BUILDING A BETTER MODEL OF VIOLENCE PREDICTION: CLINICAL PREDICTORS OF AGGRESSION AND VIOLENCE AMONG RESIDENTS OF A MAXIMUM SECURITY STATE FORENSIC PSYCHIATRIC FACILITY

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

2010

To those who might benefit from this work

ACKNOWLEDGMENTS

I would like to extend my sincere thanks to the many people who have played an integral part in the development and execution of this work:

First, I would like to acknowledge my dissertation chair and supervisor Eileen Fennell for her encouragement and support throughout my training. Her advice and direction have been greatly appreciated. I would like to thank my committee members, Duane Dede, Christiana Leonard, and Russell Bauer, for their integral contributions in the delivery of this work. I wish to thank my colleagues at the North Florida Evaluation and Treatment Center, particularly members of the Department of Psychology for their guidance and support throughout this project. Specific mention needs to be given to members of the Information Services department for their invaluable assistance during collection of these data. I am also deeply indebted to my friends and classmates, without whom the years would have been much less kind.

Finally, and most of all, I would like to thank my mom for her boundless faith, patience, and love, and for always encouraging me to explore.

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August 2010

Chair: Eileen Fennell
Major: Psychology

Three models were compared in order to evaluate their predictive utility in distinguishing aggressive from non-aggressive cases, characterizing aggression severity, and classifying verbally aggressive versus physically aggressive subjects during their first 5 weeks of treatment in a sample of 102 mentally ill criminal offenders residing in a maximum security forensic treatment facility. A modified version of the Overt Aggression Scale (OAS) was used to record instances of aggressive behaviors retrospectively within its 4 subtypes: verbal aggression, physical aggression against objects, physical aggression against self, and physical aggression against others. A combined HCR-20 Historical and Clinical subscale score was used as a measure of violence risk. While weekly Brief Psychiatric Rating Scale (BPRS) ratings served as a measure of clinical symptom severity during the evaluation period. Model A represented a baseline function based on the use of the combined HCR-20 Historical and Clinical subscale scores. Model B represented a function based on the additive benefits of BPRS items on this first model. And finally, a test model (Model T) was developed based on conceptual formulations and associations observed in preliminary analyses. Overall correct classification of aggression was aided by selective inclusion of BPRS symptom variable scores, primarily based on this

measure's ability to more accurately classify non-aggressive rather than aggressive cases. Aggression severity was primarily associated with young age and symptoms of agitation, and to a lesser degree patient history. A measure of subjective tension successfully distinguished between verbally and physically aggressive cases, but classification rates were poor across all models in predicting membership in these aggression subtypes. The benefits of correct classification of non-aggressive criminal offenders are recognized in light of current policy trends in forensic treatment settings.

CHAPTER 1
INTRODUCTION

Overview

Violence risk is a priority issue in inpatient forensic psychiatric settings. The nature of treatment and rehabilitation of mentally disordered patients who are also criminal offenders requires constant monitoring of their level of dangerousness and predictions of future violence risk by mental health professionals. At the same time, it is commonly held that consistently accurate predictions of future instances of violence cannot be made by mental health professionals because the likelihood that a person will behave aggressively is a function of a variety of dispositional and situational factors including history, temperament, and provocation, which cannot all be known in advance. However, it is possible to consider the available historical data, socio-demographic variables, mental status features, and the anticipated placement and other situational factors to establish an estimate of relative risk. In clinical forensic settings, decisions based on evaluation of these variables are often considered advisory in nature. For instance, the ultimate decision to recommend release to a less restrictive setting is based upon the entirety of information available to the treatment team. Assessment of future risk of violence in forensic populations relies on the identification of reliable predictors in forecasting future adjustment, but many of these, such as clinical symptom variables, can vary over time. It is also important to note that risk factors increase the probability of violence, but they are not necessarily causative; they are often descriptors, not predictors.

What follows is a study examining individual patient characteristics including socio-demographic variables, and historical and clinical data in order to identify risk factors for predicting violence and aggression in an inpatient psychiatric forensic setting. Recognition and selection of these predictive factors was guided by a thorough review of the literature and a

determination of their particular relevance to individuals in these settings. This review also helped in identifying and disentangling the relationships between relevant variables that were found. To this end, this investigation began with a review of issues germane to violence prediction, including the following: relevance of risk assessment in various clinical settings; factors that have been found to be associated with aggression and violence in a variety of contexts and within various populations including inpatient and forensic psychiatric settings; the debate over and strengths and weakness of clinical and actuarial approaches to violence prediction; and an appraisal of common risk assessment instruments. Finally, a method for identifying factors related to aggression and violence committed by current forensic psychiatric inpatients is put forward.

Violence and aggression engender numerous emotions among mental health professionals for a number of reasons, ranging from fears of personal safety to the legal and ethical implications of one's patients injuring other individuals. Additionally, public concern about violence by the mentally ill has accompanied the dissemination of reports of such violence through the popular media and has generated increased examination of the legal and clinical processes of violence management. Mental health professionals are increasingly asked to assess the risk of violence in many psychiatric populations. Clinicians attempting to avoid these issues by steering clear of treatment and assessment situations involving violent clients are likely to find this an unrealistic strategy, as violent patients can be found in any treatment setting, including private practice, and various medical and psychiatric inpatient units.

A more sensible approach is offered by the growing body of literature on the causes of violence among psychiatric patients, and the management of these patients, intended to inform practitioners and equip them with the tools necessary to deal with violence in various treatment

and assessment situations. Increased interest has generated a growth in the number of relevant publications on these topics as well. This literature identifies the complex interface between individual characteristics and environmental influences in the assessment of violence risk and behavior. Although this paper focuses less on placing violence among psychiatric patients within the larger perspective of societal violence, knowledge of the interaction between the causes of violence and these larger contextual elements is useful in educating practitioners and informing the planning for and treatment of individual patients.

The management of aggressive and violent patients involves a myriad of legal issues. These stem primarily from balancing the individual rights and liberties of the patient with the need to protect others from being harmed, and from the patient harming him or herself. These concerns arise in such areas as informed consent, forced medication adherence through emergency treatment order (ETOs), involuntary psychiatric hospitalization, and restraint and seclusion. These rights and responsibilities are informed by guiding ethical principles as well as specific case law, but vary by treatment context and jurisdictions (APA, 2002; Florida Statutes, 2008).

CHAPTER 2
REVIEW OF THE LITERATURE

Historical Overview of Violence Prediction

The Development of Violence Prediction

The evaluation of a patient's violence potential by mental health professionals is a controversial one. Some maintain that the prediction of violent behavior by experts, who are presumed to possess greater expertise in such matters, is no more accurate than that of intelligent laypersons and that in some cases the accuracy of predictions of dangerousness by laypersons has been found to be greater than that of trained clinicians (Menzies, Webster, McMain, Staley, & Scaglione, 1994). But Otto (2000; 2008) maintains that such conclusions are based on faulty interpretation of the research data. Another interpretation of the data suggests that criticisms of the accuracy of psychologists and psychiatrists in particular are based not on their worse-than-chance performance in evaluating the risk of future violence (since it has been shown that this is not the case either), but that they are more likely to be correct when predicting that a client will *not* be violent, than when predicting that a client will be violent. According to Otto (2008) the problem has instead been seen as a problem of over-prediction, and that expert evaluators have essentially been basing their judgments on information in ways similar to laypersons. Criticisms of these earlier studies point out that they typically employed follow-up periods that were very short, which artificially inflated accuracy of prediction. Also, violence was measured solely based on arrests and convictions, which sorely underestimates incidents of violence (which typically go underreported as they seldom call upon police involvement). It is also suggested that individuals released into the community were generally older. All of these variables have one common result: low base rates of subsequent violent behavior.

According to Rice, Harris, and Quinsey (2002) base rates of violence are significantly greater when violence is operationally defined to include self-reported acts and violence reported by collaterals (other involved parties and significant others), when follow-up periods are longer than those traditionally examined, and when individuals are younger when released. In general, the field of violence risk assessment has made notable progress since these early studies, and a number of factors have been found to be associated with violence risk.

Assessing Current Dangerousness

Before assessing future violence potential clinicians must determine an individual's present state of dangerousness and, therefore, particular attention be must be paid to their current psychological and emotional state. Menzies, Webster, and Sepejak (1985) identified various affective states thought to be associated with an increased risk of violence, and found that anger and lack of empathy were highly predictive of violent behavior. Similarly, Monahan et al. (2001), and Monahan et al. (2005). found that individuals followed in the influential MacArthur Study of Mental Disorder and Violence who rated higher on scores of anger were twice as likely as those with lower scores to act violently. This violence risk assessment study was funded by the National Institute of Mental Health and employed public-access data from the MacArthur Foundation to develop violence risk assessment software, and has been validated on numerous independent samples of patients. Findings by Berg, Bell, and Tupin (2000) and Bell (2000) also suggest that mental health professionals should be watchful for precursors of imminent violence, such as changes in an individual's symptoms and other physical signs. They identify several such signals of impending violence, including erratic eye movements, clenched jaw or hands, unusual vocalizations (chanting, grunting), flared nostrils, non-compliance with directives from psychiatric staff or family, and violation of a clinician's personal space.

Although these behavioral signals do not constitute out and out dangers in and of themselves, in each case they can lead to actual threats that need to be taken seriously by clinicians and appropriately documented and explicated. Assessment of the degree of danger of a threat is aided by a thorough evaluation of how an individual might carry out the threat, their understanding of the possible consequences of their actions, and an assessment of an individual's perceptions of alternatives to these behaviors. Findings from the MacArthur Foundation studies (Monahan and Steadman 1994; Bonnie and Monahan 1997; Silver, Mulvey, & Monahan, 1999) indicate that consideration of these alternative behaviors and perceived coping strategies by a potential offender is fundamental. For instance, a psychiatric patient may want to avenge himself against an attacker for a misperceived slight or transgression against them but may instead choose to turn and walk away when confronted by the possibility of incarceration should they physically attack the individual. Brizer and Crowner (1989) and Convit, Jaeger, Lin, Meisner, and Volavka (1988) suggest that additional information which should be gathered in violence risk assessment includes an individual's fantasies about violence, whether they keep a list of possible victims and even, to some degree, an appraisal of the intended targets. All of this information ultimately serves to inform on the relative likelihood of future violent behavior towards others.

In murder-suicides the taking of a perpetrator's own life has been conceptualized as an extension of their violent impulses turned inward when, for instance, they feel that they can no longer live without their victim. Research suggests that evaluations of violence threat requires an assessment of suicide risk. Brizer and Crowner (1989) and Convit et al. (1988) found that a history of violent suicide attempt greatly increased the probability of future violence towards others. This relationship is even more compelling when a homicidal threat has been made.

Asnis, Kaplan, Hundorfean, and Saeed (1997) found that 91% of psychiatric outpatient attempted murderers had also attempted suicide sometime in their lives. They also found that 86% of psychiatric patients reporting homicidal ideation also reported concurrent suicidal ideation.

Research examining variables thought to be contributory to violence has led to a distinction in the literature between static and dynamic risk factors**.** As the name implies, static factors are thought to be those factors that are unchangeable and therefore not amenable to intervention, such as an individual's personal history and demographic group membership. By contrast, dynamic factors are those typically targeted for change. These can include psychiatric symptoms, substance use habits, access to weapons, and deviant peer associations. This distinction allows for a systematic strategy for organizing and weighing risk factors, and ultimately can serve to inform clinicians in implementing prevention strategies for those at risk for future violence, as well as treatment and management of those who have already offended.

The Problem of Defining Violence

While patient pathology remains a central theme of violence prediction, the causes of aggression and violence are multifactorial. This is likely one of the reasons for the diversity of definitions, models, and terminology associated with studies of aggression and violence in psychiatric populations. For instance, Swanson, Bland, and Newman (1994) define violence as a physical encounter with someone, other than a spouse, which involves the use of a weapon. While Chen, Hwu, and Williams (2005) treat aggression as incorporating both verbal and physical assaults. Ryan and Maguire (2006) and Maguire and Ryan (2007) suggest that the diversity and inconsistencies in definitions, and therefore in the techniques employed to measure these constructs, represent major obstacles to the meaningful measurement and evaluation of

aggression and violence in psychiatric populations. In the present study, for instance, "aggression" and "violence" are used synonymously.

Research on Prediction – General Issues

Clinicians are frequently called upon to evaluate whether an individual who has acted violently in the past is likely to re-offend. Such evaluations are particularly common among psychiatric patients who become involved in criminal or other legal processes where admission, discharge, sentencing, probation, and any planning for eventual placement depends on an appraisal of the likelihood for future violent behavior. Beyond the context-specific interest of clinicians as to whether an individual who has acted violently in the past is likely to exhibit future antisocial behavior, there is also a concern for public safety which drives public policy, defines the context in which medico-legal decisions are made, and ultimately helps identify those individual characteristics on which clinical judgments about future violence are made. Violence prediction is predicated on the assumption that individuals who have offended in the past possess particular attributes that are associated with a greater likelihood to offend again in the future. As Martin (2003) indicates, if environmental factors and measurement error accounted for all of the variance in violent behavior, and none was accounted for by individual characteristics, then clinical judgment would contribute considerably less in decisions about disposition and placement of psychiatric patients. The literature, however, is replete with research on the many predictors of violent behavior among individuals who have previously offended, and supports the notion that underlying individual characteristics are examples of such predictors.

It should be noted that research examining predictors of aggression has varied greatly in terms of the populations and contexts in which they have been studied. While the focus of the present study is identifying predictors of aggression among adult male psychiatric residents of a state-run maximum security forensic treatment facility, others have focused on juvenile offenders

(Farrington, Loeber, & Kalb, 2001), non-criminal non-institutionalized psychiatric patients (DeMatteo, Heilbrun, & Marczyk., 2006), women (Putkonen, Komulainen, Virkkunen, Eronen, & Lönnqvist, 2003), and numerous other groups and settings. It should also be noted that the majority of studies have been conducted in North America and Europe. While some have argued that the variations in demographic characteristics from study to study necessarily limits the confidence with which statements regarding the likelihood of future violence can be made, the literature overwhelmingly suggests that the personality characteristics predictive of future violence are shared across psychiatric and offender populations (Quinsey, Jones, Book, & Barr, 2006).

Another source of potential variability in study results arises from the ways in which future risk and violent behavior (particularly re-offending and recidivism) are defined. For instance, investigations of recidivism among parolees often include behaviors considered to be violations which would not be considered antisocial or criminal were not the individuals on parole, such as failing to inform a parole officer of a change of residence or failing to meet other terms of conditional release. This definitional problem is also encountered in studies of forensic patients who may be counted as recidivist when re-hospitalized or admitted to civil treatment facilities for non-criminal behaviors. As Quinsey et al. (2006) aptly point out, the majority of crimes (such as theft, prostitution, and drug possession) are not related to violence or safety issues. Most research into violent offending among forensic psychiatric patients has involved follow-up studies of individuals discharged from various institutional settings in order to identify those characteristics which are related to later violence. Measuring these characteristics, and identifying a statistically significant relationship between distinguishing attributes and future acting out is typically accomplished through examination of hospital and police records, and

other available official documentation. While such studies focus on the risk of violent behavior among those who have already offended, these investigations are ultimately driven by an interest in identifying those predictors of violent behavior among those who have never been apprehended, thereby identifying the precursors of violent behavior. The present study confines itself to the evaluation and prediction of violence defined by a wide spectrum of behaviors, among psychiatrically hospitalized residents of a maximum security forensic treatment facility, in relation to demographic, historical, clinical, and hospitalization characteristics.

Older Studies of Violence Risk – Relevant Variables

Despite the prevalent need for violence risk evaluations, the ability of mental health professionals to accurately assess the risk of aggression is inadequate. Studies on risk assessment have generally failed to provide solutions that lend themselves to the precise and practical prediction of violence risk (Amore et al., 2008).

Swanson, Holzer, Ganju, and Jono (1990), and McNiel, Binder, and Greenfield (1988) long ago demonstrated that individual socio-demographic variables such as male gender, low socio-economic status (SES), young age, and even single marital status are positively associated with increased violence risk in community samples. Their data suggested that these variables are more predictive of violence risk than clinical variables such as psychiatric diagnosis and symptom profile. Results of other studies, by contrast, provide strong evidence that clinical variables are more predictive than historic and demographic factors in predicting risk, including personality disorder, alcohol abuse, seizure disorder, organic psychosis, schizophrenia, and mania (Taylor, 1985; Link & Stueve, 1994; Junginger & McGuire, 2004). Amore et al. (2008) argue that the emphasis on specific psychiatric diagnoses in violence prediction has been over-emphasized in the literature and that it is not the specific diagnosis, per se, that is a risk factor but rather symptom characteristics and profiles of certain disorders, such as hallucinations,

delusions, and thought disorder. They utilized the Brief Psychiatric Rating Scale (BPRS) to evaluate 24 symptom constructs (each rated along a 7-point scale of severity ranging from “not present” to “extremely severe”) that best describes a patient's present condition, in order to identify the best predictors of violence in an acute care psychiatric population; their results were mixed.

Studies by Monahan and Steadman (1983) echoed a plethora of research which showed that a history of violence is the most significant predictor of future violence. Another risk factor which has been identified as predictive of future violence is a history of incarceration (McNiel, Binder, & Greenfield, 1988). But there is less consensus regarding the factors that distinguish violence risk in populations in which everyone presumptively shares such histories. Therefore, what makes someone *more* likely to aggress, and *what form* is this subsequent aggression likely to take? The present study seeks to address these questions, and has as its main objectives to 1) identify the demographic and clinical factors associated with aggressive acts among those admitted to a maximum security forensic treatment facility in the 5 weeks following admission; 2) examine how these relate to the intensity/severity of aggressive acts; and 3) identify and distinguish the types of aggression and their association to these variables. It is believed that a model will immerge that will predict membership of residents into groups of violent offenders by the types of acts they are likely to commit (and to clarify whether differences represent distinct groups or continuums of violence). Ultimately, it is hoped that the predictive utility of clinical variables, rather than historical variables alone, will be demonstrated in assessment of violence risk.

Newer Studies of Violence Risk – Relevant Variables

Monahan (1997) aptly points out that the investigation of violence risk in actual clinical practice has suffered from problems of replication and generalizability. This is largely due to the

multitudes of variables proposed as predictive of future violence. In fact, Menzies and Webster (1995) and Menzies et al. (1994) point out that with rare exception, practically every variable investigated has been found, to some degree, to have an association with future violence. Duxbury (2002), and Scott and Resnick (2006) and Resnick and Scott (1997) argue that this does little to aid clinicians in accurately predicting which patients will display aggressive behavior. And according to Webster, Douglas Eaves, and Hart (1997) and Secker et al. (2004) much of the literature has failed to demonstrate a firm linear relationship between these identified risk factors and actual episodes of violence. Therefore, they stress that attentiveness to the interaction amongst these factors is critically important if they are to be unraveled.

According to Watts, Leese, Thomas, Atakan, and Wykes (2003), those violence risk factors which have been identified in epidemiological studies of are of little added benefit to the clinical judgments of mental health professionals because they have shown that the risk factors for violence among those with mental illness are the same as for those in the non-psychiatric population (including gender, age, employment status, and criminal history). Watts et al. (2003) also stress the importance of considering the base rate (prevalence) of violence in any population under consideration when evaluating their likelihood of future violence and the accuracy of risk assessment approaches. This often problematic issue can be addressed using Receiver Operating Characteristics (ROC) (Mossman, 1994; Rice & Harris, 1995) which provide indexes of effectiveness derived from measures of sensitivity and specificity and are analyzed similarly to effect sizes (Cohen, 1988; Cohen, 1992; Hasselblad & Hedges, 1995).

While studies of violence risk proliferate, there is a relative paucity of research into risk assessment in inpatient and residential settings, particularly during the more acute period of care. And there is an even greater scarcity of work on the clinical prediction of assaultive behavior in

forensic settings. The work of Hoptman, Yates, Wack, and Convit (1999) stands as an exception. Their work compared patient characteristics generally associated with violence in forensic psychiatric hospitals with actual assaultive behavior in order to evaluate the accuracy of clinical decisions based on these patient variables. They found that clinicians in their sample showed a high rate of accuracy of 71%, with a diagnostic sensitivity of 54% and a diagnostic specificity of 79%. Owen, Tarantello, Jones, and Tennant,(1998) described several surveys of inpatient violence, and several studies by McNiel and Binder (1994; 1995) and McNiel, Sandberg, and Binder (1998) in which mental health professionals identified those individual attributes they felt were relevant to violence prediction, and also explored the accuracy of their clinical judgments based on these characteristics.

Another significant problem intrinsic to studies of violence risk prediction is their lack of amenability to strictly experimental designs. Such studies need to take place in real world clinical settings, in which mental health professionals and other treatment staff are obligated to act when an individual is either acting aggressively or has been deemed to be at significant risk of committing violence. In such settings, the prediction of risk is affected by the act of responding to that risk and of intervening in an aggressive act. In particular, Davison (1997) notes that in such settings a variety of remedies typically follow to prevent the anticipated outcome, and that this has the effect of increasing false positive rates. Therefore, while the present study identified instances of specific aggressive behaviors for each participant there was also a careful accounting of targeted clinical interventions given in response to these behaviors over the course of the study period. In this way the value of the predictive variables could be assessed both with and without the influence of clinical interventions.

Risk Factors for Violence

History of Violence

Traditional wisdom holds that the best single predictor of future violence is a past history of violence (Klassen and O'Connor 1988). Studies based on the MacArthur Foundation data (Monahan, 2001) found that all measures of previous violence were strongly associated with future violence (these included data from such sources as hospital and arrest records, and self-report). Scott and Resnick (2006) suggest that obtaining information on the most violent act an individual has ever committed can be helpful in predicting the likelihood and severity of subsequent violent behavior. Certainly, as with any comprehensive clinical interview, obtaining a detailed violence history is critical to the evaluation of risk. Such an evaluation should include information on the type of violent act, why the violent act occurred (from the perspective of all relevant parties), who was involved, the degree of injury, and the contribution of other relevant variables (such as intoxicating substances, frequency of the type of violent act, etc.). Evaluation of an individual's history of violence is aided by official court and criminal records, which typically contain a plethora of information not only on illegal behavior but useful demographic data. One such piece of useful information is an offender's age at first arrest, which in the case of serious offending has been found to be a variable which correlates highly with recidivist criminal offending (Borum, Swartz, & Swanson, 1996). According to Wolfgang (1987), following four arrests the probability of a fifth is 80%.

Military and work records also contain a wealth of relevant information useful to evaluating an individual's violence potential. Catalano, Dooley, Novaco, Wilson, and Hough (1993) suggest that clinicians conducting risk assessments for individuals who have served in the military, should pay particularly close attention to any history of fights, unexcused absences, disciplinary actions, type of discharge, and reasons for reassignments. While work history

evaluations should also include a review of the incidence of job changes and any history of terminations from employment. Catalano et al. (1993) also reported that individuals who are frequently fired from their job are at increased risk for future violence. In fact, they found a 6-fold increase in the likelihood of future violence among those laid off from work.

Acts of violence fall along a continuum of severity often based on the lethality of the instrument of violence. This bears not only on the outcome of the violent act but upon the determination of future risk potential and re-offending. Studies by Zimring (1993) reveal that an assault with a gun was 5 times more likely to result in a fatality than an assault with a knife. Those who have used weapons in the past pose a serious risk of future violence, and the severity of this risk has been found to vary by the lethality of the weapon used. Therefore, a thorough risk evaluation must include an appraisal of an individual's access to weapons. According to a 2001 Department of Justice report it is estimated that approximately 40% of American homes contain a firearm and 20% of these maintain the gun in an unlocked and loaded condition (Webster, Vernick, Ludwig, & Lester, 1997). Therefore, asking an individual whether they have access to a weapon is critical. Quanbeck et al. (2004) also point out that tracking the movement of a weapon, for instance by asking a n individual whether they recently moved it from a locked case in the attic to the nightstand by their bed, can provide useful information as well. Reports of such behavior could clue a clinician into an exacerbation of paranoid symptoms (for instance, of someone suffering from a psychotic disorder or other mental illness) that would make them more likely to aggress against someone they misperceive as a threat.

Socio-Demographic Factors

The assessment of risk of dangerousness and future violence by mental health clinicians must also be based on a review of demographic risk factors that have been found to increase the probability of future violence. Some of these include younger age (Monahan 1981 ; Swanson &

Holzer, 1990), male gender (Tardiff & Sweillam, 1980; Tardiff, 1996), low economic status (Swanson et al., 1997), lower intelligence (Quinsey & McGuire, 1986; Borum et al., 1996), criminal history (Monahan, 1981; Convit et al., 1988), childhood abuse (Widome, 1989) childhood environment (Convit et al., 1988), and substance abuse (Steadman et al., 1998). It should be noted that while race has been explored as a violence risk factor it has been associated with errors in violence prediction (Hoptman et al., 1999).

Violent behavior is associated with membership in a younger age group. Using data from the Epidemiologic Catchment Area study Swanson et al. (1997) found a rate of violent behavior of 7.34% among those between 18 and 29, 3.59% for those between 30 and 44, 1.22% for those between 45 and 64, and a rate of less than 1% for those 65 or older.

According to the Federal Bureau of Investigation (2004) males commit violent acts at a rate 10 times greater than females. However, according to Lidz, Mulvey, and Gardner (1993) and Newhill, Mulvey, and Lidz (1995) among individuals with mental illness men and women do not differ significantly in their base rates of violent behavior. They found that, in fact, among the mentally ill base rates of violent behavior in some cases are slightly higher for women than men.

The seminal MacArthur Foundation's Violent Risk Assessment Study (Monahan, 2001) followed male and female psychiatric inpatients between 18 and 40 years of age who were subsequently released into the community. These individuals, all of whom continued to suffer from mental disorders, were monitored for 1 year for acts of violence towards others. Results indicate that men were only slightly more likely than women to be violent. In fact, it was found that women were more likely to aggress towards members of their family and those in their immediate home environment. At the same time, violence perpetuated by men was more likely to lead to arrest and medical intervention.

Krakowski and Czobor (2004) examined the relationship between gender and violence in mentally ill individuals within a psychiatric institutional setting. Among their 155 male and 67 female psychiatric inpatients they found little difference in the rates of physical assault between men and women in this setting. However, women had a higher rate of physical assaults within the first 10 days of the study, while assaults by men were more likely to result in injury.

Quanbeck et al. (2004) and Maden, Scott, Burnett, R., Lewis, and Skapinakis (2004) argue that risk evaluation should also include consideration of an individual's economic status. Borum, Swartz, and Swanson (1996) found a rate of violence 3 time greater amongst individuals defined as belonging to lower income brackets. By contrast, another study by Silver, Mulvey, and Monahan (1999) suggests that neighborhood poverty was more predictive of violent behavior than an individual's economic status.

Violence risk has been found to increase with lower intelligence, cognitive disabilities, and mental retardation (Quinsey & McGuire, 1986; Borum et al., 1996). In a study by Hodgins (1992) examining the relationship between intellectual functioning and violence risk, men with intellectual deficits were 5 times more likely to commit violent offense, while similar women were 25 times more likely. Many studies have also identified those with less education as having higher rates of violent behavior (Link, Andrews, & Cullen, 1992; Borum et al., 1996).

Environmental Factors

Among the mentally ill certain environmental variables have been found to consistently contribute to future aggression across treatment settings. Haggard-Grann, Hallqvist, Långström, and Möller (2006) found that interpersonal friction among patients, among staff, and between patients and staff in hospital treatment wards contributes to the occurrence of violence in these settings. They also found that being denied treatment can have similar negative consequences. Kerr and Roth (1986; 1987) linked aggressive behavior in psychiatric units to patient perceptions

of slow recovery from illness. Lanza (1983), and Kindy, Peterson, and Parkhurst (2005) identified a relationship between inadequate hospital staffing and the incidence of violence. Finnema, Dassen, and Halfens (1994) found that lack of freedom and privacy can contribute to aggression in a psychiatric ward. Institutional disorganization (Duxbury, 2002) and limited options for therapeutic activities (Finnema et al., 1994; Kindy et al., 2005) have also been cited as contributing to institutional violence. Perry, Pescosolido, Martin, McLeod, and Jensen (2007), and Martin (2003) aptly point out the relevance of these and other environmental variables not only on violence prediction but on the overall clinical management of psychiatric patients by reminding us that treatment environments are typically completely different in every respect to what patients are accustomed to outside of these settings.

Substance Abuse

A number of studies have reported that the majority of violent offenders are under the influence of alcohol or drugs at the time of their violent crimes and that in general there is a very strong association between violent behavior and substance abuse (Murdoch, Pihl, & Ross, 1990; Tardiff, 1999; Monahan, 2001). Roth (1994) found that in half of all violent crimes, the offense was preceded by alcohol consumption by either the perpetrator, the victim, or both. Goldstein, Bellucci, Spunt, and Miller (1991) examined the relationship between violence and stimulants, including powder and crack cocaine, amphetamines, and PCP ("angel dust"). They reported that these drugs appear to be of particular concern to violence risk as they typically result in disinhibition, instability, grandiosity, and paranoia, which are all consistent with psychotic-spectrum symptoms. They also found that the violence associated with stimulant ingestion varies by gender, with men being more likely to engage in violent crimes while under the influence and women more likely to be the victims of violence when similarly impaired.

Within a psychiatric population the potentiating effects of substance abuse on mental illness are of particular concern. Data from the MacArthur Foundation Studies illustrate that co-occurring diagnoses of mental illness and substance abuse strongly predicts future violence. In their study examining the additive effects of mental illness and substance abuse on violent behavior Steadman et al. (1998) compared rates of violence of community-based psychiatric patients and non-patients and found that the presence of substance abuse increased the rate of violence among non-patients 3 times, while it increased the rate of violence 5–fold in their outpatient psychiatric sample.

Mental Illness

One of the stigmas of mental illness is the depiction of the mentally ill as dangerous and unpredictable. At the very least these perceptions have contributed to the proliferation of studies examining whether individuals with psychiatric disorders are indeed more violent than those in the general population. The sum of the research has painted a mixed picture (Swanson et al., 1990; Link et al., 1992; Torrey, 1994; Steadman et al., 1998). Monahan (1997) examined rates of violence among psychiatric patients committed to civil settings who were subsequently discharged to the community. While he found a very weak relationship between mental illness and violence, the majority of psychiatric patients were not violent. He also noted that the rate of violence among the sample of mentally ill patients was greater only when their psychiatric symptoms flared up, such as during acute, transient exacerbation of psychotic symptoms. He also found that a diagnosis of schizophrenia, despite the common perception of an increased association with dangerous acting out and criminality, was actually associated with lower rates of violence than diagnoses of bipolar disorder or even major depression. As previously mentioned, drug abuse is strongly associated with violence risk. According to Monahan, Steadman et al. (2005) it is also a much stronger predictor of violence than mental illness. In their examination of

violence risk factors among the mentally ill Steadman et al. (1998) found no significant difference in the rates of violence between non-substance abusing patients discharged from psychiatric facilities and non-substance abusing individuals in the general population who were not suffering from mental illness. In other words, the presence or absence of mental illness was not the determining factor when considering the prevalence of violence.

Psychosis

The assessment of violence potential requires the careful review of specific psychiatric symptoms. Humphreys, Johnstone, MacMillan, and Taylor (1992) argued that the presence of a diagnosis of psychosis should be of particular relevance when assessing violence risk potential. They examined 253 psychiatric patients undergoing their first psychotic episode and found that 52 had demonstrated behaviors prior to hospitalization that were threatening towards the lives of others. Of these, 36 exhibited dangerous behaviors towards others up to a year prior to hospitalization, while the remaining 16 displayed such behaviors for more than a year prior to their first schizophrenic episode.

Krakowski, Volavka, and Brizer (1986) argue that because they have increased access to weapons people with symptoms of paranoia present as an increased risk of dangerousness. Scott and Resnick (2006) suggest that violence among paranoid psychotics is typically deliberate and premeditated and compatible with their delusional beliefs. As such, an explicit target is typically identified and the violence directed towards this misperceived tormenter (often a member of the immediate family or friend of the aggressor).

While the research is far from unequivocal, Wesley (1993) examined the contribution of specific delusions in violence prediction and found that persecutory delusions in particular (those associated with a perceived threat and being controlled by others) were strongly associated with an increased risk of violent behavior. Link et al. (1992) and Link and Stueve (1995) identified

additional types of delusional beliefs that tend to be associated with violence among mentally ill patients, including various beliefs regarding the permeability of the mind including thought insertion (the delusion that thoughts are being inserted into one's mind by someone else), thought interference, that others wish to do them harm (persecutory delusions), and that they are being followed (persecutory and referential delusions). Link and Stueve (1995) found that these delusional beliefs in particular are associated with increased rates of violence among persons with psychotic-spectrum disorders. Similarly, Swanson and Holzer (1990), Swanson and Holzer (1991), and Swanson et al. (1997) used data from the Epidemiologic Catchment Area surveys to identify risk of violence among individuals reporting delusions related to perceived external control of their thoughts and external threat. They reported a rate of assault twice as high among psychotic patients experiencing these specific delusions compared to psychotic patients with other symptoms. Similarly, a recent study by Stompe, Ortwein-Swoboda, and Schanda (2004) found that delusions related to perceived threat or thought control were not associated with an increased risk of violence, or the severity of violence, when comparing male criminal offenders with a diagnosis of schizophrenia who were found Not Guilty by Reason of Insanity (NGI) to non-offending schizophrenics. They also reported no difference in the rates of specific psychotic symptoms between each group.

Several recent, large-scale, and prominent studies seem to contradict these findings however. Studies based on data from the MacArthur Study of Mental Disorder and Violence (Appelbaum, Robbins, & Monahan,. 2000; Monahan et al. 2001) reported that the presence of delusions among discharged psychiatric patients, regardless of the particular type of delusions, was not predictive of rates of violent behavior, nor was it associated with higher rates of violence in particular. However, Monahan and his colleagues draw a distinction between delusional and

non-delusional suspiciousness, where the former is characterized by more disorganized and bizarre content, and the latter is based on misperception of hostile intent due to misinterpretation of the behavior of others. They found that non-delusional suspiciousness was indeed related to later violence.

The literature presents a mixed picture of the importance of various clinical features in determining the dangerousness of mentally ill individuals. In addition to the form and content of various delusional subtypes, the affective latency of these underlying thought disorders has been examined. For instance, Appelbaum, Robbins, and Roth (1999) examined how certain delusional beliefs make psychiatric patients feel, and whether these self-reported feelings are later associated with an increased risk of aggression. Results indicate that when patients experience delusions that make them unhappy, angry, scared, or anxious, they are more likely to engage in violent behavior. It should be noted, however, that the evaluation of violence risk potential should include questions regarding an individual's tendency to act on their delusions even when these acts are not violent. Research by Monahan (2001) also reveals that an individual's tendency to act on their delusional beliefs (non-violently) regardless of the content of that delusion is also associated with a greater tendency towards violence.

An evaluation of the form and content of hallucinatory behaviors would also seem to be instrumental to thorough violence risk assessment. However, research into whether the presence of hallucinations increases an individual's likelihood to commit violent acts is also mixed. The presence of hallucinations in and of itself does not appear to be related to an increased rate of violence (Zisook, Byrd, Kuck, & Jeste 1995) But just as with delusions the presence of hallucinations has been associated with greater violent acting out when they generate negative emotions in schizophrenic patients (fear, sadness, anger, anxiety). According to Cheung,

Schweitzer, Crowley, and Tuckwell (1997) this relationship is even more pronounced when the patient has not developed appropriate strategies for coping with their hallucinations and for managing these negative emotions.

Rudnick (1999) conducted a review of 7 controlled studies on the association between auditory command hallucinations and violence; none succeeded in demonstrating a positive relationship, and one managed to demonstrate an inverse relationship. In a similar study Scott and Resnick (2006) found a positive relationship between command hallucinations and violence when the form of the hallucination was of a person familiar to the patient and the commanded act was of a less serious nature. In stark contrast, a study by McNiel, Eisner, and Binder (2000) found that patients were twice as likely to be violent when experiencing command hallucinations to harm others. Their study examined 103 psychiatric patients within a civil facility; 33% of which reported command hallucinations over the previous year, while 22% indicated complying with these commands.

Psychiatric symptoms rarely occur in isolation, even within a specific diagnosis. Command hallucinations are often accompanied by a delusional thought structure whose content is consistent with the hallucination (Junginger, 1990). While data from the MacArthur Foundation Studies failed to reveal a relationship between non-violent command hallucinations and subsequent violence, or between general hallucinations and violence, other data support a relationship between command hallucinations to commit violence and subsequent violent acts.

People with schizophrenia commonly lack insight about their illness or the consequences of their behavior. According to Buckley et al. (2004) when compared to a non-violent control group, violent schizophrenics tended to display a particular lack of awareness regarding their mental state and the legal ramifications of their behaviors. Therefore, they argue, clinicians

should evaluate not only the positive and negative symptoms of psychotic disorder but an individual's insight into their illness and legal situation.

Walsh, Buchanan, and Fahy (2002) report that while the majority of individuals with schizophrenia do not engage in violent behavior, there is growing evidence of an association between the diagnosis of schizophrenia and criminal acts. Wallace, Mullen, and Burgess (2004) retrospectively reviewed 2861 patients with schizophrenia who had been followed over a period of 25 years, and found that patients with a diagnosis of schizophrenia had a greater number of criminal convictions (both violent and non-violent) compared to a matched comparison group. However, they also indicated that these results could be accounted for by concurrent treatment interventions, substance abuse, or active symptoms.

Mood Disorders

There is evidence of an association between depression and violent behavior as well. Numerous studies indicate that depression is the most frequent diagnosis in murder-suicides (Coid, 1983; Marzuk, Tardiff, & Hirsch, 1992; Scott, Harrington, House, and Ferrier, 1996), and there is ample evidence suggesting that individuals may commit violent acts on others when anguished, hopeless, and despaired. An early investigation of the association between depressive symptoms and specific crimes by Resnick (1969) identified a pattern of murder-suicide in which depressed mothers kill their children and then take their own life. Today this has generally been reframed as postpartum depression, where hormonal changes in a woman's body after childbirth are thought to trigger symptoms of depression. In extreme cases, this explanation has been used as a defense in cases involving women claiming that postpartum depression moved them to behave erratically or even kill their children. Rosenbaum (1990) found that murder-suicide cases in couples are often associated with depressive symptoms related to feelings of jealousy and loss.

He argues that depression in these cases is the driving force for the externalized violence, in that the homicidal act is simply an extension of the suicide.

Other mood conditions have been found to be associated with increased violence. Krakowski, Volavka, and Brizer (1986) found that while serious violence is rare among patients with symptoms of mania, they show a greater rate of assaultive and threatening behaviors. Nonetheless, they also found that individuals with manic symptoms engage in fewer criminal acts of all kinds compared to individuals diagnosed with schizophrenia. According to Tardiff and Sweillam (1980) individuals with mania are more likely to be violent or act out aggressively when restrained or when their behavior is limited in some way. More recent studies on the association between mania and violence, however, suggest a substantial connection between manic symptoms in psychiatric patients and criminal behavior. Quanbeck et al. (2004) examined 66 criminally incarcerated inmates diagnosed with bipolar disorder, and found that 77% displayed manic symptoms and 59% were psychotic at the time of arrest. They also found that these manic inmates were later discharged from inpatient community treatment at a much higher rate, and that they were seldom involved in follow-up outpatient treatment after discharge, effectively increasing their likelihood of re-offending.

Personality Factors

In addition to its association with a number of psychiatric disorders, violent behavior has been found to be more prevalent among individuals with certain types of personality disorders, as defined by the DSM-IV (1994). Tardiff (1999) and Tardiff and Sweillam (1980) found that borderline personality disorder is associated with a greater risk of violence, while Meloy and Gacono (1992) identified sadistic traits as more likely to lead to greater violence. Overwhelmingly, however, antisocial personality disorder has been found to be the most common type associated with violence (Monahan, 2001). Violence committed by those with

antisocial personality disorder has been found to be characterized by a number of features, including a motivation of revenge and co-occurring alcohol abuse (Scott, Harrington et al., 1996), and that the acts are devoid of emotionality or any pretense of moral justification (Williamson, Hare, & Wong, 1987). Heilbrun (1990) found that the combination of low IQ and antisocial personality disorder significantly increases an individual's risk of future violence. Joyal, Putkonen, Paavola, and Tiihonen (2004), emphasize the importance of assessing antisocial personality traits among the mentally ill in order to adequately ascertain violence risk potential. They found that individuals diagnosed with both schizophrenia and antisocial personality disorder are actually less likely to engage in violent acts that are provoked by their psychotic symptoms, compared with schizophrenic patients without antisocial personality disorder. They indicate that the presence of violence in individuals with these comorbid diagnoses is more likely to be associated with other factors, including excessive alcohol use, a prior squabble with the victim before the violent act, or a victim who is not a family member.

Differentiating the individual contributions of subclinical features on violence risk is a constant challenge. While certain personality disorders have been found to be associated with increased dangerousness, many individual characteristics constitute these diagnoses. The presence of some of these traits alone may not meet criteria for a diagnosis of personality disorder but may be extremely predictive of future violence. For instance, Borum et al. (1999) identified impulsivity, ostentation, a sense of entitlement, low frustration tolerance, intolerance of criticism, and even reckless driving to be personality traits associated with increased violence. Reid, Balis, and Sutton (1997) reported similar findings, adding that such individuals also tend to display little insight into their behavior and frequently externalize blame for their problems.

These personality traits tend to be associated with sudden, sporadic violence rather than premeditated or well planned violence.

While obtaining a history of repetitive antisocial behavior is well recognized as instrumental in any violence risk evaluation, the concept of psychopathy has received a great deal of attention in the literature as well. First described systematically by Dr. Hervey Cleckley in 1941 (Cleckley, 1982), psychopathy includes a specific set of personality traits and behaviors. Psychopaths are said to be superficially charming, often appear remarkably normal to observers, and tend to make a good first impression. But they are self-centered, impulsive, dishonest, they lack empathy, and they frequently engage in irresponsible behavior just for fun or to satisfy their own needs. They are driven primarily by self-gratification. They are mostly devoid of guilt, empathy, or love. When involved in interpersonal or romantic relationships they are described as unfeeling, cruel, and heartless. Psychopaths frequently make excuses for their reckless and outrageous behaviors, externalize blame for their misdeeds, and seldom learn from their mistakes or benefit from negative feedback. Hare, Hart, and Harpur (1991) developed the Psychopathy Checklist – Revised (PCL-R) in order to tap into these attributes and offer a validated measure of psychopathy. Salekin, Rogers, and Sewell (1996; 1997) and Salekin, Rogers, Ustad, and Sewell (1998) found that psychopathy is a strong predictor of violence and criminal behavior, and therefore emphasize the importance of assessing psychopathy in any evaluation of dangerousness.

Cognitive Impairment

There is ample evidence in the literature to indicate that brain injury can lead to aggressive behavior. Data from the National Institutes of Health (1998; 2001) show that following brain injury individuals may display verbal and physical aggression when no such tendencies existed prior to injury. Studies have also identified some of the typical features of aggression following

brain injury; these tend to cluster around the themes of impulse control deficits and absence of remorse. Specifically, such individuals display violent behavior with no purposeful objective or intent, they tend to exhibit reactive aggression that is often set off by trivial stimuli, these eruptions occur suddenly and without any steady buildup, and there is a notable absence of reflection or planning prior to the violent act or concern and remorse preceding the event. A further complication to assessing risk in such individuals is the episodic nature of their violence, which is characterized by frequent and long periods of relative tranquility. Kalunian, Binder, and McNiel (1990) examined the relationship between violence and organic psychosis in senile geriatric patients, and found this population, more than individuals with any other psychiatric diagnosis, to engage in more aggressive acts.

Winstanley and Whittington (2004) investigated incidents of aggression in a general hospital setting, and found that individuals were experiencing some kind of cognitive deficit in 64% of these episodes. They went on to suggest that these cognitive impairments likely resulted in their inability to inhibit there behaviors, or significantly affected their perception of the intentions of staff and peers so that they felt compelled to aggress against them.

Studies by Quinsey and Maguire (1986), Borum et al. (1996), and Emerson (1998) have each confirmed a negative correlation between general level of cognitive functioning and violence risk. And more recently, Van Winkel et al. (2006) reported significant changes in IQ scores in a longitudinal study of schizophrenic patients, and patterns of deterioration related to these IQ scores. Perry, Pescosolido, Martin, McLeod, and Jensen (2007) suggest that their findings support a claim of impaired cognitive functioning related to the more acute phases of severe psychiatric illness, which in turn may explain the greater frequency of aggression in those

who, due to mental illness, may not be able to fully appreciate the consequences of their behaviors.

Clinical Judgment in Risk Assessment

Determination of an individual's risk of future violence is frequently a critical component of a mental health assessment. Evaluation of an individual's level of dangerousness is particularly common in a number of situations, including emergency psychiatric evaluations, involuntary commitments, seclusion and restraint, release and discharge decisions, probation and parole, and death penalty evaluations.

"Risk" and "dangerousness" are not psychiatric diagnoses, but rather clinical judgments based on legal (and frequently political) policy, of an individual's proclivity for violent behavior. And there are no diagnostic techniques, interviews, or psychometric instruments which predict future violence with a great degree of accuracy in all populations.

Relatively infrequent events are particularly hard to predict. Murder, for instance, is more difficult to predict than more common offenses, such as domestic violence, due to its low base rate of occurrence. The accuracy of such predictions, however, varies greatly based on a number of variables, not the least of which is the period of time for which the behavior is being predicted. Accuracy is low for long-term clinical prediction of violence, because of low base rates of various assaultive behaviors, but also due to often vague measures of violence which can produce a high rate of false positives (Monahan, 1981).

Apperson, Mulvey, and Lidz (1993) found that the accuracy of clinical violence prediction can be influenced by a host of factors including the prediction techniques and outcome measures, the composition of the study sample, as well as the duration of the follow-up period. Interestingly, they also found that 80% of violent episodes in their sample took place over 72 hours post-admission, which speaks to the importance of longer follow-up periods, particularly

since many studies have restricted their prediction time frame to the first few days after psychiatric admission (McNiel, Binder, & Greenfield, 1988). By virtue of the limited period of time they cover these studies tend to confine violence risk assessment to patients displaying more acute psychotic symptomotology. But Hoptman et al. (1999) question the relevance of such studies to the assessment of patients in forensic patients, where residents are frequently transferred from other supervised settings in which their more severe psychotic symptoms are likely to have been remediated through some kind of treatment.

Early studies on the accuracy of clinical judgment in predicting future instances of violence suggest accuracy rates by trained professionals (psychologists, psychiatrists, social workers, and other forensic experts) no greater than those of laypersons (Swanson, 2008). In an early review by Monahan (1981) it was found that psychiatrists and psychologists evaluating institutionalized mentally ill patients, who had committed violence in the past, were accurate in no more than 1 of every 3 predictions of violent behavior over the 2-year period during which they were followed. A striking limitation of such findings, however, is the lengthy follow-up periods on which they are based. More recent studies examining clinical judgment in predicting future violence indicate that the accuracy of such predictions improves dramatically when limited to shorter periods of time (McNiel et al., 1988; McNiel and Binder, 1991; Apperson et al., 1993). McNiel and Binder (1991; 1995) examining risk assessment with psychiatric patients in civil hospitals, also found that clinical predictions of violence were more accurate than chance when the period of prediction was restricted to 1 week. In one such study, in a sample of 226 patients, they reported a sensitivity of 67% and specificity of 69% of their risk assessments.

Scott and Resnick (2006) identify 5 components of dangerousness that may aid clinicians conducting violence risk assessments. The first is the magnitude of the potential harm, which

includes the likely target of violence, whether the behavior is likely to involve harm to property or to person, and whether this harm is physical or psychological. All of these elements are said to be critical to understanding the degree of anticipated harm. The second of these main components is the likelihood of this harm, that is, the probability of the violent behavior and therefore the seriousness of an individual's intent to harm. Evaluation of an individual's past violent behavior, of course, can be helpful in predicting whether violent acts are likely to be carried out in the future. The third and related component is an examination of the frequency of the threatened behavior. Beyond simply being a measure of past behavior, however, it takes into account the number of times a particular act has occurred over a particular span of time, with greater frequency aggressive behaviors suggesting a greater risk of those behaviors occurring again in the future. The fourth component speaks to the immediacy of the threat, for instance, whether an individual is threatening to act on violent thoughts within a few hours versus within a few days or months. The final component Scott and Resnick identify includes a complex of situational factors, such as association with deviant peer group, involvement with illicit drugs or alcohol, access to weapons, and a host of socio-economic variables, from limited financial resources to family association with criminality.

In predicting future violence Scott and Resnick also propose dividing aggressive behavior into affective violence and predatory violence. Where the former involves violent behavior in response to a perceived threat, the latter is thought to be more dangerous in that it often occurs in the absence of identifiable antecedents. However, in affective aggression, where an individual identifies a target of violence, the hostile behavior can be a reaction to a perceived threat based on an internal sense of anxiety or fear rather than from the external environment. Both types of aggression can lead to deliberate, purposeful, and goal directed violence. If there is one

distinguishing feature of the types of aggression identified by Scott and Resnick, it is the level of remorse typically experienced and displayed by their perpetrators; predatory aggression is seldom accompanied by remorse for the violent act.

Actuarial Versus Clinical Methods of Violence Prediction

While violence risk assessment is commonplace in forensic psychiatric settings, the focus on the development of assessment instruments and decision making models in violence prediction has generally proceeded along two lines of research, one focusing on clinical models and the other on actuarial models. Traditional reliance on individual clinical impression as the sole source of decision-making has come increasingly under fire. Grove and Meehl (1996), and Grove (2005) echo the sentiments of many critics when they described the clinical method as "informal" and "subjective" and "impressionistic." (Grove & Meehl, 1996, pp 293-294). These same critics have hailed the actuarial method as more formal and precise. The last two decades have seen the growth of these actuarial violence risk assessment instruments based on studies identifying predictor variables shown to be related to future violence. Once evaluated on these risk variables (for instance, during an evaluation of a psychiatrically hospitalized forensic patient, in consideration of placement in a less restrictive setting) an individual is later followed-up in order to evaluate what combination of variables were best predictive of later violence. Another approach to the evaluation of violence risk comes from the development of structured clinical instruments. These tools were developed out of previous research and clinical experience rather than derived through follow-up of samples of individuals. They guide clinicians' decision-making in evaluating an individual's violence risk potential. These seemingly disparate techniques have led to what Monahan (1981) long ago called the "Clinical Versus Actuarial Debate."

The seminal work by the MacArthur Foundation (Monahan, 2001), and data on which the largest studies to date examining risk factors for violence in institutionalized patients are based, have tended to conclude that actuarial methods were greatly superior to clinical methods of prediction, and have demonstrated the largest effect sizes on predictive accuracy across clinical samples. A specific criticism of structured clinical evaluations is the subjectivity of their methods, in that they are thought to guide therapeutic decision making but that the final determination is arrived at, for all intents and purposes, intuitively and impressionistically (Loewenstein, Weber, Hsee, & Welch, 2001). These data suggest that the debate seems to be hardly a debate at all, and that unstructured clinical violence risk assessments were long ago shown to be inferior. Others, however, do not feel that the debate is dead, or at least not beyond resurrecting (Buchanan & Leese, 2001; Litwack, 2001). They argue that the implied superiority of actuarial methods over clinical assessment has not been established, and that such judgments are based on faulty interpretation of study data. For instance, Rice, Harris, and Quinsey (2002) and other critics suggest that the accuracy of actuarial methods has been greatly overstated in light of the low base rate of violence, which produces an inordinate rate of false positive errors. That is, many non-violent individuals are falsely classified as high risk and may be falsely sanctioned or detained in order to accurately capture the few individuals who represent an actual threat of violence. But even the base rate of violent offending in psychiatric populations is hotly debated, as studies have found rates from 25% (Monahan et al., 2001), 30% (Harris, Rice, & Quinsey, 1993), to even 50% (Rice, Harris, & Quinsey, 2002), which greatly affects the confidence with which predictions can be made.

While extreme positions on this debate and over reliance on solitary methodologies or philosophies should be suspect, there is growing consensus in the literature that risk assessment

decisions that are based exclusively on clinical impression are inadequate. Studies have demonstrated that actuarial techniques can lead to high levels of predictive accuracy in various psychiatric populations (Buchanan & Leese, 2001). At the same time, strict adherence to actuarial prediction methods has also been criticized. While the use of actuarial models has gained in popularity, several studies have raised specific criticisms regarding their use. Douglas, and Ogloff (2003) suggest that they offer only vague estimates of risk, and that they lack generalizability beyond specific populations. Silva, Weinstock, and Leong (2003) suggest that such instruments do little to guide violence prevention and management of risk, and that results obtained are generally insensitive to change.

The distinction between actuarial and clinical instruments is not always so clear. Litwack (2001) conducted a review in which he compared actuarial and clinical violence risk instruments, and pointed out that many actuarial methods include elements which require clinical judgment. In any case, the literature appears to bear out the dangers of using any of these measures in isolation. Use of actuarial instruments represents an effort to standardize violence risk assessment but is not meant to replace all other methodologies. Borum (1996) indicates that these measures are simply meant to guide clinical judgment so that it is consistent with sound and prevalent research. Glancy and Chaimowitz (2005) remind us that while the debate continues, the preeminent goal of risk assessment in clinical practice is the reduction of harm and the management of threat. As such, all techniques and tools which inform clinical decision making should be considered.

Structured professional judgment has evolved as another research-based technique for the assessment of violence risk. This model utilizes a professional guideline approach to decision making (Hart, 1998; Otto, 2000; Hart, 2001; Hart, 2001; Douglas & Kropp, 2002; Douglas &

Ogloff, 2003; Douglas et al., 2003), and has led to the development of numerous schemes for guiding clinical judgment. As is common to other methods based on the professional judgment technique of violence risk assessment, mental health clinicians review all clinically relevant and available data in order to identify whether particular risk factors are present. These risk factors are described, defined, and operationalized based on the research literature examining their relationship with violence, and a final judgment of violence risk is then made based on these factors. At the same time, the benefits of actuarial prediction cannot be discounted. Their pitfalls are many, and include limited generalizability, the potential exclusion of low base rate but crucial information, the use of relatively static variables, and their arguably limited contribution towards informing treatment, prevention, and management of violence. As elucidated above, however, actuarial prediction increases reliability and predictive accuracy, and promotes accountability and transparency in risk evaluation. Three of the most popular risk assessment schemes, which vary in their clinical vs. actuarial orientation, are the Historical/Clinical/Risk Management 20-item (HCR-20) scale (Webster, Douglas, Eaves, & Hart 1997), Psychopathy Checklist Revised (PCL-R) (Hare et al., 1991), and the Violence Risk Appraisal Guide (VRAG) (Harris & Rice, 1991; Harris, Rice, & Cromer, 2002). These instruments attempt to provide more structured and systematic approaches to the prediction of violence and the determination of dangerousness, as well as offering a clearer path to decision making and a view of the factors considered in making those determinations, while allowing for some scrutiny of the rationale behind the decisions that are made.

Risk Assessment Instruments

Clinicians who conduct violence risk assessments are increasingly relying on standardized instruments to guide their evaluations and aid in their predictions. These tools not only direct information gathering but can tie clinical judgment to existing research on the variables most

relevant to the assessment of future violence. The PCL-R is among the most validated and widely used risk assessment instruments. As its name implies, it is designed to measure an individual's psychopathic characteristics, such as callousness, remorselessness, lying, and failure to accept responsibility for behavior. Higher scores on this measure have been found to be associated with higher rates of recidivism in various clinical populations (Hare, Clark, Grann, and Thornton, 2000). The PCL-R uses specific scoring criteria to rate each of 20 items along a 3-point scale (from 0 to 2) derived from a semi-structured interview and available historical information. An individual's total score can range from 0 to 40, according to how much their responses are representative of the psychopathic prototype, with scores over 30 generally being reflective of significant psychopathic tendencies (Vitacco & Rogers, 2001). While it was originally developed as a measure for this specific personality disorder, it has become increasingly used as a risk assessment tool because it has demonstrated predictive accuracy in many populations and for all types of violent offenses (Gray et al., 2004). Hart et al. (1991) demonstrated that the PCL-R has a stable factor structure which captures affective and interpersonal traits as well as the behavioral elements of psychopathy. And Cooke (1998) has demonstrated the favorable psychometric properties of the PCL-R. Hare also developed a 12-item screening version of the PCL-R called the PCL-SV. Hill, Rogers, and Bickford (1996) demonstrated that this brief adaptation has good predictive validity when used to estimate violence within institutional settings. Monahan et al. (2000) have also demonstrated its predictive validity in community violence. However, Freedman (2001) and Salekin, Rogers, and Sewell (1996) suggest that the PCL-R has the potential to over predict violence because it may fail to measure factors which mediate and moderate the likelihood of future violence, such as protective positive attributes that mitigate against violence including resiliency and social competence.

Also, Dolan and Doyle (2000) point out a potential confound in that some of the PCL-R and PCL-VR items may be bound to the outcome variables of interest, like violence itself, in such checklist items as past criminal activity. They recommend various methods for statistically controlling for this potential problem, including removing these items from analysis. Nonetheless, there is ample evidence for the efficacy of this instrument for predicting violence in mentally ill criminal offenders (Gray et al., 2007).

The Historical/Clinical/Risk Management 20-item (HCR-20) scale is a risk assessment instrument developed by Webster et al. (1997) which combines clinical judgment of risk with an evaluation of relevant historical factors. The HCR-20 is named for its 20 risk factors which comprise the 3 domains of historical factors, clinical factors, and risk management factors. One of the clinical items is psychopathy, and is determined through use of the PCL-R. The HCR-20 was developed to be used with a wide variety of clinical and offender populations, and its effectiveness in predicting violent behavior has been demonstrated in numerous studies (Gray, Hill, McGleish, & Timmons, 2003). In separate retrospective analyses Strand, Belfrage, Fransson, and Levander (1998) and Douglas et al. (1999) have demonstrated the predictive accuracy of the HCR-20 in various forensic and civil psychiatric populations. While Grann, Belfrage, and Tengström (2000) and Belfrage, Fransson, and Strand (2000; 2004) have obtained similar results in prospective analyses. According to Gray and colleagues and Douglas and colleagues, the HCR-20 has also been found to be a better predictor of community violence than the PCL-SV. They also noted that in regression analyses the HCR-20 added significant predictive accuracy beyond the PCL-SV alone, and that the growing body of data appears to suggest that the HCR-20 may be a superior instrument for the prediction of violent recidivism in psychiatric populations than the PCL-R or PCL-SV.

The Violence Risk Appraisal Guide (VRAG) (Harris et al, 1991) differs significantly from the risk assessment instruments described above in that it represents an attempt at a statistically derived and algorithmic approach to evaluation of violence risk. It is an empirically derived actuarial instrument based on the authors' review of files from 1965 to 1980, of adult male psychiatric patients treated in a maximum security treatment facility, to predict violent recidivism. Specifically, they examined recidivism among more than 800 serious offenders, approximately half of whom were patients in a forensic psychiatric facility while the other half consisted of non-psychiatric convicted criminals. The VRAG uses 12 personal characteristics of an offender to give the probability, in terms of a percentage, that a criminal offender will commit a new violent offense within a specified period of time (typically with access to the community), and provides a comparison of an offender's risk potential to other offenders. It should be noted that the 12 items on the VRAG are scored using a weighing procedure developed by the authors based on a calibration sample of 618 men who committed serious, violent and/or sexual offenses and that the heaviest weighting is the PCL-R score (Dolan & Doyle, 2000). In addition to psychopathy, items are related to general antisocial tendencies including childhood behavior problems, a history of non-violent offending, and other personality disorders. The VRAG is one of the most extensively researched actuarial risk assessment instruments, and its utility and predictive validity have been widely demonstrated with a variety of populations, client cultures, and treatment settings (Lindsay et al., 2008), including individuals with intellectual deficits (Quinsey, Book, & Skilling, 2004). Using Receiver Operator Characteristics (ROC) curves, Rice and Harris (1995) found that the VRAG predicted violent re-offending with Area Under the Curve (AUCs) of 0.75, 0.74, and 0.74 for 3.5, 6, and 10 years, respectively. However, they reported less impressive results in their examination of the VRAG's predictive accuracy with

sexual recidivism in a population of pedophilic sex offenders. Webster et al. (1994) criticize the VRAG for its reliance on static factors and recommends that it be supplemented by a clinical checklist which may better capture the contribution of dynamic factors.

Numerous studies are beginning to emerge that directly compare the predictive accuracy of both actuarial and structured clinical risk assessment instruments on the same sample of offenders. Remarkably, many of these studies have reported few significant differences between these instruments in their ability to predict future violence (Barbaree, Seto, Langton, & Peacock, 2001; Kroner & Mills, 2001; Sjostedt & Langstrom, 2001; Tengström, et al., 2001; Glover, Nicholson, Hemmati, Bernfeld, & Quinsey, 2002). The prediction of future violence is far from an exact science. But as clinicians are increasingly called upon to assess patients' level of dangerousness and their potential for future aggressive behavior, they must increasingly rely on various techniques guided by research findings on which to ground their decisions. Mental health clinicians typically do not make unequivocal statements regarding an individual's future behaviors, but rather make probabilistic statements about the likelihood of future behavior. As such, their predictions will not always be correct. The use of valid and appropriate risk assessment tools in conjunction with a detailed history and clinical evaluation, however, greatly increases the accuracy of assessment of future dangerousness.

CHAPTER 3
MATERIALS AND METHODS

Methodology

Study Setting

The present study is an attempt to characterize the utility of diagnostic variables as predictors of violence in a population of residential mentally ill criminal offenders during the acute care phase of their treatment. This study examined residents of the North Florida Evaluation and Treatment Center, admitted over a 3-year period (between July 2006 and July 2009). The center is a 216-bed maximum security evaluation and treatment facility where individuals are committed by various Florida courts as either Incompetent To Proceed to trial (ITP) or Not Guilty by reason of Insanity (NGI) by virtue of major mental disorder, and on a multitude and range of criminal offenses. The center averages approximately 20 admissions per month. Residents are admitted from a number of jurisdictions compromising the criminal courts system of the State of Florida, from county jails, state psychiatric hospitals, and community placements. The stated mission of the facility is to evaluate, treat and discharge men with mental disorders, committed by criminal court, in a safe and secure environment and in a manner which ensures proper safety, security and respect for human rights. A team of psychiatrists, nurses, psychologists, counselors and paraprofessionals develops a service plan for the evaluation and treatment of each resident with the goal of a successful return to the court or community. Final diagnostic formulations are based on comprehensive review of data obtained at this secure forensic mental health treatment facility.

All residents are directly observed by treatment staff at maximum intervals of 30-minutes, 24-hours a day, 7-days a week. Residents of this facility reside in single rooms but interact with peers and staff, including treatment and security staff, and other personnel throughout the center.

A multidisciplinary treatment team evaluates each resident at least once per week during their first month of admission and then each month thereafter. All staff members maintain chart notes and share observations about each resident's behavior and their abilities and interactions with other members of the facility. This information is then used in the evaluation and treatment of residents with the goal of restoring them to competency and providing for their eventual placement needs.

Data Collection

All residents of the forensic psychiatric facility receive a comprehensive clinical evaluation consistent with treatment standards. This evaluation includes psychiatric and psychological interviews and testing by licensed clinicians, information obtained by daily observations from staff, records from previous mental health providers, and review of court and other legal documents. Therefore, the majority of assessment procedures included in the present study were part of the usual treatment approaches and practices of the facility, with the exception of the coding of chart notes retrospectively by a single evaluator and subsequent data analysis. All medical, psychological, and legal information, along with all relevant demographic characteristics were entered into a secure database in accordance with established privacy statutes.

Recording of aggressive and noncompliant behaviors are incorporated into the treatment facility's daily operations and standard operating procedures. While all staff members are involved in reporting of these incidents, documentation is typically carried out by each resident's counselor, psychiatrist, nurse, case worker, and unit staff members, each of whom has the closest and most frequent contact with each resident. During the study period several hundred ratings of aggression and disruptive behavior were retrospectively coded from these chart notes in order to characterize aggressive behavior in the sample.

Clinical, socio-demographic, and legal information was obtained through direct interview with each resident and extensive review of medical and other records. Psychiatric symptoms and diagnoses were formulated from discrete clinical judgments based on criteria from the Diagnostic and Statistical Manual, Fourth Edition, Text Revision (DSM-IV TR, APA 2000). When available, historical and clinical information was also obtained from collateral sources, including family members and other appropriate informants.

Incidents of verbal and physical aggressive behavior while at the treatment facility were assessed and documented by ward and other treatment staff and recorded in each resident's chart. These incidents were then retrospectively coded using a modified version of the Overt Aggression Scale (OAS) in order to determine the frequency and nature of violence perpetuated by each resident in the sample over the first 5 weeks of admission to the treatment facility. And the presence of historical and clinical variables were examined in order to identify factors associated with these aggressive behaviors. Interventions by treatment staff, also contained in ward records, were also included in the analyses in order to determine the predictive utility of these variables in light of treatments each participant may have received in direct response to their aggressive behaviors.

Measures

The three main measures used in this study were a modified version of the Overt Aggression Scale (OAS), the Historical/Clinical/Risk Management 20-item (HCR-20) Scale, and the Brief Psychiatric Rating Scale (BPRS). Each was used to operationalize aggression severity and type, violence risk, and clinical symptom severity, respectively.

The Overt Aggression Scale (OAS)

A modified version of the OAS by Yudofsky, Silver, Jackson, Endicott, and Williams (1986) was used to describe the frequency and severity of aggressive behavior of each

participant. The original instrument was designed to be used by treatment professionals to record incidents of aggression and violence as they occur, in a variety of settings (including work-place, medical, and psychiatric). It was developed to assess not just the prevalence of aggression but the nature of that violence in psychiatric populations. The OAS is a standardized behavior checklist for the rating of episodes of four types of aggression as they occur: verbal aggression, physical aggression against others, physical aggression against self, and physical aggression against objects. The OAS appraises each of these types of aggressive acts along a range of severity by adding weightings to violent incidents in each of these categories. While ward chart notes documented all types of acting out observed by staff as it occurred, the study analyses required the retrospective coding of these behaviors for each participant along the dimensions of the OAS checklist, adapted to include each 1-week period of the first 5 weeks after each participant's arrival.

A variation of the OAS, called the Modified Overt Aggression Scale or MOAS (Sorgi, Ratey, Knoedler, Markert, and Reichman, 1991) was developed during the course of a later study to assess the effects of Nadolol (a beta-blocker) on aggressive behavior when the original OAS was found to lack usefulness because it required evaluators to record isolated incidents of aggressive behaviors every time an individual displayed that behavior. This met with significant practical limitations. It is not difficult to imagine the challenge this would pose to treatment staff in typical psychiatric settings, where a patient is likely to display any number of behaviors many times over the course of a day. It would simply be impractical for them to stop what they are doing and separately record each behavior every time it occurs. The MOAS represented an attempt to correct this limitation by evaluating longitudinal trends. Unfortunately, while it included the same 16 behavior items as the OAS it eliminated the section on interventions. For

the purposes of the current study, the contribution of therapeutic interventions, particular the direct responses by staff to instances of aggressive behavior were instrumental to the analyses. Therefore, the original OAS was chosen as the method of recording aggressive behavior but was employed as a retrospective scale to capture each 1-week period of behavior, much as the MOAS was designed to do.

The OAS scale has been found to demonstrate good internal, interrater, and test-retest reliability (Kay, Wolkenfeld, & Murrill, 1988). It has also demonstrated utility in capturing more subtle forms of aggression that might otherwise go unrecorded. Reports of inappropriate behavior in inpatient settings frequently underestimate the prevalence of aggressive behavior (Larkin, Murtagh, & Jones, 1988), and incidents of verbal abuse, destruction of property and attempted assaults are often ignored. According to Kay et al. the OAS allows for balanced representation of overt aggression, though it has acknowledged limitations as a result of its subjectivity.

Knoedler (1989) reported on the usefulness of the MOAS in discriminating among different patterns of aggressive behavior. According to his data on the validity and reliability of the MOAS subscales, the types of behaviors which distinguish each subscale are appropriate in terms of the developmental course, as it were, of the progression of violence it attempts to capture. He also demonstrated that different raters select similar subscales to characterize observed aggressive behaviors. Smith (1988) argued that these types of scaling procedures represent necessary requirements if one is to conduct clinical studies involving the use of ordinal statistics for comparing MOAS subscale levels.

Smith (1988) also suggested that the four behavioral subscales of the MOAS should be scored separately, because each subscale describes a different type of aggressive behavior. He

argued that listing the scores for each subscale separately allows clinicians to identify changes, for instance, from a pattern of physical aggression to one of verbal aggression or vice versa, while an overall score remains unchanged. This change over time, however, was not a focus of the present study.

A criticism of both the OAS and MOAS that has been levied in the past, and which is important to recognize, is that both treat data as if they were measurable on an interval scale. Smith (1988) argued that aggression does not lend itself to such measurement, and if misused this instrument can lead to significant misinterpretation of results. He provided a useful example in illustrating this danger by noting that "one black eye [does not] equal three swearwords plus a mouthful of spittle." (p. 1081). At the same time, the overall OAS score provides a metric for aggressive severity that lends itself well to analyses supporting the use of continuous variables. Therefore, while the analysis of aggression severity in this study will proceed along these lines, in order to address the prior criticism, each type of aggressive behavior defined by the OAS will also be treated as discrete categories in an analysis characterizing aggressive subtypes in the population. When properly used the OAS has been a successful adjunct to a variety of assessment and intervention studies. It represents an attempt at a concise, standardized clinical scale for the measurement of aggressive behavior that can ultimately enhance behavior and mental status reporting.

The strength in the OAS, as it was utilized in the present study, was in its utility to assess trends in aggressive behavior over time and with repeated measurement. By setting limits on how the scale is to be applied, and acknowledging that the derived numerical scores have specific limitations in how they may be interpreted and applied, the OAS proved to be a useful scale for evaluating aggressive behavior in this study setting.

As used in the present study, the scale consists of four categories of aggression (Appendix A-1), verbal aggression, self-directed aggression, aggression against others, and aggression against objects. Each of these categories contains 4 statements that describe aggressive behaviors of increasing severity. When a patient was noted to have engaged in a violent behavior, all of those statements which are applicable to that behavior were checked off by the evaluator and assigned a weighted score whose range varies by the scale: verbal aggression is scored on a scale from 1 to 4; aggression against objects on a scale from 2 to 8; physical aggression against self is scored on a scale from 3 to 12; and physical aggression is scored on a scale from 4 to 16. Additionally, an intervention rating is given in order to assess the severity of a specific behavior by capturing the force of a direct response by staff to that behavior. For instance, the use of physical restraints or intramuscular medication to address a resident's misbehavior garners a higher aggression severity score than a behavior requiring no intervention or only a verbal reprimand. Additionally, because the highly structured and controlled setting could reasonably be thought to limit the full expression of an individuals' aggression potential if, for instance, they were put into isolation or restraints in response to misbehavior thereby limiting their ability to re-offend (and leading to a dramatic underestimation of their level of violence potential) use of this intervention score was not only substantiated in the present study but offered an approach to conducting evaluations of this type in extremely structured environments.

The frequency and severity of these four types of aggression were thereby documented, and a global measure of aggression severity was derived from the sum of the weighed scores (with verbal aggression being assigned the lowest weight and physical aggression the highest) using the most serious behaviors in each category (with a range of possible scores of 0 to 16),

and a score representing the sum of all interventions conducted to address the behavior. Thus, the overall total score reflects the number of incidents over time, their severity, the type of aggression committed, and the response to the aggression, and is a psychometrically validated method developed by the OAS authors. The OAS has also demonstrated adequate interrater and test–retest reliability coefficients, typically in the range of 0.78 and 0.87, respectively (Amore et al., 2008) and as high as 0 .9 for each (Krakowski et al., 1986; Krakowski et al., 2004).

As mentioned, the OAS was used to rate all incidents of violence retrospectively in the current study, based on careful monitoring of residents and all their behaviors occurring in the treatment setting over the evaluation period. These included behaviors within their rooms, in common areas, during both group and individual activities, and on the grounds of the facility. This was aided by video surveillance and cycles of routine monitoring by personnel in 15 and 30-minute intervals. Staff-reported incidents of non-compliance and violence, along with impressions of each resident, including their mood, demeanor, subjective distress, and verbalizations during conversation were also typically included in ward notes. When overt aggression occurred, it necessitated detailed information and documentation from treatment staff of the event and staff response.

The retrospective nature of behavior reporting in the present study successfully captured a variety of aggressive behaviors performed by patients daily, allowing estimates of the frequency and intensity of each type of aggressive behavior for each week of the 5-week study period. While this method may not represent an exact accounting of every aggressive act during this period, the benefits of a concise and standardized measure of aggression appears to outweigh the limitations of this strategy.

In addition to identifying those variables most strongly associated with violence, the effects of various interventions were also taken into account, as each resident's medication regimen and status (e.g. restriction, seclusion, and restraint) had a potential effect on the measurement of their overall overt aggression scores. For the purposes of this study, aggression was operationally defined as any single occurrence of a behavior listed on the OAS instrument.

Historical/Clinical/Risk Management 20-item (HCR-20) Scale

For each subject, demographic and psychiatric information obtained through clinical interview and extensive review of patient records were used to code the 10 Historical (static) and 5 Clinical (dynamic) correlates of violence risk identified by the HCR-20 and supported by research and established practice guidelines elucidated above (Appendix Figure B). Historical subscale items include the following: Previous Violence; Young Age at First Violence; Relationship Instability; Employment Problems; Substance Use Problems; Major Mental Illness; Psychopathy; Early Maladjustment; Personality Disorder; and Prior Supervision Failure. Clinical subscale items include the following: Lack of Insight; Negative Attitudes; Active Symptoms of Major Mental Illness; Impulsivity; and Unresponsiveness to Treatment. Each item is coded on a 3-point scale with values of 0 (available information does not indicate the presence of the item), 1 (available information suggests the possible presence of the item), and 2 (available information indicates the presence of the item). Because use of the Psychopathy Checklist (PCL) is required in order to complete the psychopathy item of the HCR-20, subject data were also coded in order to capture the 12 items encompassing the screening version of this instrument (the PCL-SV). These items include an evaluation of emotional and interpersonal characteristics (including grandiosity, superficiality, lack of empathy, deceitfulness, and lack of remorse or personal responsibility) and behavioral attributes (lack of behavioral control and impulsivity, childhood and adult antisocial behavior, and irresponsibility and lack of goals).

The HCR-20 normally includes 5 Risk Management Items that capture elements related to release and treatment planning, and required services and support. Risk Management items were not completed as a matter of standard practice at this facility, as residents are considered to have just arrived at the time their first comprehensive psychological evaluation is conducted, and during which much of this study's data were obtained. As Gray et al. (2003) point out in their study of the efficacy of the HCR-20 in predicting self-harm in mentally disordered offenders, omission of the Risk Management items is justified in cases where the projection of conditions relevant to release and discharge planning on which these scores are based are either not possible or not relevant to the imminent evaluation of risk. Therefore, the HCR-20 measure in actuality captured only the15 Clinical and Historical items, and will instead be referred to simply as the "HCR" for the purposes of the present study.

Assessment of Psychiatric Symptoms Using the Brief Psychiatric Rating Scale (BPRS)

In order to evaluate a broader range of psychological symptom variables than the HCR Clinical items are able to capture, each subject was assessed using the Brief Psychiatric Rating Scale (BPRS). Ratings were completed weekly, with scores averaged across the 5-week evaluation period. The BPRS was originally developed by Overall and Brown (1962) as a quick way to measure psychiatric symptom change over time, in various clinical populations and with individuals with a wide range of diagnoses. It has since become one of the most commonly used semi-structured instruments for the assessment of psychiatric symptoms in both clinical and research settings (Jacobs, Ryba, & Zapf, 2008). The original 16-item BPRS was expanded to 18 items with the addition of the two symptom items of excitement and disorientation (Overall & Klett, 1972), and later to 24 items through the addition of six more symptom items, including bizarre behavior, elevated mood, motor hyperactivity, distractibility, self-neglect, and suicidality (Lukoff, Nuechterlein, & Ventura, 1986). These additions were made in order to increase the

instrument's sensitivity to a broader range of psychotic and affective symptoms (Ventura, Nuechterlein, Shaner, & Liberman, 2000). The BPRS is particularly useful in helping to judge the effectiveness of treatment in patients who have moderate to severe psychoses (Fayek, Kingsbury, & Simpson, 2002).

Trained clinicians rate each of these symptom constructs along a 7-point Likert-type scale of severity ranging from 1 indicating "not present/no impairment" to 7 indicating "extremely severe" in order to best describe a patient's present state. These judgments are based on both observation and verbal reports by the patient, and depend on the symptom domains being assessed. The BPRS allows for the extraction of symptom clusters and dimensions, which vary somewhat from study to study, but typically include positive and negative symptoms of psychosis, mania, and depression and anxiety. The symptoms comprising each cluster of the 24-item BPRS are as follows: a) positive symptoms encompass bizarre behavior, unusual thought content, disorganization, hallucination, and suspiciousness; b) negative symptoms include blunted affect, motor retardation, emotional withdrawal, and self-neglect; c) mania comprises motor hyperactivity, elevated mood, excitement, distractibility, hostility, and grandiosity; and d) depression/anxiety encompass depression, anxiety, suicidality, and guilt (Lukoff et al., 1986). Each BPRS provides well elucidated anchor points and probe questions for each item which, when accompanied by appropriate clinician training, have been shown to increase the reliability of BPRS scores (Ventura, Green, Shaner, & Liberman, 1993). Numerous studies have demonstrated the sensitivity, effectiveness, and good interrater reliability of the BPRS as a measure of psychiatric symptoms over time (Hedlund & Vieweg, 1980; Hafkenscheid, 1993; Ventura et al., 1993; Roncone et al., 1999; Lachar et al., 2001). These studies have also examined the BPRS across psychiatric settings, and with clinicians who varied in their level of

training on the instrument. Concordance rates across all BPRS items were found to be adequate when based on patient verbal report and behavior, demonstrating acceptable internal validity (Greenwood & Burt, 2000). And good concurrent validity has been demonstrated, with high correlations between global and subscale scores between the BPRS and the Brief Symptom Inventory.

BPRS symptom data have been factor analyzed in a number of studies, in order to clarify facets of mental illness gathered from various psychiatric populations. But the vast majority of these analyses have been conducted using the 16- and 18-item BPRS, and generally have limited their investigations to a subset of patients, such as chronically ill schizophrenics (Malla & Norman, 1983; Overall & Beller, 1984; Long, Harring, Brekke, Test, & Greenberg, 2007). There exist only a few published factor analyses of the 24-item BPRS. Van der Does, Dingemans, Linszen, Nugter, and Scholte (1993) reported a four-factor model, similar to the one described above, using a population of recent-onset schizophrenia patients. Their principal components analysis of the BPRS scores yielded a four-dimensional structure (positive symptoms, negative symptoms, disorganization, and depression) and a categorical analysis resulted in predominantly positive, negative, and disorganized clusters (though more than half of their sample reportedly could not be classified to any of these groups). Dingemans, Linszen, Lenior, and Smeets (1995) demonstrated a five-factor solution using a more diverse population of psychiatric patients. They added the BPRS items of Elevated Mood, Distractibility, and Motor Hyperactivity, to the 18-item version in order to form a "disorganization" factor. Van der Does and colleagues (1993) had used this same structure but termed the factor "mania." Using a sample of mentally ill homeless subjects Burger, Calsyn, Morse, Klinkenberg, and Trusty (1997) also reported a five-factor solution for the 24-item BPRS. They termed these factors positive symptoms, negative

symptoms, anxious–depressive symptoms, hostile–suspiciousness, and "activity." Overall, it would seem that the research supports these types of factor structures but that the specific composition of factors for each version of the BPRS varies across samples.

Therefore, the present study utilized the 18-item BPRS instrument with 5-factor structure that has been well-validated for use with populations of psychiatrically hospitalized forensic patients (Appendix Figure A-3). These 18 clinical variables can be viewed as clusters of closely related symptoms, with each factor indexing a single underlying latent construct whose individual items correlate more highly with each other than with symptom items in other clusters. These factors are Affect Symptoms (which includes somatic concern, anxiety, guilt, and depressed mood), Positive Symptoms (consisting of conceptual disorganization, grandiosity, hallucinatory behavior, and unusual thought content), Negative Symptoms (consisting of emotional withdrawal, motor retardation, and blunted affect), Resistance Symptoms (including hostility, suspiciousness, and uncooperativeness), and Activation (with the symptom variables of tension, mannerisms and posturing, excitement, and disorientation).

Correlations between BPRS symptom clusters as well as BPRS items were examined to determine which psychiatric symptoms and symptom clusters were related to the types and frequencies of aggressive behaviors observed, and to individual historical and demographic variables. Subsequent analyses were conducted to examine the multi-determined relationships between symptoms, aggression, and patient history variables.

Analytic Strategy

Descriptive statistics and frequency distributions of the averaged aggression rating were examined to characterize the nature and prevalence of aggression in the study sample during the evaluation period. Initial analyses using Spearman's correlations were used to examine the relationship among continuous variables, while Chi-square tests were used to test the difference

between categorical variables. Principle analyses consisted of using logistic and multiple regressions to compare the utility of the clinical, historical, and demographic characteristics in building predictive models of aggression and violent behavior. Subsequent analyses utilized Receiver Operating Characteristics (ROC) curves, areas under the curve (AUCs), and odds ratios in order to address traditional criticisms of measures of predictive accuracy when they are highly dependent on the base rate of the criterion variable, such as correlation and indexes obtained from 2x 2 contingency tables (false positives and false negatives). Because violence is a relatively low base rate event, even in this population, ROC provided a more efficient method of estimating the predictive relevance of individual patient variables. According to Rice and Harris (1995) studies of risk assessment typically demonstrate a base rate of violence below 50%. At these levels, they argue, the base rate of the criterion variable significantly weakens the size of correlations. Additionally, ROC curves can be applied to data consisting of continuous predictor variables (such as symptom severity) and a dichotomous dependent measure (such as membership in a subtype of violent offending). Areas under the curve (AUCs) were used as a measure of accuracy for identified predictive factors. While odds ratios were used to evaluate the effect of individual patient characteristics on violence group membership (as defined by the OAS). Douglas et al. (1999) recommend a cutoff of 2.5 or 3.00 as the lower demarcation of a strong association.

The AUC value (also known as the concordance index or c-statistic) provided by the ROC curve is a combined measure of sensitivity and specificity that serves as an indicator of the overall performance of the logistic regression functions. In other words, this statistic is interpreted as the percentage of all possible pairs of cases in which the model assigned a greater probability to a correct case assignment than to an incorrect case assignment. It is the average

value of sensitivity for all possible values of specificity, with values ranging from 0 (no discriminating power) to 1 (perfect accuracy). Chance-level performance is indicated by an AUC of 0.5, represented by a diagonal line on the graph. Therefore, while the numerical value provided by the AUC is informative ROC plots can also be used to define detection cut-off points. A general guide to the accuracy of a function is as follows: 0.90 -1, excellent; 0.80-0.90, good; 0.70-.080, fair; 0.60-0.70, poor; 0.50-0.60, fail.

ROC curves can have different levels of diagnostic value (Figure 3-1, left). Each of these ROC curves have different AUCs. Line A, which is never observed in real world cases, represents a perfect test, where the area under the ROC curve=1. The diagonal line represents chance level and has an AUC of .5. Curves B and C, which lie between these two extremes, represent curves with actual predictive value. Line B, with the wider arch that hugs the X axis has the greater AUC and, therefore, would have a greater ability to distinguish between violent and non-violent cases in the sample.

Additionally, ROC curves with equal AUCs can have different levels of diagnostic value. (Figure 3-1, right). Both of these curves have the same areas under the ROC curve, but they are not equivalent. In the high sensitivity range (high false positive range), test B is superior. While in the low sensitivity range (false positive rate range) test A is superior.

In order to perform the full ROC curve analysis the residuals obtained in the logistic regression analyses were entered as independents, with the dichotomous violence dependent serving as the classification variable. Residual analysis proceeded utilizing an analog of Cook's distance, *D*, which is a measure of the influence of each case in the regression function taking into account the impact of individual cases as well as the magnitude of their standardized

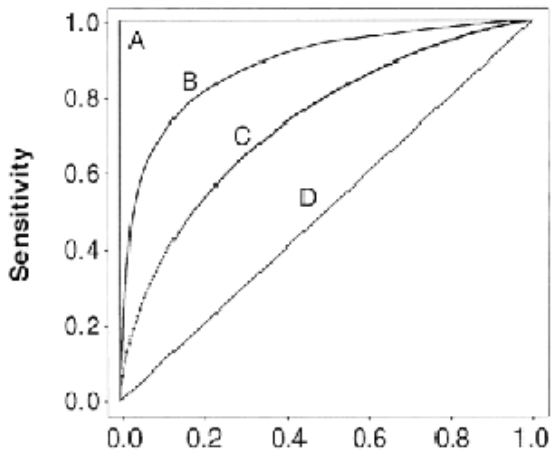
residuals. Given the concern regarding the effect of extreme scores in the sample, this statistic also provides a measure of the effect that deleting cases has on residuals for all other cases.

It should be noted that the determination of adequate sample size presented as a complex problem throughout the analyses. Sample size calculations were based on the number of covariates and the smallest proportion of negative cases in the sample, in accordance with criteria suggested by Peduzzi, Concato, Kemper, Holford, and Feinstein (1996). Additionally, regarding parameters for the standard error of area, analyses were conducted assuming a nonparametric distribution. (The smooth or "fitted" ROC curves represent parametric estimates, while the empirical (non-parametric) ROC curve are rutted due to the discrete points on which they are based). Tables 3-1 and 3-2 display summaries of each statistical strategy.

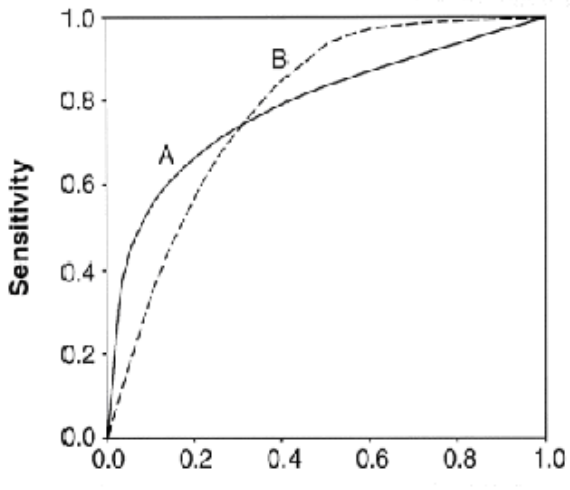
Treatment of Outliers

Extreme scores were expected within a population of mentally ill criminal offenders on measures of mental illness (symptom severity) and maladaptive behaviors (aggression). Because a conceptual priority throughout the design and implementation of this study was its real-world applicability it was felt that elevated scores, in particular, represented naturally occurring phenomena and statistically valuable information. When outliers were identified, an examination of these cases was conducted to see whether individual scores on relevant measures differed significantly so that these deviations could be adequately characterized. Capturing the influence of all scores in the data set was consistent with the conceptual and design priorities of the author. However, the potential impact of outliers on a sample of this size could not be taken too lightly. Therefore, each analysis was conducted both with and without the identified outliers excluded from the data set.

Figure 3-1. Receiver Operating Characteristics (ROC) Curves of Varying Predictive Value



1-Specificity



1-Specificty

Note: Adapted from Park, Mo Goo, and Jo (2004)

Table 3-1. Summary of principal univariate analyses conducted.

Variables	Purpose	Statistic	Examples
Categorical	Sample characteristics	Frequencies, Percentiles	Primary diagnosis
	Group differences	Pearson's Multidimensional Chi-square	Ethnicity
			Abuse history
			Head trauma
			Religious affiliation
			Admission number
			Charge severity
			Presence of violence
			Type of violence (verbal/physical)
			Veteran status
			Treating psychiatrist
			Marital Status
Continuous	Sample characteristics	Descriptives	Age
	Correlations	Spearman's Rho	Education
			Mini Mental Status Exam score
			Beck Hopeless Scale score
			HCR scores (Total, Clinical, and Historical subscales)
			OAS scores (Aggression Severity)
			BPRS scores (Affect, Positive, Negative, Resistance, and Activation clusters, and Total score)

Note. BPRS = Brief Psychiatric Rating Scale, HCR= Historical/Clinical/Risk Management violence risk assessment scheme; OAS = Overt Aggression Scale.

Table 3-2. Summary of principal multivariate analyses conducted.

Purpose	Statistic	Variables in each equation
Aggression vs. non-aggression	Logistic Regression	Model A (HCR Total)
	Receiver Operating Characteristics (ROC)	Model B (HCR Total + BPRS Total)
	Area Under the Curve (AUC)	Model T (HCR Historical + BPRS Activation + BPRS Withdrawal + Age)
Aggression severity	Multiple regression	Model A (HCR Total)
		Model B (HCR Total + BPRS Affect + BPRS Positive + BPRS Resistance + BPRS Activation)
		Model T (HCR Historical + BPRS Activation + BPRS Withdrawal + Age)
Aggression category (verbal/physical)	Logistic Regression	Model A (HCR Total)
	Receiver Operating Characteristics (ROC)	Model B (HCR Total + BPRS Total)
	Area Under the Curve (AUC)	Model T (BPRS Subjective Tension)

Note. BPRS = Brief Psychiatric Rating Scale, HCR= Historical/Clinical/Risk Management violence risk assessment scheme; OAS = Overt Aggression Scale.

CHAPTER 4
RESULTS

The final sample consisted of 102 mentally disordered male criminal offenders residing in a maximum security forensic treatment facility. These were sequentially assigned cases to this single author in the Department of Psychology of the North Florida Evaluation and Treatment center (NFETC). The sample initially consisted of 105 participants but 3 were excluded due to incomplete records (this unavailability of pertinent records also precluded an assessment of any differences between the excluded cases and the final study sample). Sample characteristics are presented in Appendix B.

Of these cases, 92 had been adjudicated by their committing court and admitted to the NFETC as ITP, while 10 had been adjudicated as NGI. Treatment modalities for residents at the facility did not differ between type of disposition. Multi-dimensional Pearson's Chi-square confirmed that there was no relationship between disposition (NGI vs. ITP) and subject classification as aggressive or-non-aggressive, χ^2 = (1, N=102)=1.448, p=0.315, and no relationship between disposition and verbal aggression, Pearson's χ^2 (1, N=102)=0.222, p = 0.638, or physical aggression, χ^2 =(1, N=102)=1.478, p=0.224.

The ethnic/racial composition of the study sample was as follows: 67 African Americans (65.7%), 30 Caucasians (29.4%), 4 Hispanic (3.9%), and 1 Asian (1%). The mean age of the sample was 36.75 (SD=12.44) with a range of 19 to 77 years. The mean level of education was 12.58 (SD=11.82). For 74 of these residents (72.5%) this was their first admission to this facility, while 24 (23.5%) of the residents in this sample were on their second admission, and 4 (3.9%) were on their third. In each case, the evaluation period consisted of the first 5 weeks of the most recent admission for each subject.

The distribution of primary intake diagnoses for participants, corresponding to DSM-IV classifications (2000), was as follows: 83 (81.4%) Schizophrenia and Other Psychotic Disorders, 9 (8.8%) Mood Disorders, 1 (1%) Anxiety Disorders, 1 (1%) Adjustment Disorder, 7 (6.9%) Substance Related Disorders, and 1 (1%) Delirium, Dementia, and Amnestic and Other Cognitive Disorders. It should be noted that many of residents carried overlapping psychiatric diagnoses, particularly co-morbid substance abuse/dependence as well as a host of medical problems. Nonetheless, these primary diagnoses correspond to and are consistent with established procedures favoring parsimony in computerized record keeping. Primary intake diagnosis was made by one of 5 attending psychiatrists who also completed the weekly BPRS ratings. Multi-dimensional Pearson's Chi-square confirmed that there was no relationship between rater and symptom severity as assessed by the BPRS factor scores.

The severity of participants' criminal offenses was assessed by noting the most severe charge in each case according to the Florida Criminal Code (2009) which is consistent with established protocol in the reporting of crime statistics (FBI Unified Crime Reports, 2004). The distribution of charge severity in this sample was as follows: 7 (6.9%) 1st degree felonies, 40 (39.2%) 2nd degree felonies, 44 (43.1%) 3rd degree felonies, and 11 (10.8%) capital offenses.

Appendix tables B-1 and B-2 present the descriptive characteristics of the sample, including the distribution of scores across relevant measures (i.e. HCR, BPRS, and OAS scores) and other variables, including total, subscale, and factor scores in each case. The mean HCR Total score was 18.7 (*SD*=4.99, range: 7-30). The mean HCR Historical items subscale score was 12.73 (*SD*=3.66, range: 3-20). And the mean HCR Clinical items subscale score was 6.02 (*SD*=2.2, range: 1-10). The tables of sample characteristics also include the proportion of aggressive and non-aggressive cases based on the author's operational definitions (n=59 and 43,

respectively), the frequency of specific behaviors in each category of aggression captured by the OAS, and other relevant features of the sample.

Univariate Analyses

Bivariate correlations were conducted in order to identify salient associations between variables. It was hypothesized that these relationships were likely to be influenced by some combination of several factors.

While non-parametric correlations were initially proposed in order to sidestep all parametric assumptions about the nature of the underlying data distribution, a number of methods were employed to examine the univariate normality of the data.

First, the author employed the visual method for detecting outliers from scatterplot and boxplots of the relationship between the interval level variables to identify cases that had an unusual value for a single variable. This was followed up by conversion of each variable score to standard scores. Due to the sample size univariate outliers were identified as cases with standard scores of ±3.0 or beyond. Using these techniques, a few outliers were identified in both the dependent and independent measures, including 3 subjects who consistently produced exceedingly high scores on most measures.

Before deciding whether to retain or omit outliers from the analyses an examination was conducted of the raw scores that made these cases outliers (Appendix C-1). In each case scores were consistent and in the correct direction of the anticipated relationship. Because nonparametric tests are based upon rankings of magnitudes the contribution of extreme values in terms of the interval measures was greatly reduced compared to their effect in parametric statistical tests. Therefore, no transformations were undertaken and it was decided that these scores would be retained. Multivariate normality was addressed separately in subsequent analyses.

Spearman's rho was utilized as the non-normal distribution of some data (particularly from demographic and lower order variables rather than principle dependent measures) required the use of non-parametric tests.

As indicated previously, numerous demographic variables have been found to be associated with violent behavior. The majority of these relationships, however, were not replicated in this sample and very few were found to be associated with the presence of aggression, or associated with its severity or type.

As expected, an association was found between the BPRS total score (the measure of symptom severity) and aggression frequency (r=.281, p<.001) and aggression severity (r=.298, p<.001). A small association was also found between aggression severity and Positive Symptoms (r=.251, p=.001), Resistance (r=.248, p=.001), and Activation (r=.307, p=<001), and between aggression frequency and these same symptom clusters (r=.261, p=.001; r=.237, p<.001; and r=.314, p<.001, respectively). Surprisingly, no association was discovered between Negative Symptoms and aggression. Likewise, there was no relationship found between Beck Hopelessness Scale score (BHS; a measure of pessimism about the future and a useful diagnostic measure of suicidality in clinical populations) and aggression. Therefore, the anticipated "protective benefits" of depression in individuals with mental illness, as it relates to aggressive behavior, was not observed in this sample.

In both the aggressive and non-aggressive samples Pearson's multidimensional Chi-square tests failed to reveal significant relationships between aggression severity, and between aggression type (verbal vs. physical) and any of the following categorical variables: primary diagnosis, treating psychiatrist, disposition (ITP vs. NGI), charge severity, admission number, ethnicity, veteran status, religious affiliation, marital status, trauma/abuse history, head trauma

history, or suspicion of malingering. However, the relationship between charge severity and aggression category approached significance in the aggressive-group, Pearson's χ^2 (3, N=102)=7.526, p=.057. While an association between admission number and aggression severity trailed a little further behind when the whole sample was considered, Pearson's χ^2 (74, N=102)=92.933, p=.068.

Due to the presence of multiple predictor variables comparisons of the individual contributions of each could not be accomplished by contrasting the simple correlation coefficients. Subsequent statistical techniques were chosen to capitalize on both the nominal and interval nature of the measures in exploring the linear relationships between predictor and criterion variables. Risk, symptom, and aggression severities (as assessed by HCR, BPRS, and OAS, respectively) were each measured on a continuous scale by using their overall/total scores, as was aggression frequency (also provided by the OAS instrument).

Multivariate Analyses

Correlations amongst predictor variables was expected given that both the BPRS and the HCR Clinical subscale, in particular, examine psychological functioning and assess aspects of an individual's presenting symptoms. This initially presented as a concern in what inferences could eventually be drawn regarding the relative contribution of each predictor variable to the success a given model. However, correlations typically revealed weak associations between HCR, BPRS, and OAS scores. As many of the variables were correlated, however weakly, it was impossible to attribute the variance in the dependent variable explicitly to any one independent variable. On this basis, logistic regression was used to test several models based on a combination of HCR subscale scores, BPRS individual and item factor scores, and other salient personal variables, on the dichotomous dependent variable of identification of subjects as aggressive vs. non-

aggressive, with any codable behavior lending to a classification as "aggressive." Multiple regression techniques were then used to test the predictive utility of these models in assessing an individual's level of aggression severity during the evaluation period, with scores on the OAS serving as the criterion. Finally, frequency of aggressive acts was used to identify subjects as primarily verbal aggressors or physical aggressors, and the utility of the models in making these predictions was evaluated. It was thought that, taken together, these could characterize aggressive behavior in the sample and provide useful estimates of a participant's likelihood of violent behavior and level of aggression severity.

While variables could not be manipulated directly as in the case of a controlled experiment, these techniques allowed a test of several models in order to clarify precisely which of the observed sets of variables (scores on a number of predictors) are influencing the results and which of these gives rise to the best prediction of violence (the criterion variable).

It should be noted that multiple regression typically requires a large number of observations in order to have sufficient power to obtain meaningful results. The number of cases should far surpass the number of predictor variables included in the regression. According to Tabachnick and Fidell (2001) a minimum of five times as many participants as predictor variables is necessary, while ten times is considered acceptable. The current investigation utilizes a subject sample 11 times the number of predictors under investigation.

Aim 1 - Predicting Aggression vs. Non-Aggression

Normality

Non-parametric alternatives were employed for all analyses. However, an examination of residuals was conducted to assess the normality of errors and homoscedasticity assumptions. An assessment of QQ plots indicated that linearity assumptions were not violated. And inspection of the correlation matrix revealed most correlations were in the range of 0.2-0.3, with only one

reaching 0.40, indicating that no problems of multicollineraity between constructs existed. An analysis of the standardized residuals identified 1 case beyond the 2 SD multivariate cutoff commonly recommended (case# 6635, SD=2.08552; standardized residuals greater than 2.58 are outliers at the .01 level, while those greater than 1.96 are outliers at .05 level). Because outliers are cases that have an unusual combination of values for a number of variables, and can significantly affect regression results, serious consideration was undertaken to evaluate whether this case should be excluded from the analysis since, as previously mentioned, capturing extreme scores was consistent with the conceptual priorities of this study. Visual inspection of this individual case revealed relationships between variable scores that were in the anticipated and logical directions. And because this case essentially fell on the cut-off point (which could as easily have been set at 3 SD given the conceptual framework of this study), it was felt that this case should be included in the analysis. However, due to the relatively small sample size the potential effect of outliers is amplified considerably. For this reason, rather than removing this case from the analysis it was modeled separately.

Model A

In order to test a "real world model" representing standard practice in violence risk assessment, an analysis was run with HCR Total score as the sole regressor (hereafter referred to as Model A). Examination of the case processing summary revealed that no cell was empty or particularly small, and that all cases were used in the analysis. The classification table presented the initial success rate for this analysis before the regressors (predictors) were included. This intercept-only (or "null") hypothesis provided a baseline for comparing the improvement of subsequent models in correctly classifying cases. It indicated that 100% of the observed aggressive subjects would be correctly categorized prior to inclusion of these predictors, while none of the non-aggressive subjects would be correctly predicted. It also estimated an overall

correct classification rate of 57.8%. With the predictor included the number of cases correctly classified rose marginally to 59.8%. Correct assignment of aggressive subjects was 79.7%, while correct assignment of non-aggressive subjects was 32.6%.

Omnibus test results provided a measure of the ability of all predictors in the model to jointly predict the dependent variable. The "Enter" method was employed in which all model terms were entered in one step. The finding of a significance likelihood ratio χ^2 (1, N=102)=7.849, p<0.1) indicated that the predictor in Model A was significantly related to the response variable (classification as aggressive versus non-aggressive), indicating adequate fit of the data to the model. The -2 log likelihood value (132.041) indicated a good fit when compared with the null model, which also indicated that the predictor was significantly related to the response variable. Assessment of the Hosmer and Lesmeshaw test values provided an additional measure of goodness-of-fit between the observed and predicted number of cases in the aggressive vs. non-aggressive conditions. This test is considered more robust than the traditional χ^2 test, particularly in cases such as those in this study when continuous covariates are in the model and sample size is relatively small. The high p value, χ^2 (8, N= 102)=6.71, p=.568, is another indication that the model adequately fit the data.

As HCR Total score was the only regressor, it provided the only coefficient (along with the constant) for the linear logit equation. The coefficient in the equation for violence, which was found to be significant in Model A is indicated as 0.110, Wald's χ^2 (1, N= 102)=6.277, p<0.05, while the *Exp(B)* multiplier is 1.116. The coefficient for HCR Total score means that, on average, a one point increase in HCR score adds 0.1 to the log odds in favor of a participant being correctly identified as aggressive. That is, the odds in favor of a subject being aggressive are multiplied by $e^{0.1}$=1.116. This small effect was confirmed by the Nagelkerke R^2 value in the

model summary**,** which indicated that the predictor was accounting for only as much as 8.7% of the variation in classification. Therefore, the effect of the independent variable on the odds ratio in the final model was negligible.

The analysis was re-run with the identified outlier excluded. The case processing summaries revealed that the excluded case was one that was classified as non-aggressive, and that the null hypothesis now demonstrated a 58.4% overall accuracy of case classification (up slightly from 57.8% in the original null model). With the outlier removed from the regression analysis correct assignment of violent subjects remained unchanged at 79.7%, while correct assignment of non-violent subjects increased modestly from 32.6% to 33.3%, with a proportional increase in overall accuracy from 59.8% to 60.4%. The overall model was still significant, χ^2 (1, N= 102)=7.849, p<0.001, indicating that the predictor in the model was still significantly related to the response variable of violence classification. Other model fit indices were comparable to the previous analysis, including -2 log likelihood of 129.291, and Hosmer and Lesmeshaw χ^2 (8, N= 102)=7.889, p=0.444, all indicating adequate fit of the data.

The effect on the revised sample was still small, with the predictor in the model now accounting for up to 10.1% of the variation in classification (a modest increase from 8.7%). This indicates that the effect of the independent variable on the odds ratio in the final model was negligible, and that removal of the outlier from the analysis added little to the strength or predictive utility of the HCR Total score.

The coefficients in the equation for violence changed negligibly, though the HCR Total score, which was approaching the .001 level of significance now achieved it, Wald's χ^2 (1, N= 102)=7.090, p<0.01. The coefficient in the equation for aggression increased from 0.110 to 0.120, while the *Exp(B)* multiplier increased from 1.116 to 1.128. These values, therefore,

remained essentially unchanged, suggesting that the identified "outlier" should be retained in subsequent analyses in order to preserve the integrity of the data.

Model B

The effects of including the BPRS Total score in this basic model were then evaluated, as the additive benefit of this clinical symptom measure in predicting violence above and beyond the HCR alone is a basic question clinicians utilizing this measure would pose. Model B, therefore, includes HCR and BPRS as regressors in the 2-predictor model.

The classification table for the null hypothesis indicated the same initial overall classification rate of 57.8% prior to inclusion of the regressors in the model. With inclusion of the Model B regressors this rose to 62.7%, with a correct classification rate of 78% for aggressive cases (down from 79.7% in the HCR-only model) and 41.9% correct classification of non-aggressive cases (up from 32.6%). The omnibus test for model coefficients indicated that the model as a whole was significant χ^2 (2, N= 102)=9.161, p=0.01, and indicators of model fit were comparable to those in Model A (with -2 log likelihood=129.72; and Hosmer and Lesmeshaw Test χ^2 (8, N= 102)=6.149, p=.631). The combined variable model accounted for 11.5% of the variation in classification (up slightly from 8.7% in Model A). Additionally, examination of the regression coefficients indicated that the BPRS variable contributed negligibly to the model, as HCR Total was the only significant variable, B=0.100, χ^2 (1, N= 102)=5.054, p<0.05.

The overall correct assignment of cases increased from 58.4% to 62.4% in the outlier-excluded condition, with correct assignment of violent cases down from 79.7% to 77.6%, and correct classification of non-aggressive subjects up from 33.3% to 41.9%. With the outlier excluded the overall model continued to be significant χ^2 (2, N=102)=9.003, p=.010, and model fit indices are still adequate (-2 log likelihood=128.776**,** and Hosmer and Lesmeshaw Test χ^2 (8,

N=102) = 6.273, *p*=.617). The amount of explained variation in classification remained at 11.5%, with or without the outlying case in the analysis. And once again, the HCR Total score continued to be the only statistically significant variable in the model, Wald's χ^2 (1, *N*= 102)=4.957, *p*<0.05, *B*=0.099. Exclusion of the outlier had no appreciable effect on the model or the observed contribution of its variables.

Test Model (Model T)

Model T is a 4-predictor model consisting of variables chosen based on both theoretical considerations as well as the correlations observed in the univariate analyses. This model includes HCR Historical score ("Historical"), BPRS Activation cluster score ("Activation"), BPRS Emotional Withdrawal item score ("Withdrawal"), and participant age. Results of the regression analysis with these added variables indicated that the overall percentage of correctly assigned cases to aggression group increased from Model A, from 59.8% to 66.7%. The percentage of correctly classified violent cases was unchanged at 79.7%, but the correct classification of non-violent cases rose from 32.6% to 48.8%. These represent minor improvements in the initial model, and speak to the questionable utility of the added variables in adding to the accurate prediction of aggressive subjects, though there appears to be a marked improvement in the classification of non-aggressive cases.

The measure of the ability of all predictors in the model to predict the dependent variable was again given by the omnibus test, which indicated a significant likelihood ratio χ^2 (4, *N*= 102)=18.403, *p*=.001, and a good model fit. The observed -2 log likelihood value (120.478) also indicated a good fit when compared with the null model, meaning that at least one of the predictors in the Test Model was significantly related to the response variable. This statistic is necessary in contrasting models with dissimilar numbers of regressors as it evaluates the

significance of the change in χ^2 that results from the removal of additional regressors from the full model. The Hosmer and Lesmeshaw test table confirmed the model fit between the observed and predicted number of cases in the aggressive vs. non-aggressive conditions, χ^2 (8, N=102) = 2.237, p=.973, indicating once again that the model adequately fit the data.

The coefficients for the linear logit equation indicated that the intercept (constant) and the coefficients of each regressor produced the following logit equation representing the contribution of each of the predictors:

Logit= 0.111(HCR H) + 0.175(BPRS Activation) - 0.065(Age) + 0.532

However, the p values from Wald's Tests for all but the age and BPRS Activation variable were non-significant, indicating that History and Withdrawal had a negligible effect. The BPRS Activation variable appeared to exercise the most influence on whether or not someone was classified as aggressive or non-aggressive, (Activation B=0.175, Wald's χ^2 (1, N= 102)=.730, p<.05) followed by participant age (Age B=-0.056, Wald's χ^2 (1, N=102)=8.086, p=.01). The effect of the independent variables on the odds ratio is given by *Exp(B),* with the odds ratio determined by dividing 1 by the *Exp(B)* value. This indicates that participants of greater age were 0.945 times more likely to be aggressive (therefore *less* likely to be aggressive). Also, participants with higher Activation cluster scores (i.e. who experience symptoms related to general agitation) were 1.191 times more likely to be aggressive. This small effect is confirmed by the Nagelkerke R^2 value that measures the strength of these of associations and indicates that the predictors in the test model are accounting for up to 22% of the variation in classification; a relatively small amount, but a considerable increase from the HCR-only model of 8.7%

The interpretation of the coefficients can be awkward. In this case, for instance, for a unit increases in age the log odds of being aggressive versus non-aggressive increases by B=-0.056.

For the sake of clarification coefficients are exponentiated and interpreted as odds-ratios, given by the value of *Exp(B)*. In this case, for each year a participants' age increases their odds of being violent decreases by a factor of 0.945 (values less than 1 indicate that an increase in the value of the predictor variable is associated with a *decrease* in the odds of the event). The 95% confidence interval values indicate that the magnitude of this decrease is likely to be in the range of 0.910 to 0.983. And for each unit increase in BPRS Activation score, the log odds of being aggressive versus non-aggressive increases by B=0.175, corresponding to each 1 point increase on the Activation score increasing the odds of being aggressive by a proportional amount (by a factor of *Exp(B)*=1.191 ($CI_{.95}$=1.035,1.369).

This 4-predictor regression analysis was re-run with the previously identified outlier excluded from the analysis. Classification accuracy was essentially unchanged across each group. The rate of correctly identified violent subjects remained unchanged at 79.7%. Classification accuracy of non-violent subjects increased slightly from 48.8 % to 52.4%. And there was a small increase in overall correct classification from 66.7% to 68.3%. Re-examination of goodness-of-fit measures including likelihood ratio χ^2 (4, N=101)=21.532, p<.001), -2 log likelihood (115.609), and the Hosmer and Lesmeshaw Test χ^2 (1, N= 101)=3.691, p=.884, continued to indicate adequate fit of the data to the model, and that at least one of the predictors was significantly related to the response variable. It should be noted that the Omnibus Tests of Model Coefficients was significant at a greater statistical level. With the outlier removed from the analysis both the Age and Activation items remained statistically significant (Activation, B=0.193, Wald χ^2 (1, N=101)=6.725, p=.01; Age, B=-0.064, Wald χ^2 (1, N=101)=9.600, p<.01). Removal of the identified outlier also allowed the HCR Historical item to achieve statistical significance (B=-0.131, Wald's χ^2 (1, N= 101) = 4.138, p<.05).

Only Withdrawal failed to influence the model. History now exercised a comparable degree of influence classifying cases as Activation (*B*=.131, with associated odds ratio *Exp(B)*=1.140, $CI_{.95}$=1.005,1.293). Participant age exercised the least amount of influence while still remaining significant, and the predictors now accounted for up to 25.8% of the variation in classification, an increase from 22.2% in the function that included the outlying case.

Taken together, elimination of the outlier from the regression analysis had a significant impact in that the relative contribution of the History variable achieved statistical significant. However, its relative contribution was quite small, and the relationship between variables and their relative combined effects in the model predicting aggression classification changed marginally. Additionally, the overall predictive accuracy with the outlier removed increased very little, from 66.7 % to 68.3 %, with an equally small increase in the explained variation in classification from 22% to 25.8%.

Results of these analyses suggest that young age and increased Activation cluster symptoms had a significant effect in the prediction of violence in the Test Model, while the Historical subscale score of the HCR (which characterizes static variables related to participants' past experiences) contributes as well, but only when extreme cases are excluded from the analysis. Otherwise it contributes negligibly to the correct classification of individuals as aggressive or non-aggressive. Despite findings that mood symptoms (and depression in particular) may serve as a protective factor in violence risk, Emotional Withdrawal (a BPRS item that captures this clinical entity) appears to have negligible predictive value. Table 4-1 displays the success rates of each model, while Table 4-2 displays the correlations, odds ratios, and influence of individual predictors in each model in correctly classifying non-aggressive and

aggressive cases. Tables 4-3 and 4-4 display these same values derived from analyses with the outlier excluded from consideration.

Graphical Evaluation of Predictive Models

Model T, which includes the variables of age, Activation, Withdrawal, and History appears to be render better overall rates of accurate classification of cases than those that are based solely on the HCR Total score (Model A, and the traditional measure of violence risk), and Model B (the addition of BPRS Total score to the HCR measure) which speaks to their relative predictive utility. However, additional diagnostic measures should be applied before such assertions can be made. The histogram of predicted probabilities or classplot (Figure 4-1) provides an alternative way of assessing correct and incorrect predictions under the Test Model.

The X axis indicates the predicted probability from 0.0 to 1.0 of the dependent classification (aggressive vs. non-aggressive) being classified 1. Zero corresponds to predicting that a subject will be non-aggressive, while 1 indicates that he will be aggressive. The line of N's and Y's under the X axis indicate that a prediction of 0 to 0.5 corresponds to the case being classified as non-aggressive, and 0.6 to 1 corresponds to a case being classified as aggressive.. The Y axis indicates the number of cases classified (frequency). Inside the plot are columns of observed N’s and Y's corresponding to no-aggression and yes-aggression classifications.

A look at the plot of observed groups and predicted probabilities of the Test Model using the whole sample reveals a principally normal distribution rather than the desired U-shaped distribution, which indicates that the predictions were not well-differentiated. Instead, the classplot suggests that many predictions were close to the cut point of 0.5, which would in turn suggest poor model fit. There also appear to be a number of errors; Y's to the left are false predictions of subjects as non violent, while the N’s to the right are false predictions of subjects as aggressive. However, the plot also reveals that Model T classified difficult cases fairly well

(those at $p = 0.5$), which likely explains the adequate numerical goodness-of-fit indicators reported above.

A final method for evaluating the logistic regression model makes use of Receiver Operating Characteristics (ROC) curve analysis in which the model's predicted values are used to differentiate between positive and negative cases. The power of these values to accomplish this differentiation in cases is quantified by the Area under the ROC curve (AUC).

The logistic regression analysis of Model A (the "real world" model) identified a significant function using HCR Total score as the sole regressor, Wald's χ^2 (1, N= 102) = 6.277, p<.05. It produced an overall correct classification rate of 59.8%, with a correct assignment of violent subjects of 79.7%, and a correct assignment of non-violent cases of 32.6%. The ROC curves based on this model reveal the true diagnostic utility of the HCR total score when used alone, with a fair AUC value of 0.649 (p=.011, $CI_{.95=}$.543-755) for aggressive cases (Figure 4-2), but poor prediction of non-aggressive cases, with an AUC=0.351 (p=.011, $CI_{.95=}$.245-457) (Figure 4-3).

An additional Model A ROC curve was created with the outlier excluded from the dataset. This produces very similar results in both the aggressive classification AUC (.660, p<.01, $CI_{.95=}$.554-.765; rather than .649) and non-aggressive classification (.340, p<.01, $CI_{.95=}$.235-.446; down from .351). Additionally, the form of the ROC curves are essentially identical and do not reveal any substantial differences in predictive reliability from the analysis utilizing all cases.

With the addition of BPRS Total score Model B was also found to be significant overall χ^2 (2, N=101)=9.161, p=.01, producing a slightly improved overall correct classification rate of 62.7%. But this improvement was based on an increase in the successful classification of non-aggressive cases (to 41.9%) rather than better identification of aggressive subjects (which

actually fell 1 point to 78%). This is reflected in the ROC curve for Model B, which describes a very different function from the one produced by Model A. It describes an observed correct classification of aggressive cases far below chance (AUC=.266, p<.001, $CI_{.95=.}$169-.364) (Figure 4-4) but superior correct classification of non-aggressive cases (AUC=.734, p<.001, $CI_{.95=}$ .636-.831) (Figure 4-5), with similar values observed with the outlier removed; AUC=.717, p<.001, $CI_{.95=}$.616-.817, for non-aggressive cases and .283, p<.001, $CI_{.95=}$.183-.384, for aggressive cases. Additionally, with the outlier removed, the forms of the ROC curves are essentially identical and do not reveal any substantial differences in predictive reliability from the analysis utilizing all cases.

The numerical and graphical output for the ROC analyses (Table 4-5, Figures 4-6 and 4-7) indicates the true diagnostic value of the proposed model (Model T). Once again, the addition of the BPRS items in the model appears to have created a function that describes a very different relationship from the one observed in the HCR-only Model A, and one which is similar to Model B, which not coincidentally also utilized a BPRS variable (Total score). Violence group classification drops sharply in Model T compared to the HCR-only model when predictions are made based on the proposed logistic regression (AUC=.312, p=.001, $CI_{.95=}$.210-.141) (Figure 4-6). However, prediction of non-aggressive cases based on the Test Model is vastly superior (AUC=.688, p=.001, $CI_{.95=}$.586-.790). (Figure 4-7). Examination of the combined plot (Figure 4-8) suggests that an essentially inverse but proportional relationship is obtained, with both the Test model and Model B evidently predicting opposite events from the HCR-only model, and doing so fairly well, and showing proportional deficiencies in the prediction of membership in the other group.

With the outlier removed these values did not change appreciably. As before, the nature and magnitude of the observed relationships were essentially unchanged, with a similar and equally poor AUC for classification of aggressive cases in the Model T (.312, p=.001, $CI_{.95=}$.210-.414, down from .313) and fair AUC for classification of non-aggressive cases (.687, p=.001, $CI_{.95=}$.585-.790, down from .688). The form of the curve also did not reveal substantial differences in the previously observed relationships.

Aim 2 – Predicting Aggression Severity

Normality and statistical considerations

The use of multiple regression requires adherence to similar restrictive assumptions of logistic regression, including multivariate normality of the data, the assumption of homogeneity of variance-covariance matrices, and the avoidance of multicolinearity. Given a larger sample size these procedures are sufficiently robust to cope with some skewness. But the problem of outliers is particularly serious given the study sample, and required probing of the data for violations of these underlying assumptions.

In order to evaluate the presence of outliers for subsequent multivariate analyses the author evaluated Mahalanobis D^2, a multidimensional version of the z-score that measures the distance of a case from the multidimensional mean (centroid) of a distribution given the multidimensional variance (covariance) of the distribution. A case is considered a multivariate outlier if the probability associated with its D^2 is 0.001 or less. It should be noted that D^2 follows a χ^2 distribution with degrees of freedom equal to the number of variables included in the calculation. Mahalanobis D^2 requires that the variables be metric, therefore this statistic is applicable to the interval level variables used to explore aggression severity in this study, which is measured as a continuous variable. In the dataset, no cases had Mahalanobis D^2 with a probability less than or equal to 0.001, and therefore no cases were excluded from these analyses.

Though there was an adequate theoretical basis to expect some variables to exert a greater influence over the Model T (for example, ratings of "hostility" more than "motor retardation" in predicting aggression within BPRS symptom clusters), the vast majority did not lend themselves easily to combinations reflecting firm theoretical considerations or grounding in previous research findings. Therefore, the "Enter" (simultaneous) method was used to evaluate the relative contribution of each predictor variable in the multiple regression analyses. This also served to address concerns regarding sample size.

The square of the measure of correlation (R^2) specifies the proportion of the variance in the criterion variable which is accounted for the proposed model, thereby providing a measure of how good a prediction one can make of the criterion variable by knowing the predictor variables. It should be noted, however, that an adjusted R^2 value is used that takes into account the number of variables in each of the models as well as the number of subjects/observations on which each model is based. This provides the most constructive measure of a model's success. Standardized Beta weights (β), measured in units of standard deviation, are calculated to provide a measure of how strongly the predictors impact the criterion variable, with higher beta values indicating greater influence of the predictor variable on the criterion variable. Beta regression coefficients were computed in order to assess these associations and compare the strength of each predictor and criterion variable's relationship.

The first multiple regression analysis was conducted in order to once again evaluate the "real-world" model (Model A) in which HCR Total score is the sole regressor. The next analysis evaluated the inclusion of BPRS factor scores to this function (Model B). Finally, the Test Model T variables of participant age, History, Activation, and Withdrawal were entered into a separate regression in order to evaluate their utility in predicting aggression severity.

Model A

Examination of the model output revealed that Model A was significant, $F(1, 2)=11.308$, $p=.001$, but that it accounted for only 9.3% of the variance in aggression severity scores; not a particularly good model (Adjusted $R^2=0.093$). This corresponds to a small effect size (f^2) of 0.1025. As Model A had only one regressor, ANOVA results confirmed the same overall model significance. As the HCR total score was the sole regressor in this analysis, it is necessarily the sole influence ($\beta=0.319$) that along with the absolute t value ($t=-3.363$, $p=0.001$) suggests that this variable was having a moderate impact on the aggression severity score. As Model A represents an evaluation of the traditional violence risk assessment instrument, the observed relationship follows the expected course: as the total score increases on this measure of violence risk there is an observed increase in the severity of aggression observed in the sample. Specifically, the Model A β value indicates that a change of one point in this predictor variable will result in a positive change of 0.319 standard deviations in aggression severity score.

Model B

The resilience of the multiple regression procedure allowed for the exploration of the contribution of a greater number of predictors than in the previous version of Model B and capture the utility of BPRS factor scores without the need to subsume them under the BPRS Total score. A-priori sample size calculations for multiple regression indicated that with a desired statistical power level of 80%, an alpha level of .05, and a small anticipated effect size, the number of predictors (not including the regression constant) could be safely increased to 5 (the calculations in fact revealed that a sample size of 97 would have sufficed). Univariate analyses identified 4 of the 5 BPRS factor scores as correlated, though weakly, with aggression severity. These included the following: Affect ($r=0.212$, $p<.05$), Positive Symptoms ($r=0.244$, $p<.05$), Resistance ($r=0.251$, $p<.05$), and Activation ($r=0.336$, $p<.001$). No Negative Symptom

cluster items (which are comprised of Emotional Withdrawal, Motor Retardation, and Blunted Affect) were found to be associated with aggression severity. It is noteworthy, however, that Emotional Withdrawal was found to be associated with the *presence* of violence in the sample but not its severity, which supports its previous inclusion in Model T. These BPRS factor scores were then entered into the Model B multiple regression analysis with the HCR Total score, in order to compare this combined model to the HCR-only Model A.

Table 4-7 indicates the descriptive characteristics of the study sample based on these new variables. The overall model was found to be statistically significant, $F(5,96)=3.908$, $p<.01$) and now explained 12.6% of the variance in aggression severity. This represents a very modest improvement over Model A (at 9.3%). The Adjusted R^2 of 0.126 corresponds to a moderate increase in effect size ($f^2= 0.144165$). But further examination of the coefficients revealed that only History was significant ($t=2.853$, $p=.005$). The BPRS factor scores appeared to contribute negligibly to the Model B function.

Model T

Examination of model output confirmed the overall significance of the Model T $F(4,97)=11.308$, $p=.001$) and indicated that the model now accounted for a similar percentage of the variation in aggression severity scores at 12.3%, down from 12.6% in Model B but still improved from Model A. This also corresponded to an increase in effect size ($f^2=0.140251$). Overall, however, this was still not a great model. Examination of the coefficients further revealed that only Activation ($t=3.227$, $p<.001$) and History ($t=2.40$, $p=.05$) were significant variables, with the former exercising a slightly greater influence on the model (Activation $\beta=0.303$; History $\beta=0.225$). Age and Withdrawal appear to have had a negligible impact on the model. This is not surprising as neither was found to be associated with aggression severity in the earlier univariate analysis, but both were retained in order to preserve the consistency of the

model. It should be noted that colinearity diagnostics revealed no significant correlations between predictor variables (History Tolerance value= 0.987, *VIF*=1.013; Activation Tolerance value=0.985, *VIF*=1.015). Post-hoc statistical power calculations given the observed alpha level, the number of predictors, the observed R^2, and the sample size indicate an observed power of 0.9377. Therefore, though the effect size of this model falls within the moderate range, the odds of observing an effect when it occurs are quite good. Table 4-8 displays a summary of each regression analysis with the relative contribution of each predictor in modeling aggression severity.

Aim 3 - Predicting Aggression Category

The final analysis attempted to characterize the nature of violence in the study sample. Once subjects were identified as either aggressive or non-aggressive (based on the same criteria employed in the initial logistic regression) and variables were evaluated for the degree of their association with aggression severity, final analyses were conducted to characterize aggression subtypes and test the predictive utility of Model T compared to Models A and B in successfully classifying these cases. The 4 violence groupings articulated in the modified OAS aggression instrument (verbal aggression, physical aggression against objects, physical aggression against self , and physical aggression against other persons) were re-worked in order to characterize subjects as primarily verbal aggressors (Verbal) and physical aggressors (Physical). This transposition was easily affected as the aggressive behaviors of all subjects but one were characterized primarily by one of these 2 types based on a simple frequency of behaviors. The remaining case achieved higher scores within the self-harm grouping of the OAS instrument than in the other 3. As he was the only subject to do so, and because self-harm was felt to represent a unique type of behavior fairly distinct from those guiding the author's research hypotheses, this

case was coded according to the category in which this subject attained his *second* highest score, that of verbal aggression.

Normality

Because these analyses were conducted on a subset of the total sample, an assessment of normality was again conducted, with an emphasis on evaluating the normality of errors and homoscedasticity assumptions. An analysis of the standardized residuals identified 3 cases beyond the recommended 2 SD multivariate cutoff (case# 705724, SD=-2.09379; case# 706549, SD=2.06410; and case# 706843, SD=-2.02036). These values fall between the .05 and .01 significance level cut-offs (of 2.58 and 1.96, respectively). For the reasons enumerated earlier, it was decided that these cases would be modeled separately in the subsequent analyses.

Model A

In order to evaluate the utility of Model A in differentiating the Verbal group from the Physical group, HCR Total score was again entered into a logistic regression as the sole predictor using all cases previously identified as "aggressive" (N=59).

The classification table for the null presents the initial success rate for this analysis before the regressor is included, and indicates that 100% of the observed Verbal subjects would be correctly classified prior to inclusion of the predictor, while none of the Physical cases would be correctly classified. This represents a chance-level prediction of the hit rate based on using the largest category to classify all cases. The null model, therefore, estimates an overall correct classification rate of 79.7%. With the HCR predictor included the classification rates are identical. The overall model does not achieve significance, χ^2 (1, N= 59)= 0.052, p=.820. While the Hosmer and Lesmeshaw model fit index appears adequate, χ^2 (8, N= 59)=3.690, p=.884, results of the omnibus test indicates that the HCR Total predictor does a poor job classifying

subjects. Model A captures a maximum of only 1% of the variation in classification of aggression type. With the identified outliers excluded from this analysis the function still fails to achieve statistical significance χ^2 (1, N= 59)=1.580, p=.209. Taken together, The HCR fails to differentiate between verbal and physical aggressors in the sample.

Model B

Due to the limitations imposed by the sample size on the number of permissible predictors in the logistic regression, evaluation of the additive benefits of Model B variables to the HCR-only model were once again based on the BPRS total score rather than factor scores, giving us the 2-predictor model originally evaluated in the analysis of aggressive/non-aggressive classification. However, while univariate analyses indicated that HCR Total was associated with violence category in the total sample (r=.218, p<.01, N=102), there was no correlation found in the aggressive-only sample, and no association indicated between BPRS Total (or factor scores for that matter) and aggression subtype. It is therefore not surprising that addition of the BPRS symptom variables did not improve classification of aggression subtype, as the overall model again failed to achieve significance, χ^2 (2, N= 59)=4.531, p=.104, and the HCR term was also not found to be significantly related to the criterion, Wald's χ^2 (1, N= 59)=.441, p=.506.

However, the BPRS variable came very close to achieving significance in this model, with Wald's χ^2 (1, N= 59)=3.751, p=.053. For this reason it was thought that perhaps the model was being weighted down, so to speak, by inclusion of the HCR term. In order to test this notion and evaluate the full benefit of the BPRS the model was subsequently tested with the BPRS Total score as the sole regression term. Once again, however, the BPRS Total score variable failed to achieve significance in the model, Wald's χ^2 (1, N= 59)=3.456, p=.063. Taken together BPRS

aggregate scores do not prove to be useful in successfully distinguishing verbal from physical aggressors in the full sample of violent subjects.

With the previously identified outliers removed from the analysis, the model subsequently demonstrated an ability to distinguish between verbal and physical cases. The overall model was significant χ^2 (2, *N*= 59)=10.839, *p*<.01, and demonstrated good model fit (-2 Log likelihood=38.536, and Hosmer and Lemeshow Test χ^2 (7, *N*= 59)=5.297, *p*=.624. But most notably, the BPRS regressor achieved significance, Wald's χ^2 (1, *N*= 59)=5.967, *p*=..05). The model now explained an even greater proportion of the variation in classification; up to 30.0%, which is the most of any model thus far. Examination of the coefficients also revealed that the impact of the BPRS variable had increased (*B*=-0.125; *Exp(B)* =.883), but the HCR variable remained non-significant (*B*=.174, Wald's χ^2 (1, *N*= 59)=3.410, *p*=.065. The odds ratio, given by *Exp(B)*=.910 indicates that for each unit increase in BPRS score the odds of being classified as physically aggressive decreased by a factor of .910

Model T

Finally, Model T was evaluated for its ability to successfully distinguish between aggression subtypes. The original 4-predictor Model T successfully contributed to increasing classification rates of aggressive and non-aggressive cases. This model included participant age, History, Activation, and Withdrawal as regressors. However, univariate analyses failed to demonstrate an association between any of these variables and aggression category, and identified only one variable as correlated with aggression group: the BPRS item of Subjective Tension. Therefore, the revised Model T included this variable as the sole predictor in the logistic regression.

The overall correct assignment of cases was unchanged, but the revised Model T was found to be significant χ^2 (1, N=59)=5.585, p=.05, with adequate model fit indicated by the -2 log likelihood (54.013) and Hosmer and Lesmeshaw Test χ^2 (1, N=59)=8.133, p=.321. Between 9.0% and 14.2% of the variation in classification is explained by this model. The influence of Tension was significant, though barely, χ^2 (1, N=59)=4.215, p=.040 and its impact on the model given by its coefficient of -0.691, while the odds ratio is given by the *Exp(B)* multiplier of 0.501, This indicates that subjects with higher scores on the Tension measure are about half as likely to be classified as Physical. This also indicates that for each 1 point increase on the BPRS Tension item score, the odds of a subject being classified as Physical decreased by half, $CI_{.95}$=0.259,0.969.

Evaluating this effect with the outliers excluded produced omnibus tests showing that the overall model was still significant, χ^2 (1, N=56)=6.416, p=.05). Model fit indices were again adequate, including -2 log likelihood (42.960) and Hosmer and Lesmeshaw Test, χ^2 (7, N=56)= 7.172, p=.411. But the influence of the Tension regressor, while still significant, Wald's χ^2 (1, N=56)=4.339, p=.05, decreased very slightly to *Exp(B)*=0.410. Altogether, the direction and nature of the relationships were maintained. Table 4-9 displays the correlations between predictors in each model and aggression subtypes. Table 4-10 summarizes the success rates and predictive efficacy of each model in distinguishing between Verbal and Physical cases.

Receiver Operating Characteristics (ROC) Analysis of Violence Subtype

Examination of the ROC curve based on the Model T regression for the differentiation of verbally aggressive from physically aggressive cases (Figure 4-9) indicates an AUC value of .696, p<.05, $CI_{.95=}$.551,.841. With the outlying cases excluded from the analysis, this value jumps to .738, p<.05, $CI_{.95=}$.592,.883. Additionally, the form of the ROC curves changes, so that

in the low sensitivity range (low false positive rate range) the model with the outliers excluded is superior. Table 4-11 indicates the relative influence of variables within models in correctly classifying cases**.** Table 4-12 and 4-13 provide these same results when outlying cases were excluded from the analyses.

Table 4-1. Success rates and strength of overall models in classifying cases (N=102)

	Correct Classification %			Omnibus Test			
Model	Overall	Non-Aggressive	Aggressive	Chi-square	df	p	% Max Explained Variance
A	79.7	32.6	59.8	6.841	1	p<.010	8.7
B	78.0	41.9	62.7	9.161	2	p=.010	11.5
T	79.7	48.8	66.7	18.403	4	p=.001	22.2

Note: Model A: 1-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR). Model B: 2-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR), and Brief Psychiatric Rating Scale total score (BPRS). Model T: 4- predictor model comprised of historical subscale score of the Historical/Clinical/Risk Management violence risk assessment scheme (History), participant age, activation cluster symptoms of the Brief Psychiatric Rating Scale (Activation); and Emotional Withdrawal item score of the Brief Psychiatric Rating Scale (Withdrawal).

Table 4-2. Correlations, odds ratios, and strength of individual predictors in each model in correctly classifying aggressive cases (N=102)

		Spearman's		Wald's Chi-square			Odds Ratio	
Model	Variables	r	p		df	p	Exp(B)	95% CI
A	HCR	0.255	.01	6.277	1	.010	1.116	1.024-1.217
B	HCR	0.255	.010	5.054	1	.030	1.106	1.013-1.207
	BPRS	ns	ns	2.212	1	.030	1.029	0.991-1.069
T	History	0.196	.050	3.186	1	ns	1.117	0.989-1.264
	Age	-0.259	.010	8.086	1	.000	0.945	0.91- 0.098
	Activation	0.240	.020	5.987	1	.010	1.191	1.035-1.369
	Withdrawal	0.327	.000	0.73	1	ns	0.852	0.591-1.200

Note: BPRS = Brief Psychiatric Rating Scale; AUC = area under the receiver operating characteristic curve; HCR=Historical/Clinical/Risk Management violence risk assessment scheme total score; History= historical subscale score of the Historical/Clinical/Risk Management violence risk assessment scheme; Age = participant age; Activation=activation cluster symptoms of the Brief Psychiatric Rating Scale; Withdrawal = Emotional Withdrawal item of the Brief Psychiatric Rating Scale.

Table 4-3. Success rates and strength of overall models in classifying cases with outliers excluded (N=101)

	Correct Classification %			Omnibus Test			
Model	Overall	Non-Aggressive	Aggressive	Chi-square	df	p	% Max Explained Variance
A	79.7	33.3	60.4	7.849	1	.01	10.1
B	62.4	41.9	77.6	9.000	2	.01	11.5
T	79.7	52.4	68.3	21.532	4	.000	25.8

Note: Model A: 1-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR). Model B: 2-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR), and Brief Psychiatric Rating Scale total score (BPRS). Model T: 4-predictor model comprised of historical subscale score of the Historical/Clinical/Risk Management violence risk assessment scheme (History), participant age, activation cluster symptoms of the Brief Psychiatric Rating Scale (Activation); and Emotional Withdrawal item score of the Brief Psychiatric Rating Scale (Withdrawal).

Table 4-4. Correlations, odds ratios, and strength of individual predictors in each model in correctly classifying aggressive cases with outliers excluded (N=101)

		Spearman's		Wald's			Odds Ratio	
Model	Variables	r	p	Chi-square	df	p	Exp(B)	95% CI
A	HCR	0.254	.01	7.090	1	.008	1.128	1.032-1.232
B	HCR	0.254	.01	4.957	1	.026	1.140	1.012-1.205
	BPRS	0.188	ns	2.191	1	ns	1.029	0.991-1.069
T	History	0.19	ns	4.138	1	.042	1.140	1.005-1.293
	Age	-0.273	.006	9.600	1	.002	0.938	0.900-0.977
	Activation	0.223	.025	6.725	1	.01	1.213	1.048-1.404
	Withdrawal	-0.012	ns	1.386	1	ns	0.795	0.542-1.165

Note: BPRS = Brief Psychiatric Rating Scale; AUC = area under the receiver operating characteristic curve; HCR=Historical/Clinical/Risk Management violence risk assessment scheme total score; History= historical subscale score of the Historical/Clinical/Risk Management violence risk assessment scheme; Age = participant age; Activation=activation cluster symptoms of the Brief Psychiatric Rating Scale; Withdrawal = Emotional Withdrawal item of the Brief Psychiatric Rating Scale.

Table 4-5. Areas Under the Receiver Operating Characteristic Curve (AUCs) for each model in classifying aggressive and non-aggressive cases (N=102)

	Area Under the Curve (AUC)		
Model	Non-Aggressive	Aggressive	p
A	0.351	0.649	.011
B	0.734	0.266	.000
T	0.688	0.312	.001

Note. Model A: 1-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR). Model B: 2-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR), and Brief Psychiatric Rating Scale total score (BPRS). Model T: 4- predictor model comprised of historical subscale score of the Historical/Clinical/Risk Management violence risk assessment scheme (History), participant age, activation cluster symptoms of the Brief Psychiatric Rating Scale (Activation); and Emotional Withdrawal item score of the Brief Psychiatric Rating Scale (Withdrawal).

Table 4-6. Areas Under the Receiver Operating Characteristic Curve (AUCs) for each model in classifying aggressive and non-aggressive cases with outlier excluded (N=101)

	Area Under the Curve (AUC)		
Model	Non-Aggressive	Aggressive	p
A	.353	.647	.012
B	.717	.283	.000
T	.684	.316	.002

Note. Model A: 1-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR). Model B: 2-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR), and Brief Psychiatric Rating Scale total score (BPRS). Model T: 4- predictor model comprised of historical subscale score of the Historical/Clinical/Risk Management violence risk assessment scheme (History), participant age, activation cluster symptoms of the Brief Psychiatric Rating Scale (Activation); and Emotional Withdrawal item score of the Brief Psychiatric Rating Scale (Withdrawal).

Table 4-7. Model B descriptive characteristics

Variable	Mean	Std. Deviation	N
OAS	15.450	29.673	102
HCR	18.700	4.997	102
Affect	3.458	2.366	102
Positive	7.100	4.437	102
Resistance	4.179	3.287	102
Activation	4.240	3.735	102

Note: OAS=OAS total score; HCR=HCR total score; Affect=BPRS affect cluster symptoms; Positive=BPRS positive symptoms cluster score; Resistance= BPRS Resistance cluster symptoms; Activation=BPRS activation cluster symptoms.

Table 4-8. Summary of multiple regression analysis for variables predicting aggression severity (N = 102)

Variable	Model A			Model B			Model T		
	B	SEB	β	B	SEB	β	B	SEB	β
HCR	1.893	0.563	0.319***	1.631	0.572	0.275*			
BPRS									
Affect				-0.113	1.207	-0.009 n/s			
Positive				0.449	0.912	0.067 n/s			
Resistance				-0.218	1.256	-0.024 n/s			
Activation				1.842	1.136	0.232 n/s	2.407	0.746	0.303**
Age							-0.216	0.226	-0.091 n/s
History							1.827	0.761	0.225*
Withdrawal							0.173	2.247	0.007 n/s
R^2	0.102			0.169			0.158		
Adjusted R^2	0.093			0.126			0.123		
F Change	11.308***			3.908**			4.543**		
Effect Size f^2	0.1026			0.112			0.140		

Note. *p < .05 **p < .01 ***p<.001

Model A: 1-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR). Model B: 5-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR), Brief Psychiatric Rating Scale total score (BPRS), BPRS Affect Cluster score ("Affect"), BPRS Positive Symptoms Cluster score ("Positive Sx"), BPRS Resistance Cluster score ("Resistance"), and BPRS Activation Cluster score ("Activation"). Model T: 4- predictor model comprised of historical subscale score of the Historical/Clinical/Risk Management violence risk assessment scheme (History), participant age, activation cluster symptoms of the Brief Psychiatric Rating Scale (Activation); and Emotional Withdrawal item score of the Brief Psychiatric Rating Scale (Withdrawal)

Table 4-9. Correlations between predictors and aggression subtypes (N=59)

Spearman's Correlations					
		Verbal		Physical	
Model	Variables	*r*	*p*	*r*	*p*
A	HCR	0.212	0.033	0.102	ns
B	HCR	0.212	0.033	0.102	ns
	BPRS	0.262	0.008	-0.135	ns
T	Tension	0.275	0.035	0.275	0.035

Note: HCR=HCR total score; BPRS=BPRS total score; Tension=BPRS Subjective tension item score.

Table 4-10. Success rates and strength of overall models in distinguishing between verbally and physically aggressive cases (N=59)

	Correct Classification %			Omnibus Test			
Model	Overall	Verbal	Physical	Chi-square	df	*p*	% Max Explained Variance
A	79.7	100	0	1.58	1	ns	1
B	79.7	100	0	4.531	2	ns	11.6
T	79.7	100	0	5.585	1	0.018	14.2

Note. Model A: 1-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR). Model B: 2-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR), and Brief Psychiatric Rating Scale total score (BPRS). Model T: 1- predictor model comprised of Tension item score of the Brief Psychiatric Rating Scale ("Tension").

Table 4-11. Correlations, odds ratios, and strength of individual predictors in each model to distinguish between verbally and physically aggressive cases (N=59)

Model	Variables	Wald's Chi-square	df	*p*	Odd Ratio Exp(B)	95% CI
A	HCR	0.052	1	ns	1.014	0.897-1.147
B	HCR	0.441	1	ns	1.045	0.918-1.190
	BPRS	3.751	1	ns*	0.938	0.878-1.001
T	Tension	4.215	1	0.04	0.501	0.259-0.969

Note. Model A: 1-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR). Model B: 2-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR), and Brief Psychiatric Rating Scale total score (BPRS). Model T: 1-predictor model comprised of Tension item score of the Brief Psychiatric Rating Scale ("Tension").

Table 4-12. Success rates and strength of overall models in distinguishing between verbally and physically aggressive cases – outliers excluded from the analysis (N=56)

	Correct Classification %			Omnibus Test			
Model	Overall	Verbal	Physical	Chi-square	df	*p*	% Max Explained Variance
A	83.9	100	0	1.58	1	ns	4.7
B	83.9	97.9	11.1	10.839	2	0.004	30
T	83.9	100	0	6.416	1	0.011	18.5

Note. Model A: 1-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR). Model B: 2-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR), and Brief Psychiatric Rating Scale total score (BPRS). Model T: 1- predictor model comprised of Tension item score of the Brief Psychiatric Rating Scale ("Tension").

Table 4-13. Correlations, odds ratios, and strength of individual predictors in each model to distinguish between verbally and physically aggressive cases - outliers excluded from the analysis (N=56)

Model	Variables	Wald's Chi-square	df	*p*	Odd Ratio Exp(B)	95% CI
A	HCR	1.466	1	ns	1.098	0.944-1.279
B	HCR	3.41	1	ns	1.19	0.989-1.431
	BPRS	5.967	1	0.015	0.883	0.799-0.976
T	Tension	4.339	1	0.037	0.41	0.177-0.949

Note. Model A: 1-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR).Model B: 2-predictor model comprised of Historical/Clinical/Risk Management violence risk assessment scheme total score (HCR), and Brief Psychiatric Rating Scale total score (BPRS). Model T: 1-predictor model comprised of Tension item score of the Brief Psychiatric Rating Scale ("Tension").

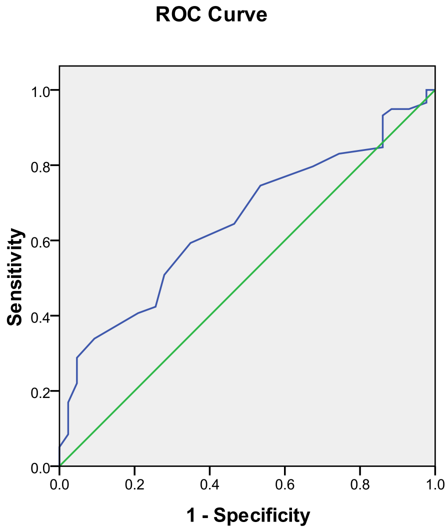
Figure 4-1. Classplot of correct and incorrect predictions of aggression under Model T

```
             Observed Groups and Predicted Probabilities

       8 +                                                                                                    +
         |                                                                                                    |
         |                                                                                                    |
F        |                                                                                                    |
R      6 +                                                     Y                                              +
E        |                                                     Y                                              |
Q        |                                                Y    Y                                              |
U        |                                                Y    Y                                              |
E      4 +                              Y                 Y    Y    Y          Y                              +
N        |                              Y                 Y    Y    Y          Y                              |
C        |                              Y                 Y  Y N    YY  Y      YYY   Y       Y                |
Y        |                              Y                 Y  Y N    YY  Y      YYY   Y       Y                |
       2 +                              NN         Y      N  Y N N  NYY YY    YNNYY  Y  Y  Y Y    YY          +
         |                              NN         Y      N  Y N N  NYY YY    YNNYY  Y  Y  Y Y    YY          |
         |     N          Y  NN N  NNNNYNNNNY NNY  NN YN  NYNNYN NY NNN NYNYYNNNNYY YYN Y YYYNY Y YN Y  Y   Y |
         |     N          Y  NN N  NNNNYNNNNY NNY  NN YN  NYNNYN NY NNN NYNYYNNNNYY YYN Y YYYNY Y YN Y  Y   Y |
Predicted ---------+---------+---------+---------+---------+---------+---------+---------+---------+----------
  Prob:   0       .1        .2        .3        .4        .5        .6        .7        .8        .9         1
  Group:  NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
```

Note: Predicted probability is of membership for Yes-Aggressive group. The Cut Value=.50
Symbols: N=No Aggression; Y=Yes Aggression. Each Symbol Represents .5 Cases.

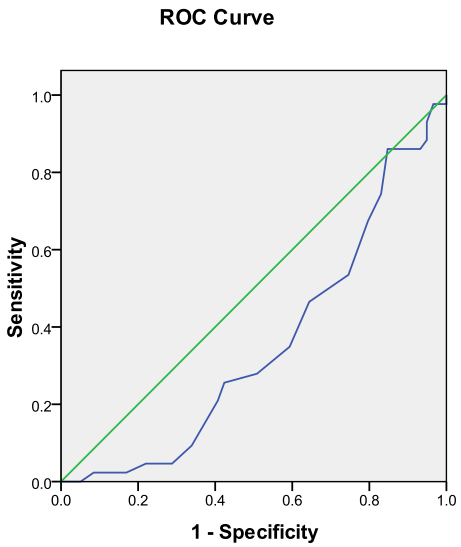
Figure 4-2. Receiver Operating Characteristics (ROC) curve for Model A (HCR total score only) and classification of aggressive cases



Diagonal segments are produced by ties.

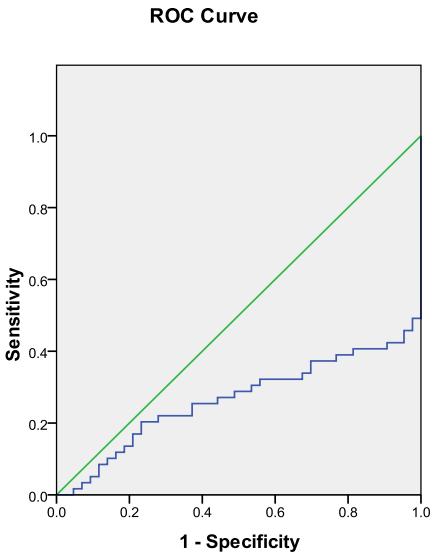
Note: Sensitivity= true positive rate. 1-Specificity=false positive rate

Figure 4-3. Receiver Operating Characteristics (ROC) curve: Model A (HCR total score only) and classification of non-aggressive cases



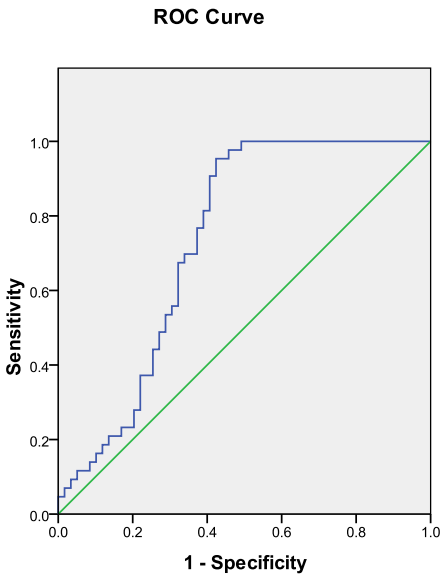
Note: Sensitivity= true positive rate. 1-Specificity=false positive rate

Figure 4-4. Receiver Operating Characteristics (ROC) curve: Model B (HCR plus BPRS) and classification of aggressive cases



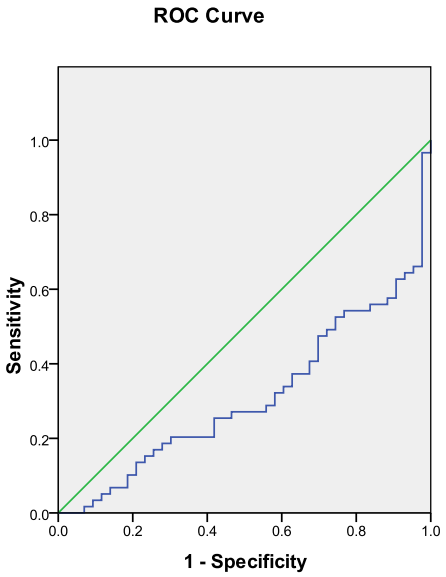
Note: Sensitivity= true positive rate. 1-Specificity=false positive rate

Figure 4-5. Receiver Operating Characteristics (ROC) curve: Model B (HCR plus BPRS) and classification of non-aggressive cases



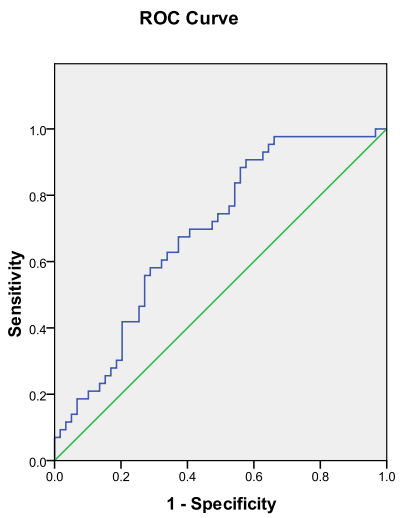
Note: Sensitivity= true positive rate. 1-Specificity=false positive rate

Figure 4-6. Receiver Operating Characteristics (ROC) curve: Model T (age, history, activation, emotional withdrawal) and classification of aggressive cases



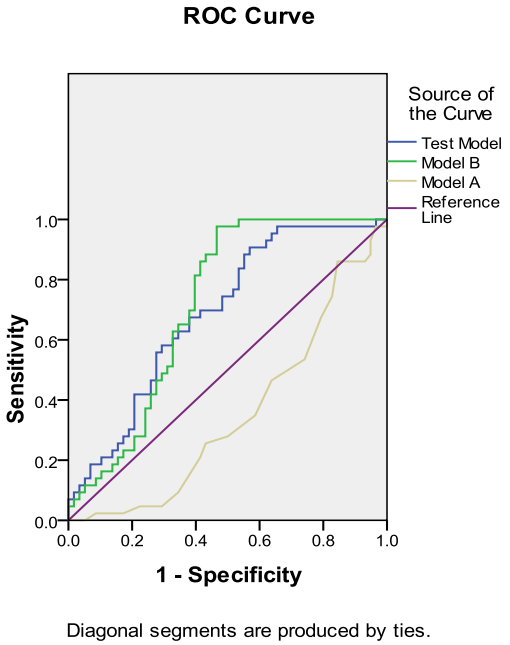
Note: Sensitivity= true positive rate. 1-Specificity=false positive rate.

Figure 4-7. Receiver Operating Characteristics (ROC) curve: Model T (age, history, activation, emotional withdrawal) and classification of non-aggressive cases.



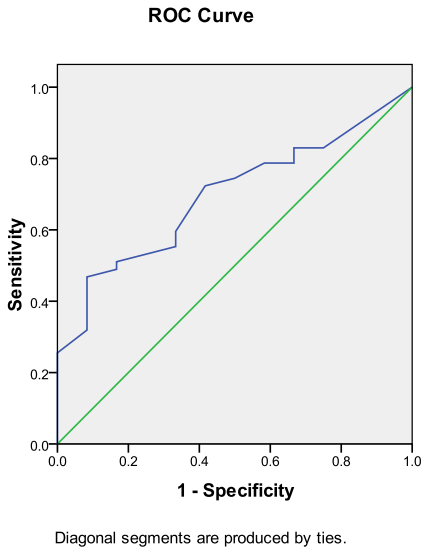
Note: Sensitivity= true positive rate. 1-Specificity=false positive rate

Figure 4-8. Receiver Operating Characteristics (ROC) curve: Models A, B, and T, and classification of non-aggressive cases.



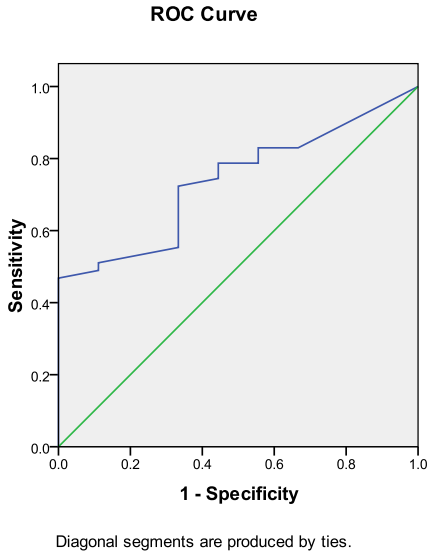
Note: Sensitivity= true positive rate. 1-Specificity=false positive rate

Figure 4-9. Receiver Operating Characteristics (ROC) curve: Model T (BPRS tension item) and classification of physically aggressive cases (N=59)



Note: Sensitivity= true positive rate. 1-Specificity=false positive rate.

Figure 4-10. Receiver Operating Characteristics (ROC) curve: Model T (BPRS tension item) and classification of physically aggressive cases With Outliers Excluded (N=56)



Note: Sensitivity= true positive rate. 1-Specificity=false positive rate.

CHAPTER 5
DISCUSSION

Aim 1 - Predicting Aggression vs. Non-Aggression

A logit model was used to predict classification of subjects as aggressive or non-aggressive. Age and Activation symptoms were shown to be statistically significant predictors of aggression, but aggression was significantly related to Historical subscale score only in the analysis that was conducted with the outlier excluded. For every one unit increase in Activation score the odds of classification as aggressive (versus non-aggressive) increased by a factor of 1.178, while for each 1 year increase in participant age the odds decreased by 0.94. The experimental function provided a maximum correct classification of cases of 25.8%, based largely on its greater ability to identify non-aggressive subjects rather than aggressive subjects. Though this represents a fairly small proportion of cases, this is more than a two-fold increase in the least successful model based on the traditional measure of violence risk, the HCR Total score.

Direct comparison of the odds ratios obtained in the present study with those found in others using similar predictors and comparable forms of the OAS instrument to measure aggression, suggest that the sample is not unique. Watts, Leese, Thomas, Atakan, and Wykes (2003) reported odds ratios of 1.120 and 1.800 for their modified OAS total score and BPRS symptoms cluster score (hostile-suspiciousness), respectively, for actual assault in a sample of patients in a locked psychiatric unit. They also reported odds ratios of 1.08, 0.60, and 1.99 on their modified OAS measure, anxiety-depression BPRS symptom cluster score, and withdrawal-retardation BPRS symptom cluster score, respectively, and aggressive behavior. And Amore et al. (2008) reported odds ratios for BPRS subscales and symptoms clusters and a number of risk factors for physically aggressive behavior during psychiatric hospitalization within the same

range: hostility-suspiciousness (1.14), anxiety-depression (0.95), thought disturbance (1.07), activation (1.14), and anergia (1.04). By comparison, the best fitting model for correctly classifying aggressive cases achieved odds ratios of 1.19 and 1.12 for BPRS Activation cluster symptom score and HCR Historical subscale score, respectively (and 1.21 and 1.14 when the effects of outliers were excluded from the analysis).

According to Fleiss, Williams, and Dubro (1986) odds ratios above 2.50 should be considered clinically important. But studies of violence prediction do not typically report such values. Additionally, the present study serves to address the paucity of reliable research addressing models of aggression in a population of hospitalized mentally ill criminal offenders. It should be noted that the traditional HCR variables were consistently strong predictors across each model for correctly classifying aggressive cases, which further legitimizes the continued use of the HCR-20 as one of the standard measures of violence risk assessment, particularly when used in isolation.

Initially, the ROC curves based on Model T seemed paradoxical. For the purpose of comparison, a subsequent logistic regression analysis was conducted with the 5 BPRS factor score as regressors, an analysis of dubious statistical validity given the small sample and number of predictors in the regression. Not surprisingly the function was not found to be significant and therefore no discernable contribution of individual variables could be identified. However, obtained residuals were used to construct ROC curves evaluating the predictive reliability of BPRS factor scores when used alone. These aggregated clinical symptom measures appeared to provide a fair method of predicting violent cases (AUC = 0.668, $p<.01$), and was comparable to the HCR when used alone. And it proved to be similarly unreliable in discerning non-violent cases (AUC=0.332, $p<.01$). These explorations of the data suggest that these clinical factor

clusters could prove to be comparable to the HCR total score in correctly assigning violent cases, and that further investigation utilizing larger samples is indicated.

Another subsequent post-hoc exploration of the data revealed a comparable AUC value to the best model (Model A) when the BPRS Activation cluster (the most salient variable in the regression analysis) is considered alone (AUC=.645, $p<.01$). But this is not the case when the age variable was considered in isolation (AUC=.349, $p<.01$). It is striking that the age-only predictive value is comparable to the combined function. Therefore, age appears to reduce the predictive utility of the model in predicting aggressive cases, but not in predicting non-aggressive cases.

In their evaluation of the predictive validity of several risk assessment measures with male offenders with intellectual disabilities, Lindsay et al. (2008) demonstrated the utility of HCR subscale scores. They reported AUCs of .600 and .720 for HCR Historical and Total scores, respectively. A study by Banks et al. (2004) based on actuarial models of prediction achieved an AUC of .738 in predicting violent incidents in a mainstream offender sample. While Harris and Rice (2003) reported predictive accuracies as high as AUC=.900. Taken together the use of structured combinations of risk variables has been found to produce superior predictive models of aggression. In the present study the HCR-only model produced a total sample AUC value of .649, which falls within the low range of values reported in the literature for the predictive abilities of this measure. This is likely due to the truncated form employed in this study, in which the 5 Risk Management items were not scored, thereby reducing the ability of the HCR measure to do what it reportedly does best: distinguish violent from non-violent cases. By comparison, the models that included BPRS symptom and demographic variables produced AUC values that fell far below even chance levels. Ironically, they produced superior classification of *non*-aggressive

cases. Model B, which examined the simple additive effect of the BPRS on the HCR model, produced and AUC of .734 (p<.001) while the more selective Test Model produced an AUC of .688 (p=.001) for the prediction of non-aggressive cases. By comparison, the identification of these cases by the HCR fell far below chance levels (AUC=.351, p=.011). The prediction of non-aggressive cases, it should be noted, has clinical utility and is not well addressed by traditional measures. This appears to support the author's initial hypothesis that supplementing commonly used risk assessment measures with those assessing clinical symptom variables has practical benefit in providing a complete predictive algorithm for violent and non-violent behavior. But clearly these variables tell a different story depending on how they are combined.

It is tempting to examine AUC values for all of the variables and draw causative conclusions based on these regarding their relationship with the yes/no prediction of aggression. The examination of ROC curves is useful in refining the statistical inferences one makes based on the logistic regression models, but direct comparisons of multi-variable effects should be made with extreme caution. However, it would seem that the correct classification of violence potential is aided by the consideration of symptom variables and their severity, particularly those related to general agitation. Also, throughout this analysis the effect of age appears in the anticipated direction, with younger age being related to aggression. A few variables appear to suffice towards increasing the accuracy of the prediction of aggressive behavior, supporting a less-is-more strategy to violence prediction. However, diagnostic tests of the strength and predictive benefit of the Test Model suggest that its true contribution is in its ability to help in the prediction of non-violent rather than violent cases. As such, it demonstrates utility as a potential adjunct to more traditional risk assessment measures. The use of one such established measure, the HCR, is further substantiated in the present study.

Aim 2 - Predicting Aggression Severity

Taken together, using the enter method, a significant model emerged with Activation (a BPRS factor cluster that includes the diagnostic items of subjective tension, mannerisms and posturing, excitement, and disorientation) and History (the HCR Historical subscale that captures 10 static variables related to a person's background) found to be predictive of aggression severity. Other variables in the model were not significant predictors. It is noteworthy that Activation was also found to be the sole statistically significant clinical predictor in the logit model used to predict classification of subjects as aggressive or non-aggressive. Also, Model T was found to be superior to models based solely on the traditional risk assessment device (HCR) and to a model based on the simple additive influence of the HCR with a measure of aggregated symptom variables (BPRS Total score). Thus the selective addition of clinical symptom variables, as captured by the BPRS overall score (and by the BPRS factor scores to a lesser degree) is substantiated in the sample and provides an algorithm for predicting aggression intensity from this combination of risk assessment items and symptoms of mental illness. This algorithm is also superior to those offered by models in which these instruments are used in isolation.

The research on violence prediction has typically concerned itself with yes/no classification of violence risk potential, and rarely on characterizing aggression intensity should violence occur. One exception includes a study by Nicholls, Brinka, Greaves, Lussier, and Verdun-Jones, (2008) who used the OAS to explore differences between male and female forensic psychiatric inpatients in order to identify the mental health, psycho-social, and criminogenic contexts in which aggression occurs. Many studies exploring the severity of aggression are primarily concerned with identifying gender differences in their samples. Steinert, Wiebe, and Gebhardt (1999) conducted a similar evaluation of aggressive behavior against self

and others among newly admitted schizophrenic patients, employing a stepwise multiple regression to identify predictors of the number and duration of re-hospitalization. The present study appears to address a marked scarcity of research regarding the relationship between aggression severity, risk assessment, and clinical variables not only in forensic patients, but psychiatric patients in general.

Aim 3 - Predicting Aggression Category

Identification of verbal-aggressive and physical-aggressive subtypes represented a simple extension of analyses distinguishing between aggressive and non-aggressive groups, with the dichotomy in this case characterizing the nature of aggression rather than its presence. Taken together, logistic regression analysis performed with aggression category as the criterion variable and a score on a measure of subjective tension as the predictor significantly distinguished between verbal-aggression and physical-aggression subtypes. While univariate analyses were expected to reveal significant intercorrelations for each type of aggressive behavior and ratings of risk and symptoms severity, no other demographic, clinical, or historical variable was found to even be associated with aggression grouping. The degree of this model's predictive utility in correctly classifying aggression type is at least comparable to measures used to initially distinguish aggressive and non-aggressive cases and is, in fact, superior when extreme cases are excluded from the analysis.

An older study by Kay, Wolkenfeld, and Murrill (1988) used a modified version of the OAS to characterize the nature and prevalence of aggression among psychiatric patients, and found that this instrument successfully discriminated between cases of autoaggression, physical assault, and general aggression, and could serve to clarify the interaction of demographic, clinical, affective and behavioral characteristics. Gray et al. (2003)conducted prospective evaluation of the utility of various measures in predicting aggression subtypes. They explored the

benefits of the HCR-20, Psychopathy Checklist (PCL), Beck Hopelessness Scale (BHS), BPRS, and age at first psychiatric admission to distinguish between verbal aggression, violence to property, and physical violence. They found that the HCR Clinical and Historical subscales were good predictors of these behaviors, though the combined benefit of the HCR-20 total score was superior to the use of either subscale alone. They reported correlations between .53 and .56 between subscale scores and these behaviors, AUCs between .79 and .83, and odds ratios between 2.55 and 8.85. By comparison, bivariate correlations between predictors in each of the models and aggression subtypes were very small in the present sample, and ranged from .102 to .275. Similarly, while Gray and colleagues identified the BPRS as a good predictor of verbal and physical aggression, with correlations between .58, AUCs between .81-.84, and odds ratios between 2.31-4.00, only the BPRS Tension variable even achieved statistical significance in the current sample.

In comparison, the models utilized in the present study are less effective in classifying aggression subtypes. It should be noted, however, that studies employing retrospective analyses, as in the present study, have tended not to find all HCR-20 scales to be such good predictors of all forms of aggression (Douglass et al., 1999). This may be due to their dependence on chart notes rather than direct observation for obtaining relevant information regarding target behaviors.

Additional Findings

The present study failed to replicate meaningful associations between violence type or severity and age, education, history of head trauma (with loss of consciousness), history of abuse (physical, emotional, sexual, or combat-related), or primary psychiatric diagnosis, which have been reported elsewhere. Moreover, the dimensions of psychopathology proposed in the present study appear to be mostly non-contributory. Nonetheless, associations were found between at

least one symptom cluster that characterizes participant's subjective impression of tension, excitement, and disorientation, and the frequency and severity with which they aggress.

Examining the relationship between both independent measures and other demographic variables replicated some interesting findings, such as the well-known relationship between youth and increased impulsivity. Another finding of interest in the data is of the association between head injury and affective symptoms, particularly somatization. Studies have supported a link between a history of head injury and violent behavior, even many years following injury (Kim, 2002). While the present study failed to replicate this result, head injury was found to be associated with the BPRS clinical variables of Somatic Concern and Subjective Anxiety (r=.243, p<.05 and r=.205, p<.05, respectively). It is possible that the experience of multiple head traumas increases an individual's subjective concern for their own medical wellbeing. Alternatively, these associations may be related to organic trauma-related personality changes.

This study also confirmed the absence of significant redundancy between the HCR and BPRS clinical items. This may explain why, according to the results, they characterize opposite behavioral states equally well, with the BPRS essentially predicting *non*-violence, and the HCR doing what it does best, correctly assigning violent cases. To some degree, they can be interpreted as complimentary measures of self-control and adaptation of subjects to their environment, which are clinically relevant in their own rights and could provide useful information to clinicians when used in tandem.

Methodological Considerations

The choice of Logistic coefficients was based on both conceptual and statistical considerations. The identification of significant bivariate correlations guided much of the preliminary consideration of relevant variables. Regression functions can be found to be non-significant, as in the case of Model T, when their corresponding correlations are found to be

significant. This is because logistic coefficients represent only partial coefficients controlling for other variables in the model, while correlation coefficients are uncontrolled. Also logistic coefficients represent both linear and nonlinear relationships, while correlations reflect only linear relationships. And finally, significant parameter estimates indicated that there was a relationship between the predictors and criterion variables, though these relationships may not have applied overall. However, in order to make overall statements about the significance of the independent variables both the parameter estimates and correlations need to be statistically significant. For this reason the identification of salient variables proceeded from not only conceptual and methodological priorities but from simple univariate analyses.

A major concern of the author was the operational definition of aggression as an all-or-none construct where, for the purposes of group membership, a single event characterized an individual as "aggressive." This rarely happened however, as aggressive behaviors were seldom isolated and typically aligned under dominant subtypes that lent themselves easily to one grouping. Other studies have employed median cutoff scores to characterize violent behavior (Gray et al., 2003), rather than the single-event classification scheme employed here. But the limited sample and relatively low base rate of aggressive behavior in the sample precluded use of this method. Additionally, as the intent of the study was not to differentiate between severe aggression and "average" or mild aggression, the use of the single-event scheme was substantiated. No doubt, however, it provided very different information regarding the sample than other predictive studies employing the alternate technique. Gray and colleagues used a median-split cut-off point to differentiate cases scoring higher and lower on measures of their target behavior, and then employed a Mann-Whiteny U comparison of means for those scoring above and below this median value for each of their predictors. Due to limited sample size, the

present study approached the research question from the opposite end by dividing subjects into aggressive and non-aggressive cases and then comparing these groups on their scores of the predictor. This technique has been widely used (Belfrage et al., 2000) as it lends itself to the type of retrospective analysis conducted in the present study.

An additional methodological concern was that while the overall scores on each measure were treated at ordinal or interval level (and provided the means to operationalize target behaviors of interest) the items on which they are based were sometimes categorical. However, according to Wagner, Beiden, and Metz (2001) ROC curves are not affected by the use of a Likert-type and other scales that use discrete multi-point systems of the type employed in both of the risk and clinical measures (HCR and BPRS). According to them, ROC curves built on discrete rating and continuous scales are not typically different, particularly when resulting operating points are well distributed.

A number of individual scale items (9 from the BPRS and 2 from the HCR) were found to be correlated with the dependent measure to some degree. But statistical limitations precluded evaluation of the predictive contribution of these underlying clinical substrates. Therefore they were aggregated into their superordinate categories for computational reasons.

Sample Size

A major limitation to achieving multivariate significance is sample size. Reliability of estimates decline heavily when there are few cases for each observed combination of independent variables. In extreme cases, if there are too few cases compared to the number of variables, it becomes increasingly difficult to converge on a solution. Peduzzi et al. (1996) recommend that the smaller of the classes of the dependent variable have at least 10 events per parameter in the model. While the study analyses proceeded in accordance with these criteria,

these essentially represent a minimum requirement. Salient relationships may have been missed given the size and nature of the sample.

Due to the stringent statistical limitations imposed by the methodologies employed, it was necessary to combine some categories of both the independent and dependent variables not only to make the analysis simpler, but because the number of cases in some categories were too small to conduct certain tests. As the number of categories increased more parameters needed to be estimated, and it became increasingly difficult to obtain significant results. For this reason, for instance, aggression type was dichotomized. But this resulted in a fundamental alteration of the research question. Similarly, it would have been preferable to model aggressive cases separately, once identified, in the assessment of aggression severity. But this would have reduced the sample size to where only 1 predictor could have been employed in the multiple regression analysis.

Additional univariate analyses could have been used to further explore the relationships between aggression severity and the BPRS factor scores, but the intent of this study was to build models of prediction based on multiple variables, which required multivariate techniques, but also larger sample sizes..

Unrecorded Aggression

An examination of what constituted "aggressive" behavior begs the question of what overt behaviors did *not* meet this definition while still representing deviant or unwanted behaviors in this population. For instance, it was common to find case notes in subjects' charts referring to disregarding rules, non-compliance, resisting instructions, being demanding, requiring multiple prompts by staff, manipulativeness, and refusing participation in therapeutic activities. These appeared to constitute a "passive-aggressive" subtype that, although not captured by the OAS instrument, could offer therapeutically useful information and help characterize yet another model of aggressive behavior. In their study of the changes in aggressive behavior throughout

the course of dementia, Keene et al. (1999) referred to “aggressive resistance” as, “Resisting anyone's attempt to help or being uncooperative in any situation (p 543).” Though their definition captures resistance in an entirely different psychiatric population (and includes resistance by patients during intimate care), this concept seems applicable to this sample as well, as it describes a form of deliberate though non-violent behavior that straddles the line between defiance and active aggression.

Resistance and uncooperativeness in forensic psychiatric patients has been widely explored in the context of malingering research. Merten, Friedel, and Stevens (2006) explored the prevalence and influence of uncooperativeness in producing invalid forensic neuropsychological test profiles due to negative response bias in patients. But there is a dearth of research on this phenomenon as it relates to the behavioral management of inpatient criminal offenders. The literature has more often addressed this issue in terms of treatment non-compliance among community dwelling offenders and practices of outpatient forensic mental health treatment (Lamb, Weinberger, & Gross, 1999). This would appear to represent an opportunity for future research.

Similarly, review of patient charts often revealed references to a host of sexually inappropriate behaviors including flirtatious behavior towards female staff, making sexual comments, masturbating in public, and preoccupation with inappropriate sexual themes. While not coded as aggressive according to the norms of the OAS instrument, sexual aggression has been linked to a host of behavioral disturbances in psychiatric patients. The issue of psychiatric patients who sexualize their encounters with treatment staff (particularly female nurses) is specifically addressed by Massoc (2003) and Higgins, Barker, and Begley (2009). They describe unwanted sexual attention and behaviors from patients as a form of sexual aggression and

boundary violation similar to physical violence. Here as well, research has rarely addressed these behaviors within the context of an inpatient psychiatric treatment facility for criminal offenders. This phenomenon also warrants further consideration.

The reality of the coding scheme necessitated some interpretation of intent. For example, the measure did not differentiate between the instigators and victims of aggression, for instance, separating those who might be defending themselves against unprovoked attacks by becoming violent themselves. Also, a behavior such as "making a mess" is a codable form of "aggression against objects" according to the OAS instrument. In one case a participant was noted to have clogged his toilet and flooded his room. But whether this constituted aggression or accident was subject to some interpretation, as was the evaluation of treatment notes with vague references to residents as "argumentative" and "inappropriate" without mention of specific behaviors.

Strengths of the Study Design

Despite the low base rate of severe violence in this setting, because the OAS captures a range of types and severity of aggressive behaviors many residents were found to engage in some of these acts. Common aggressive behaviors included making threats of violence, throwing or kicking objects, head-banging, hitting, pushing, and kicking others.

While many studies have examined aggression and violence within in-patient psychiatric and criminal justice settings, and have noted contributing factors as diverse as patient perception of staff behaviors (interpersonal conflict, limit-setting by staff) and psychotic symptoms and tension (Nolan, Shope, Citrome, and Volavka, 2009), it is reasonable to question whether the highly structured and controlled nature of this environment, as a maximum security forensics unit, may ultimately have limited the full expression of aggression in this population. The modified OAS coding scheme, which captured not only the severity of behavior but the intensity of responses ("interventions") to these behaviors, was an attempt to account for this possible

limitation and preserve the potential for results to have practical application in the environment from which these data were derived. The effects of various interventions were expected play a role in modifying the predictive value of identified variables and factors. But while the coding scheme incorporated a unique violence rating system that captured the force of direct clinical intervention in this population, a subsequent examination of the bivariate correlations reveals that this addition did little to affect the strength of the associations that were found, either negatively or positively. The correlation coefficients observed were almost identical in each relationship found when this weighted measure was removed.

The retrospective nature of this study, one in which aggressive behaviors were evaluated for the first 5 weeks following a resident's admission to the treatment facility, utilizing various archival sources, may be considered a weakness of this study by some. But the design benefited largely from well defined and standardized instruments in the scoring and evaluation of aggressive behaviors in this population. The traditional reliance on subjects' autobiographical verbal report was strengthened through review of various collateral and historical sources, and extensive review of comprehensive chart notes from each resident's treatment team.

Previous studies have suffered from imprecise definitions of aggression and violence, use of non-standardized scales in the evaluation of these behaviors, and poorly defined assessment periods. Some studies have favored prospective designs, arguing that only these can fully capture aggression as it occurs in a naturalistic fashion. But these methods fail to address the practical needs of those conducting research and working within in-patient mental health and residential environments. Chief among these is the impracticality of study designs requiring 24 hour 1-to-1 observation of all participants. Such studies not only lack workability but have limited generalizability.

This study attempted to identify dynamic variables that are associated with aggressive and violent behavior in a residential forensic psychiatric setting. A focus on standardized clinical variables, and psychiatric symptom profiles in particular, represented a departure from early investigations of the prediction of violence based on clinical judgment alone, which rarely produced better than chance results. It was also an attempt to supplement later investigations that relied on general historical, demographic, and static risk factors for violence. As previously enumerated, many studies have revealed at least some association between violence and a number of these variables (such as age, mental health status, and drug abuse history) while equal numbers of investigations have failed to reveal significant relationships. The majority of these relationships were not supported in the present study sample.

CHAPTER 6
SUMMARY AND CONCLUSIONS

Doctrine holds that past violent behavior is the best predictor of future violence. Indeed, research shows that many measures of prior violence, including self-report, arrest records, and hospital records, are strongly related to future violence, and that this relationship holds in the case of institutional violence (Sirotich, 2008). A number of clinical variables, particularly variables related to psychopathology, were expected to emerge as significant predictors of aggressive behavior in this population. It was also expected that some of these might mediate the predictive utility of purely historical factors. The aim of the present study was to determine violence risk factors and ascertain the level of predictive utility of these factors in this setting.

It was thought that the addition of these variables could increase the accuracy of violence predictions when based on systematic review and a comprehensive inventory of symptom variables provided by the BPRS, and their selective application within models of prediction. It was hypothesized that this would aid in the identification of individuals likely to commit aggressive acts during their treatment, could provide an algorithm for expectancies regarding the intensity of aggression when it occurs, and help predict what form this violence might take. Iterations of each model were compared against a form of what has become the standard risk assessment instrument in the field, the HCR, in order to assess the benefits of including a wider array of symptom items than is provided by this brief measure. Aggressive acts were coded retrospectively during thorough review of ward charts, and according to standardized criteria of a modified version of the Overt Aggression Scale in order to capture a full array of both verbally and physically aggressive acts. Taken together, the addition of these symptom variables produced models with a small added benefit in their ability to correctly classify and characterize aggressive behavior. And for those who did aggress, these models did a meager job of predicting

the form this violence might take. However, in each case, these models proved better than those based on business-as-usual approaches. Ultimately, violence risk assessment was augmented, however slightly, by a combination of clinical and non-clinical predictors. At the same time, this study illustrated the importance of considering more than just static historical variables in the evaluation of risk. So while studies have frequently demonstrated (and is has become a veritable mantra in the social sciences) that past behavior is the best predictor of future behavior, despite its correlation with a number of measures this single variable (History) did not contribute significantly to *any* of the models evaluated, except in a single case when extreme scores were excluded from the analysis.

Sometimes less is more. The addition of a more comprehensive assessment of symptoms of mental illness did not ultimately increase the utility of the more established and parsimonious risk assessment device in identifying aggressive cases. However, the author established the complimentary utility of a test model by demonstrating its predictive strength in correctly identifying exactly those types of cases the traditional method fails to uncover. And a subset of variables was successfully identified, including age, tension, and agitation that proved useful in predicting frequency and severity of aggression in this population, though they typically added minimally to successfully predicting the form this aggressive behavior is likely to take.

Even more precise approaches to the prediction of aggressive behavior may lead to the identification of additional subsets of violence and enable more effective and specific treatment outcomes. The classification of violent subjects continues to be a priority in many settings. There remain significant social and financial implications to misclassifying non-violent subjects as violent, in terms of restriction of freedoms, unnecessary psychopharmacological intervention, and stigmatization. The author's hypothesized model, which takes into account a wider array of

symptom variables associated with mental illness, is demonstrated as superior in correctly classifying this group; that is, in identifying non-aggressive cases. This has clinical utility in a population in which the modal behavior *is* violence. As a matter of public policy based increasingly on the application of least restrictive measures in managing mentally ill criminal offenders, the proposed model appears tailor made to the task of tackling modifiable risk factors of aggression, and serving as a compliment to the mission of identifying individuals who might benefit from interventions for persistently violent mentally ill men within the forensic mental health system of Florida.

APPENDIX A
RATING SCALES

A-1. Modified version of the Overt Aggression Scale.

AGGRESSIVE BEHAVIOR (code most severe)

Subject #

Category	Behaviors	Item Score	Multiplier	Total Severity
Verbal Aggression	Makes loud noises, shouts angrily	1	x1	
	Yells mild insults (E.g. "You're stupid!)	2	x1	
	Curses viciously, uses foul language in anger, makes moderate threats to others or self	3	x1	
	Makes clear threats of violence toward others or self ("e.g. I'm going to kill you"), or requests to help to control self	4	x1	
Physical Aggression Against Objects	Slams door, scatter clothing, makes a mess.	1	x2	
	Throws objects down, kicks furniture without breaking it, marks the wall.	2	x2	
	Breaks objects, smashes windows	3	x2	
	Sets fires, throws objects dangerously	4	x2	
Physical Aggression Against Self	Picks or scratches skin, hits self, pulls hair (with no or minor injury only)	1	x3	
	Bangs head, hits fist into objects, throws self onto floor or into objects (hurts self without serious injury)	2	x3	
	Small cuts or bruise, minor burns.	3	x3	
	Mutilates self, makes deep cuts, bites that bleed, internal injury, fracture, loss of consciousness, loss of teeth.	4	x3	
Physical Aggression Against Other People	Makes threatening gesture, swings at people, grabs at clothes.	1	x4	
	Strikes, kicks, pushes, pulls hair (without injury to them)	2	x4	
	Attacks others, causing mild to moderate physical injury (bruises, sprain, welts).	3	x4	
	Attacks others, causing severe physical injury (broken bones, deep lacerations, internal injury)	4	x4	
	INTERVENTION (code all that apply)			
	None	0	-	
	Talking to patient	1	-	
	Closer observation	2	-	
	Holding patient	3	-	
	Immediate medication given by mouth	4	-	
	Immediate medication given by injection	4	-	
	Isolation without seclusion (time-out)	3	-	
	Seclusion	5	-	
	Use of restraints	5	-	
	Injury requires immediate medical treatment for pateint	5	-	
	Injury requires immediate medical treatment for other person	5		
			Final Score	

A-2. HCR risk assessment instrument (adapted from the HCR-20)

HCR- 20 Coding Sheet

Subject # _____ **Date** _____

Historical Items		Code (0,1,2)
H1	Previous Violence	
H2	Young Age at First Incident	
H3	Relationship Instability	
H4	Employment Problems	
H5	Substance Use Problems	
H6	Major Mental Illness	
H7	Psychopathology	
H8	Early Maladjustment	
H9	Personality Disorder	
H10	Prior Supervision Failure	
Historical Items Total		*/20*
Clinical Items		Code (0,1,2)
C1	Lack of Insight	
C2	Negative Attitudes	
C3	Active Symptoms of Major Mental Illness	
C4	Impulsivity	
C5	Unresponsive to Treatment	
Clinical Items Total		*/10*
Risk Management Items	In___ Out___ (placement)	Code (0,1,2)
R1	Plans Lack Feasibility	
R2	Exposure to Destabilizers	
R3	Lack of Personal Support	
R4	Noncompliance with Remediation Attempts	
R5	Stress	
Risk Management Items Total		*/10*
HCR-20 Total		***/40***

Note: Scoring: 0=not present; 1=possible/less serious; 2=definite/serious; I=insufficient information.

A-3. Brief Psychiatric Rating Scale (BPRS) – 18 Item

Subject #

Rating	
0=Not assessed	4=Moderate
1=Not present	5=Moderately severe
2=Very mild	6=Severe
3=Mild	7=Extremely severe

Factor	Item	Description	Score
Affect	Somatic Concern	Preoccupation with physical health, fear of physical illness, hypochondriasis.	
	Anxiety (subjective)	Worry, fear, over-concern for present or future, uneasiness.	
	Guilt Feelings	Self-blame, shame, remorse for past behavior.	
	Depressed Mood	Sorrow, sadness, despondency, pessimism.	
		Factor Score	
Positive	Conceptual Disorganization	Thought processes confused, disconnected, disorganized, disrupted.	
	Grandiosity	Exaggerated self-opinion, arrogance, conviction of unusual power or abilities.	
	Hallucinatory Behavior	Perceptions without normal external stimulus correspondence.	
	Unusual Thought Content	Unusual, odd, strange, bizarre thought content.	
		Factor Score	
Negative	Emotional Withdrawal	Lack of spontaneous interaction, isolation deficiency in relating to others.	
	Motor Retardation	Slowed, weakened movements or speech, reduced body tone.	
	Blunted Affect	Reduced emotional tone, reduction in formal intensity of feelings, flatness.	
		Factor Score	
Resistance	Hostility	Animosity, contempt, belligerence, disdain for others.	
	Suspiciousness	Mistrust, belief others harbor malicious or discriminatory intent.	
	Uncooperativeness	Resistance, guardedness, rejection of authority.	
Activation	Tension (subjective)	Physical and motor manifestations of nervousness, over-activation.	
	Mannerisms & Posturing	Peculiar, bizarre, unnatural motor behavior (not including tic).	
	Excitement	Heightened emotional tone, agitation, increased reactivity.	
	Disorientation	Confusion or lack of proper association for person, place or time.	
		Factor Score	
		BPRS Total	

APPENDIX B
SAMPLE CHARACTERISTICS

B-1. Descriptive characteristics of categorical variables (N=102)

DSM Primary Diagnosis	N (Frequency)	Percent
Schizo & Other Psychotic d/o	83	81.4
Mood d/o	9	8.8
Anxiety d/o	1	1
Adjustment d/o	1	1
Substance Related d/o	7	6.9
Delirium, Dementia, Other Cognitive d/o	1	1

Ethnicity	N (Frequency)	Percent
African-American	67	65.7
Caucasian	30	29.4
Hispanic	4	3.9
Asian	1	1

Abuse History	N (Frequency)	Percent
None	43	42.2
Physical	16	15.7
Sexual	3	2.9
Combat	3	2.9
Multiple Trauma	18	17.6
Unknown	19	18.6

Head Trauma with LOC	N (Frequency)	Percent
None	56	54.9
Single Episode	25	24.5
Multiple Episodes	21	20.6

Religious Affiliation	N (Frequency)	Percent
No Affiliation	23	22.5
Protestant	1	1
Catholic	12	11.8
Jewish	2	2
Muslim	5	4.9
Baptist	13	12.7
Church of Christ	1	1
Pentecostal	4	3.9
Jehovah Witness	2	2
Generic Christian	18	17.6
Methodist	3	2.9
Other	1	1
Unknown	17	16.7

Admission Number	N (Frequency)	Percent
1	74	72.5
2	24	23.5
3	4	3.9

Charge Type	N (Frequency)	Percent
First Degree Felonies	7	6.9
Second Degree Felonies	40	39.2
Third Degree Felonies	44	43.1
Capital Offenses	11	10.8

Violent	N (Frequency)	Percent
No	43	42.2
Yes	59	57.8

Violence Type	N (Frequency)	Percent
None	42	41.2
Verbal	46	45.1
Objects	3	2.9
Self	1	1
Others	4	3.9
Verbal/Self	1	1
Verbal/Others	5	4.9

Veteran Status	N (Frequency)	Percent
None	86	84.3
Army	13	12.7
Air Force	1	1
Coast Guard	1	1
Unknown	1	1

Psychiatrist	N (Frequency)	Percent
1	17	16.7
2	14	13.7
3	30	29.4
4	12	11.8
5	6	5.9
6	18	17.6
7	5	4.9

B-2 Descriptive characteristics of continuous variables.

	Mean	Std. Error of Mean	Median	Mode	Std. Deviation	Variance	Minimum	Maximum	Sum	Percentiles 25.0	50	75	90
AGE	36.75	1.23	36	21	12.44	154.8	19	77	3749	25.8	36	46	56
EDUCATION LEVEL	12.58	1.17	11	12	11.83	139.91	6	99	1283	9.0	11	12	14
MMSE	22.96	0.51	24	26	4.86	23.64	7	30	2089	20.0	24	26	29
BHS	4.910	0.52	3	1	4.82	23.19	0	19	422	1.0	3	9	12
HCR Scores													
Historical Subscale	12.73	0.36	13	10	3.66	13.37	3	20	1298	10.0	13	16	17
Clinical Subscale	6.02	0.22	6	7	2.18	4.75	1	10	614	4.0	6	8	9
Total Score	18.7	0.49	18	16	5.00	24.97	7	30	1907	15.0	18	22	26
Aggressive Incidents													
Verbal	2.20	0.38	1	0	3.86	14.93	0	23	224	0	1	3	7.7
Objects	0.41	0.12	0	0	1.25	1.55	0	8	42	0	0	0	1.0
Self	0.11	0.07	0	0	0.72	0.51	0	7	11	0	0	0	0
Others	0.38	0.10	0	0	1.02	1.05	0	7	39	0	0	0	1.0
Total	3.10	0.53	1	0	5.37	28.82	0	25	316	0	1	3	9.7
Aggression Severity	15.45	2.94	2	0	29.67	880.49	0	150	1576	0	2	15	64
BPRS													
Affect	3.46	0.23	3.38	0	2.37	5.6	0	9.25	353	1.58	3	5	6.6
Positive	7.1	0.44	6.65	6.5	4.44	19.69	0	18.50	724	3.69	7	10	14
Negative	2.93	0.25	2.63	0	2.53	6.39	0	9.25	299	0.69	3	5	7.2
Resistance	4.18	0.33	3.71	0	3.29	10.8	0	14.25	426	1.69	4	6	9.5
Activation	4.24	0.37	3.59	0	3.74	13.95	0	18.75	432	1.69	4	5	9.5
Overall	21.85	1.14	20.5	11	11.54	133.22	2.33	52.75	2228	13.2	21	28	39

Note: MMSE=Mini Mental Status Examination; BHS=Beck Hopelessness Scale.

B-3. Correlations between HCR and BPRS instruments and aggression measures.

			N=102	N=102	N=59	N=102	N=59
Measure	Subscale/Factor	Variable	Violence Y/N r	OAS Severity r	OAS Severity r	Verbal vs. Physical r	Verbal vs. Physical r
HCR-20	Total Score		.255**	.324**	.273*	.218**	-
	History Subscale		.196*	.251*	-	.180*	-
		Previous Violence	-	-	.358**	-	-
		Employment Problems	-	-	.276*	-	-
	Clinical Subscale		.284**	.367***	.334**	.227**	-
		Lack of Insight	-	-	-	-	-
		Negative Attitudes	-	-	.265*	-	-
		Impulsivity	.208*	-	.302*	-	-
BPRS	Total		-	.313***	.412**	-	-
	Affect		-	-	-	-	-
		Somatic Concern	-	-	-	-	-
		Anxiety (subjective)	.222*	.212*	-	-	-
	Positive Symptoms		-	.244*	.355**	-	-
		Conceptual Disorganization	-	-	.299*	-	-
		Grandiosity	.238*	.217*	-	.174*	-
		Hallucinatory Behavior	-	.228*	.332**	-	-
		Unusual Thought Content	-	-	.283*	-	-
	Negative Symptoms		-	-	.292*	-	-
		Emotional Withdrawal	.327***	-	-	-	-
	Resistance		-	.251*	.264*	-	-
		Hostility	.288***	.365***	.311*	.194*	-
		Uncooperativeness	-	-	-	-	-
	Activation		.240*	.336***	.372**	-	-
		Tension (subjective)	.241*	.294**	.281*	.275*	.275*
		Mannerisms & Posturing	-	-	-	-	-
		Excitement	.327***	.388***	.303*	-	-
		Disorientation	-	-	.266*	-	-

Note: *p < .05 **p < .01 ***p<.001

B-4. Correlations between demographic variables and aggression measures

Measure	Subscale/Factor	Variable	N=102 Violence Y/N r	N=102 OAS Severity r	N=59 OAS Severity r	N=102 Verbal vs. Physical r	N=59 Verbal vs. Physical r
Demographics		Primary Dx	-	-	-0.268*	-	-
		Psychiatrist	-	-	-	-	-
		Charge Severity	-	-	-	-	-
		Age	-0.259**	-	-	-	-
		Admission #	-	-	-	-	-
		Veteran Status	-	-	-	-	-
		Religion	-	-	-	-	-
		Marital Status	-	-	-	-	-
		Education	-	-	-	-	-
		MMSE	-	-	-	-	-
		Head Trauma	-	-	-	-	-
		Abuse	-	-	-	-	-
		BHS	-	-	-	-	-
		Malingering	-	-	-	-	-
		Ethnicity	-	-	-	-	-
		Disposition	-	-	-	-	-

Note: *p < .05 **p < .01 ***p<.001

APPENDIX C
ANALYSIS OF UNIVARIATE OUTLIERS

C-1. Cases with extreme scores on primary measures.

Subject	Variable	Mean	SD	Subject's Score	Z-Score
7044	BPRS Resistance Factor	4.18	3.29	14.25	3.06
7099	BPRS Activation Factor	4.24	3.74	18.75	3.88
7044	BPRS Activation Factor	4.24	3.74	9	3.88
2042	OAS Total (Aggression Severity)	21.85	11.54	112	3.25
2689	OAS Total (Aggression Severity)			146	4.40
6781	OAS Total (Aggression Severity)			150	4.53
6781	Frequency of Aggression	3.10	5.37	21	3.33
7053	Frequency of Aggression	3.10	5.37	22	3.52
2689	Frequency of Aggression	3.10	5.37	24	3.89
2042	Frequency of Aggression	3.10	5.37	25	4.01

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BIOGRAPHICAL SKETCH

Dominique Delalot was born in New York City New York, where he lived throughout his formative years. He graduated from the United Nations International School in 1987, completing the International Baccalaureate degree. He attended the aeronautics programs at Hawthorne College in Antrim New Hampshire from 1987 to 1988, and Bridgewater State College in Bridgewater Massachusetts from 1988 to 1991, earning certifications in flight training towards becoming a commercial pilot. He subsequently completed a Bachelor of Science in psychology at Bridgewater Sate College, and returned home to complete a Master of Arts in general psychology at New York University in 1994.

Since then, he has worked as a study coordinator and research assistant at numerous New York area hospitals. From 1994 to 1995, he conducted research at Mount Sinai Medical Center's Positron Emission Tomography (PET) Laboratory on the means to reduce and reverse memory loss associated with aging, and worked on developing innovative approaches to learning and memory enhancement in normal older individuals. From 1997-2000, he worked at New York University Medical Center and the affiliated Veteran's Affairs New York Harbor Healthcare System on studies examining treatment refractory schizophrenia, the efficacy of pharmacological interventions in the treatment of cocaine dependent outpatients, and the cognitive effects of antidepressant medications on healthy individuals. And, from 2001 to 2004, he worked at the Functional Brain Imaging Laboratory of North Shore University Hospital / Long Island Jewish Medical Center studying brain dysfunction underlying cognitive and affective abnormalities in Parkinson's disease.

He arrived at the University of Florida in 2004, where he focused his efforts on gaining further specialized training in neuropsychology with a variety of medical populations, gaining additional experience in assessment and intervention in cases of severe psychopathology and

exposure to additional theoretical models of therapy, and working in a variety of inpatient and outpatient settings. The pursuit of a variety of experiences led to an opportunity to work with mentally ill criminal offenders at the North Florida Evaluation & Treatment Center in Gainesville, Florida. The present research on the static and dynamic risk variables predictive of violence in a population of psychiatrically hospitalized criminal offenders was based on this work. He completed his Doctor of Philosophy in the Department of Clinical and Health Psychology (Neuropsychology Track) in the summer of 2010, and continued his clinical work with individuals suffering from various mental diseases, and research efforts examining the neurological underpinnings of psychological disorders.