequent empirical validation of the risk assessment instrument on a regular basis (yearly or every two years). The first occurrence of validation for the revised system requires two full years of implementation (one year of active cases, and one full year of follow-up). The predictive validity of the items used to predict violence can change over time as juveniles and their families change. Thus it is important to validate the instrument to assess its predictive validity over time, and to calculate the predicted probabilities used to predict subsequent risk. The cross-validation method which uses independent estimation and validation samples should be used for subsequent validation research.

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