Prediction of Restraints Among Youth in a Psychiatric Hospital: Application of Translational Action Research*

Carolyn J. Tompsett,[1] Sarah Domoff,[1] and Paul Boxer[2]

[1]Bowling Green State University
[2]Rutgers University

This study extends a translational action research program by applying a theoretically based measure of risk in predicting incidents of restraint among children and adolescents in a secure psychiatric hospital. Youth inpatients ($N = 149$, aged 5–17 years) were assessed at intake for the presence of selected individual and contextual risk factors, and their involvement in critical incidents was tracked (i.e., number of episodes in which restraint was applied) for the remainder of their hospitalization. Models including history of aggression or history of previous placements as well as combined models including several individual and contextual factors significantly predicted the likelihood of a youth becoming involved in at least one restraint. Unique predictors of restraint involvement included history of aggression against adults and history of previous psychiatric hospitalizations. None of the variables assessed predicted the extent of a youth's restraint involvement. The implications of these findings are discussed with respect to future research and empirically informed practice with high-risk youth. © 2011 Wiley Periodicals, Inc. J Clin Psychol 67:368–382, 2011.

Keywords: aggression; violence; child clinical psychology

Persistent, serious aggressive behavior in the population of adolescents hospitalized for psychiatric problems is notoriously difficult to manage. The effectiveness of psychological interventions targeting aggression might be attenuated by comorbid psychopathology, such as major depression (King et al., 2006; Knox, King, Hanna, Logan, & Ghaziuddin, 2000). Pharmacologic interventions for aggression have produced mixed results (Coccaro, Kavoussi, & McNamee, 2000; Schur et al., 2003). Thus, the restrictive techniques of *seclusion* and *restraint* often are the sole remaining options for handling such behavior. However, the application of these restrictive interventions is fraught with challenges. For example, critics have cited the lack of evidence for long-term benefits, potential physical injury, and psychological harm resulting from seclusion and restraint, along with the absence of a sound and empirically based theory underpinning the application of these techniques (e.g., Measham, 1995; Mohr & Anderson, 2001; Mohr, Mahon, & Noone, 1998).

In part because of these issues, seclusions and restraints were designated as "last resorts" in the *Children's Health Act of 2000* (PL 106–310), and, more recently, a call to eliminate the use of seclusions and restraints was part of the applied research agenda of Substance Abuse and Mental Health Services Administration (SAMHSA; Curie, 2005). A detailed understanding of risk factors for a target behavior is requisite for the development of appropriate prevention and intervention strategies (Institute of Medicine, 1994). In this study, we tested the predictive validity of a new risk assessment questionnaire for estimating the likelihood that youth would become involved in critical incidents requiring restrictive intervention. The results of these

analyses are discussed in the framework of a translational action research program, balancing the need for strong science with the demands of clinical work in an applied setting.

Aggressive Behavior in the Youth Inpatient Population

A wealth of research conducted in normative and even at-risk populations has identified a great number of risk factors as precursors to and correlates of adolescent aggressive and antisocial behavior (Dodge & Pettit, 2003). The developmental-ecological view on aggression development that has emerged from this literature emphasizes the importance of both individual factors and social-contextual factors in risk for aggression. For example, individual factors include genetic and predispositional risk, marked by family histories of mental illness and criminal behavior (Biederman et al., 2001; Haber, Jacob, & Heath, 2005; Herrenkohl et al., 2007; Jaffee et al., 2005; Maes, Silberg, Neale, & Eaves, 2006). Other individual risk factors include low intelligence (particularly a low Verbal IQ and poor academic achievement; Huesmann, Eron, & Yarmel, 1987), psychiatric diagnoses (e.g., ADHD, depression; Harty, Miller, Newcorn, & Halperin, 2009; Rowe, Maughan, & Eley, 2006; Thompson, Whitmore, Raymond, & Crowley, 2006), personality traits including emotional dysregulation and disinhibition, and callous-unemotional traits (Crowell, Beauchaine, & Linehan, 2009; Frick, 2006), and early involvement in aggressive behavior (Broidy et al., 2003; NICHD, 2004). Research on developmental trajectories of aggression repeatedly emphasizes that once a history of aggressive behaviors is established, this individual history is a very reliable predictor of future aggressive acts (Frick, 2006; Moffitt, 2006).

Despite the strength and variety of individual risk factors that have been identified in the literature, the importance of contextual risk factors is also highlighted in models predicting aggression in childhood or adolescence. Contextual risk factors include histories of abuse or maltreatment, exposure to violence in the social environment, peer victimization, and previous hospitalizations or foster care placements. Toth, Cicchetti, and Kim (2002) found that children with maltreatment experiences (including sexual abuse, physical abuse, emotional abuse, and neglect) had higher rates of externalizing behaviors than nonmaltreated children (Toth et al.). Exposure to abuse and violence across situations is also a predictor of aggression, including exposure to domestic violence and community violence, (Boxer, Gullan, & Mahoney, 2009; Malik, 2008; Onyskiw, 2003), as well as victimization by peers (Schwartz, McFayden-Ketchum, Dodge, Pettit, & Bates, 1998).

In contrast to the literature summarizing predictors of aggression in normative and at-risk populations, relatively few studies have applied an individual-contextual view of the development of aggression to understanding aggression among youth admitted to inpatient psychiatric treatment. Some studies with adults suggest that use of structured risk assessments improves prediction of aggression among hospitalized adults, although much of this work was limited to samples of patients with psychotic disorders (Daffern, Ferguson, Ogloff, Thomson, & Howells, 2007). However, the majority of efforts to predict risk for aggression among hospitalized youth have relied on demographic or retrospective archival data. Retrospective studies have identified diagnosis of conduct disorder, history of hospitalization, being on medication, family history of psychiatric problems, history of family violence, and minority ethnic status as predictors of aggression during psychiatric hospitalization among adolescents (Day, Franklin, & Marshall, 1998; Gullick, McDermott, Stone, & Gibbon, 2005; King et al., 2006).

Challenges in Studying Aggression and Critical Incidents Among Inpatient Youth

As noted, despite evidence of some risk factors of aggression in high-risk youth, relatively few studies have examined if these individual and contextual factors could predict risk for aggression among hospitalized youth, and thus, risk for restraint and seclusions. This gap in research is partly because of an absence of a strong theoretical framework guiding the research on aggression among hospitalized youth. Other challenges, such as lack of availability and time with this population, thwart efforts to systematically examine predictors and to examine

large samples of this population. Furthermore, regulations set forth by psychiatric institutions protecting client confidentiality such as the Health Insurance Portability and Accountability Act (HIPAA) present potentially insurmountable obstacles to researchers attempting to study this population. Specifically, researchers have reported delays in data collection, added cost to uphold these regulations, and difficulty in obtaining de-identifiable data when studying hospitalized participants (Lydon-Rochelle & Holt, 2004; Ness, 2007).

The Current Study

This study is the newest iteration of a translational action research project conducted jointly by academic researchers and the clinical staff and supervisors of a secure, publicly funded psychiatric hospital for children and adolescents. Translational action research is aimed at translating findings from developmental science into applied practice (Boxer, 2007; also see Hunter, Elias, & Norris, 2001). In essence, the action research approach permits the findings from one phase of inquiry to inform immediately the practical approach of the next phase of inquiry, with scientific research and applied practice occurring simultaneously (Hunter et al.). Our process began with a 2003 pilot study (Boxer, Bhandari, & Bow, 2003) and continued with an extensive clinical record analysis of 484 adolescent inpatients (Boxer, 2007; Boxer & Terranova, 2008). This line of research generated a number of both individual and contextual risk factors that showed promise as predictors of involvement in and frequency of incidents of restraint. Based on these identified risk factors for critical incidents, we developed a brief clinical rating scale instrument to allow a prospective examination of predictors of restraint. Clinical staff and supervisors were consulted during the development of this measure to ensure that results would be clinically meaningful and that the measure would be easy to complete in the context of the hospital's extensive intake assessment procedures. At the same time, researchers worked to ensure that the measure would be able to further the development of a better understanding of risk for aggression. Upon approval from internal and external research review boards, data were collected prospectively on 149 inpatients admitted to treatment. The newly developed risk instrument was completed during the intake period, and indicators of critical incidents were tracked until the participant was discharged from the hospital.

The goal of this study is to address the limitations of previous research by prospectively assessing theoretically defined predictors of aggression in an adolescent inpatient sample. It was predicted that, given the individual-contextual theory on the development of aggression, both individual factors (history of aggression, family history of mental illness, family history of criminal behavior, body mass index (BMI), intelligence, and psychiatric diagnoses) and contextual factors (history of maltreatment, exposure to violence, peer victimization, and previous institutional placements) would significantly predict extent of involvement in critical incidents.

Methods

Participants

Participants were 149 youth aged 5–17 years (88 males, 61 females; mean age at admission = 14 years, standard deviation [SD] = 3) admitted from January–June 2008 to a secure, publicly funded inpatient psychiatric hospital in the Midwest. Information on critical incident involvement was collected through the end of November 2008, and only those participants who were discharged before data collection ended were included in the study. As a result, one patient who was admitted during the initial time frame was not included in the study because he had not yet been discharged when data collection ended. Sixty-eight study participants (45.6%) identified as White, 59 (39.6%) as African American, and 22 (14.7%) as Native American, Hispanic, or other/biracial. Mean length of stay in the facility was 41.46 days (SD = 46.33, Median [Mdn] = 19 days, range = 2–221 days). Within this sample the most common diagnosis was bipolar disorder, with 48.3% of the sample receiving this as a primary diagnosis and 7.2% as a secondary diagnosis. The next most common category of diagnosis

was other mood disorders, occurring as a primary diagnosis among 29.5% and as a secondary diagnosis among 1.8% of the sample. Diagnoses of disruptive behavior disorders (conduct disorder or oppositional defiant disorder) were relatively less common, occurring as a primary diagnosis among 5.4% of the sample and as a secondary diagnosis among 15.4%.

Measure/Sources of Data

Risk analysis measure. The Risk Analysis Checklist for Institutionalized Youth (RACIY) was completed by each participant's individual therapist early in treatment. This measure was based on previous research identifying history of aggression, history of maltreatment, history of exposure to violence, and family history of mental health and criminal problems as being associated with inpatient aggressive incidents (Boxer, 2007). Areas of assessment were chosen based on existing literature with inpatient and community samples of adolescents and covered a number of domains of possible risk. A total of 27 items were assessed.[1] Areas of assessment are as follows:

- History of aggression. Therapists were asked to report whether a patient had engaged in each of several types of aggressive behaviors during the following developmental periods: 4 years or younger, 5–10, 11–13, and 14 years of age or older. Types of aggressive behaviors assessed were aggression against adults, aggression against peers, property damage, aggression against animals, sexual aggression, use of a weapon, nonlethal aggression against the self, and suicide attempts. To account for varying ages of participants, history of each type of aggression was trichotomized into $0 = $ no history, $1 = $ aggression reported for one developmental period, and $2 = $ aggression reported for two or more developmental periods. In addition, a total number of types of aggression score was computed by summing how many of the eight different types of aggression were reported, regardless of developmental period.
- History of maltreatment and exposure to violence. History of maltreatment included history of physical abuse, sexual abuse, emotional abuse, and neglect. History of exposure to violence included history of being exposed to domestic violence, being victimized by peers, and being exposed to community violence. History of maltreatment and exposure to violence were coded by therapists as being not present, chronic, having been experienced in a single mild incident, or having been experienced as a single severe incident. After analyzing frequencies, it was determined that very few single (mild or severe) incidents were reported, and so all maltreatment or exposure to violence variables were coded as $0 = $ no history of maltreatment and $1 = $ any history of maltreatment for remaining analyses (Boxer & Terranova, 2008).
- Family history of associated risk conditions. Family history of mental illness or criminal involvement was coded as $0 = $ no family members, $1 = $ one family member, and $2 = $ two or more family members.
- Demographics. Sex, age, and ethnicity of the patients were obtained by intake clinicians.
- BMI. BMI was calculated using height and weight measurements taken by a nurse at intake.
- Previous placements. Coders summed the total of each previous placement in inpatient hospitals, residential treatment facilities, and foster care from patient guardians at admission.
- Intellectual functioning. A Wechsler Intelligence Scale for Children was administered by a master's-level or PhD-level psychologist to a subset of patients within the first two weeks of admission; it is noted that many patients expected to be "short term" (stay less than 14 days) were not administered this test. The continuous index scores from the Verbal

---

[1]For a copy of the current measure, contact Paul Boxer, Ph.D., Rutgers University, 101 Warren St., Newark, NJ 07102. E-mail: pboxer@rutgers.edu

Comprehension Index, Perceptional Reasoning Index, Working Memory Index, and Processing Speed Index were used as predictors.
● Psychiatric diagnostics. Staff psychiatrists assigned Axis I diagnoses from the Diagnostic and Statistical Manual of Mental Disorders fourth edition (DSM-IV; American Psychiatric Association, 1994) as well as Global Assessment of Functioning (GAF) scores at intake.

Criterion indicators. A database of critical incidents is maintained by hospital staff. This database was used to generate the following outcome variables: (a) "any involvement" = dichotomous variable, indicating any critical incident involvement during the patient's hospitalization; (b) "total events" = sum of the number of critical incidents during the hospitalization; (c) "total patient to staff" = sum of the number of critical incidents recorded as having been provoked by the patient aggressing against a staff member; (d) "total patient to patient" = sum of the number of critical incidents recorded as having been provoked by the patient aggressing against another patient; and (e) "total self-injurious" = sum of the number of critical incidents recorded as having been provoked by the patient demonstrating aggression against himself or herself. Critical incidents are categorized as either seclusions or restraints. Seclusions occur rarely, accounting for only 9 of 233 critical incidents, and so were not included in our analyses.

Restraint refers to restricting an individual's movement in some way by the application of force. Although a physician is required to officially initiate an intervention involving restraints, most commonly a nurse or direct care worker makes the initial decision to suggest the need for this intervention to the psychiatrist on call. It is rare for the client's therapist to be involved in the determination for the need for a restraint. Restraints are permitted only in incidences when the staff member determines that the patient is in imminent danger of harming him/herself or another individual. Although hospital guidelines are clear that other types of disruptive behavior (such as destruction of property without threat to self or others) are not sufficient to justify a restraint, the determination of what behavior represents imminent danger is left to the psychiatrist or other staff member. There are three types of restraint. Physical restraint involves limiting movement through direct contact with staff (staff hold a youth in place). Mechanical restraint involves the use of some apparatus to limit movement (e.g., by strapping a youth to the bed). Chemical restraint involves the use of medication to reduce agitation, and is not used as such at the host facility. It is noted that per hospital policy, children under 13 years of age are not permitted to be secluded or mechanically restrained. However, younger children are permitted to be physically restrained, and children under 13 years of age were equally likely as children 13 and over to be involved in a critical incident ($\chi^2 = .22$, $p = .64$). As a result, the younger group was retained in the sample.

Procedures

All procedures were reviewed and approved by human subjects research committees at the host facility, the state agency overseeing activities at the facility, and the first author's institution. Consent for all intake evaluation assessments was obtained from patient parents or legal guardians as part of the standard admission procedure. Although staff make every effort to engage patients during the intake process, they do not sign assent forms. Risk analysis forms were completed by patient therapists within the first few days of admission. Therapists were asked to complete these forms, because they have regular contact with patient family members, and routinely gather information on patient history as part of treatment planning. It was expected that because therapists would collect this information as part of their initial contacts, completion of the form itself would take no more than an additional 5–10 minutes. Therapists who completed the form included eight social workers with MSW degrees, two therapists with MAs in psychology, three psychologists with PhDs, and two psychiatric residents with MDs. The bulk of the risk analysis forms were completed by the social workers (83%), with PhD-level psychologists making up the next largest group (10%). Only one individual completed all risk forms, as each patient is assigned to a single therapist and duplicate histories are not collected. Previous retrospective research reported adequate

inter-rater reliability for variables similar to those included on the current measure (Boxer, 2007). Additional information on demographics, history of institutional placement, BMI, intelligence testing, and admission diagnosis was obtained from inpatient charts. Data on criterion behavior were extracted from the host facility's critical incident database and provided directly by the facility's chief information officer.

Results

Descriptive Analyses

Table 1 displays descriptive statistics on criterion behavior indicators for the youth involved in at least one restraint. Of the 149 youth in the sample, 40 (26.8%) were involved in restraints during treatment, accounting for a total of 224 incidents of restraint. Most of these youth ($N = 37$, 93%) were involved in 15 or fewer restraints, while two were involved in 22 and a third was involved in 31. These three outliers were trimmed to values of 16 and 17, to retain the maximum number of cases available while reducing the impact of the most extreme values (Tabachnick & Fidell, 2001). An inverse transformation was used to reduce the relatively severe skew of the total events variable (Tabachnick & Fidell). Of the restraints, 40 were mechanical and 184 were physical. Incidents recorded as caused by patient-to-staff aggression were by far the most common ($N = 145$), with rates of patient-to-patient ($N = 20$) and self-injurious incidents ($N = 30$) being lower and not significantly different from each other, paired $t(39) = .270$, $p = .789$.

Table 2 displays descriptive statistics on study predictors for the total sample. The following variables each had outliers, defined as values more than three standard deviations above the mean, that were trimmed by changing the outlying value to one higher than the next highest value: BMI (1), psychiatric hospitalizations (3), residential treatments (2), foster care placements (2), and GAF (2).

Several history of aggression variables had limited frequencies of "extensive" duration: aggression against animals, sexual aggression, use of weapons, and suicide attempts (see Table 2). To maximize data available while acknowledging the limitations of the data, for both step 1 and step 2 analyses, two models were used to examine history of aggression: The first model used dichotomized versions of all aggression variables ($0 =$ no history, $1 =$ any history), and the second model used full (trichotomized) data for the subset of aggression variables with sufficient rates of extensive duration. Family history of criminal behavior was also dichotomized into none/any history to account for the low rates of 2+ family members reported.

Prediction of Any Incident Involvement

A two-stage analytic approach was taken to determine significant predictors from the large number of risk factors measured. In the first stage, separate logistic regression models of

Table 1

Descriptive Statistics for Criterion Behavior Indicators, Restraint-Involved Group (n = 40)

Indicator	*M*	*SD*	*Mdn*	Range
Total restraints	5.60	6.83	2.0	1–31
Self-directed aggression	0.75	1.50	0.0	0–7
Patient-directed aggression	0.50	1.04	0.0	0–6
Staff-directed aggression	3.63	4.72	1.0	0–20
Proportion	%	*N*		
Self-directed aggression	13.4%	30		
Patient-directed aggression	8.9%	20		
Staff-directed aggression	64.7%	145		
Missing	12.9%	29		

Note. M = mean; SD = standard deviation; Mdn = median.

Table 2

Descriptive Statistics for Predictor Variables

Predictor	N	M	SD	History None (%−0)	Some (%−1)	Extensive (%−2)
Risk analysis measure						
History of aggression						
Towards adults	149	1.02	.73	25.5	47.0	24.8
Towards peers	149	.99	.72	26.2	49.0	24.8
Property damage	149	.93	.75	31.5	44.3	24.2
Against animals	149	.15	.46	88.6	7.4	4.0
Sexual aggression	149	.23	.52	81.2	14.1	4.7
Weapon use	149	.16	.39	84.6	14.8	.7
Against self	149	.68	.68	43.6	44.3	12.1
Suicide attempts	149	.21	.44	80.5	18.1	1.3
Family risk						
Family history of mental illness	149	.83	.80	41.6	33.6	24.8
Family history of criminal behavior	149	.37	.61	69.8	23.5	6.7
History of maltreatment				None (%−0)	Single incident (%−1)	Chronic (%−2)
Physical abuse	149	.45	.79	73.8	7.4	18.8
Sexual abuse	149	.38	.71	75.8	10.7	13.4
Emotional abuse	149	.63	.88	63.8	9.4	26.8
Neglect	149	.64	.91	65.8	4.7	29.5
Exposure to violence				None (%−0)	Single incident (%−1)	Chronic (%−2)
Domestic violence	149	.58	.88	68.5	5.4	26.2
Peer victimization	149	.42	.76	75.2	8.1	16.8
Neighborhood violence	149	.36	.74	79.9	4.7	15.4

Predictor	N	M	SD	Range
Additional intake variables				
Body mass index	143	25	7	13.6–47.3
Previous placements				
Psychiatric hospitalization	144	2.60	3.51	0–17
Residential treatment	144	.33	.75	0–4
Foster care	144	.51	1.00	0–5
Intellectual functioning				
WISC Verbal Comprehension Index	66	82.98	14.39	50–112
WISC Perceptual Reasoning Index	66	82.97	15.82	49–118
WISC Working Memory Index	60	79.03	16.64	50–129
WISC Processing Speed Index	61	75.16	15.01	50–115
GAF at intake	149	23.62	2.06	15–40

Primary DSM-IV diagnosis	N	% of sample
Bipolar disorder	149	48.3
Other mood disorder	149	29.5
Thought or psychotic disorder	149	8.7
Disruptive behavior disorder	149	5.4
Other disorder	149	8.0

Note. M = mean; SD = standard deviation; WISC = The Wechsler Intelligence Scale for Children; DSM-IV = Diagnostic and Statistical Manual of Mental Disorders; GAF = Global Assessment of Functioning.

theoretically grouped blocks of predictor variables (see Table 2) were computed to examine prediction of a criterion variable indicating any restraint during treatment (0 = no incidents, 1 = one or more incidents). This was done to prevent problems of interpretation arising from

collinearity across multiple predictor categories, given typical covariation of risk domains. In all of these analyses, sex and age were included as control variables in the first step. Time to first restraint was also entered as a first step control. For youth with no restraints, this variable was equated to total length of stay in days. This variable was included to acknowledge the interplay between incident involvement and length of stay, as youth who stay longer in the hospital have more time in which to aggress, while, conversely, youth involved in more incidents are more likely to have their discharge date delayed (see Boxer, 2007). Most (98%) cases had values of 111 days or less; the remaining four cases were greater than three standard deviations above the mean and were trimmed to values of 112, 113, 114, and 115. In the second stage of analyses, the same blocks of variables were examined in linear regression models as they predicted total restraint involvement, with the addition of one model including only those variables identified as significant predictors in a previous study using archival data (Boxer, 2007).

The first stage of analyses identified the following blocks of variables that significantly predicted beyond the effects of the three control variables: dichotomized aggression variables together, the subset of trichotomized aggression variables, and previous placements (see Table 3). Nonsignificant models included family risk indicators, history of maltreatment, history of exposure to violence, BMI, intellectual functioning (four Wechsler Intelligence Scale for Children fourth edition subscales), and a model incorporating DSM-IV diagnosis with global assessment of functioning (GAF) score at intake. Table 3 summarizes the degree to which each significant model fits with estimates of the parameters and the classification statistics for each model. It is noted that across models, specificity (identification of cases at low risk) was greater than sensitivity (identification of cases at high risk).

Two additional models were also run. The first combined variables identified as significant predictors of incident involvement by previous research using archival data with a similar sample (Boxer, 2007). The combination of total history of aggression, BMI, previous inpatient hospitalizations, previous residential treatments, history of exposure to domestic violence, and history of being victimized by peers did significantly predict incident involvement beyond the effects of the control variables (Table 3). The second model combined all variables from significant models into a single count of cumulative risk. This was done both to test whether accumulated risk itself is a significant predictor of restraints, in keeping with studies identifying accumulated risk as a significant predictor of psychopathology (e.g., Rutter, 1979; Sameroff, 2000) and to create an index that is comparable to existing measures of risk for aggression that aggregate risk factors to create a total score (e.g., Lodewijks, Doreleijers, Ruiter, & Borum, 2008; Murrie, Cornell, Kaplan, McConville, & Levy-Elkon, 2004). Lower

Table 3
Comparison of Significant Logistic Regression Models

Model	Hosmer-Lemeshow test	R_L^2 Value (%)	Overall correct classification (%)	Correct prediction of restraint involvement (%)	Correct prediction of no restraint involvement (%)
History of aggression, dichotomized variables	$\chi^2(8) = 3.55$, $p = .895$	13.9	75.6	32.4	93.3
History of aggression, trichotomized variables	$\chi^2(8) = 10.61$, $p = .225$	11.2	73.2	24.3	93.3
Previous institutional placements	$\chi^2(8) = 6.69$, $p = .570$	13.1	73.8	25.7	93.1
Combined	$\chi^2(8) = 10.81$, $p = .213$	14.7	74.4	28.6	93.0
Cumulative risk	$\chi^2(8) = 3.45$, $p = .903$	11.0	74.5	18.9	93.5

incidence variables of history of residential placements, history of foster care placements, history of exposure to domestic violence, and history of victimization by peers were each dichotomized with 1 = any history. High BMI, history of aggression, and history of inpatient placement were each dichotomized with 1 = higher than the sample mean plus one standard deviation. Scores on the cumulative risk index ranged from 0–6, with a mean of 1.83 and standard deviation of 1.56. The model testing this cumulative risk index did significantly predict incident involvement beyond the effects of the control variables, Model $\chi^2(4) = 18.08$, $p < .01$. By compiling all significant factors into a single variable, this index is comparable to existing risk assessment measures that yield a single summary score for predicting risk. To facilitate the comparison of existing measures, a receiver operating characteristic (ROC) analysis was conducted (e.g., Mossman, 1994). The area under the curve (AUC) for the cumulative risk index predicting any incident of restraint was .64, significantly greater than the chance value of .50 ($p < .01$). The optimal cut score for this cumulative index of elevated risk was 1, suggesting that youth who have elevated risk on even one of the domains included in the cumulative risk index are at higher risk for being restrained.

   Details on specific predictors within models are summarized in Table 4. Although the overall model of dichotomized aggression variables was significant, no unique predictors were identified within the model. Within the significant trichotomized aggression model, only aggression against adults emerged as a unique predictor. The previous placements model also yielded only one unique predictor of restraint involvement: history of previous inpatient hospitalizations. The same predictor emerged as a unique predictor within the model combining variables significant across previous archival research.

Predictors of Extent of Incident Involvement

To determine predictors of the number of incidents during a youth's hospital stay, a series of ordinary least squares (OLS) regression models were run using the same theoretical blocks of variables. For these analyses, which considered criterion information spanning the full length of treatment, time was operationalized via total length of stay in days. One outlying value was trimmed to one above the next highest value. Because age was not predictive of incident involvement, only sex and length of stay were included in analyses as control variables. None of the models predicted total critical incident involvement beyond the effects of the control variables. An additional model tested the combination of predictors identified as significant by previous research (Boxer, 2007). Together total aggression, BMI, and previous residential treatments did not significantly predict beyond the control variables of gender and length of stay. A model examining cumulative risk also did not significantly predict extent of incident involvement.

Discussion

The goal of the current study was to test the use of a theoretically based and empirically derived prospective measure of risk in predicting aggressive incidents within an inpatient youth population. An individual-contextual model was used in the design of the risk determination instrument, with both individual (history of aggression, BMI, family history of mental illness or criminal behavior) and contextual (history of maltreatment, exposure to violence, peer victimization, and history of previous placements) risk factors considered. Analyses showed that some measured risk factors, as well as an index of cumulative risk, were able to distinguish significantly between youth who were and were not involved in restraint incidents during treatment.

   History of aggression emerged as the only significant individual-focused predictor of involvement in incidents of restraint. The model including yes/no variables for every type of aggression measured was predictive, even while none of the individual types of aggression emerged as more predictive than any other. This finding suggests that knowing about the diversity of different types of aggression in a youth's history can be useful in predicting their involvement in critical incidents, even while simply knowing whether or not they have engaged in any one specific type of aggression may not be as useful. The risk analysis measure also

Table 4

Significant Logistic Regression Models Predicting Any Restraint Involvement

	B	SE (B)	Wald	p	OR
History of aggression, dichotomized variables; Model $\chi^2(11) = 21.35$, $p < .05$					
Gender (1 = male, 2 = female)	−.666	.498	1.784	.182	.514
Age	.113	.083	1.854	.173	1.120
Time to first incident	−.607	.520	1.360	.243	.545
Towards adults	1.168	.733	2.536	.111	3.214
Towards peers	1.259	.665	3.583	.058	3.524
Property damage	−.288	.553	.271	.603	.750
Against animals	−.612	.729	.704	.401	.542
Sexual aggression	−.157	.566	.077	.781	.855
Weapon use	−1.088	.658	2.732	.098	.337
Against self	.539	.482	1.253	.263	1.715
Suicide attempts	.610	.571	1.141	.286	1.840
History of aggression, subset of trichotomized variables; Model $\chi^2(7) = 17.12$, $p < .05$					
Gender (1 = male, 2 = female)	−.305	.503	.368	.544	.737
Age	.071	.080	.808	.369	1.074
Time to first incident	−.514	.477	1.161	.281	.598
Towards adults	.939	.425	4.870	.027	2.556[a]
Towards peers	.306	.372	.678	.410	1.358
Property damage	−.454	.351	1.672	.196	.635
Against self	.366	.320	1.306	.253	1.442
Previous institutional placements; Model $\chi^2(6) = 19.09$, $p < .01$					
Gender (1 = male, 2 = female)	−.518	.498	1.081	.299	.596
Age	−.022	.085	.068	.795	.978
Time to first incident	−.210	.509	.170	.680	.811
Inpatient hospitalizations	.204	.069	8.724	.003	1.227[a]
Residential treatment	.378	.310	1.487	.223	1.459
Foster care placements	.245	.244	1.012	.314	1.278
Combined model; Model $\chi^2(9) = 24.52$, $p < .01$					
Gender (1 = male, 2 = female)	−.454	.518	.767	.381	.635
Age	−.010	.093	.011	.917	.990
Time to first incident	−.056	.538	.011	.917	.945
Total aggression	.170	.159	1.136	.286	1.185
BMI	.013	.040	.107	.744	1.013
Inpatient hospitalizations	.199	.071	7.840	.005	1.220[a]
Residential treatment	.331	.323	1.049	.306	1.392
Exposure to domestic violence	.596	.487	1.499	.221	1.815
Victimization by peers	−1.079	.575	1.191	.275	.193
Cumulative risk model; Model $\chi^2(4) = 18.08$, $p < .01$					
Gender (1 = male, 2 = female)	.718	.451	2.528	.112	2.049
Age	.058	.079	.550	.458	1.060
Time to first incident	−1.375	.494	7.732	.005	.253[a]
Cumulative risk	.416	.132	9.912	.002	1.515[a]

Note. SE = standard error; OR = odds ratio; BMI = body mass index.
[a]Statistically significant odds ratios.

assessed persistence of each type of aggression across developmental periods, and although only a few types of aggression had base rates of persistence significant enough to merit analysis, the model including these types of aggression (aggression against adults, peers, self, and property damage) was also significantly predictive. Among these chronic predictors, aggression against adults emerged as a unique predictor of restraint involvement. These findings are consistent with literature citing past history of violence as the most consistent

predictor of future violence (Borum & Verhaagen, 2006) among normative populations. Although knowing the variety of different types of aggression a patient has engaged in can result in a generally predictive model, knowing the persistence of a patient's aggression in these areas over time is even more useful. It is perhaps not too surprising that a persistent history of aggression against adults is most predictive of critical incidents, given that the most common reason for restraint in this sample is patient-to-staff aggression. Again, this finding supports our overall impression that an individual's history of aggression in the community is predictive of his or her aggressive behavior even within the unique, controlled setting of a hospital.

Among contextual risk factors, the model incorporating history of previous placements significantly predicted restraint involvement. Within this model, history of previous inpatient psychiatric placements was the sole unique predictor. This predictor was also the sole unique predictor within the model incorporating risk factors found significant in a prior study using archival data with a similar sample (Boxer, 2007). It is difficult to disentangle the possible mechanisms of the association between history of psychiatric placements and involvement in critical incidents during a current placement. It seems likely that the most aggressive youth are more likely to both aggress while hospitalized and engage in behaviors that lead to repeated hospitalizations. However, the disruptive effects of repeated placements away from home may also contribute to increased aggression, consistent with analogous disruptions in care such as divorce (e.g., Amato, 2001). It is even possible that during repeated hospitalizations youth are socialized to become more aggressive, through witnessing the aggressive acts of other patients in the same hospital unit, by observing staff responses to aggressive acts, or through some other mechanism. Previous research has described how grouping high-risk adolescents into intervention programs can be particularly troublesome in that peers may reinforce each other's deviant behaviors (Dishion, McCord, & Poulin, 1999). Contagion effects have found to be dependent on the discrepancy between the individual and the group (discrepancy-proportional peer influence; Boxer, Guerra, Huesmann, & Morales, 2005). Thus, being socialized to engage in more aggressive behavior depends on the discrepancy (in number) between the aggressive individuals and the nonaggressive individuals. Although not presently examined, considering the ratio of aggressive individuals to nonaggressive individuals in various living areas of the hospital could be explored in future studies. Although it may be difficult to isolate the roles of youth variables and hospital practices in examining this relationship, any future progress in identifying possible effects of hospitalization (including involvement in critical incidents) on aggressive behavior during later placements could contribute to important changes in hospital practices.

Finally, the cumulative effect of having multiple risk factors proved to significantly predict involvement in any critical incidents. Although the model of cumulative risk was not markedly more predictive than models combining subsets of specific risk factors, these results are consistent with other findings—that the accumulation of multiple risk factors is a significant consideration in prediction of outcomes among children and adolescents (Rutter, 1979). This cumulative risk index also comprises a comprehensive measure combining all variables found significant by the current prospective study and related archival studies, and it creates an aggregate measure of risk that can be applied clinically by tallying identified risk factors (Boxer, 2007). The AUC statistic for this index is comparable to some other measures predicting general aggression, including those focused on psychopathy (the Psychopathy Checklist, Youth Version, Antisocial Process Screening Device, and the Psychopathy Content Scale of the Millon Adolescent Clinical Inventory; Murrie et al., 2004), but it did not perform as well as a more intensive measure predicting more nuanced aggression outcomes (the Structured Assessment of Violence Risk in Youth; Lodewijks et al., 2008). As will be discussed below under study limitations, it appears likely that, with a more refined outcome variable, the performance of the current cumulative risk index would be significantly higher. However, these results indicate that combining the significant variables identified by the current study into a measure of cumulative risk can result in a useful predictive index, suggesting that future research on risk factors may benefit from attention to their role within a model of cumulative risk.

It is somewhat surprising that the same variables that predicted any involvement in restraints did not also predict extent of involvement. Research examining prediction of

aggression in community samples tends to find that variables such as history of aggressive behaviors do tend to predict the degree of future aggression, and not merely its presence or absence (Borum & Verhagen, 2006; Moffitt, 2006). It appears likely that, within the hospital setting, there may be a distinction between variables that predict initiation of any restraint involvement and those that predict repeated involvement. Responses of staff or youth perception of consequences for early instances of aggressive behavior may be particularly salient variables that were not tapped by the measures used in the current study.

Limitations

This study marks the continuation of an ongoing translational action research program and has improved on prior research by utilizing a prospective measure of risk based on previous studies. A number of limitations remain to be addressed in future work. The measure analyzed turned out to be more specific than sensitive, more reliably predicting who was not involved in critical incidents than who was. This pattern is consistent with several other measures using characteristics of the individual to predict aggression in inpatient settings, despite differences in time frame and age of sample (Almvik, Woods, & Rasmussen, 2000; McNiel & Binder, 1994). It appears likely that sensitivity of the current measure could be improved by adding additional risk factors or greater detail to the assessment of existing variables. For example, although the assessment of history of maltreatment was consistent with existing measures of maltreatment as a risk factor (see Boxer & Terranova, 2008 for a review), perhaps with more information on recency of maltreatment, identity of the perpetrator, or the child's understanding of the maltreatment, this variable could become more useful within the context of the broader risk analysis. Similarly, while the theoretical underpinnings of the measure focused on prediction of aggression, perhaps the inclusion of risk factors expected to predict emotional dysregulation may result in a stronger association with incidents of restraint. The most common diagnosis among our sample was bipolar disorder, suggesting that difficulty regulating mood may be a common problem, and perhaps a common predictor of restraints, in an inpatient setting.

A related limitation is that the current outcome variable of interest, restraint, is only an approximation of aggressive behavior and may be subject to additional influences that reduce sensitivity of a predictive measure. As noted earlier, hospital staff are under continuous pressure to reduce incidents of restraint. It is likely that many youth who were at risk for inpatient aggression were not restrained, whether because of skillful de-escalation interventions by staff or therapists' incorporation of the risk analysis measure into more intensive or targeted treatment plans. Although therapists were encouraged to attend closely to the risk analysis measure to improve fidelity of data collection and to enhance its practical application, application of the measure in treatment planning would serve to decrease the sensitivity (but not specificity) of the measure by preventing restraint of individuals identified as high risk. Therefore, the use of the risk analysis measure in treatment planning for youth enrolled in this study would represent a serious limitation of the study. However, because of the difficulties inherent in doing research with this highly protected population, which was within a setting focused on their clinical needs and not on research, avoiding this kind of limitation in the future may be extremely difficult. Rather, the improvement of sensitivity of prediction might better be obtained by future research utilizing more detailed outcome measures, such as third-party observations of aggressive behaviors, which may present its own challenges but would not require staff to ignore potentially useful information in their treatment planning.

Therapists working with hospitalized youth and their families gathered the data. Although every effort is made by agency staff to obtain accurate information at intake, validity of the data depends on the reports gathered from youth and families and, therefore, may contain some inaccuracies due to inconsistent recollection or reporting. Future research using this measure should focus on expanding the assessment of reliability, particularly inter-rater reliability, of this measure. In addition, the current study focuses on individual and contextual factors associated with patients, and it does not attempt to compare across hospital units or hospitals. Significant models incorporating these patient centered variables yielded modest associations with the outcome variable, suggesting that additional unmeasured factors may

also be contributing to the likelihood of restraint involvement. It is likely that environmental factors such as staff characteristics and hospital policies also influence rates of restraint, and future research on prediction of inpatient aggression may benefit from incorporating more hospital-level variables along with the study of patient-centered risk.

Conclusions

Despite these limitations, this study found that risk factors assessed at admission to a psychiatric hospital can predict critical incidents of aggression during the course of hospitalization. Although future research efforts may refine sensitivity of prediction and expand assessment to additional domains, the current results support the routine assessment of risk for aggression among admitted inpatients. Future research may include efforts to improve the reliability of this measure, particularly inter-rater reliability. Efforts to improve validity, including attention to construct, convergent, and concurrent validity, will also further the aim of refining a risk analysis measure that is both scientifically supported and of practical use for clinicians. Once risk factors are identified, hospitals can then target preventive efforts at those patients who are most likely to aggress. Any changes to hospital practice that can reduce aggression among these most at-risk patients can contribute to efforts to reduce incidents of restraint in compliance with calls to eliminate use of this intervention.

References

Almvik, R., Woods, P., & Rasmussen, K. (2000). The Brøset Violence Checklist: sensitivity, specificity, and interrater reliability. Journal of Interpersonal Violence, 15, 1284–1295.

Amato, P.R. (2001). Children of divorce in the 1990s: An update of the Amato and Keith (1991) meta-analysis. Journal of Family Psychology, 15, 355–370.

American Psychiatric Association. (1994). Diagnostic and statistical manual of mental disorders (4th ed.). Washington, DC: Author.

Biederman, J., Faraone, S.V., Hirschfeld-Becker, D.R., Friedman, D., Robin, J.A., & Rosenbaum, J.F. (2001). Patterns of psychopathology and dysfunction in high-risk children of parents with panic disorder and major depression. American Journal of Psychiatry, 158, 49–57.

Borum, R., & Verhaagen, D. (2006). Assessing and managing violence risk in juveniles. New York: Guilford Press.

Boxer, P. (2007). Aggression in very high-risk youth: Examining developmental risk in an inpatient psychiatric population. American Journal of Orthopsychiatry, 77, 636–646.

Boxer, P., Bhandari, R.P., & Bow, J.N. (2003, November). Exploration of factors predicting seclusion and restraint among child and adolescent psychiatric inpatients. Poster presented at the annual meeting of the Association for the Advancement of Behavior Therapy, Boston.

Boxer, P., & Terranova, A.M. (2008). Effects of multiple maltreatment experiences among psychiatrically hospitalized youth. Child Abuse, 32, 637–647.

Boxer, P., Guerra, N.G., Huesmann, L.R., & Morales, J. (2005). Proximal peer-level effects of a small-group selected prevention on aggression in elementary school children: An investigation of the peer contagion hypothesis. Journal of Abnormal Child Psychology, 33, 325–338.

Boxer, P., Gullan, R.L., & Mahoney, A. (2009). Adolescents' physical aggression towards parents in a clinic-referred sample. Journal of Clinical Child and Adolescent Psychology, 38, 106–116.

Broidy, L.M., Nagin, D.S., Tremblay, R.E., Bates, J.E., Brame, B., Dodge, K.A., … Vitaro, F. (2003). Developmental trajectories of childhood disruptive behaviors and adolescent delinquency: A six-site, cross-national study. Developmental Psychology, 39, 222–245.

Coccaro, E.F., Kavoussi, R.J., & McNamee, B. (2000). Central neurotransmitter function in criminal aggression. In D.H. Fishbein (Ed.), The science, treatment, and prevention of antisocial behaviors: Application to the criminal justice system (pp. 6-1–6-16). Kingston, NJ: Civic Research Institute.

Crowell, S.E., Beauchaine, T.P., & Linehan, M.M. (2009). A biosocial developmental model of borderline personality: Elaborating and extending Linehan's theory. Psychological Bulletin, 135, 495–510.

Curie, C.G. (2005). SAMHSA's commitment to eliminating the use of seclusion and restraint. Psychiatric Services, 56, 1139.

Daffern, M., Ferguson, M., Ogloff, J., Thomson, L., & Howells, K. (2007). Appropriate treatment targets or products of a demanding environment? The relationship between aggression in a forensic psychiatric hospital with aggressive behavior preceding admission and violent recidivism. Psychology, Crime and Law, 13, 431–441.

Day, H.D., Franklin, J.M., & Marshall, D.D. (1998). Predictors of aggression in hospitalized adolescents. The Journal of Psychology, 132, 427–434.

Dishion, T.J., McCord, J., & Poulin, F. (1999). When interventions harm: Peer groups and problem behavior. American Psychologist, 54, 755–764.

Dodge, K.A., & Pettit, G.S. (2003). A biopsychosocial model of the development of chronic conduct problems in adolescence. Developmental Psychology, 39, 349–371.

Frick, P.J. (2006). Developmental pathways to conduct disorder. Child and Adolescent Psychiatric Clinics of North America, 15, 311–331.

Gullick, K., McDermott, B., Stone, P., & Gibbon, P. (2005). Seclusion of children and adolescents: Psychopathological and family factors. International Journal of Mental Health Nursing, 14, 37.

Haber, J.R., Jacob, T., & Heath, A.C. (2005). Paternal alcoholism and offspring conduct disorder: Evidence for the "common genes" hypothesis. Twin Research and Human Genetics, 8, 120–131.

Harty, S.C., Miller, C.J., Newcorn, J.H., & Halperin, J.M. (2009). Adolescents with childhood ADHD and comorbid disruptive behavior disorders: Aggression, anger, and hostility. Child Psychiatry and Human Development, 40, 85–97.

Herrenkohl, T.I., McMorris, B.J., Catalano, R.F., Abbott, R.D., Hemphill, S.A., & Toumbourou, J.W. (2007). Risk factors for violence and relational aggression in adolescence. Journal of Interpersonal Violence, 22, 386–405.

Huesmann, L.R., Eron, L.D., & Yarmel, P.W. (1987). Intellectual functioning and aggression. Journal of Personality and Social Psychology, 52, 232–240.

Hunter, L., Elias, M.J., & Norris, J. (2001). School based violence prevention: Challenges and lessons learned from an action research project. Journal of School Psychology, 39, 161–175.

Jaffee, S.R., Caspi, A., Moffitt, T.E., Dodge, K.A., Rutter, M., Taylor, A., & Tully, L.A. (2005). Nature × nurture: Genetic vulnerabilities interact with physical maltreatment to promote conduct problems. Development and Psychopathology, 17, 67–84.

King, C.A., Knox, M.S., Henninger, N., Nguyen, T.A., Ghaziuddin, N., Maker, A., & Hanna, G.L. (2006). Major depressive disorder in adolescents: Family psychiatric history predicts severe behavioral disinhibition. Journal of Affective Disorders, 90, 111–121.

Knox, M., King, C., Hanna, G.L., Logan, D., & Ghaziuddin, N. (2000). Aggressive behavior in clinically depressed adolescents. Journal of the American Academy of Child & Adolescent Psychiatry, 39, 611–618.

Lodewijks, H.P.B., Doreleijers, T.A.H., de Ruiter, C., & Borum, R. (2008). Predictive validity of the Structured Assessment of Violence Risk in Youth (SAVRY) during residential treatment. International Journal of Law and Psychiatry, 263–271.

Lydon-Rochelle, M. & Holt, V.L. (2004). HIPAA transition: Challenges to multisite medical records validation study of maternally linked birth records. Maternal and Child Health Journal, 8, 35–38.

Maes, H.H., Silberg, J.L., Neale, M.C., & Eaves, L.J. (2006). Genetic and cultural transmission of antisocial behavior: An extended twin parent model. Twin Research and Human Genetics, 10, 136–150.

Malik, N.M. (2008). Exposure to domestic and community violence in a non-risk sample: Associations with child functioning. Journal of Interpersonal Violence, 23, 490–504.

Measham, T.J. (1995). The acute management of aggressive behaviour in hospitalized children and adolescents. The Canadian Journal of Psychiatry, 40, 330–336.

Moffitt, T.E. (2006). Life-course-persistent versus adolescence-limited antisocial behavior. In D. Cicchetti & D. Cohen (Eds.), Developmental psychopathology, Volume 3: Risk, disorder, and adaptation (2nd ed., pp. 570–598). New York: Wiley.

Mohr, W.K., & Anderson, J.A. (2001). Faulty assumptions associated with the use of restraints with children. Journal of Child and Adolescent Psychiatric Nursing, 14, 141.

Mohr, W.K., Mahon, M.M., & Noone, M.J. (1998). A restraint on restraints: The need to reconsider the use of restrictive interventions. Archives of Psychiatric Nursing, 12, 95–106.

Mossman, D. (1994). Further comments on portraying the accuracy of violence predictions. Law and Human Behavior, 18, 587–593.

Murrie, D.C., Cornell, D.G., Kaplan, S., McConville, D., & Levy-Elkon, A. (2004). Psychopathy scores and violence among juvenile offenders: A multi-measure study. Behavioral Sciences and the Law, 22, 49–67.

National Institute of Child Health and Human Development, Early Child Care Research Network. (2004). Trajectories of physical aggression from toddlerhood to middle childhood. Monographs of the Society for Research in Child Development, 69.

Ness, R.B. (2007). Influence of the HIPAA privacy rule on health research. Journal of the American Medical Association, 298, 2164–2170.

Onyskiw, J. (2003). Domestic violence and children's adjustment: A review of research. Journal of Emotional Abuse, 3, 11–45.

Rowe, R., Maughan, B., & Eley, T.C. (2006). Links between antisocial behavior and depressed mood: The role of life events and attributional style. Journal of Abnormal Child Psychology, 34, 293–302.

Rutter, M. (1979). Protective factors in children's responses to disadvantage. In M.W. Kent & J.E. Rolf (Eds.), Primary prevention in psychopathology (Vol. 8): Social competence in children (pp. 49–74). Hanover, NH: University Press of New England.

Sameroff, A.J. (2000). Dialectical processes in developmental psychopathology. In A. Sameroff, M. Lewis, & S. Miller (Eds.), Handbook of developmental psychopathology (2nd ed., pp. 23–40). New York: Kluwer Academic/Plenum.

Schur, S.B., Siklich, L., Findling, R.P., Crimson, M.L., Derivan, A., MacIntyre, J.C., … Jensen, P.S. (2003). Treatment recommendations for the use of antipsychotics for aggressive youth (TRAAY): Pt. 1. A review. Journal of the American Academy of Child and Adolescent Psychiatry, 42, 132.

Schwartz, D., McFayden-Ketchum, S.A., Dodge, K.A., Pettit, G.S., & Bates, J.E. (1998). Peer group victimization as a predictor of children's behavior problems at home and in school. Development and Psychopathology, 10, 87–99.

Tabachnick, B.G., & Fidell, L.S. (2001). Using multivariate statistics. Boston: Allyn and Bacon.

Thompson, L.L., Whitmore, E.A., Raymond, K.M., & Crowley, T.J. (2006). Measuring impulsivity in adolescents with serious substance and conduct problems. Assessment, 13, 3–15.

Toth, S.L., Cicchetti, D., & Kim, J. (2002). Relations among children's perceptions of maternal behavior, attributional styles, and behavioral symptomatology in maltreated children. Journal of Abnormal Child Psychology, 30, 487–500.