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Jennifer L. Skeem, Edward P. Mulvey, Paul Appelbaum, Steven Banks, Thomas Grisso, Eric Silver and Pamela Clark Robbins

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# IDENTIFYING SUBTYPES OF CIVIL PSYCHIATRIC PATIENTS AT HIGH RISK FOR VIOLENCE

JENNIFER L. SKEEM

*University of California, Irvine*

EDWARD P. MULVEY

*University of Pittsburgh*

PAUL APPELBAUM

STEVEN BANKS

THOMAS GRISSO

*University of Massachusetts*

ERIC SILVER

*Pennsylvania State University*

PAMELA CLARK ROBBINS

*Policy Research Associates*

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Advances in risk assessment have improved the ability to identify psychiatric patients at high risk for violence. Identifying these patients is necessary for developing treatment to address their needs. However, if violence is caused by risk factors that vary across patients, relatively homogeneous subgroups of high-risk patients must be identified and studied to develop effective risk management programs for each. This study was designed to identify and describe valid subtypes of patients reliably identified as at high risk by the multiple Iterative Classification Tree (ICT) risk assessment approach. After existing typologies of violent individuals were integrated to develop hypothesized subtypes of high-risk patients, data on 165 patients identified as at high risk by the multiple ICT were used to determine whether clinically meaningful subtypes could be identified and externally validated. Three groups (alpha, beta, and delta) largely consistent with the hypothesized subtypes and their correlates were identified. The implications of these findings for research and treatment development efforts are discussed.

**Keywords:** violence; psychiatric patients; subtypes; variants, psychopathy; psychosis

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Recent research has provided some clarification about the relation between mental illness and violence. It is now generally recognized that only a small proportion of violent crime is attributable to individuals with mental illness (see Monahan, 1992), that most mentally ill people are not violent (J. Swanson, Holzer, Ganju, & Jono, 1990), and that the use of alcohol and other drugs more than mental illness per se contributes to psychiatric patients' involvement in violence (Steadman et al., 1998). A large body of recent research on several "state-of-the-art" risk assessment tools also has considerably improved the ability to identify mentally ill people who are likely to be involved in violence (e.g., Banks et al., in press; Harris, Rice, & Quinsey, 1993; Webster, Douglas, Eaves, & Hart, 1997).

The development of these risk assessment tools has implications for risk management and intervention with violence-prone patients. The ability to better identify high-risk patients allows agencies to prioritize treatment resources to reduce their risk (see Andrews, Bonta, & Hoge, 1990; Bonta, Wallace-Capretta, & Rooney, 2000) and paves the way for developing systematic treatment approaches to address their needs. With respect to the latter point, although most extant research frames violence risk as a static phenomenon, contemporary conceptualizations of violence risk emphasize its dynamic nature (e.g., Heilbrun, 1997; Monahan & Appelbaum, 2000; Mulvey & Lidz, 1998; Skeem & Mulvey, 2002). According to this conceptualization, even among "high-risk" patients, violence risk ebbs and flows as the state of dynamic risk factors for violence changes (see Kazdin, Kraemer, Kessler, Kupfer, & Offard, 1997; Kraemer, Kazdin, Offord, & Kessler, 1997). Thus, to reduce risk, researchers and practitioners must design focused interventions that target and attempt to modify high-risk patients' dynamic risk factors for violence.

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Arguably, discovering these patients' dynamic risk factors for violence and developing systematic interventions to address them are the next key challenges for progress in this field. To meet these challenges, it first must be determined whether there are meaningful subtypes of patients within the group of patients at high risk for violence. If violence is caused by risk factors that vary, even across high-risk patients, relatively homogeneous patient subgroups must be identified and studied to develop appropriate treatment programs that target a limited number of major risk factors for each in an integrated manner.

There are two reasons to believe that despite common assumptions, high-risk patients are not a homogenous group that would uniformly respond to a single intervention approach. First, there is direct evidence that patients differ, sometimes dramatically, in their frequency and severity of violence. As is the case in the general population (Blumstein, Cohen, Roth, & Visher, 1986), violent incidents tend to be concentrated in a small but critical subgroup of the patient population (Banks et al., in press). For example, Gardner, Lidz, Mulvey, and Shaw (1996) found that modal patients (55% of their sample) were not violent. However, the most violent 5% of psychiatric patients accounted for nearly half (45%) of all violent incidents. These frequently violent patients' incidents were also more serious than those of other patients.

Second, psychiatric patients are a heterogeneous population with regard to many other aspects of their lives, including symptomatology, living situations, and mental health and criminal histories. Given this fact, paths toward violent behavior are likely to differ substantially across individuals (see Marzuk, 1996; Mulvey, 1994). In fact, patients diagnosed with particular disorders (e.g., antisocial personality disorder) may arrive at those diagnoses through vastly different routes (e.g., 29 trillion different symptom combinations; Rogers & Dion, 1991), which may translate into considerable heterogeneity in diagnostic groups. The same also may be true of patients at high risk for violence. A review of the best studied risk assessment tools (e.g., Harris et al., 1993; Webster et al., 1997) suggests that patients could be classified as at high risk on the basis of quite different combinations of risk factors.

Patients classified as at high risk may differ considerably from one another, even if identified with a “case-sorting” risk assessment tool such as that developed from the MacArthur Violence Risk Assessment Study (Monahan et al., 2001), the multiple Iterative Classification Tree (ICT; Banks et al., in press). Although the decision tree approach that underlies the multiple ICT recognizes that different risk factors may characterize different groups of patients, patients classified as at high risk ultimately are homogeneous only with respect to their levels of violence risk. Each patient may arrive at a given risk classification on the basis of numerous combinations of variables.

Currently, software is being developed to accompany an expanded multiple ICT (see Banks et al., in press). Assuming that the model is successfully validated, this software (when developed and distributed) will provide clinicians with a relatively easy method for identifying high-risk patients. The challenge of focusing treatment on appropriate issues, however, will still remain. Although valuable for identifying high-risk groups, ICT classifications provide little information about the nature of these patients and the types of treatment that may best suit their needs.

This study was designed to provide an elaborated view of the types of high-risk patients identified by the multiple ICT. Notably, because clinicians typically must assess and treat patients before they are involved in violence, we focused on identifying subtypes of high-risk patients rather than violent patients. The broader purpose of this study was to determine whether there are meaningful subtypes of patients at high risk for violence to promote the future development of systematic treatment programs that identify and target major dynamic risk factors for each subtype. Research with criminal offenders has shown that certain treatments are particularly effective in reducing recidivism when they target specific types of offenders (Andrews et al., 1990; Gendreau & Ross, 1987; Palmer, 1992). A valid typology ultimately would aid in developing effective risk intervention strategies, perhaps resulting in appropriate patient-treatment matching.

#### **IDENTIFYING HIGH-RISK PATIENTS: THE MULTIPLE ICT**

The participants in the present study (i.e., patients identified as at high risk by the multiple ICT in the MacArthur Risk Assessment

Study) are of particular clinical and policy concern. Banks et al. (in press) found that although these patients made up only 15% of the sample, they accounted for over 67% of reported violent incidents. Identifying any subtypes within these high-risk patients and developing effective targeted treatment programs to address their needs could considerably reduce violence among patients.

The multiple ICT is the most recent and sophisticated of three incremental risk assessment approaches developed from the MacArthur study, each of which is based on the ICT's statistical approach (Banks et al., in press; Monahan et al., 2001; Steadman et al., 2000). This ICT decision tree approach selects an optimal predictor of violence from a pool of over 100 risk factors, splits a sample of patients into high-risk ( $\geq 37\%$  violent) and low-risk ( $\leq 9\%$  violent) groups on the basis of values of that predictor, and repeats the process for each of the new sample partitions. This partitioning approach is then repeated by pooling together the patients who were not classified as at high or low risk in the first solution and completing a second iteration with these yet unclassified patients. This process is repeated until no more patients can be classified into high- or low-risk groups of at least 50 cases.

The multiple ICT (Banks et al., in press) integrates the predictions of five decision trees developed using the process described above. Each of the five trees features a different risk factor as the starting point for the development of the tree. A composite risk score is computed by assigning patients scores on each tree and then summing these scores. The composite score determines the classification of a patient into one of five risk groups. Banks et al. (in press) found that among patients in the five risk groups, 1%, 8%, 26%, 56%, and 76% were involved in at least one violent incident during the first 20 weeks after hospital discharge, and 0%, 2%, 10%, 22%, and 37% were involved in two or more violent incidents during the same period. The area under the receiver operating characteristic curve for the multiple ICT model is 0.88, higher than comparable values found in other studies of violence prediction. Integrating the results of multiple models increases predictive accuracy, perhaps because each model uses different sets of risk factors and taps different interactive processes related to violence (Banks et al., in press).

The most frequently violent patients in the MacArthur study (i.e., those in the fourth and fifth multiple ICT risk groups) were the participants in the present study. Because the multiple ICT uses many different combinations of risk factors to classify patients, patients are necessarily homogeneous only with respect to violence risk. Thus, although clinicians may soon be able to identify high-risk patients using the multiple ICT (assuming its successful validation), they will know relatively little about the characteristics of these patients on the basis of their risk classifications. In this study, we sought to identify and describe valid subtypes of these patients using cluster-analytic strategies. By describing patients' characteristics, we hoped that this study would provide clues for developing strategies to treat them (cf. Monahan & Appelbaum, 2000).

#### **DEVELOPING HYPOTHESIZED SUBTYPES OF HIGH-RISK PATIENTS**

The initial step of this study involved integrating existing theory and research to develop hypothesized subtypes of high-risk patients. These subtypes guided the study's cluster-analytic strategy. Formulating a priori hypotheses about the nature of potential subtypes and subjecting them to the danger of refutation (Meehl, 1978) addresses some of the uncertainties involved in cluster analyses and provides a strong framework for interpreting their results.

*Reviewing typologies.* Because no typologies of violence-prone or violent civil psychiatric patients have been empirically investigated and published, our hypotheses about the types of high-risk patients that might exist were informed by work on typologies developed with similar populations. The typologies most relevant to patients at high risk for violence arguably are of people who have often been violent and who have high likelihoods of mental disorders. Thus, we reviewed typologies of prisoners (Bohn, Carbonell, & Megargee, 1995; Van Voorhis, 1988, 1994; Wrobel, Wrobel, & McIntosh, 1988), mentally disordered offenders (Blackburn, 1975, 1996, 1998; Blackburn & Coid, 1999; Toch & Adams, 1994; Wales, 1995), "difficult" psychiatric patients (Nakatani, Ohki, Yamada, Iwanami, & Fujimori, 1992), and male batterers (Hamberger, Lohr, Bonge, &

Tolin, 1996; Holtzworth-Munroe, 2000; Holtzworth-Munroe & Stuart, 1994).<sup>1</sup> We did not review typologies that have not been empirically investigated (e.g., Litwack & Schlesinger, 1987; Walker, 1991).

We then integrated these typologies to derive hypotheses to guide our investigation of possible subtypes of high-risk patients. These included hypotheses about the dimensions that might maximally discriminate among hypothesized subtypes. In integrating typologies, we placed greater emphasis on typologies that were both based in theory and had been empirically investigated (i.e., Blackburn, 1998; Holtzworth-Munroe & Stuart, 1994; Van Voorhis, 1994). Because we expected that the high-risk patients would be psychiatrically impaired but capable of functioning in the community, we placed little emphasis on subtypes of patients in these typologies who had no psychiatric problems or were “institutionalized.”

*Hypothesized subtypes.* Although the typologies reviewed were developed for different populations, they overlap in their descriptions of particular co-occurrences of characteristic backgrounds, symptoms, and violence. On the basis of the commonalities among typologies, we hypothesized three major subtypes of psychiatric patients at high risk for violence, which we labeled alpha, beta, and delta. Table 1 lists each of these hypothesized subtypes and the corresponding groups found in the cited literature.

Alpha patients were hypothesized to be the most highly and generally violent, with violence often (but not always) occurring for purposeful reasons or to reach a clear external goal. When violent offenders are distinguished on the basis of the extent to which they have been involved in solely reactive violence or a mixture of reactive and instrumental violence, the latter group manifests significantly more traits of primary psychopathy (Cornell et al., 1996; see also Hart & Dempster, 1997). Alpha patients are likely to have antisocial values, abuse substances, and, more importantly, manifest an affective deficit associated with such core psychopathic traits as callousness and emotional detachment. Those who seek help may do so for depression but are unlikely to be highly anxious. These patients are likely to have long criminal histories with an assortment of offenses and somewhat limited employment and relationship histories. Alpha patients are similar to the following groups identified in past research: primary psycho-

**TABLE 1: Commonalities Among Typologies on the Basis of Co-Occurrences of Characteristic Backgrounds, Symptoms, and Violence**

<i>Typology (population)</i>	<i>Alpha</i>	<i>Beta</i>	<i>Delta</i>
Van Voorhis (1994) (prisoners)	Committed criminal; most character disordered	"Charlie" of character- disordered type	Mentally disturbed
Toch and Adams (1994) (mentally disordered prisoners)	Composite career offender; compounded career offender	Chronic exploder; skid row exploder	Acute disturbed exploder
Blackburn (1998) (mentally disordered offenders)	Primary psychopath	Secondary psychopath	Disturbed
Nakatani, Ohki, Yamada, Iwanami, & Fujimori. (1992) (difficult psychiatric patients)	Antisocial- manipulative	(Emotionally) agitated-unstable	Aggressive- impulsive
Holtzworth-Monroe & Stuart (1994) (Male batterers)	Violent-antisocial	Dysphoric-borderline	—

pathic patients (Blackburn, 1998), violent or antisocial patients (Holtzworth-Monroe & Stuart, 1994), committed criminal and character-disordered patients (Van Voorhis, 1994), antisocial-manipulative patients (Nakatani et al., 1992), and composite and compounded career offenders (Toch & Adams, 1994). These types share some features with historical theories of primary psychopathy (see Skeem, Poythress, Edens, Lilienfeld, & Cale, in press).

Beta patients were hypothesized to be moderately violent, often in emotionally driven responses to perceived provocation or stressors (see Cornell et al., 1996). They are dysphoric, anxious, emotionally volatile, hostile, and impulsive, and they are heavy substance abusers. They may have limited criminal histories and good employment histories relative to the primary psychopathic features and psychotic (but not neurotic) types. Relative to the other types, beta patients may have more troubled interpersonal relationships. Beta patients are similar to

the following types identified in past research: dysphoric-borderline patients (Holtzworth-Monroe & Stuart, 1994), secondary psychopathic patients (Blackburn, 1998), chronic disturbed exploder and skid row exploder patients (Toch & Adams, 1994), agitated-unstable patients (Nakatani et al., 1992), and an emotionally unstable variant of character-disordered patients ("Charlie"; Van Voorhis, 1994). This group may be distinguished from the alpha group primarily on the basis of the beta group's greater affective capacity and greater emotional problems (for a review of related theories, see Skeem et al., in press).

Delta patients were hypothesized to be moderately to seriously violent, with violence often occurring during periods of acute psychosis and agitation. They often experience positive symptoms of psychosis, including hallucinations and delusions, and may often be hostile, cynical, and paranoid. These patients have relatively long histories of intensive treatment and limited histories of arrest and employment. Delta patients are most like the following types identified in past research: mentally disturbed patients (Van Voorhis, 1994), disturbed patients (Blackburn & Coid, 1999), acute disturbed exploder patients (Toch & Adams, 1994), and aggressive-impulsive patients (Nakatani et al., 1992).

*Beyond labels.* We assigned abstract labels (*alpha*, *beta*, and *delta*) to the hypothesized subtypes to avoid the assumption that each subtype invariably exhibits a specific type of disorder or violence. First, we did not hypothesize that beta (or even alpha) patients were necessarily "psychopathic" according to contemporary assessment criteria (see Hare, 1991) or that delta patients invariably met diagnostic criteria for psychotic disorders. Second, multiple motives and contributing factors often underlie a single violent act. For example, as noted by Bushman and Anderson (2001), violence can include both reactive and instrumental components. Moreover, reactive violence can involve controlled planning (e.g., to exact revenge), and instrumental violence can become more automated with practice (e.g., to react to an opportunity for gain). Nevertheless, our review suggested that we could identify individuals with particular constellations of characteristics who often were involved in mixed reactive and instrumental, habitually reactive, and "psychotic" patterns of violence. Our explor-

atory labels of *alpha*, *beta*, and *delta* were intended only to facilitate the study of high-risk subtypes.

#### TESTING HYPOTHESIZED SUBTYPES OF HIGH-RISK PATIENTS

In this study, we sought to determine whether these hypothesized subtypes existed in the select sample of civil psychiatric patients reliably identified as at high risk by the multiple ICT. Our goal was to isolate and provide a detailed view of relatively homogeneous subgroups of high-risk patients for future study and targeted intervention. Comprehensive data on risk factors and community violence from the MacArthur Violence Risk Assessment Study provided a rare opportunity to address these goals.

### METHOD

#### PARTICIPANTS

The methodology of the MacArthur Violence Risk Assessment Study has been described in detail elsewhere (e.g., Monahan et al., 2001; Steadman et al., 1998) and will be presented here in only broad terms. In fact, this study's basic data set and a detailed description of many of the variables listed below are available at <http://macarthur.virginia.edu>. Participants were sampled from three acute inpatient psychiatric facilities (in Pittsburgh, Pennsylvania; Kansas City, Missouri; and Worcester, Massachusetts). The inclusion criteria for participating were (a) civil admission; (b) age between 18 and 40 years; (c) English speaking; (d) White or African American ethnicity (or Hispanic in Worcester only); and (e) a medical record diagnosis of schizophrenia, schizophreniform disorder, schizoaffective disorder, depression, dysthymia, mania, brief reactive psychosis, delusional disorder, alcohol or other drug abuse or dependence, or a personality disorder.

During the study period, 1,136 patients enrolled in the study. The sample for the present study was the subgroup of 165 patients who were classified by the multiple ICT into the fourth and fifth high-

risk groups. These high-risk patients were often young ( $M = 28$  years,  $SD = 6$  years), White (61%; African-American, 39%; Hispanic, 3%), male (64%), involuntarily admitted (52%) patients with independently determined primary diagnoses of (a) depression or dysthymia (40%), (b) schizophrenia or schizoaffective disorder (6%), (c) bipolar disorder (8%), (d) substance abuse (41%), (e) personality disorder (4%), or (f) other disorders (1%). Some 56.4% of patients were diagnosed with comorbid major mental disorders (a to c above) and substance abuse disorder.

Although the 165 high-risk patients in this sample did not differ significantly from the remaining sample in age, they were somewhat less likely to be White,  $\chi^2(1, N = 939) = 5.2, p < .05$ ; more likely to be involuntarily admitted,  $\chi^2(1, N = 939) = 35.6, p < .001$ ; and less likely to be diagnosed with schizophrenia or schizoaffective disorder,  $\chi^2(1, N = 939) = 18.9, p < .001$ . They were also more likely to be diagnosed with alcohol abuse disorders,  $\chi^2(1, N = 939) = 65.2, p < .001$ , and drug abuse disorders,  $\chi^2(1, N = 939) = 57.9, p < .001$ ; less likely to be classified as having major mental disorders but no substance abuse disorders; and more likely to be classified as having major mental disorders and substance abuse disorders,  $\chi^2(3, N = 939) = 120.4, p < .001$ .

#### PROCEDURE

Patients were interviewed in the hospital by a research interviewer to obtain data on demographic and historical factors and then by a research clinician chiefly to confirm the medical record diagnosis using the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., revised; *DSM-III-R*) checklist (Janca & Helzer, 1990).

After enrolled patients were discharged from the index hospitalization, research interviewers attempted to recontact them in the community and interview them five times (every 10 weeks) over a 1-year period to obtain information about a range of factors, including their involvement in violence. Collateral informants (often family members) who were familiar with patients' activities in the community were also interviewed on the same schedule. In addition to interviews with patients and collateral informants, hospital and arrest records were used as sources of information.

## MEASURES

Although the data set from the larger study offered a wide array of descriptive variables on these patients and their violence, this investigation used only measures that potentially were useful in distinguishing among or describing the hypothesized subtypes of high-risk patients. On the basis of the three steps of this investigation, three subsets of measures were chosen. First, cluster-analytic strategies were used to determine whether there were groups of patients that were consistent with the hypothesized subtypes. For this step, measures that were likely to differentiate among the subtypes were selected. Second, the identified groups were tested to determine whether they differed as expected on measures that were not used to derive them in the cluster analyses. For this external validation step, a second set of measures likely to distinguish among the groups (but with low correlations with the clustering measures) was selected. Third, the identified and validated groups were more fully described, using a subset of variables that could provide a richer picture of their individual characteristics. Each subset of measures is presented below. To conserve space, we provide only brief descriptions of these measures, which were described in detail by Monahan et al. (2001) and Monahan and Steadman (1994).

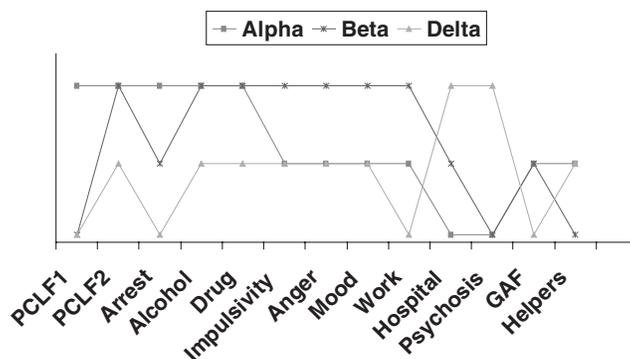
### Clustering Measures

The first crucial decision involved in cluster analysis is the choice of variables used to group the cases. The goal of this process is to select a sufficient number of variables to represent relevant individual differences across patients without including variables that provide no relevant information for classification or dilute the analyses (Andenberg, 1973). In this study, the choice of clustering measures was grounded in theory rather than based on strictly empirical criteria (e.g., selecting variables with maximum variance). As noted earlier, formulating hypotheses about the nature of the clusters and subjecting them to the risk for refutation (Meehl, 1978) helps address the uncertainties involved in cluster analyses and provides a framework for interpreting their results.

The principal criterion in selecting the variables on which to cluster the patients was that of distinguishing among the hypothesized types (alpha, beta, and delta). Thirteen clustering variables were selected chiefly on the basis of their relevance for doing so.<sup>2</sup> These variables appeared likely to distinguish among the hypothesized types of high-risk patients, tapped general constructs, and provided unique information (i.e., all but one intervariable correlation < .30). A table that explains the decision-making process for each variable is available from the first author. However, analyses described below suggest that the cluster solution obtained in this study was not highly dependent on the variables selected.

The 13 clustering variables included violence-relevant personality traits (psychopathy, impulsivity, and anger); interpersonal relationships and support; legal, employment, and psychiatric treatment histories; psychiatric symptoms and functioning at admission; and substance-related diagnoses, each of which is described below. Figure 1 depicts the theoretical score configurations for the hypothesized types across the selected clustering variables. These score configurations were relative (e.g., the alpha group was hypothesized to have high scores on both factors of the Psychopathy Checklist: Screening Version [PCL:SV] relative to the other subtypes, not necessarily in absolute terms).

*Psychopathy factor scores.* Patients' dimensional scores on the two scales of the PCL:SV (Hart, Cox, & Hare, 1995) were used as clustering variables. Briefly, scores on the PCL:SV are highly correlated ( $r = .80$ , Hart et al., 1995) with those of its parent measure, the Revised Psychopathy Checklist (Hare, 1991). Interrater reliability on the PCL:SV in this study was "good" ( $\kappa = .66$ , Cicchetti & Sparrow, 1981), when interviewers were defined as in agreement when their PCL:SV total scores fell within five points of one another (see Skeem & Mulvey, 2001). PCL:SV Factor 1, Emotional Detachment, represents the core affective and interpersonal traits of psychopathy. Factor 2, Social Deviance, reflects behavioral indices of an antisocial lifestyle. Although these scales were moderately correlated ( $r = .55$ ), both were included because they represent conceptually distinct facets of psychopathy that were thought likely to distinguish between alpha



**Figure 1: Theoretical Score Configurations for Hypothesized Patient Subtypes**

and beta groups (see Skeem et al., in press), with the beta group obtaining a lower Factor 1 (but not Factor 2) score than the alpha group (see Figure 1).

*Impulsivity and anger.* Two additional measures of personality traits were used as clustering variables. The Impulsivity—Non-Planning subscale of the Barratt Impulsiveness Scale (BIS; Barratt, 1994) was used to reflect a “lack of concern for the future,” and the Anger—Arousal subscale of the Novaco Anger Scale (NAS; Novaco, 1994) was used to operationalize the physiological activation of anger. As shown in Figure 1, these scales were thought likely to be helpful in distinguishing between the alpha and beta groups, with the beta group being more impulsive and hostile.

*Arrest, work, and psychiatric treatment histories.* Patients’ self-reported frequencies of prior arrests (coded as none, once, twice, or three or more) since age 15 were used to reflect their criminal histories. Similarly, patients’ self-reported employment status prior to hospital admission (employed or unemployed) was used to reflect their recent work histories, and their self-reported numbers of prior psychiatric hospitalizations were used to reflect their treatment histories. As shown in Figure 1, these three variables were thought likely to be helpful in distinguishing among all three subtypes.

*Relationships and social support.* To provide a general index of the extent to which patients described themselves as having supportive relationships with others, the number of positive and material helpers was used. This reflected the numbers of individuals whom patients named as providing instrumental help and/or emotional support and was based on a social network inventory (Estroff & Zimmer, 1994). Relative to the other subtypes, the beta group was predicted to perceive less supportive relationships (see Figure 1).

*Symptoms and functioning at admission.* Research clinicians' structured assessments were used to characterize patients' psychiatric states at admission, including the Anxiety-Depression and Thought Disturbance subscales of the Brief Psychiatric Rating Scale (BPRS; Overall & Gorham, 1962) and the Global Assessment of Functioning (GAF; American Psychiatric Association, 1987). As shown in Figure 1, these types of symptoms and functioning were thought to be relevant to distinguishing among all three subtypes (e.g., with the delta group manifesting more thought disturbance and lower functioning than other subtypes).

*Substance-related diagnoses.* On the basis of the research clinicians' administration of the *DSM-III-R* checklist, the indicators "alcohol-related diagnosis" (i.e., alcohol abuse or dependence) and/or "drug-related diagnosis" (i.e., drug abuse or dependence) were coded. Relative to the other subtypes, the delta group was predicted to have fewer substance-related diagnoses (see Figure 1).

### **External Validation Measures**

Because cluster analyses impose structure even when there is none, it is important to validate a cluster solution by determining whether the identified groups differ in theoretically coherent ways across measures that were not used to cluster the groups. In this study, preliminary external validation analyses were conducted on measures that were likely to distinguish among the hypothesized subtypes (i.e., were theoretically relevant) but had low ( $r < .30$ ) correlations with the variables used to cluster the groups (i.e., did not overlap with the cluster-

**TABLE 2: Criterion Variables and Hypotheses for Externally Validating Violent Subtypes**

<i>Variable</i>	<i>Hypotheses About Group Differences*</i>	<i>Consistent With Statistical Results?</i>
Variable Set 1		
Anxiety at admission	Beta group > other groups	No
Personal problem at admission	Beta group > other groups	Yes
Violent fantasies at baseline	Delta group > other groups	Partially
Antisocial personality disorder	Alpha group > other groups	Yes
Cluster B personality disorder	Alpha and beta groups > delta	Yes
History of property arrests	Alpha group > beta group	Yes
Living alone at baseline	Beta group < other groups	Yes
Variable Set 2		
Hallucinating before incident	Delta group > other groups	Yes
Drinking/using drugs before incident	Alpha group and beta group > other groups	No
Incident type (serious)	Alpha group > beta group	Yes
Cocombatant type	Alpha group more varied, fewer family members than other groups	No
Attendance at treatment	Alpha and delta groups < beta group	No

ing variables). These measures described patients' states at baseline and violence and treatment compliance during follow-up.

Table 2 depicts hypotheses about subtype differences across these two variable sets. For example, on the basis of theory, the delta group was expected to be hallucinating during violent incidents and to manifest poorer treatment compliance during follow-up.

*Baseline variables: psychiatric state, property arrests, and personality disorders.* Hospital records were used to code patients' reasons for admission, including anxiety, personal problems (with relationships, work, etc.), and threatening suicide (all coded as yes or no). Patients' reports of whether they were experiencing violent fantasies about injuring someone (Grisso et al., 1999) and were living alone at the time of the baseline interview were also used as external validation measures. As a gross proxy measure of the instrumentality of past offenses, police records of patients' arrest for crimes against property since age 18 (coded as yes or no) were used.

Two measures of personality disorders were used, including codes from hospital records of whether patients had been diagnosed with

antisocial personality disorder and codes of whether patients had been diagnosed with any Cluster B personality disorders (antisocial, borderline, histrionic, narcissistic) on the basis of research clinicians' administration of the Structured Interview for *DSM-III-R* Personality (Pfohl, Blum, Zimmerman, & Stangl, 1989). Hypotheses about the differences among subtypes with respect to each of these baseline variables are provided in Table 2.

*Follow-up variables: the nature of violence and treatment compliance.* The subgroups were also externally validated by determining whether there were theoretically coherent differences in the nature of their most serious violent incidents and their treatment compliance during the first 20 weeks after hospital discharge.<sup>3</sup>

Violence was assessed by asking patients and collaterals at follow-up interviews whether and how often patients had engaged in any of eight categories of aggressive behavior (see Silver, Mulvey, & Monahan, 1999). Aggressive acts reported by any information source were then reviewed to obtain single, reconciled reports of the acts. Violence was defined as battery that resulted in physical injury (ranging from bruises to death), sexual assaults, the use of weapons, or threats made with weapons in hand.

In this study, the patients' most serious violent incidents were coded to reflect the type of incident (throw, push, kick, or choke; hit or beat up; weapon threat or use; and other), the type of primary combatant (family or spouse equivalent, friend or acquaintance, or stranger), and whether the patients reported that they were hearing voices, drinking alcohol, or using drugs just before the incidents occurred.

For the purposes of this article, a gross index of treatment compliance was operationalized as the ratio of the number of treatment sessions attended to the number of sessions that were scheduled during each of the first two follow-up periods. The measure was based on patients' self-reports and was coded into three categories (< 5% of sessions missed, 6% to 24% of sessions missed, and > 24% of sessions missed). Hypotheses about how each subtype would perform on these follow-up variables are provided in Table 2.

### Descriptive Measures

Finally, several measures were used simply to provide a fuller clinical description of the types of patients identified via the cluster analysis and validated on external variables. These measures are listed below and were described in detail by Monahan et al. (2001). Variables that were endorsed by fewer than 5% of the high-risk patients in this study were excluded from comparison.

*Violence frequency.* The number of violent incidents (as defined above) that each patient had during the full-year follow-up period was assessed.

*Diagnoses.* On the basis of the research clinicians' administration of the *DSM-III-R* checklist, each patient was coded as yes or no for having the following categories of disorders: depression or dysthymia, schizophrenia or schizoaffective disorder, bipolar disorder, and personality disorder only. In addition, standard cutting scores for the PCL:SV were used to diagnose "potential psychopathy" (total > 13) and "psychopathy" (total > 18; Hart et al., 1995).

*Other aspects of state at admission.* Hospital records were used to code whether the reasons for patients' admission included substance abuse, delusions, hallucinations, decompensation, violence, aggression (nonviolent), suicide attempts, and evaluation.

During the baseline interviews, clinician researchers asked patients several questions about hallucinations and delusions, including adaptations from the Diagnostic Interview Schedule (Robins, Helzer, Croughan, & Ratcliff, 1981) and questions about whether patients were experiencing command hallucinations. They considered all available information in light of *DSM* criteria to judge whether patients experienced several types of delusions. In addition, eight screening questions about people following or seeking to harm patients and outside forces being in control of their minds were used to judge whether patients experienced threat or control-override delusions (Appelbaum, Robbins, & Roth, 1999).

*Arrest seriousness.* Patients' self-reported types of prior arrests (coded as property or minor or violent or serious) since age 15 were used to reflect the seriousness of their criminal histories (see Monahan et al., 2001).

## RESULTS

Cluster analysis was the primary analytic approach used in this project. There are two primary problems associated with cluster analysis (see Aldenderfer & Blashfield, 1984; Borgen & Barnett, 1987; Lorr, 1994; Morey, Blashfield, & Skinner, 1983), each of which was considered in designing the analytic strategy. First, as noted earlier, cluster analysis imposes structure and can create groups though none exist. Second, alternative methods of cluster analysis use different rules of group formation and often produce different solutions for identical data sets. We attempted to address these problems by (a) applying a theoretical approach for selecting variables and testing for hypothesized groups, (b) using well-validated clustering methods best suited to the nature of the hypothesized groups (e.g., not highly distinct), (c) deriving a "consensus" cluster solution on the basis of agreement across five "missing imputed" (MI) data sets (see below), and (d) attempting to validate the consensus cluster solution by determining whether the groups identified differed in theoretically coherent ways across variables that were not used to derive the cluster solution. Cluster analysis involves an input stage, in which the data are selected and prepared for clustering; an algorithm stage, in which a clustering method is applied to the data; and an output stage, in which the results are produced and studied for statistical and theoretical sensibleness (Gnadadesikan et al., 1989). These stages are addressed below.

### STAGE 1: INPUT VARIABLES

In this study, the input stage involved imputing missing data to produce complete data sets, transforming the clustering variables into a common scale, and choosing a distance metric. First, because the data

set consisted of a highly select group of 165 high-risk patients, we wished to avoid obtaining unrepresentative or unreliable results by excluding cases with missing values. The best available means of addressing this issue was to complete multiple imputation analyses on the clustering variables (for a description, see Schafer & Olsen, 1998). This process replaces missing values with stochastic scores based on the predicted distribution. We applied Schafer's (1997a) NORM software to replace each missing value with five stochastic scores, which resulted in five new MI data sets. Five data sets were developed because three to five imputations typically provide "excellent results" (Schafer, 1999). Multiple imputation requires that several data sets be analyzed and their results reconciled. This process helps estimate the uncertainty introduced by imputing missing values. Second, all scores were transformed into  $z$  scores in an effort to equalize the role of the variables in cluster analyses. Euclidean distance was chosen as the measure of profile (dis)similarity.

#### STAGE 2: APPLYING CLUSTERING ALGORITHMS

Having selected the 13 clustering variables and prepared five MI data sets, the next stage involved applying cluster analyses to the data. This involved cluster analyzing the five MI data sets, selecting the most reliable and interpretable solution, and developing a single consensus cluster solution by combining MI data sets.

*Clustering the five MI data sets.* To derive a cluster solution, two clustering methods that perform well in recovering known group structures were integrated (see Aldenderfer & Blashfield, 1984; Borgen & Barnett, 1987; Lorr, 1994; Morey et al., 1983). Specifically, Ward's method was used to generate promising solutions to "seed" or specify starting points for the k-means pass method.

First, Ward's method was applied to the 13 clustering variables. The number of clusters was estimated on the basis of consideration of the scree method, the variance ratio criterion (VRC; Calinski & Harabasz, 1974; see also Milligan & Cooper, 1985), and the interpretability of the solutions (Blashfield & Aldenderfer, 1988). Because the agglomeration coefficients usually suggested a three-cluster solution, and the VRC suggested a two- or three-cluster solu-

tion,<sup>4</sup> both solutions were retained for further evaluation. Second, these Ward's two- and three-group solutions were used to specify an initial partition for the k-means pass method of cluster analysis.

Although all of the analytic steps described below were completed for both the two- and three-group solutions, the three-group solution was chosen because it was more interpretable, externally valid, stable (across methods), and replicable (across subsamples) than the two-group solution. Thus, the remainder of this article focuses on the three-group solution.

*Deriving consensus clusters from the five MI data sets.* After applying the above analyses to the five MI data sets, five three-group cluster solutions were derived. The next step involved combining these results into a single three-group solution. To determine the extent to which one solution's classifications were roughly the same as those of the others, each solution's group memberships were cross-tabulated. Although the average chance-corrected rate of agreement across the five solutions was poor ( $\kappa = .33$ ), this partially reflected error associated with inserting different randomly imputed missing values in each data set, because clustering methods produce different results on the basis of different subsamples of data (Aldenderfer & Blashfield, 1984). To address this problem, an attempt was made to identify the solution that was most replicable across subsamples. Three MI solutions were found to manifest a good average level of agreement with one another ( $\kappa = .54$ ). Because three MI data sets typically are sufficient (Schafer & Olsen, 1998), these three data sets were used to develop a single, stable consensus cluster solution. Group membership in this solution was determined on the basis of the most frequent cluster assignment given to each case across the three data sets.

The three MI, three-group solutions were in 100% agreement about the cluster membership of 97 cases, 67% agreement about 56 cases, and 0% agreement about 12 cases. The consensus cluster solution represented the entire sample of 165 cases on the basis of majority cluster assignment (the 12 cases in the 0% agreement class were assigned to groups on the basis of a fourth MI data set's solution). The scores of the three groups in this solution across the variables used to cluster them are depicted in Table 3.

**TABLE 3: Comparisons of Identified Groups on Clustering Variables**

<i>Variable</i>	<i>Alpha</i> (n = 80)	<i>Beta</i> (n = 62)	<i>Delta</i> (n = 23)
Prior hospitalizations***	3.3	1.0	10.0
% worked part-time or full-time***	27.5	67.7	13.0
Arrest history (% ≥ 3 shown here)*	77.8	68.9	52.4
BPRS Anxiety-Depression subscale**	14.5	13.3	10.8
BPRS Thought Disturbance subscale***	5.8	5.6	10.8
BIS Impulsivity—Non-Planning subscale**	29.6	25.1	26.3
NAS Anger—Arousal subscale***	36.4	33.0	36.6
% any alcohol-related diagnosis*	72.5	82.3	52.2
% any drug-related diagnosis**	70.0	61.3	34.8
GAF score***	24.9	32.2	24.0
PCL Part I***	6.4	2.2	3.8
PCL Part II***	9.7	6.5	6.6
Number of positive and material helpers	4.6	4.7	4.5

*Note.* BPRS = Brief Psychiatric Rating Scale; BIS = Barratt Impulsiveness Scale; NAS = Novaco Anger Scale; GAF = Global Assessment of Functioning; PCL = Psychopathy Checklist.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ , based on analysis of variance or chi-square test.

### STAGE 3: EVALUATING THE OUTPUT

Having developed a single consensus cluster solution, the final analytic stage involved examining the output for statistical and theoretical coherence. Thus, the three groups of the consensus cluster solution were examined for robustness across different selected variable sets, compared statistically to determine whether they were externally valid, and interpreted and evaluated for consistency with the hypothesized subtypes of high-risk patients.

*Testing the effect of the variable selection process.* The hypothesized subtypes of high-risk patients and criteria used to select the 13 variables on which to cluster cases were described in detail earlier. There was a possibility that the variables selected were strongly influential in determining the cluster solution, despite the assumption that these variables represented distinct, theoretically relevant components of the hypothesized subtypes. If the identified three-cluster solution was not highly dependent on the variables selected, any single variable could be deleted without obvious effect (Andenberg, 1973). In application of this principle, 13 different cluster analyses

were performed in which each of the 13 variables used to derive the study's ultimate three-group solution was sequentially deleted, and the data were cluster analyzed on the 12 remaining variables. The method used to cluster cases<sup>5</sup> was the same as that described above for developing the study's ultimate solution.

This process produced 13 three-group solutions (only three-group solutions were entertained). The case classifications described by each of these solutions were cross-tabulated with those of the ultimate solution to determine the extent to which the classifications were in agreement. The average chance-corrected rate of agreement across the 13 solutions was fair ( $\kappa = .49$ ,  $SD = .15$ ). When corrected for error associated with imputing missing data,<sup>6</sup> the average chance-corrected rate of agreement was good ( $\kappa = .71$ ,  $SD = .21$ ). This suggests that the cluster solution derived was not highly dependent on the variables selected.<sup>7</sup>

*Validating the consensus clusters.* As explained earlier, validation analyses were completed to assess whether the three consensus groups identified appeared to actually be present in the data. Specifically, the identified groups were compared to determine whether they differed in coherent ways across two sets of variables that were not used to derive the cluster solution. The first set of "baseline" variables referenced patients' histories, symptoms, and personalities; the second set of "follow-up" variables referenced the natures of patients' most serious violent incidents and treatment compliance.

The baseline variables were used together in a direct discriminant function analysis to predict membership in the three consensus groups. Two functions were computed, with a combined  $\chi^2(18, N = 126) = 51.55, p < .001$ . After removal of the first function, there was still a strong association between groups and predictors,  $\chi^2(8, N = 126) = 18.89, p < .01$ . This provides support for the existence of these three groups. The univariate differences among groups across these variables are described in Table 4, and Table 2 indicates that five of the seven hypotheses about group differences were consistent with the results. The nature of these differences is described below.

Univariate tests were applied to the follow-up variables because a few patients did not have violent incidents, and many were not involved in treatment. As shown in Tables 2 and 4, although there

**TABLE 4: Univariate Comparisons of Identified Groups on External Validation Variables**

<i>Variable</i>	<i>Alpha % (n = 80)</i>	<i>Beta % (n = 62)</i>	<i>Delta % (n = 23)</i>
Baseline variables used in DFA			
Property arrests (% with $\geq 1$ )*	56.3	35.5	56.5
Lived alone at baseline*	17.9	6.5	30.3
Violent fantasies*	60.0	37.1	59.1
Chart ASPD diagnosis*	37.5	25.8	13.0
SID-P Cluster B diagnosis*	84.6	65.2	57.1
Present at admission: personal problem**	31.6	53.2	17.4
Present at admission: suicide threat*	68.4	56.5	39.1
Present at admission: anxiety	5.1	9.7	17.4
Follow-up variables			
Hearing voices just before incident*	3.7	3.6	25.0
Incident type**			
Throw, push/grab/slap, kick/bite/choke	6.5	28.6	12.5
Hit, beat up	38.7	50.0	50.0
Weapon threat or use	45.2	19.0	31.3
Other	9.7	2.4	6.3
Type of cocombatant			
Spouse equivalent/family	33.9	46.3	33.3
Friend/acquaintance	45.8	34.1	53.3
Stranger	20.3	19.5	13.3
Used drugs or alcohol before incident	63.6	63.9	42.9
Treatment noncompliance (shown: missed over one fourth of sessions)			
Weeks 1 to 10 after discharge	31.0	40.0	25.0
Weeks 11 to 20 after discharge	44.8	44.4	22.2

*Note.* DFA = discriminant function analysis; ASPD = antisocial personality disorder; SID-P = Structured Interview for DSM-III-R Personality.

\* $p < .05$ . \*\* $p < .01$ , based on univariate chi-square test.

were several expected trends, only two of the five hypotheses about group differences were statistically consistent with the results. This provides more limited support for the existence of the three groups. Given the exploratory nature of this study and the fact that it could not be designed to specifically target differences among the identified groups, these results are nonetheless promising.

*Describing the consensus clusters.* Additional analyses were completed to provide a fuller clinical description of the three groups derived via cluster analyses and validated on external variables. These

**TABLE 5: Descriptive Comparisons of Identified Groups**

<i>Variable</i>	<i>Alpha % (n = 80)</i>	<i>Beta % (n = 62)</i>	<i>Delta % (n = 23)</i>
<b>Violence</b>			
Average number of violent incidents	3.3	2.0	1.8
Violent during the 1-year follow-up	77.5	66.7	78.3
<b>Any diagnosis of</b>			
Depression/dysthymia*	60.0	51.6	26.1
Schizophrenia/schizoaffective disorder***	3.8	3.2	26.1
Bipolar disorder	7.5	8.1	21.7
Personality disorder only**	2.5	0.0	17.4
<b>Psychopathy diagnosis</b>			
Potential psychopathy (PCL:SV total > 12)***	80.9	11.3	31.8
Psychopathy (PCL:SV total > 17)***	41.2	0.0	9.1
<b>Present at admission</b>			
Depression*	59.5	53.2	30.4
Substance abuse**	73.4	75.8	43.5
Delusions*	2.5	8.1	17.4
Hallucinations	21.5	12.9	21.7
Command hallucinations*	21.3	16.1	43.5
Decompensation	10.1	11.3	13.0
Suicide attempt	34.2	33.9	34.8
Violence	10.0	12.9	21.7
Argue/threaten/homicidal ideation	27.5	32.3	47.8
<b>Delusions</b>			
Threat/control-override***	6.3	11.3	43.5
Persecution***	12.5	14.5	39.1
Body/mind control ***	3.8	9.7	34.8
Thought broadcasting***	2.5	1.6	30.4
Grandiosity	5.1	9.7	17.4
<b>Seriousness of arrest**</b>			
None	4.8	11.1	35.0
Minor	44.4	46.7	15.0
Serious	50.8	42.2	50.0

*Note.* PCL:SV = Psychopathy Checklist: Screening Version.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ , based on univariate chi-square test.

analyses focus on patients' diagnoses, states at admission, degrees of violence, and arrest histories. Univariate differences among the groups on these variables are presented in Table 5.

The descriptions of the three groups presented below in the discussion section integrate Tables 3 to 5, emphasizing differences among the groups in the clustering, external validation, and descriptive vari-

ables. To develop a clearer picture of the differences among these groups, these statistics were also computed for “prototype” cluster groups, using only the 97 cases in which the three MI solutions were in 100% agreement about group membership. These cases likely share multiple characteristics with one another, fall near each group’s centroid, and best capture the essence of each group. The statistics on these prototype groups (available from the first author) substantiate and amplify the differences among groups described below. Labels were assigned to the groups on the basis of the extent to which they were similar with the hypothesized subtypes in their characteristic backgrounds, symptom constellations, and violence. The groups were labeled alpha (48%), beta (38%), and delta (14%).

It should be noted that these groups were similar to one another in demographic composition and in the frequency of their violence. For example, there were no significant differences across groups in their age,  $F(2,164) = 0.76, ns$ ; gender,  $\chi^2(2, N = 165) = 0.75, ns$ ; or race,  $\chi^2(2, N = 165) = 1.8, ns$ . There was only a trend for differences among groups in the frequency of violent incidents during the 1-year follow-up period,  $F(2,119) = 2.4, p = .09$ , with the beta group having an average of 2.0 violent incidents, the alpha group 3.3 incidents, and the delta group 1.8 incidents. Of patients in each of these groups, 66.7%, 77.5%, and 78.3%, respectively, had at least 1 violent incident during the follow-up period.

*Evaluating the consistency of groups with hypothesized subtypes.* On the basis of past theory and research, we hypothesized that we would find three groups of violent patients. As suggested by their assigned labels, the groups identified in this study shared several critical features with the hypothesized types of alpha, beta, and delta. Figure 2 depicts the relative scores of the identified groups across the clustering variables, with hypothesized and obtained scores for each group plotted separately. These figures suggest that many of the predictions about whether each group would score low, medium, or high on these variables relative to the other groups were accurate. Departures of these findings from the hypothesized subtypes are discussed below.

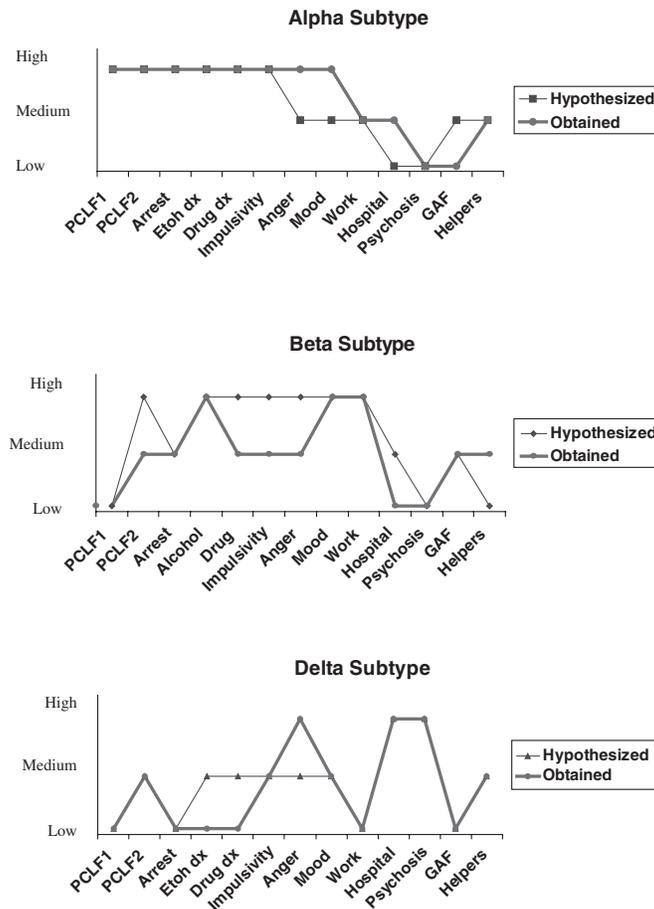


Figure 2: Theoretical and Obtained Relative Score Configurations for Subtypes

## DISCUSSION

This study was designed to provide a detailed view of the types of civil psychiatric patients reliably identified by the multiple ICT (Banks et al., in press) as at high risk for violence. More generally, we sought to determine whether hypothesized subtypes of patients existed in this select high-risk sample to promote the future develop-

ment of targeted treatment programs for these patients. The results of this study suggest that these high-risk patients are best classified into one of three groups: (a) alpha patients (48%), who generally are depressed and abuse drugs heavily, but manifest multiple core traits of psychopathy and have extensive histories of arrest, including those for property crimes; (b) beta patients (38%), who typically are dysphoric, dependent on alcohol and other drugs, and sensitive to personal problems, with Cluster B personality traits and relatively good histories of adjustment; and (c) delta patients (14%), who typically are delusional, have less drug and alcohol involvement, often experience command hallucinations, and have histories of intensive treatment. These three groups are largely consistent with hypothesized subtypes. Moreover, they were identified by applying multiple methods of cluster analyses, integrating the most stable results to develop a consensus cluster solution, and validating that solution on external variables. In short, the groups make theoretical sense, have some sound empirical grounding, and have implications for future research and treatment development efforts. After describing these groups (see Tables 3 to 5), we discuss their implications.

#### DESCRIBING PATIENT SUBTYPES

*Alpha group.* Patients classified in the alpha group tend to have marginal employment histories, moderate hospitalization histories, and poor functioning at baseline (GAF). Members of this group are likely to have had somewhat more frequent arrests for more serious crimes than members of the other two groups, and the majority have been arrested for at least one property-related crime.

Members of the alpha group have a high incidence of alcohol- and (particularly) drug-related disorders, and approximately half are diagnosed with depression or dysthymia. At admission, they tend to present as anxious-depressed (BPRS), with over two thirds threatening to commit suicide and one third having recently attempted suicide. They were also highly likely to have been abusing substances at the time of admission (73%). Although a significant minority (21%) reported experiencing hallucinations, few were rated as delusional (2%). Members of the alpha group have more violent fantasies and are some-

what more impulsive (BIS) and angry (NAS) than members of the beta group and, to a lesser extent, the delta group. The most distinguishing characteristics of this group are its moderate level of emotionally detached, psychopathic traits (PCL:SV Factor 1) and marked antisocial behavior (PCL:SV Factor 2). Relative to the other two groups, the alpha group was much more likely to qualify for diagnoses of psychopathy, with 41% obtaining scores suggestive of psychopathy *per se* and 81% obtaining scores indicative of “potential” psychopathy (PCL:SV total). Members of this group were also more likely than those of the remaining groups to receive diagnoses of antisocial personality disorder (37%) and Cluster B personality disorder (85%).

During their most serious violent incidents, alpha group members were more likely than members of the beta group and, to a lesser extent, members of the delta group to engage in serious acts of violence (e.g., threatening others with or using weapons). Almost two thirds of these patients consumed alcohol or drugs just prior to their most serious incidents. Their co-combatants were often friends or acquaintances (46%). Only 44% of these patients were involved in treatment at the first follow-up. Of these patients, 31% (during the first follow-up) and 45% (during the second follow-up) missed over one fourth of their scheduled treatment sessions during the first 20 weeks after hospital discharge.

*Beta group.* Patients in the beta group tend to have better employment histories, more limited hospitalization histories, and better functioning at baseline (GAF) than those in the other two groups. Members of this group also are least likely to live alone. Although they have prior arrests, they are less likely to have been arrested for property crimes, and their arrests are somewhat less likely to be for serious violent crimes (e.g., rape, robbery, murder) than members of the other two groups.

Members of the beta group have a remarkably high incidence of alcohol-related disorders and a high incidence of drug-related disorders. Approximately half of them also carry diagnoses of depression or dysthymia. The patients are significantly more likely than those in the other two groups to be hospitalized for difficulty coping with personal problems, including problems with relationships. They present

as only slightly less anxious-depressed (BPRS) than patients in the alpha group at admission, with over half having threatened to commit suicide and over one third having attempted suicide. Over 75% of these patients were abusing substances at the time of admission. Members of the beta group rarely have symptoms of psychosis. They have fewer violent fantasies and are somewhat less angry (NAS) and impulsive (BIS) than members of the other two groups. They manifest few core characteristics of psychopathy (PCL:SV Factor 1), such as emotional detachment, and rarely have PCL:SV scores that are suggestive of psychopathy (11%) or qualify for diagnoses of psychopathy (0%). Nevertheless, they do exhibit several signs of impulsive, antisocial lifestyles (PCL:SV Factor 2), and almost two thirds obtain Cluster B personality disorder diagnoses.

During their most serious violent incidents during the 20 weeks after their hospital discharge, beta group members are less likely than the other two groups to threaten others with or to use weapons. Almost two thirds of these patients, like those in the alpha group, used drugs or alcohol prior to their most serious violent incidents. Their cocombatants often were their spouse equivalents or family members (46%). Only 44% of these patients were involved in treatment at the first follow-up. Despite their relatively good functioning, 40% to 45% of these patients missed over one fourth of their scheduled treatment sessions during the first 20 weeks after hospital discharge.

*Delta group.* Patients classified in the delta group, the most distinct of the three groups, tend to have the poorest employment histories, the most frequent histories of hospitalization, and the poorest functioning at baseline (GAF) relative to those in the other two groups. They also are most likely to live alone at baseline. Although they were the least likely to have frequent prior arrests, 50% had three or more arrests. Their arrests were often for property crimes and for serious crimes (e.g., rape, robbery).

Although members of the delta group have a significantly lower incidence of depression and alcohol- and drug-related disorders than members of the other two groups, over half have alcohol-related diagnoses, and over one third have drug-related diagnoses. Relative to members of the other groups, members of the delta group are more likely to obtain diagnoses of schizophrenia and, to a lesser extent,

bipolar disorder. At admission, they are much more likely than those in the other groups to present as thought disordered (BPRS), with command hallucinations (44%) and a range of delusions, including threat or control-override (43%) and persecutory (39%) delusions. They are less likely, however, to have been abusing substances (43%). Although they are more likely to present with recent aggressive acts or homicidal ideation (48%) and violence (22%) than members of the other groups, this difference is not statistically significant. The delta group has an intermediate level of violent fantasies, anger (NAS), and impulsivity (BIS) relative to the other two groups. They manifest few "core" characteristics of psychopathy (PCL:SV Factor 1), and only 9% obtain scores suggestive of psychopathy, but they do exhibit anti-social lifestyles (PCL:SV Factor 2). Members of this group were more likely than those of the other two groups to obtain personality disorder "only" diagnoses (17%), and 57% obtained Cluster B personality disorder diagnoses. It should be noted that members of this group have "psychotic features" primarily in the sense that they are characterized by symptoms of suspiciousness and positive symptoms of psychosis; only 48% of this group obtain formal diagnoses of schizophrenia, schizoaffective disorder, or bipolar disorder.

During their most serious violent incidents, delta group members were more likely than members of the other two groups to hear voices just before the incidents. Approximately 43% used drugs or alcohol just prior to the incidents. These incidents tended to be moderately serious (e.g., hit, beat up, or weapon threat or use) and involved friends or acquaintances as cocombatants (53%). Contrary to expectations, members of this group did not manifest less treatment attendance during follow-up. Unlike the other groups, fully 75% of this group's members were involved in treatment at the first follow-up. Similarly, of these patients, only 22% (during the first follow-up) and 25% (during the second follow-up) missed at least one fourth of their scheduled treatment sessions during the first 20 weeks after hospital discharge.

*Consistency with hypothesized subtypes.* As shown in Figure 2, most of the departures of the findings from the predicted groups relate to the unexpectedly high level of psychiatric impairment in the alpha

group. In this sample of psychiatric patients who present at emergency rooms, there may be no untroubled, prototypically “primary psychopathic” individuals. This group had more prior hospitalizations, more symptoms of anxiety and depression, and more anger than expected. (The fact that this group is more disturbed than straightforward, primary psychopaths may in part explain why we did not find that the beta group suffered from more anxiety, depression, anger, substance abuse, and similar symptoms than the other groups.)

In this sample, there was less distinction between the alpha and beta groups than would be expected on the basis of the hypothesized subtypes. However, we believe that the beta group’s more stable work histories and the alpha group’s greater traits of psychopathy (particularly PCL:SV Factor 1 traits of emotional detachment) are important distinctions between the groups that have implications for the development of risk reduction programs. The delta group was consistently distinct from the other groups, and most of the predictions made for the group were consistent with the results. There was, however, a higher level of compliance with treatment appointments and (paradoxically) co-occurring personality disorder in this group than might have been expected.

#### CONCEPTUALIZING PATIENT SUBTYPES AS PROTOTYPES

It is noteworthy that systematic differences among these patients were found, given that substantial effort was devoted in prior work to producing a quite “homogeneously” violent sample by systematically combining multiple risk factors (see Banks et al., in press). It is also remarkable that these patients were similar in many ways to our hypothesized types, given that these hypotheses were drawn from research with other (predominantly male and nonpatient) populations. Nevertheless, we do not present the three groups above as the “complete and correct” typology for all high-risk psychiatric patients. Like Gnadadesikan et al. (1989), we believe that “clustering data is often convincingly useful even if an unambiguously ‘correct’ solution is lacking. [The solutions] are not as clean-cut as one might like but they do *help to summarize the types that are available* [italics added]” (p. 45).

Individual differences among patients contribute to the difficulty in identifying a clearly “correct” solution. In fact, the alpha, beta, and delta subtypes identified in this study should be conceptualized not as discrete, uniform classes of patients but instead as “idealized patients” (see Tucker & Messick, 1964) who fall near the centroid of each group and most closely capture its essence. According to this prototype approach, each subtype is a graded category, with individuals who share many features with the idealized patient falling near the center and those sharing fewer features falling near the subtype’s indistinct edge.

This conceptualization is important for two reasons. First, idealized patients represent the key dimensions on which the subtypes differ, but the groups clearly overlap at their edges. For example, although each subtype has a different relative emphasis, all three abuse substances and manifest traits of personality disorders. Second, and more important, patients classified in each subtype will differ from one another, sometimes in important ways. One cannot, and clearly should not, assume that a patient classified as alpha is necessarily psychopathic (only 41% are) or that a patient classified as delta can be diagnosed as psychotic (only 48% can be). Patients rarely will share all of the idealized patient’s characteristics.

#### **LIMITATIONS AND IMPLICATIONS FOR TYPOLOGICAL RESEARCH**

The inevitable shortcoming of any work of this sort is that it requires validation to be truly convincing. Although the cluster analysis used to identify these three subtypes of violent patients was replicated across clustering methods and validated on the basis of external variables, it would still be informative to replicate it on an independent sample. Because the present study was completed with a high-risk subset of 165 patients drawn from a larger pool of over 1,000 civil psychiatric patients, however, fully replicating this study might be difficult because only a small percentage of patients typically qualify as at high risk (see Banks et al., in press). Nevertheless, more focused validation work on these subtypes is feasible and would prove valuable. In

future work, the identified high-risk subtypes could be compared on specific, theoretically relevant outcome measures. For example, some variant of Cornell et al.'s (1996) measure of the instrumentality of violent offenses could be used to determine whether the alpha group's violence included some incidents that were more purposeful and focused on material gain than that of the beta group, which would be more exclusively reactive. Similarly, groups could be compared to determine whether particular types of traditional treatment were more effective in reducing their violence potential (e.g., with delta group members responding more to antipsychotics and beta group members responding to substance abuse treatment). Future work also could focus on describing how high-risk patients in these identified subtypes differ from low-risk patients with similar characteristics. For example, given a sample of patients with histories of violence, heavy substance use, and Cluster B personality traits, are there subgroups with more instrumental than purely reactive violence, more traits of psychopathy than borderline personality disorders, and worse versus better histories of adjustment? Similarly, given a sample of civil patients with psychosis, how do particularly violent patients differ from the larger group of low-risk patients?

Notably, this study focused on finding subtypes of patients who were reliably identified as at high risk for violence. We focused on high-risk patients because contemporary risk assessment technology permits clinicians to identify patients who are at high risk for violence, and clinicians typically seek to intervene with these patients to prevent violence. The recent development of the multiple ICT and its reliable identification of a select group of high-risk patients provided an ideal opportunity to study these high-risk patients. Nevertheless, to date, there have been no systematic studies of subtypes of violent psychiatric patients. Further research is needed to determine whether subtypes of violent patients exist and to assess the extent to which these violent subtypes overlap with high-risk subtypes. There likely will be some overlap, given that the majority of high-risk patients in the three identified subtypes in this study (67%, 78%, and 78%) were involved in at least one serious violent incident during a 1-year follow-up period.

**IMPLICATIONS FOR TREATMENT  
DEVELOPMENT RESEARCH**

This study chiefly was designed to provide a detailed view of the types of patients reliably identified as at high risk by the multiple ICT. The multiple ICT's reliance on many different combinations of risk factors to classify patients' risk of violence is associated with both benefits and costs. Although this reliance increases the reliability and accuracy of its risk classifications, patients who are classified as at high risk may arrive at that classification through multiple routes that are not readily apparent to those who must make decisions about how to treat them. Thus, this study also was designed to promote the future development of targeted treatment programs for identified subtypes of patients. It is not necessary to map out all the contours of the differences among these subtypes before exploring appropriate intervention strategies. In fact, given the level of violence risk among these patient subtypes, it would be more productive to explore methods for reducing their violence potential while continuing to flesh out distinctions among them.

A necessary step toward developing treatment strategies for alpha, beta, and delta patients is to identify causal dynamic risk factors for violence in each group. In this study, we did not explore the relation between specific risk factors and violence within these subtypes. To do so would be somewhat circular, given that our high-risk sample was identified by repeatedly examining the relations between hundreds of risk factors and violence in the larger sample (Banks et al., in press). Our focus was on identifying homogeneous subgroups of high-risk patients. To genuinely identify causal dynamic risk factors for violence in each of these subgroups, future work must demonstrate that a changeable risk factor is associated with, closely precedes, and increases the likelihood of violence for each group (Kraemer et al., 1997; Skeem & Mulvey, 2002). Alternatively, one might conduct a controlled trial of a treatment program that systematically targeted a limited number of key risk factors for a given subtype and carefully assessed the relation among intervention efforts, change in risk factors, and reduction in violence risk. In this section, we offer tentative hypotheses about the key risk factors that experimental treatment programs could target for each subtype on the basis of (a) the assumption

that descriptions of the subtypes' characteristics may provide "clues" about appropriate treatment (Monahan & Appelbaum, 2000), and (b) the little available literature on dynamic risk factors and their prediction of proximate violence in other populations (e.g., Hanson & Harris, 1998, 2000; Lipsey, Wilson, Cohen, & Derzon, 1997).<sup>8</sup>

*Are tailored treatment programs needed?* We should note that it may be necessary to develop tailored treatment approaches to effectively address the needs of high-risk subtypes and reduce their violence potential. First, although there are indications that treatment involvement reduces violence potential among general civil psychiatric patients (Monahan et al., 2001), these groups of high-risk patients may not respond to "treatment as usual." Many have substance abuse disorders and/or personality disorders, which are consistently shown to complicate "first-line" treatments for Axis I disorders and are related to poorer outcomes (see Andreoli, Gressot, Aapro, Tricot, & Gognalons, 1989; Drake, Mercer-McFadden, Mueser, McHugo, & Bond, 1998; Morgenstern, Langenbucher, Labouvie, & Miller, 1997; Pilkonis & Frank, 1988; Shea, Widiger, & Klein, 1992; Wong, 2000). Nevertheless, there is evidence that tailored treatment programs can be effective, even with these disorders. For example, dialectical behavior therapy (DBT; Linehan, 1993) for borderline personality disorder has been shown to be more effective for a range of outcomes that include reducing substance abuse (Dimeff, Rizvi, Brown, & Linehan, 2000; Linehan et al., 1999) and perhaps aggression (see Koerner, Linehan, & Dimeff, 1999). Similarly, programs that integrate mental health and substance abuse treatment strategies have been shown to improve treatment adherence and outcome (see Drake et al., 1998, for a review).

Second, given that the majority of patients from the most prevalent high-risk subtypes (beta and alpha) are not involved in treatment after discharge or miss over one quarter of their scheduled appointments, it may be that treatment as usual will fail to engage these patients successfully. Patients must obtain sufficient "doses" of treatment to & Rollnick, 1991), which may be used as a prelude to other treatment, has been shown to be effective in improving treatment adherence and outcome with dual-diagnosis patients (e.g., Daley & Zuckoff, 1998; Martino, Carroll, O'Malley, & Rounsaville, 2000; A. Swanson,

Pantalon, & Cohen, 1999). It improve (see Monahan et al., 2001). Motivational interviewing (Miller's approach to treatment engagement) may be relevant to tailored treatment programs for high-risk subtypes. For particularly resistant but repetitively violent patients, outpatient commitment may be necessary (see J. Swanson et al., 2000). These points suggest that it may be necessary to tailor treatment approaches explicitly to the needs of each high-risk subtype to effectively reduce violence potential.

*What key risk factors might tailored treatment programs target?* For the beta group, key targets for experimental treatment programs may include substance abuse, negative affect, and poor coping and self-regulation skills. First, substance abuse (particularly drinking) appears to be one of the group's core problems, is ostensibly a changeable risk factor, and has a clear relation to violence (see Hanson & Harris, 1998; Lipsey et al., 1997). Second, negative affect (e.g., depression, dysphoria, anxiety) and problems in coping with personal stressors (e.g., relationships) are common in this group and appear related to violence (see Estroff & Zimmer, 1994; Hanson & Harris, 1998). Third, Cluster B traits, which include poor self-regulation, characterize this group and may predict violence (see Davidson, Putnam, & Larson, 2000; Hanson & Harris, 2000). Although components of integrated dual-diagnosis programs (see Drake et al., 1998) and a version of DBT for patients with substance problems (Dimeff et al., 2000) provide leads for addressing some of these issues, their ability to reduce violence potential has not been systematically tested.

Given their rates of drug abuse and negative affect, alpha patients, like beta patients, may also benefit from a treatment program that focuses on these same targets. However, to reduce violence potential with this group, it might be particularly helpful to also focus on the antisocial and psychopathic traits that distinguish the idealized, or prototypical, alpha patient. Despite common assumptions that psychopaths are "untreatable," recent evidence suggests that the outlook for treating psychopathy need not be so pessimistic (see Blackburn, 2000; Losel, 1998; Salekin, 2002; Skeem, Monahan, & Mulvey, 2002; Wong, 2000). Research with correctional offenders suggests that programs that directly target "criminogenic factors," including procriminal attitudes (e.g., entitlement, victim blaming), are effective

in reducing recidivism (Andrews et al., 1990; Gendreau, 1996; see also Hanson & Harris, 1998). Components of a treatment program developed by Wong (2000) for psychopathy may be relevant to reducing alpha patients' violence potential, although the effectiveness of this program has yet to be tested.

For delta patients, treatment targets may include the positive symptoms of psychosis that characterize the idealized patient. These high-risk patients often experience command hallucinations and delusions (threat/control-override and persecutory; see Table 5) and sometimes hallucinate just before violent incidents (Table 4). Although these symptoms did not predict community violence among the larger group of patients in this MacArthur study (Appelbaum, Robbins, & Monahan, 2000; see also Lidz, Mulvey, & Gardner, 1993), they may be relevant treatment targets for this high-risk subgroup.

Specifically, a low correlation between a symptom and violence does not rule out the symptom's relevance as a potential treatment target for some patients. For example, if most highly anxious patients reacted to anxiety by withdrawing, but a few patients reacted by approaching aggressively, the correlation between anxiety and violence would approximate zero. Nevertheless, for the small group of high-risk, "aggressive approachers," anxiety facilitates aggression and is an important treatment target. Delta patients may react to delusions and hallucinations in violent ways, even if these symptoms do not reliably precipitate violence in the broader group of patients.<sup>9</sup> Alternatively, the disorganization associated with active psychosis may increase the risk for violence for delta patients in less direct ways not clearly specified by these data (e.g., by increasing substance use, stressing the supportive social network, decreasing patients' abilities to work and function).

If symptoms of psychosis are directly or indirectly related to delta patients' violence, targeted pharmacological approaches, especially those for treatment resistant psychotic symptoms, may be helpful (Buckley, 1999; Hector, 1998; Keck, Strakowski, & McElroy, 2000; Tardiff, 1996; Volavka, 1999), as might cognitive-behavioral strategies for addressing suspiciousness, delusions, and beliefs about voices and for coping with intrusive psychotic symptoms (see Fowler, Garety, & Kuipers, 1995; Haddock & Slade, 1996).

The current study provides only clues about potential treatment targets, on the basis of patients' characteristics. It remains for future research to determine (a) whether treatment programs that provide a structure for systematically addressing a limited number of key risk factors for each subtype will be effective in reducing violence potential, and (b) which key risk factors will be the most effective targets for these programs. Clearly, however, given these patients' degree of risk, exploring effective treatment strategies is an important pursuit for future investigation.

### CONCLUSION

This study explored the possibility that there are clinically meaningful subtypes of psychiatric patients among patients reliably identified as at high risk for violence by the multiple ICT. The results suggest that there are three variants of high-risk patients that are consistent with hypothesized subtypes: alpha, beta, and delta. Like most exploratory work, this study highlights the additional work that must be done to flesh out the full contours of these subtypes. The demonstration that these three groups appear to exist, however, provides direction for the next set of advances in risk management and intervention with particularly high-risk patients. Specifically, it provides a framework for systematically investigating the differential effects of particular types of interventions with these patients. Risk assessment and management requires this richer, more differentiated view of high-risk patients to achieve its potential.

### NOTES

1. A written review of these typologies is available from the first author. Notably, although most (70.5%) of the patients in the present study were abusing substances at the time of admission, typologies of substance abusers and dual-diagnosis patients were not used because they (a) are typically organized around the abuse of a particular substance (e.g., Alterman et al., 1998; Babor et al., 1992) or around the primacy of the mental or the substance abuse disorder (e.g., Bennett & McCrady, 1993; Lehman, Myers, Dixon, & Johnson, 1994; Zimberg, 1999), and (b) have little to do with violent offending. In addition, typologies of criminal populations are emphasized because the civil patients in this sample represented the most extreme 15% of patients with respect to violence and had a modal number of three or more prior arrests (70%; see below).

2. Specifically, on the basis of their relevance for distinguishing among hypothesized subtypes, the full pool of 137 variables was winnowed to an intermediate pool of 29 potential variables. This intermediate pool of variables was reduced to the final set of 13 clustering variables on the basis of their (a) relevance for distinguishing among hypothesized subtypes, (b) levels of generality, and (c) correlation with other variables in the pool. For example, when variables in the intermediate pool of 29 variables were at least moderately correlated ( $r > .30$ ), a single variable that seemed most general and relevant to distinguishing among groups was chosen to avoid implicitly weighting certain variables more heavily in the cluster analysis. On the basis of this principle, 11 of 29 variables were rejected. In an effort to maximize the participant-to-variable ratio, 5 additional variables were rejected because they were highly specific and/or did not contribute substantially to the remaining variables in discriminating among hypothesized subtypes.

3. Analyses are restricted to the first 20 weeks to preserve statistical power, because this is when the data were most complete. If a patient had no incidents during the first 20 weeks, the most serious violent incident during the entire 1-year follow-up period was used. The measures of violence on the basis of the full 1-year follow-up period included all patients who completed at least one follow-up interview. Because patients completed different numbers of follow-up interviews, each patient did not have an equal likelihood of having a violent act or incident of treatment noncompliance reported. However, preliminary analyses suggested that using these patients rather than only those who completed all five follow-up interviews did not appreciably affect the results (see Steadman et al., 1998).

4. When the Variance Ratio Criterion (VRC) is in error, it tends to err by only one cluster. The VRC decreased as the number of clusters increased, which suggested that clusters existed in the data set and that if the VRC was in error, there were likely three groups. Moreover, the difference in VRCs between the two- and three-group solutions was typically only one point.

5. The clustering method applied was the same as that used to develop the three-group solution described below. Specifically, Ward's method was used to define a starting point for the k-means pass method. For these analyses, a single missing imputed (MI) data set (defined later) was used.

6. To obtain an estimate of agreement that was not deflated by error associated with inserting randomly imputed missing values in the data, the  $\kappa$  analysis was repeated after selecting only the 97 cases for which each of the three ultimate MI solutions (see text below) was in 100% agreement about cluster membership.

7. The single exception to this statement applies to the employment history variable. The solution that excluded this variable was in poor agreement with the original solutions ( $\kappa = .13$  and  $.20$ , respectively). Apparently, when this variable was left out of the analysis, otherwise distinct clusters merged (Andenberg, 1973).

8. Notably, the assumption that patient characteristics provide clues about treatment is untested, and we wish to avoid entrenching clinical beliefs that particular symptom constellations invariably underlie violence and should be the focus of treatment (Mulvey & Lidz, 1988). Violence is an interactive process that involves particular person-situation combinations and contextual factors (e.g., poor neighborhoods) that are easily overlooked (see Silver, Malvey, & Monahan, 1999). Nevertheless, treatment often focuses by necessity on what can be changed with individual patients, and the development of effective treatments for violence reduction should arguably build on existing empirically supported treatments (see Chambless & Ollendick, 2001).

9. The content and themes of the delta group's symptoms seem directly relevant to violence potential, and such symptoms have been shown to predict violence in some past research, particularly that completed with mentally disordered offenders (see Buchanan et al., 1993; Hersch & Borum, 1998; Juninger, 1996; Link & Steuve, 1994; Taylor, 1998; Wesseley et al., 1993). Psy-

chotic patients found in criminal contexts may be more likely to have violence-relevant symptoms than those found in civil psychiatric contexts. To the extent that high-risk, delta patients overlap with this mentally disordered offender population (see Table 3, arrest history), these psychotic symptoms could be relevant to violence potential in delta patients. This hypothesis remains to be tested.

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