PATHWAYS TO HIGH-LETHALITY SUICIDE ATTEMPTS

by

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Abstract

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by

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The purpose of this study was to develop a model of the trajectory to high-lethality suicidal behavior for individuals with Major Depressive Disorder (MDD) and Borderline Personality Disorder (BPD). An increased number of previous suicide attempts, substance use immediately prior to the attempt, and objective planning were proposed to lead directly to an attempt of higher lethality. Meanwhile, aggression and impulsivity were hypothesized to lead indirectly, through their association with past suicidal behavior, to a higher lethality attempt. Path analysis revealed a revised model that applied only to individuals with BPD. In this final model, impulsivity was found to be significantly associated with higher-lethality suicide attempts and the frequency of an individual's past suicidal behavior. Additionally, the traits of impulsivity and aggression were found to be significantly correlated in the multivariate model. Pathways linking alcohol use at the time of the attempt to the lethality of suicidal behavior and aggression to the frequency of an individual's past suicidal behavior were not found to be significant, and no model using the variables of interest in this study could be determined for individuals with MDD. These results are discussed in light of current theories of suicidal behavior and in terms of their implications for clinical practice.

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Chapter 1:

Background and Introduction

As it has for decades, suicide remains one of the leading causes of death in the United States, claiming over 32,500 lives annually (Beck, Kovacs, & Weissman, 1979; Center for Disease Control, 2006; Kung, Hoyert, Xu, & Murphy, 2008; Weed, 1985). Both suicide and suicide attempts are emotionally, mentally, and physically taxing for family members and friends. Further, suicide attempts that are of significant medical consequence, i.e., high-lethality suicide attempts, are costly to society as individuals who make such attempters often require health resources and disability dollars for extended periods (Holmstrand, Nimeus, & Traskman-Bendz, 2006; Young, Weinberger, & Beck, 2001).

Most individuals who commit, attempt or contemplate suicide suffer from one or more psychiatric disorders (Goldstein, Black, Nasrallah, & Winokur, 1991; Holmstrand et al., 2006; O' Donnell, Farmer, & Catalan, 1996). Borderline Personality Disorder (BPD) and Major Depressive Disorder (MDD) are among those disorders most often associated with suicidal behavior. As many as 70% of individuals diagnosed with BPD attempt suicide at least once in their lifetime, and almost 10% of individuals who suffer from BPD commit suicide (American Psychiatric Association [APA], 2001; Soloff, Lis, Kelly, Cornelius, & Ulrich, 1994; Soloff, Lynch, Kelly, Malone, & Mann, 2000; Stone, 1989). Further, psychological autopsies have revealed that between 7% and 38% of individuals who committed suicide suffered from BPD (Linehan, Cochran, & Kehrer, 2001).

Individuals with MDD are also more likely to attempt suicide than individuals with other psychiatric disorders and normal controls, and they are at considerable risk for completing suicide (Chen & Dilsaver, 1996; Corbitt, Malone, Haas, & Mann, 1996; Soloff et al., 1994;

Tremeau et al., 2005). It has been estimated that individuals with depressive disorders are up to 70% more likely to commit suicide than individuals in the general population (Khan, Leventhal, Khan, & Brown, 2002). Additionally, studies have found that between 30% and 80% of individuals who died by suicide suffered from MDD (Bertolote, Fleischmann, DeLeo, & Wasserman, 2003; Lonnqvist, 2000).

While those who suffer from MDD and BPD are at high risk for suicide, not all attempts made by individuals suffering from these disorders are lethal (Shearer, Peters, Quaytman, & Wadman, 1988; Soloff et al., 1994). Conservative estimates suggest suicide attempts occur eight times more often than completions (Maris, Berman, & Silverman, 2000). Consequently, individuals with BPD are often conceptualized by clinicians as individuals who make many low-lethality attempts in response to minor, usually interpersonal, incidents (Brodsky, Groves, Oquendo, Mann, & Stanley, 2006; Goldney, 1981; Gunderson, 1984; Soloff et al., 1994). Yet, a significant portion of individuals with BPD die at their own hand, and individuals with BPD have been found to make as lethal suicide attempts as individuals with MDD (Brodsky et al., 2006; Corbitt et al., 1996; Soloff, Fabio, Kelly, Malone, & Mann, 2005).

Beyond understanding that individuals with BPD are at risk for making medically-serious attempts, clinicians face a critical challenge in determining which individuals are at risk for high-lethality behavior. Individuals who make medically-serious suicide attempts require many resources, including disability dollars and health care (National Institute of Medicine [IOM], 2002). Furthermore, individuals who make high-lethality attempts have been found to be at a higher risk for completing suicide than both community samples (Beautrais, 2001) and individuals who make low-lethality attempts (Beautrais, 2004; Hawton & Fagg, 1988; Ostama & Lonnqvist, 2001). Considering the high costs surrounding high-lethality suicidal behavior,

efforts aimed at improving understanding of such behavior are merited. In fact, both the National Institute of Medicine (IOM; 2002) and the U.S. Public Health Service (1999) have recently deemed suicide and suicidal behavior a significant public health problem and have made the prevention of such behavior a national imperative. These institutions have, furthermore, called on scientists and practitioners to aide in prevention efforts by studying these phenomena.

Despite the importance of understanding high-lethality behavior, few studies of such behavior exist (see O' Donnell et al., 1996; Soloff et al., 2005). The studies that do exist present conflicting portraits of the vulnerabilities and situational factors that precede high-lethality behavior (Corbitt et al., 1996; Elliott, Pages, Russo, Wilson, & Roy-Byrne, 1996; Shearer et al., 1988; Soloff et al., 2005; Zalsman et al., 2006).

An examination of current empirical information and theoretical ideas regarding suicidal behavior in the context of different disorders offers a potential explanation for the inconsistencies in the literature. Some researchers have found that characteristics of suicide attempters, high-lethality suicide attempters, and suicide attempts are not specific to diagnosis. These researchers have, however, acknowledged that certain traits and characteristics are more closely associated with specific disorders (Mann, Waternaux, Haas, & Malone, 1999; Soloff et al., 2000; Soloff et al., 2005). Meanwhile, other researchers have found that traits that distinguish suicide attempters and their lethality status differ across diagnoses (Elliott et al., 1996; Keilp et al., 2006; Tremeau et al., 2005). One group of suicidologists (Keilp et al., 2006) has even suggested that the universality of some findings represents the tendency for samples across studies to be disproportionately comprised of individuals with BPD or borderline characteristics.

Most recently, equivocal findings regarding the universal importance of specific risk

factors for suicidal behavior, including medically-serious suicidal behavior, have been explained by the theory that two distinct clinical endophenotypes or clinical presentations that confer risk for suicidal behavior exist (Carballo, Akamnonu, & Oquendo, 2008; Joiner, Brown, & Wingate, 2005). That is, suicidologists have suggested that known biological, developmental, and psychological risk factors for suicidal behavior "converge on…two general categories of risk for suicide" (Joiner et al., 2005, p. 287). According to this theory, one endophenotype for suicidal behavior and completion is a propensity to experience hopelessness and pessimism, i.e., depression; and, the other endophenotype is a tendency towards impulsivity or behavioral dysregulation, or characteristics of BPD. These authors further postulate that distinct trajectories to suicidal behavior for each of these endophenotypes exist. For example, based on a review of the extant literature, Carballo and colleagues (2008) have suggested that the interaction of abnormal norepinephrine levels and childhood abuse can lead to impulsive presentations. Among those who tend to experience psychological pain or be pessimistic and hopeless, the onset of a mental disorder has been suggested as an important trigger for suicidal behavior (Joiner et al., 2005). While these authors have hypothesized that different pathways to suicidal behavior exist for each endophenotype, specific trajectories to suicidal behavior for each endophenotype have yet to be offered. Joiner and colleagues (2005) have identified such hypothesizing and study as an important direction for future research.

Correlates of Suicidal Behavior & High-lethality Attempts

In empirical studies, many variables have been associated with suicidal behavior, in general, and high lethality suicidal behavior specifically (Maris et al., 2000). Identified risk factors for high-lethality suicidal behavior include certain demographic characteristics, such as older age, male gender, lower socioeconomic status (Beautrais, 2003; Brent, 1987; Shearer et al.,

1988; Soloff et al., 2005; Zalsman et al., 2006), and family histories that include suicidal behavior and substance use disorders (Beautrais, 2003; Shearer et al., 1988; Soloff et al., 2005). Identified intrapersonal psychiatric risk factors for high-lethality suicidal behavior include certain disorders, such as MDD, substance use disorders, eating disorders, and antisocial personality disorder. Psychiatric histories that include previous suicidal behavior (Beautrais, 2003; Brent, 1987; Elliott et al., 1996; Shearer et al., 1988; Soloff et al., 2005) and increased contacts with mental health treatment and facilities (Beautrais, 2003; Soloff et al., 2005) have also been associated with high-lethality suicidal behavior. Finally, increased levels of hopelessness and suicidal intent immediately prior to an attempt have been correlated with higher-lethality suicidal behavior (Brent, 1987; Goldney, 1981; O'Donnell et al., 1996).

While a variety of variables have been empirically associated with high-lethality suicidal behavior, empirical understanding of such behavior is incomplete as the significance of certain risk factors has been found to vary across studies. Furthermore, few models incorporating multiple vulnerabilities and attempt characteristics have been proposed and tested (Goldstein et al., 1991; IOM, 2002; Rudd, Joiner, & Rajab, 2000; Zalsman et al., 2006). Finally, a dearth of third variable analyses precludes understanding of potential indirect causes of high-lethality suicidal behavior.

From among a variety of possible predictors, trait impulsivity and aggression, the frequency of prior attempts, alcohol use, and objective planning prior to the attempt were included for empirical study in this project because these variables are often encountered in populations at-risk for suicidal behavior. Moreover, such predictors may be recognized by clinicians prior to an attempt, and these variables are among those whose relationship to suicidal behavior, especially high-lethality behavior, is neither well understood nor well-studied

(Cherpitel, Borges, & Wilcox, 2004; Elliott et al., 1996). Demographic variables related to suicide, such as male gender and older age (Wenzel & Beck, 2008), were not included in the model because these factors cannot be targeted in prevention and treatment efforts, and their relation to suicidal behavior of differing severities is better understood (Blair-West, Cantor, Mellsop, & Eyeson-Annan, 1999).

Traits.

Impulsivity and aggression have been found to predict suicidal behavior (Keilp et al., 2006; Mann et al., 1999). However, such traits have not been linked to high-lethality behavior in individuals with BPD or MDD (Brodsky, Malone, Ellis, Dulit, & Mann, 1997; Corbitt et al., 1996; Soloff et al., 2005; Soloff et al., 2000; Zalsman et al., 2006). While a direct relationship between these traits and high-lethality suicidal behavior has not been established, impulsivity and aggression have both been linked to the frequency of attempts made over a lifetime, suggesting these traits may indirectly contribute to high lethality suicide attempts as prior attempts have been associated with subsequent attempts of higher-lethality (Kullgren, 1988; Soloff et al., 2000).

Impulsivity. Impulsivity levels have been found to differentiate between attempters and nonattempters. Those who make attempts have been found to have higher levels of impulsivity (Horesh et al., 1997; Mann et al., 1999). Additionally, higher levels of impulsivity have been associated with higher levels of suicide risk in multivariate analysis (Horesh et al., 1997). While some literature suggests a strong, robust association between impulsivity and past suicidal behavior, Keilp and colleagues (2006) recently found that impulsivity does not predict status as an attempter once borderline personality traits are considered. Furthermore, impulsivity has not been found to discriminate between high- and low-lethality BPD attempters (Brodsky et al.,

1997; Soloff et al., 2005; Soloff et al., 2000).

Despite evidence that impulsivity is not directly related to the medical seriousness of an individual's suicidal behavior, impulsivity has been linked to the frequency with which an individual attempts suicide (Brodsky et al., 1997). An increased frequency of past attempts, in turn, has been related to subsequent higher lethality suicidal behavior (Soloff et al., 1994; Soloff et al., 2005). These relationships suggest impulsivity may indirectly contribute to high-lethality suicidal behavior.

Impulsivity may also confer risk for higher-lethality suicidal behavior through its association with planning prior to an attempt (Zalsman et al., 2006). Increased levels of planning have been rather definitively associated with higher-lethality suicidal behavior (Beck & Steer, 1989; Goldney, 1981; Haw, Hawton, Houston, & Towsend, 2003; Michel, 1987; Mieczkowski et al., 1993; Zalsman et al., 2006). Meanwhile, the association between impulsivity and planning prior to an attempt is not yet understood. In one study, impulsivity was not found to predict objective planning (Soloff et al., 1994). However, another study found that impulsive individuals can and do plan their suicide attempts, and even impulsive suicide attempts may be preceded by lengthy periods of rumination and forethought (O'Donnell et al., 1996).

The traits of impulsivity and aggression have also been found to co-occur within individuals (Keilp, et al., 2006). Meanwhile, findings from one indirect test of the association between trait impulsivity and alcohol use prior to an attempt suggested impulsive individuals were not more likely than non impulsive attempters to use alcohol to facilitate an attempt (Simon et al., 2001).

Aggression. Numerous studies have found aggression to be associated with suicide attempts in patients with MDD and BPD (Keilp et al., 2006; Mann et al., 1999; Oquendo et al.,

2000). While the research relating aggression to the presence of suicidal behavior is consistent, it has been found, virtually without exception, that individuals who make high- and low-lethality attempts do not differ in their levels of aggression (Soloff et al., 2005). Aggression, moreover, has not been found to predict the maximum lethality of an individual's suicide attempt(s) among individuals with MDD or BPD (Shearer et al., 1988; Soloff et al., 2000; Zalsman et al., 2006). However, one study has shown aggression to be related to violent method choice in completed suicides. This suggests that aggression may be indirectly linked to high-lethality behavior (Dumais et al., 2005).

There are other reasons to believe aggression may be indirectly associated with lethality. Anger, a construct often associated or interchanged with aggression (Buss & Perry, 1992), has been found to be significantly correlated with suicide risk (Horesh et al., 1997; Kullgren, 1988). Further, some researchers have suggested that non-significant findings regarding the effects of increased aggression on more serious suicidal behavior may reflect limits in our ability to adequately measure aggression (Goldney, 1981; Krakowski, 2003). Finally, some findings suggest personality-disordered individuals, particularly those who are impulsive and aggressive with a *co-morbid* depressive disorder, may be at higher risk for more frequent and more medically-severe suicidal behavior than individuals with MDD or BPD alone (Black, Bell, Hulbert, & Nasrallah, 1988; Friedman, Aronoff, Clarkin, Corn, & Hurt, 1983; Fryer, Frances, Sullivan, Hurt, & Clarkin, 1988; McGlashan, 1987). However, others studies have found that individuals with co-morbid BPD and MDD are no more likely to make high-lethality attempts or more frequent attempts than individuals with MDD or BPD alone (Corbitt et al., 1996; Yen et al., 2004).

As for the relationship between aggression and the other variables of interest in this

study, findings relating aggression to the frequency of an individual's suicide attempts are equivocal (Soloff et al., 2000; Soloff, Lynch, & Kelly, 2002). Furthermore, pathological aggression has been linked to substance use disorders; however, the association between aggressive tendencies and alcohol use before an attempt remains unknown (Brady, Myrick, & McElroy, 1998). Improving understanding of the interrelationships between impulsivity, aggression, substance use and suicide has been identified as an area in need of further study (Wilcox, Conner, & Caine, 2004). Finally, aggression has not been found to predict the amount of planning in which an individual with BPD, MDD, or both engages prior to the attempt (Soloff et al., 2000).

Impulsive aggression. The trait of impulsive aggression, or a propensity towards unpremeditated and spontaneous aggression, has been established as one of the most important risk factors for suicidal behavior (Dumais et al., 2005; Mann et al., 1999; Yen et al., 2004). This trait has also been linked to high-lethality attempts and completions (Campi-Azevedo, Boson, De Marco, Romano-Silva, & Correa, 2003; Mann et al., 1999). Mann and colleagues (1999) even highlight this trait as both a cause and consequence of other risk factors for suicidal behavior such as child abuse and head injury. Accordingly, impulsive aggression has been proposed as a trait that may mediate or moderate the effects of other known risk factors for suicidal behavior. Impulsive aggression, along with impulsivity and aggression, has also been genetically linked to suicidal behavior and alcoholism. All have been proposed to originate, at least in part, from abnormalities in genes that encode for the production and transport of serotonin (Mann et al., 1996; Mann et al., 1999).

Once again, confusion surrounding the contribution of impulsivity and aggression to suicidal behavior may reflect limits in the ability to measure or adequately distinguish

impulsivity, aggression and impulsive aggression from each other, or failures in the literature to adequately represent the construct that has been measured (Davidson, Putnam, & Larson, 2000; Mann et al., 1999). In fact, Roggenbach and colleagues (2002) have stated, "the term 'aggressivity' is often not well defined and not unambiguously discriminated from 'impulsivity'" (p.200). The result, they state, is difficulty interpreting data and therefore garnering an accurate understanding of the relationships between aggression, impulsivity, impulsive aggression and suicidality.

Attempt Characteristics.

In this study, the contribution of three characteristics of the index attempt, planning, alcohol use prior to the attempt, and the extent of an individual's previous suicidal behavior, were examined. Acts that involve planning or acts that have been organized and premeditated, have been found to be consistently more lethal than unplanned attempts (Goldney, 1981; Haw et al., 2003; Michel, 1987; Mieczkowski et al., 1993; Zalsman et al., 2006). Further, a prior history of suicidal behavior has also been established as a predictor of high-lethality behavior (Soloff et al., 2000). However, the relationship between acute alcohol use as a means of facilitating an attempt and the lethality of the subsequent act is not well understood (Elliott et al., 1996).

Objective planning. With one exception (Soloff et al., 2005), studies have found that objective planning or premeditation, organization and preparation for death prior to the attempt is correlated with high-lethality suicidal behavior and completion (Beck & Steer, 1989; Goldney, 1981; Haw et al. 2003; Mieczkowski et al., 1993; Michel, 1987; Zalsman et al., 2006). Specifically, a study of MDD and Bipolar attempters found objective planning to distinguish those individuals who had engaged in higher lethality behavior in their lifetimes from those who had not (Zalsman et al., 2006). Similarly, in studies of young, female attempters aged 18-30,

objective planning was found to discriminate high-lethality suicide attempters from other attempters and to predict the lethality of an individual's attempt across diagnoses (Goldney, 1981; Michel, 1987; Mieczkowski et al., 1993). Objective planning has also been found to discriminate between suicide completers and attempters (Joiner et al., 2003; Michel, 1987; Mieczkowski et al., 1993). The study in which objective planning was not found to discriminate between high and low-lethality attempters, however, involved attempters with BPD (Soloff et al., 2005). However, more careful examination of findings from this study revealed that objective planning trended towards being significantly higher among individuals who had made high-lethality attempts (p=.12) and that small sample sizes may have limited the researchers' power to detect significant differences between high- and low-lethality attempters on this variable. Thus, as findings from previous studies suggest objective planning is associated with higher-lethality attempts, objective planning was hypothesized to be associated with higher-lethality attempts in this study.

Increased number of prior lifetime attempts. The number of previous suicide attempts made by an individual has been found to be one of the most robust and important predictors of subsequent suicidal behavior (Apter et al., 1991; Beautrais, 2004; Shearer et al., 1988). Among attempters, across diagnoses, individuals with higher numbers of prior attempts are also at an increased risk for completing suicide (Beck, Schuyler, & Herman, 1974; Goldstein et al., 1991; Holmstrand et al., 2006; Kullgren, 1988). Increased lifetime attempts have also been found to be more prevalent among high-lethality BPD attempters than low-lethality BPD attempters (Soloff et al., 2005; Soloff et al., 1994) and among young adults who make high-lethality attempts as compared to non-suicidal controls (Beautrais, 2003). Although an increased number of lifetime attempts has not remained a significant predictor of lethality status in multivariate regression

analyses in some studies (Beautrais, 2003; Clark, Gibbons, Fawcett, & Scheftner, 1989; Soloff et al., 2005), other studies have found it to be an important predictor of the medical lethality of a subsequent attempt in multivariate analyses (Shearer et al., 1988; Soloff et al., 2000).

An examination of information on the association between prior attempts and other variables of interest in this model revealed that an individual's number of prior attempts has not been associated with objective planning for a subsequent attempt in individuals with MDD, BPD, or co-morbid MDD and BPD, nor have these variables been found to be related among attempters with other or no known diagnoses (Mieczkowski et al., 1993; Soloff et al., 2000).

Alcohol use at the time of the attempt. Alcohol use disorders, both as primary and secondary disorders, have been implicated as risk factors for high-lethality behavior in individuals with MDD and BPD; however, definitive evidence that such co-morbidity predicts lethality or completion does not exist (Beautrais, 2003; Beck & Steer, 1989; Elliott et al., 1996; Goldstein et al., 1991; Shearer et al., 1988; Soloff et al., 1994; Soloff et al., 2005; Wilcox et al., 2004). Acute alcohol use, or alcohol use immediately prior to an act, has also been associated with suicidal behavior (Cherpitel et al., 2004; Chiles, Stroshal, Cowden, Graham & Linehan, 1986; Powell et al., 2001). However, the effect of acute alcohol use on the lethality of a suicide attempt has not been well studied (Elliott et al., 1996). Moreover, the few studies that have empirically examined the relationship between acute alcohol use and the lethality of suicidal behavior provide contradictory information (Elliot et al., 1996; Goldney, 1981; Powell et al., 2001).

Some suicidologists (Beck & Steer, 1989; Maris et al., 2000) believe that alcohol is used to enable more medically-serious attempts. Specifically, these authors suggest that alcohol may be used to increase the lethality of an intentional drug overdose (Maris et al., 2000), or, more

generally, to alter an individual's consciousness, e.g., mood, control and judgment, and therefore, allow him or her to inflict more serious self-injury on him- or herself (Beck & Steer, 1989; Maris et al., 2000). Thus, alcohol use, and more specifically alcohol consumed with the intent of facilitating an attempt, will be investigated as a correlate of high-lethality suicidal behavior in this study.

Trait Theories and Amended Crescendo Models of Suicidal Behavior

Theoretically, those variables included in the model are of interest because they represent an assessment of two divergent theories regarding diatheses for suicidal behavior. Crescendo models of suicidal behavior, such as Joiner's amended crescendo (2002) model, suggest that, even when known and enduring biological and trait risk factors for suicidality and completion are considered, previous suicidal behavior proves a non-trivial predictor of subsequent, higher-lethality suicidal behavior. In crescendo models, the mechanism by which suicide risk increases subsequent to suicidal behavior is also posited. According to this model, changes in the valence and/or intensity of feelings associated with suicidal behavior and suicidal thoughts, which occur after a suicide attempt, allow an individual to more easily inflict serious self-harm with intent to die in future crises.

Meanwhile, trait models of suicidal behavior, such as Clark and colleagues' (1989) model, posit that predisposing intrapersonal factors (and not past suicidal behaviors or changes that occur subsequent to a suicide attempt) predict the frequency of suicidal behavior over the life course. Thus, the trait hypothesis of suicidal behavior suggests that once predisposing factors are considered, the predictive utility of past suicidal behavior on future suicidal behavior disappears because "the number of attempts made by an individual over time are less a reaction to previous attempts and more the expression of some fundamental underlying process" (Clark,

Gibbons, Fawcett, & Scheftner, 1989, p. 44).

While Joiner's model (2002) theorizes how suicidal behavior escalates and can therefore account for higher lethality behavior, Clark and colleagues' model explains subsequent suicide attempt risk. Thus, it is unclear whether trait models apply to high-lethality suicidal behavior.

Purpose

While studies have attempted to capture clinical correlates of suicidal behavior (Mann et al., 1999; Soloff et al., 2005), fewer have aimed to develop profiles of high-lethality attempters or correlates of high-lethality attempts. Furthermore, no study to date has attempted to present a comprehensive portrait of the interactions between trait vulnerabilities and attempt characteristics that may lead directly or indirectly to a high-lethality attempt using path analysis.

The purpose of this study was to examine pathways to a high-lethality suicide attempt among individuals with MDD and individuals with BPD, two populations at high-risk for suicidal behavior and completion. A model based on a review of the literature was proposed. In this model, an increased number of prior attempts, acute substance use, and objective planning were hypothesized to lead directly to an attempt of higher lethality. Additionally, aggression and impulsivity were proposed to lead indirectly, through their effects on increasing the number of prior attempts and acute substance use, to higher lethality attempts (see Figure 1).

Chapter 2:

Method

Participants & Procedures

This study used archival data from 70 suicide attempters who met criteria for BPD or MDD and who were recruited over a 15-year period as part of a larger study undertaken by staff at the New York State Psychiatric Institute (NYSPI). Accordingly, approval for the larger study was granted by the NYSPI Institutional Review Board (IRB), while approval for this archival study was granted by the IRB at John Jay College of Criminal Justice, the institution with which the principal investigator of this archival study is affiliated. All individuals whose data were included in this study gave their informed consent prior to participating and received treatment in exchange for participating. All clinical ratings were administered by trained masters- and doctoral-level clinicians at NYSPI. Furthermore, diagnoses and ratings of suicide attempts were discussed and agreed upon at bi-weekly meetings staffed by a team of NYSPI clinicians.

The average age of participants was 33.6 years (*SD*=13.1 years, range=18-81). Sixty-seven percent (*n* =47) of participants were female. Over 80% of participants identified themselves as Caucasian (82.9%, *n* =58), while 14% of participants identified themselves as African American (*n*=10) and 3% identified themselves as Hispanic (*n* =2). Thirty-six percent of all participants affiliated themselves with the Catholic religion (*n* =25), while 17% identified themselves as Jewish (*n*=12) and 14% as Protestant (*n*=10). Over half of all participants were unemployed at the time of assessment (64.3%, *n*=45). Eighty-six percent of participants had completed high school and/or further studies (*n*=60). Finally, the majority of participants (55.7%, *n*=39) were single at the time of the assessment.

For the purposes of this study, participant data were divided into two groups. One group

was comprised of individuals who met criteria for a diagnosis of Borderline Personality Disorder (57.1%, *n*=40); the other group was made up of individuals who met criteria for a diagnosis of Major Depressive Disorder and had no Axis-II pathology upon admission (42.9%, *n*=30). All participants in this study had made at least one suicide attempt in their lifetime. On average, participants had made 2.5 attempts (*SD*=1.9, range=1-12). The average lethality of the participants' most recent suicide attempt was 3.6 (*SD*=1.7, range=0-7).

Measures

Data collected from a variety of instruments were used to capture the traits, attempt characteristics, and demographic variables of interest in this study.

Baseline demographic form. The Baseline demographic form is a structured protocol that was developed at NYSPI to ensure similar and comprehensive information regarding a participant's personal, family, social, and psychiatric history is consistently obtained by raters. In this study, information pertaining to age, gender, race, ethnicity, religion, marital status, children, education, and employment was used.

Brown-Goodwin Lifetime History of Aggression (Brown-Goodwin; Brown, Goodwin, Ballenger, Goyer, & Major, 1979). The Brown-Goodwin is a 10-item, clinician-administered assessment tool that measures the extent of an individual's aggressive behavior in certain situations (e.g., at work and in school) and against certain individuals (e.g., towards teachers, supervisors, and other individuals) and/or inanimate objects (e.g., property destruction). It also captures an individual's involvement in illegal behavior. Items are scored on a scale of 0 to 3, with total scores ranging from 0-30. Higher scores represent a history, at any age, of more frequent aggressive behavior in a variety of situations. This measure has been found to have good construct validity and interrater reliability (Kruesi et al., 1991). To avoid inflating the

aggression scores in this population of suicide attempters, an individual's score on the item on the Brown-Goodwin, revised edition that assesses self-injurious and suicidal behavior, or aggression towards the self, was not included in the total score (Zalsman et al., 2006). In this sample, Cronbach's alpha coefficient for the Brown- Goodwin was .76.

Columbia Suicide History Interview. The Columbia Suicide History Interview is a clinician administered interview that aids interviewers in collecting information about individuals' suicide attempts or acts of deliberate self-injury that involve some intent to die. The interview contains questions that ask individuals to discuss, in a narrative form, what precipitated their attempt and what the consequences were. For this study, information regarding individuals' past suicidal behavior, i.e., the number of attempts made prior to their index suicide attempt, was collected from information from this measure.

Lethality Scale (Beck, Beck, & Kovacs, 1975). The lethality scale quantifies the medical consequences of a suicide attempt. The lethality of an attempt is classified on a scale of 0-8, with higher scores indicating the event resulted in more serious medical consequences. Different scales exist for different methods, but scoring remains consistent: zero represents few, if any medical consequences ("fully conscious and alert") and eight represents death. As scores greater than three indicate the need for hospitalization to address injuries sustained during an attempt, past studies have considered attempts scored three or higher on the Lethality Scale to be of high-lethality (Malone, Corbitt, Li, & Mann, 1996; Oquendo et al., 2003). Finally, among individuals who had accurate preconceptions about the lethality of their chosen method, the scale has been found to have good concurrent validity with the *Suicide Intent Scale* (Beck et al., 1974; Beck et al., 1975).

Schedule for Interviewing Borderlines (SIB; Baron, 1980). The SIB is a clinician-

administered instrument used to diagnosis schizotypal and borderline personality disorders. The SIB consists of 21 subscales. However, for this study, only the impulsivity subscale was used. This subscale consists of nine items that mainly capture nonaggressive impulsive behavior: overspending, impulsive sexual behavior, gambling, drug use, alcohol use, shoplifting, overeating, oversleeping, and anti-social behavior (Stanley et al., 2000). Each item is scored on a scale of 0-3, with higher scores indicating more frequent or severe patterns of the behavior. The total severity score for this subscale, which could range from 0-27, was used. The SIB has been found to have good interrater and test-retest reliability. It has also been shown to have adequate diagnostic specificity and sensitivity. In addition, the impulsivity subscale of the SIB has been found to have good concurrent validity with other measures of impulsivity (Pfohl, Stangl, and Zimmerman, 1982; Kavoussi, Coccaro, Klar, Bernstein, & Siever, 1990). Cronbach's alpha coefficient for the impulsivity subscale in this study was .73.

The Structured Clinical Interview for DSM-IV, Axis I and Axis II (SCID; First, Spitzer, Gibbon & Williams, 2002; SCID-II; First, Gibbon, Spitzer, Williams, & Benjamin, 1997): The SCID and SCID-II are clinician-administered instruments that help researchers and clinicians make standardized, reliable and accurate diagnoses of Axis I and Axis II disorders (Huprich, 2005). Questions aim to capture symptoms of an individual's pathology (SCID) and the subject's typical behavior, relationships, capacity for self-reflection, and internal experience (SCID-II) and are based upon DSM diagnostic criteria for major axis I psychiatric disorders and axis II personality disorders, respectively. In this study, information collected from these measures was used to determine if individuals had lifetime diagnoses of MDD and/or BPD or any other personality disorder. The SCID- I and the SCID-II have been found to have excellent validity: diagnoses made with this instrument have been found to align well with diagnoses made

subsequent to a clinical interview (Jacobsberg, Perry, & Frances, 1995).

Suicide Intent Scale (Beck, et al., 1974). The SIS is a 15-item, interviewer-administered measure that aims to retrospectively capture the circumstances surrounding an attempt (i.e., degree of planning and isolation) and an attempter's thoughts and feelings at the time of the attempt (i.e., expectation regarding fatality and wish to die). Items are scored 0-2, with higher scores reflecting more intense expectations or planning. The scale has been found to have adequate internal consistency, excellent inter-rater reliability, and adequate construct validity (Beck et al., 1974; Silver, Bohnert, Beck, & Marcus, 1971; Hawton, 1989). A factor analysis, conducted by Mieczkowski and colleagues (1993), determined that two factors explain the variance in scores on the SIS. In this study, the objective planning factor, which is comprised of eight items (1-7 & 15), was used. Higher scores on this subscale represent higher levels of premeditation, organization (e.g., precautions against discovery), and preparation for death (e.g., leaving a suicide note). The planning subscale has been found to have good internal consistency and good predictive validity (Mieczkowski et al., 1993). In this sample, Cronbach's alpha coefficient for the objective planning subscale was .65. Finally, SIS item number 19, which asks individuals to rate the relationship between alcohol intake immediately before the attempt and the attempt, was used to understand participants' alcohol use at the time of the incident. Higher scores on this item indicate that alcohol was used to facilitate the attempt.

Chapter 3:

Results

Prior to conducting bivariate, correlational and path analyses, the data were cleaned. Missing values on all variables, except medical lethality, were replaced with the mean value of the variable across cases. As medical lethality was the main variable of interest, missing information on this variable served as an exclusion criterion for the entire record for this study. To determine which statistical tests and parameter estimation procedures were appropriate, assessments of normality were conducted on each of the variables independently and an assessment of multivariate kurtosis was undertaken. Furthermore, tests for univariate and multivariate normality were conducted on the entire sample's distributions, and separately, on the distributions of each of the diagnostic groups.

For the sample as a whole, distributions of the scores on the alcohol use and prior attempts variables, as well as the distribution of participant ages, were found to depart significantly from a normal distribution. When normality was evaluated by group, score distributions for these same variables were found to be non-normal in each group, with the exception that the distribution of the age variable was found to be normal in the MDD sample. Additionally, medical lethality among the BPD sample was found to be positively skewed. Transformations were not conducted on any of these variables as utilizing transformed variables in subsequent multivariate analyses would imply that the relationships between the transformed variables and other included variables were curvilinear (Gao, Mokhtarian, & Johnston, 2008). In addition to implying relationships that have not been supported in the literature, univariate transformations often do not affect the multivariate kurtosis of the data (Gao et al., 2008).

Regarding multivariate normality, the joint multivariate kurtosis values and their

associated critical ratios indicated the data were multivariate normal for each group and for the combined sample. Accordingly, the maximum likelihood estimation method was used to calculate model fit indices and parameter estimates in this study (Byrne, 2001; Curran, West & Finch, 1996; Gao et al., 2008; Muthen & Kaplan, 1985).

Bivariate analyses

Demographic information, by group, is presented in Table 1. Mean or median scores, as appropriate, and the standard deviations of score distributions, by group, on the measures of attempt characteristics and traits used in this study are presented in Table 2. Chi-square analyses, independent sample t-tests, and Mann-Whitney U tests, as appropriate, were conducted to determine if participants in the BPD and MDD groups differed demographically, on their trait levels, or in the characteristics of their attempts. On average, individuals with BPD, were more likely to be single, younger, more impulsive and aggressive, and to have made more prior attempts than their MDD counterparts.

Correlational Analyses

Pearson's Product Moment, Point Biserial, and Spearman's Rank correlation coefficients were calculated to determine relationships between demographic, trait, and attempt characteristic variables within each group. Correlations between attempt characteristics, traits, and certain demographic variables, by group, are presented in Tables 3a and 3b. Among individuals with BPD, significant positive correlations were found between impulsivity and aggression (r=.333, p<.05) and impulsivity and number of prior attempts (r=.317, p<.05). Meanwhile, among individuals with MDD, no associations were observed to be significant. As correlational analyses revealed that none of the demographic variables that differed between groups, i.e., marital status or age, were related to any of the endogenous, or dependent, variables in either

group, these variables were not included in further analyses (Bakker, Demerouti, Taris, Schaufeli, & Schreurs, 2003).

Multivariate/Path Analysis

Path analysis, performed by AMOS 5.0 software (Arbuckle, 2003), was used to examine the relationships between the suggested predictors of high-lethality suicidal behavior, i.e., specific trait vulnerabilities (aggression and impulsivity) and attempt characteristics (substance use immediately prior to the attempt, number of prior attempts, and objective planning prior to the event), and high-lethality suicidal behavior. Specifically, multiple fit indices provided by AMOS were examined to asses overall model fit, and once a good fitting model was determined, path estimates were evaluated to understand the magnitude and significance of the relationships between the exogenous and endogenous variables included in the model (Albright & Park, 2009; Garson, n.d.; Kline, 2004).

Regarding model fit, first, the chi-square statistic was examined to understand the fit between the observed covariance matrix and the matrix estimated when the model being tested was assumed to be true (Tabachnick & Fidell, 2000). Then, the Non-Normed Fit Index (NNFI; Bentler & Bonett, 1980), which compares the fit of the proposed model and a baseline, null model and penalizes for poor model parsimony, was evaluated. Finally, the Root Mean Square of Approximation (RMSEA; Steiger and Lind, 1980), which estimates the lack of fit in the model compared to a perfect model and penalizes for poor model parsimony, was examined. In the case of the chi-square statistic, a non-significant chi-square statistic indicates good fit (Tabachnick & Fidell, 2000). Regarding the RMSEA, values less than .05 indicate good fit (Browne & Cudeck, 1993). For the NNFI, values greater than .95 are indicative of model fit (Hu & Bentler, 1999).

Fit indices for the proposed model in each group indicated the baseline model did not fit the data well. For the MDD group, NNFI equaled 0. For the BPD group, NNFI was equal to .540, and the RMSEA equaled .094.

Post hoc analyses.

To improve model fit, post hoc analyses were performed. Post hoc analyses suggest certain changes, or the addition of certain previously unspecified paths, to improve model fit. Modification of path models based on post-hoc analyses can be performed as long as such changes are theoretically defensible (Byrne, 2001).

Post hoc analyses suggested that the addition of a path specifying impulsivity as a direct predictor of lethality would improve model fit in the BPD group. Because the addition of this path was theoretically defensible (Bongar, 1991; Linehan, 1993), it was added to the BPD model. After the addition of this path, model fit indices were recalculated and examined. All indices of fit suggested the revised model fit the data well for individuals in the BPD group. Specifically, the test for the overall goodness of fit of the model was nonsignificant, $X^2(8, N= 40) = 7.995$, p=.434; the NNFI for the model was greater than .95 (NNFI=1.00); and the RMSEA was 0.00, i.e., less than .05. The revised model for the BPD group, including the standardized regression weights for the structural paths, is shown in Figure 2.

For the MDD group, findings from post hoc analyses suggested that no model comprised of the constructs operationalized in this study would fit the data for this group.

Third variable analyses.

After post hoc analyses were conducted and a revised, good-fitting model was determined, a multiple group path analysis was conducted to understand which relationships were moderated by diagnostic group membership (Garson, n.d.). This analysis involved fitting

the revised baseline model across both groups simultaneously and then comparing the model fit of the unconstrained model to the fit of the model when specific paths were constrained equal across groups.

Results from the multiple group path analysis are presented in Table 4. Constraining the paths between impulsivity and number of prior attempts and impulsivity and medical lethality equal across groups significantly deteriorated model fit ($X^2_{difference}$=7.95, df=2, p=.019), indicating that the effect of this trait on suicidal behavior differed across groups.

Beyond the formal test for moderation conducted in the multiple group path analysis, no other formal tests of third variables were conducted as only relationships between exogenous variables and lethality were detected. That is, as no intermediate variables were found to be significantly related to lethality, the conduct of further formal tests of third variable effects was rendered unnecessary (Baron & Kenny, 1986; Holmbeck, 1997).

Chapter 4:

Discussion

The purpose of this study was to propose and test a model of high-lethality suicidal behavior in individuals with MDD and in individuals with BPD. The proposed model included the number of prior attempts, acute substance use, and objective planning as direct predictors, and aggression and impulsivity as indirect predictors, of high-lethality suicidal behavior. The proposed model fit neither for individuals with MDD nor for individuals with BPD. However, subsequent post hoc analyses and modifications to the model enabled development of a model that fit for individuals with BPD. The revised model showed that impulsivity was directly related to the frequency of an individual's past suicidal behavior and the medical seriousness of the index attempt. However, neither alcohol use prior to the attempt nor aggression was found to be significantly related to the frequency of an individual's past suicidal behavior or the lethality of the index attempt. Furthermore, in the multivariate model, a history that included higher numbers of prior suicide attempts was not found to confer risk for a subsequent higher-lethality attempt among individuals with BPD. No model using the variables of interest in this study could be determined for individuals with MDD.

The fact that the model fit for individuals with BPD but not for individuals with MDD aligns well with emerging ideas that there are two clinical endophenotypes for suicidal behavior. Both Joiner and colleagues (2005) and Carballo and colleagues (2008) have suggested that two distinct clinical presentations confer risk for suicidal behavior and that the trajectories to suicidal behavior for these two types of individuals differ. The authors offer these ideas as a means of clarifying the large but disjointed and sometimes contradictory literature on risk factors for suicidal behavior. Further, they suggest that such understanding can aid clinicians in predicting

and, therefore, preventing suicidal behavior. Findings from this study add empirical support to these authors' conclusions. The same pathways to high-lethality suicidal behavior that fit for impulsive individuals (i.e., those with BPD) did not explain suicidal behavior for those characterized by a propensity to experience pessimism and hopelessness (i.e., those with MDD).

Findings from this study also elucidate specific risk factors that may contribute to suicidal behavior, including high-lethality suicidal behavior, among individuals with BPD. Impulsivity proved a strong and robust predictor of both the number of attempts an individual with BPD had made in his or her lifetime and the medical seriousness of the index attempt. These findings provide additional support for research that has shown impulsivity to be an important predictor of attempter status (Horesh et al., 1997; Mann et al., 1999) and the frequency of an individual's suicidal behavior (Brodsky et al., 1997). However, the finding that impulsivity is an important, robust, and direct predictor of attempt lethality contrasts with findings from previous studies, which have shown that impulsivity is not related to the medical seriousness of an attempt (Soloff et al., 2000; Soloff et al., 2005).

One possible explanation for this difference in findings is that this study employed an analytic strategy that allowed for the relationships between impulsivity, the number of prior attempts, and attempt lethality to be considered simultaneously. Previous multivariate research has used stepwise linear modeling to understand such relationships (see, e.g., Soloff et al., 2000). Such an approach can mask the influence of more distal factors on outcome variables, especially when those distal factors are also related to intermediate outcomes (Byrne, 2001; Cohen, Cohen, West, & Aiken, 2003). Thus, the influence of impulsivity on attempt lethality in previous studies may have been obscured by the inclusion of an individual's number of prior attempts as a predictor early in the analytic process. In fact, in this study, impulsivity was related to the

frequency of an individual's previous suicidal behavior, an intermediate variable on the proposed trajectory to medically-serious suicidal behavior.

Another potential explanation for the finding that impulsivity, and not the frequency of an individual's prior attempts, was a significant correlate of high-lethality suicidal behavior derives from trait theories of suicidal behavior (Clark et al., 1989). Trait theories of suicidal behavior suggest that intrapersonal factors, such as impulsivity, and not past suicidal behavior, confer risk for future suicidal behavior (Clark et al., 1989). That is, according to trait models, suicidal behavior is inherent or predetermined, and a suicide attempt at any point in an individual's history represents a manifestation of an intraindividual characteristic. Meanwhile, amended crescendo models of suicidal behavior suggest that experience with suicidal behavior, or even suicidal ideation, results in cognitive and emotional desensitization, which in turn, facilitate subsequent suicidal behavior (Joiner, 2002; Joiner et al., 2005). In other words, according to this model, suicidal behavior, especially of higher-lethality, is a behavioral capability that is acquired via previous experience with suicidal thoughts, wishes, urges, and behavior. Findings from this study show that impulsivity and not prior attempts contribute to high-lethality suicidal behavior among individuals with BPD, suggesting that trait theories of suicidal behavior, and not amended crescendo models of suicidal behavior (Joiner, 2002; Joiner et al., 2005), explain high-lethality suicidal behavior among individuals with BPD.

Finally, the method of assessing impulsivity used in this study could also account for these findings. In this study, impulsivity was measured using the SIB (Patton, 1980), a measure which examines impulsive *action* (i.e., gambling and substance use; Stanley et al., 2000). Meanwhile, to understand impulsivity, most researchers (see, for instance, Brodsky et al., 2006; Keilp et al., 2006; Soloff et al., 2005) continue to employ the Barratt Impulsivity Scale (BIS;

Barratt, 1959) or a self-report measure of global impulsivity that is comprised of three factors: motor impulsivity (impulsive action), cognitive impulsivity (distractibility) and non-planning impulsiveness (present orientation; Patton, Stanford, & Barratt, 1995). Thus, differences in the impulsivity construct measured in this study, as compared to in others, could explain differences in the observed results.

In addition to highlighting the influence of impulsivity on the trajectory to high-lethality suicidal behavior for individuals with BPD, these findings may add support to a growing understanding that impulsive individuals can and do plan their attempts, with significant medical consequence (Baca–Garcia et al., 2005; Nakagawa et al., 2008; Wyder & DeLeo, 2007). In this study, in which trait impulsivity was found to be robustly associated with the medical seriousness of an individual's attempt, the path between objective planning and high-lethality behavior trended towards significance. Considering the pervasive belief that impulsive individuals make non-serious, impulsive attempts (Brodsky et al., 2006; Corbitt et al., 1996), this particular finding provides important information to practitioners.

Finally, the finding that impulsivity was significantly correlated with aggression and the findings from bivariate analyses align well with previous research findings. Trait levels of impulsivity and aggression have been found to be correlated across studies (see Critchfield et al., 2004 for a review). In fact, some (see, e.g., Mann et al., 1999; Seroczynski et al., 1999) have suggested the overlap of these two traits is so universal and robust that impulsivity and aggression should be considered together as one trait or phenotype. Others (Critchfield et al., 2004; Loney, Kramer, & Milich, 1981), however, disagree, believing these traits represent two distinct, but correlated, latent constructs. Regardless, empirical information supporting an association between impulsivity and aggression is robust.

Meanwhile, bivariate analyses revealed that attempters with BPD were more aggressive and impulsive than attempters with MDD and that individuals with BPD had histories that contained more suicide attempts than individuals with MDD. These results replicate those findings observed in other studies (Corbitt et al., 1996; Soloff et al., 2000). Similarly, the observed differences in the demographic variables between groups align well with previous research findings. Studies (Corbitt et al., 1996; Brodksy et al, 2006; Soloff et al., 2000) have repeatedly shown that individuals with BPD first attempt suicide at younger ages and that individuals with BPD are more likely to be single than individuals with MDD. Finally, the lethality of the index attempt was not found to significantly differ across groups. In this study, data showed that individuals with MDD and individuals with BPD made index attempts of similar, rather high lethality. This finding simultaneously contrasts with clinical lore, which holds that individuals with BPD do not make serious suicide attempts (Brodsky et al., 2006), and adds support to those data demonstrating that individuals with BPD make as serious suicide attempts as individuals without BPD (Corbitt et al., 1996; Keilp et al., 2006; Soloff et al., 2000).

In this study, two hypothesized pathways were not supported. First, the pathway between aggression and the number of suicide attempts was not found to be significant. Additionally, alcohol use prior to the attempt was not found to be associated with attempt lethality. While these findings contradicted expectations, they are supported by some findings in the extant literature. For instance, some researchers (Brodsky et al., 1997; Soloff et al., 1994) have found that aggression, or factors related to aggression such as anger and hostility (Stanley et al., 2000), are not related to higher numbers of lifetime attempts among individuals with BPD. Similarly, alcohol use prior to the index attempt has not been found to be associated with the lethality of subsequent attempts (Elliot et al., 1996). Though the observed non associations between

aggression, alcohol use prior to the attempt and suicidal behavior replicate some findings in the existing literature, other studies have provided contradictory information (Keilp et al., 2006; Oquendo et al., 2000; Powell et al., 2006). These later studies provided the basis for inclusion of these paths in the hypothesized model.

There are several possible explanations for these null findings. First, an examination of the construct captured under aggression, or more specifically, of the association captured by the path linking aggression to suicidal behavior, may explain why aggression was not found to be associated with an individual's number of prior attempts. In this path analysis, the path coefficient between aggression and number of prior attempts represents the magnitude of the relationship between aggression and prior attempts after the shared variance between impulsivity and aggression has been removed (Cohen et al., 2003). Therefore, this path captures the association between those aspects of aggression not associated with impulsivity and suicidal behavior. More precisely, considering the measure used to capture aggression in this study, i.e., the Brown-Goodwin Lifetime History of Aggression, this path likely represents the relationship between argumentativeness or verbal aggression and antisocial behavior, two specific components of aggression, and suicidal behavior (Suris et al., 2002). Meanwhile, studies (Koller, Preub, Bottlender, Wenzel, & Soyka, 2002; Mann et al., 1999; Placidi et al., 2001) have concluded that impulsive aspects of aggression are those that drive observed relationships between aggression and suicidality or that *impulsive* aggression, and not general aggression or other aspects of aggression, is the trait which is robustly associated with suicidal behavior. Thus, one may expect, as seemingly observed in this study, that non impulsive aspects of aggression are not significantly related to suicidal behavior.

Another potential explanation for these findings is the composition of the sample. In this

study, the BPD sample was predominantly female (75%). Recently, aggression researchers have suggested that serotonergic system abnormalities may *not* be a primary determinant of aggression in females (Birger et al., 2003; Higley et al., 1996; Manuck et al., 1998) or in individuals with personality disorders (Limson et al., 1991; Stanley et al., 2000). Meanwhile, deficient serotonergic system functioning continues to be appreciated as a fundamental cause of suicidal behavior across populations (Cocarro et al., 1990; Mann et al., 1996; Placidi et al., 2001). Thus, one proposed explanatory mechanism for observed relationships between aggression and suicidal behavior, deficient serotonergic system functioning (Brown et al, 1979; see Placidi et al., 2001 for a review), may not apply to individuals with BPD or females.

Similarly, previous research has demonstrated that the relationship between alcohol use prior to an attempt and suicidal behavior may be moderated by gender. Specifically, researchers have found that males are more likely to use alcohol prior to an attempt than females (see Cherpitel et al., 2004, for a review). Thus, the finding that acute alcohol use was not related to attempt lethality may also be explained by the composition of the sample. As an examination of potential biological explanations for observed findings was beyond the scope of this study, future studies may wish to examine these ideas.

Strengths & Limitations

This study has several methodological strengths. First, path analytic procedures were used to analyze the data. This analytic procedure allowed for the influence of multiple factors, and the influence of interactions among these variables, on high-lethality suicidal behavior to be understood simultaneously. Hence, results from this study may provide a more accurate understanding of the influence of certain risk factors on high-lethality suicidal behavior than either those studies that have employed univariate analyses (Goldstein et al., 1991) or those that

considered multiple predictors but which did not employ statistical methods that allowed for the influence of interactions among predictor variables to be considered (Shearer et al., 1988; Soloff et al., 2000; Zalsman et al., 2006). In fact, as stated previously, simultaneous consideration of results from this study and past studies suggests that the relationship between impulsivity and high-lethality behavior may have been obscured in past studies because those studies employed analytic strategies that included the number of prior attempts as a predictor early in the analytic process. Considering available information estimating that over 50% of individuals who complete suicide do so on their first attempt (Maris et al., 2000), additional studies that employ analytic strategies that can preclude number of prior attempts from serving as a suppressor variable seem warranted. Such (path) analyses may provide the field with accurate, practical, and useful information regarding suicide prevention. In fact, leading suicidologists (see, for instance, Conner, Beautrais, & Conwell, 2001; Ellis & Rutherford, 2008; Joiner et al., 2005) have encouraged researchers to test and propose multivariate models and consider the impact of interactions among predictor variables when modeling suicidal behavior. They believe that such methodology can provide more accurate information about the correlates of suicidal behavior, and therefore, can be of greater clinical utility to the field.

Second, this study examined high-lethality suicidal behavior in two groups at high-risk for suicidal behavior and completion: individuals with MDD and individuals with BPD. Because model fit was examined in both of these groups, results from this study can inform understanding about the universality of predictors of high-lethality behavior across these disorders. Furthermore, in evaluating model fit in each of these two groups, this study addressed a concern about the suicide literature recently offered by Keilp and colleagues (2006). These researchers suggested that over-reliance on information derived from studies of samples

disproportionately comprised of individuals with BPD has led to unwarranted generalizations and therefore inaccurate understanding of the risk factors and trajectories to suicidal behavior among individuals without BPD.

Finally, this study is one of the few that has specifically focused on high-lethality suicidal behavior. Despite the high costs associated with such behavior, few studies have examined this type of suicidal behavior (Elliott et al., 1996; O'Donnell et al., 1996; Soloff et al., 2005). Rather, studies have more often explored suicidal behavior as a unitary construct, despite ideas and emerging data that suggest suicidal behavior of differing lethalities is not equal (Beautrais, 2004; Soloff et al., 2005). Thus, this study provides novel and important information about a costly and understudied phenomenon. More specifically, this study provides important, novel, and practical information about medically-serious suicidal behavior in individuals with BPD. That is, this study provides information about high-lethality suicidal behavior in a group of individuals who have long been (mistakenly) conceptualized as individuals who do not make high-lethality attempts (Brodsky et al., 2006) and who have, therefore, been almost universally ignored in the few studies of high-lethality suicidal behavior that currently exist (see Soloff et al., 2005, for a notable exception).

There are also limitations to the current study. First, while this was one of the first studies to develop a multivariate model of high-lethality behavior, the model has not been verified in an independent sample. Replication studies are needed to confirm these findings (Byrne, 2001; Ellis & Rutherford, 2008; Maris et al., 2000). Additionally, longitudinal studies could be conducted as they would allow those cause-and-effect relationships suggested by findings from this study to be confirmed (Kline, 2005).

The size of the sample represents another limitation of this study. In path analysis, as a

rule of thumb, the data must contain at least five times as many records as parameters included in the model (Kline, 2005). This rule suggests that the size of the BPD sample in this study is small yet adequate but that the size of the MDD sample may not be large enough. As inadequate samples (and for that matter, adequate but small samples) may produce unstable results (Kline, 2005), replication studies are again needed to confirm these findings.

Reliance on measures that require participants to accurately understand and report on latent constructs and characteristics of past suicide attempts is another limitation of this study. Information collected from these instruments can be inaccurate due to recall or social-desirability biases (Edwards, 1953; Sackett, 1979). Future studies may benefit from employing behavioral measures of latent traits, such as the Go/No-Go, a psychomotor performance task that measures behavioral impulsivity (Saunders et al., 2008).

Finally, the exclusive focus on diatheses that place an individual at long-term risk is also a limit to the current study. Since Mann's seminal paper (Mann et al., 1999), support for a stress-diathesis model of suicidal behavior has grown (Caraballo et al., 2008). Accordingly, leading suicidologists (Beautrais, 2001; Ellis & Rutherford, 2008) have continually encouraged researchers to empirically investigate potential stressors, diatheses and stress-diathesis models of suicidal behavior. Limits in the available data made it impossible to determine the effects of an acute stressor on suicidal behavior. Thus, future models might consider and test the influence of specific acute stressors, such as interpersonal problems or the onset of a psychiatric disorder, on medically-serious suicidal behavior. In fact, future studies could investigate the influence of acute depression or a history of recurrent depressive episodes on the lethality of suicidal behavior among individuals with BPD. Although 75% of this BPD sample had a history of MDD, the timing of the onset of a depressive episode relative to suicidal behavior could not be determined.

An investigation of this particular stressor in the context of BPD is left to future studies.

Future Directions

Several directions for future research follow from this study. The development of a model of the trajectory to high-lethality suicidal behavior for individuals with MDD and no personality disorder seems warranted. In this study, no model of high-lethality behavior derived from the traits of impulsivity, aggression, number of prior attempts, substance use prior to the attempt, and objective planning fit for individuals with MDD. As researchers have demonstrated the influence of certain cognitive variables on suicidality, such as cognitive rigidity, problem-solving deficits, a negative self-concept, hopelessness, helplessness, unlovability, and deficient reasons for living, especially among individuals with MDD and other mood disorders (Beck, Brown, Steer, Dahlsgaard, & Grisham, 1999; Beck, Steer, & Kovacs, 1985; Ellis & Rutherford, 2008; Oquendo et al., 2000; Rudd et al., 2001), future researchers may consider such factors when devising pathways to high-lethality behavior among individuals with MDD.

Additionally, in order to realize more accurate measurement of latent constructs, such as impulsivity and aggression, researchers could use data collection and analytic techniques, such as structural equation modeling, which allow for information from multiple measures of the same construct to be combined.

Clinical Implications

Identifying risk factors and attempt characteristics that contribute to high lethality suicidal behavior has important clinical implications. For example, information from this study may aid clinicians in identifying those individuals who are at risk for high-lethality suicidal behavior. Specifically, findings from this study suggest clinicians should evaluate individuals' trait impulsivity to better understand their risk for medically-serious suicidal behavior.

Similarly, findings from this study suggest that individuals with BPD who display high levels of trait impulsivity can and do plan their attempts, with significant medical consequence. Thus, clinicians should be aware of actions that suggest an individual is preparing to kill him or herself, even when that individual's history may suggest that he or she behaves impulsively. Findings from this study may also be used to refine intervention efforts aimed at preventing high-lethality suicidal behavior or treating individuals who have made medically serious attempts. Others (see Greening et al., 2008) have also suggested that impulsivity is an important and viable target of intervention efforts, and some (see, for instance, Linehan, 1993) have utilized strategies aimed at reducing impulsive behavior with suicidal individuals with BPD with encouraging results (see Koerner & Dimeff, 2007, for a review of the efficacy data on Dialectical Behavior Therapy). Findings from this study encourage the continuation of efforts aimed at reducing impulsivity as a means of decreasing high-lethality suicidal behavior among individuals with BPD.

Table 1. *Demographic Characteristics of BPD Group and MD Group*

	BPD Group %/M	MD Group %/M	X^2 /t/Z(p)
Age[+]	26.0	40.0	-3.992(.000)**
Female	72.5%	60.0%	1.214(.271)
Ethnicity			1.484(.476)
Caucasian	87.5%	76.7%	
African American	10.0%	20.0%	
Hispanic	2.5%	3.3%	
Marital Status			20.220(.000)**
Married	5.0%	40.0%	
Single	77.5%	26.7%	
Divorced/Widowed/ Separated	17.5%	33.3%	
Religion			4.179(.524)
Catholic	27.5%	46.7%	
Protestant	15.0%	13.3%	
Jewish	17.5%	16.7%	
None	12.5%	6.7%	
Other	22.5%	16.7%	
Currently unemployed	67.5%	62.1%	1.475(.478)
Education			8.473(.076)
Some high school	5.0%	26.7%	
High school graduate	22.5%	23.3%	
Some college	40.0%	20.0%	
College graduate	20.0%	13.3%	
Graduate school graduate	12.5%	16.7%	

*Notes: *=p<.05; **=p<.001; [+]= comparison of mean ranks using Mann-Whitney U Test conducted. For this variable, median values, as opposed to mean values, of the distributions are provided.*

Table 2. *Scores on Measures of Attempt Characteristics and Traits by Group*

	BPD Group M(SD)	MD Group M(SD)	t/Z(p)
Number of prior attempts[+]	1.00(2.16)	1.00(1.35)	-1.966(.049)*
Medical lethality of most recent attempt	3.78(1.59)	3.30(1.78)	1.173(.245)
Alcohol intake prior to most recent attempt[+]	0.00(1.02)	0.00(.95)	-.233(.816)
Objective planning prior to most recent attempt	6.01(2.95)	7.42(3.52)	-1.82(.073)
Aggression	9.62(5.21)	5.58(3.19)	3.997(.000)**
Impulsivity	6.17(3.93)	3.26(2.69)	3.488(.001)**

*Notes: *=p<.05; **=p<.001; [+]= comparison of mean ranks using Mann-Whitney U Test conducted For these variables, median values, as opposed to mean values, of the distributions are provided.*

Table 3a. *Correlation Matrix for Individuals with BPD*

	1.	2.	3.[+]	4.[+]	5.[+]	6.	7.[+]	8.
1. Impulsivity								
2. Aggression	.333*							
3. Age[+]	-.068	.250						
4. Alcohol use[+]	-.135	-.123	.240					
5. Prior attempts[+]	.317*	-.022	.073	-.163				
6. Planning	.088	-.115	-.105	-.258	.038			
7. Marital Status[++]	-.011	.062	.124	-.185	-.094	.157		
8. Lethality[+]	.175	-.153	.163	.149	.083	.248	.033	

*Note: *=p<.05, **=p<.01, [+]=Spearman's Rank correlation computed, [++]=Point Biserial correlation computed[1].*

Table 3b. *Correlation Matrix for Individuals with MDD*

	1.	2.	3.[+]	4.[+]	5.[+]	6.	7.[+]	8.
1. Impulsivity								
2. Aggression	.336							
3. Age	-.085	-.107						
4. Alcohol use[+]	-.059	-.218	-.103					
5. Prior attempts[+]	-.259	-.246	-.154	.217				
6. Planning	-.022	-.162	-.014	.067	.021			
7. Marital Status[++]	-.108	-.046	.085	.219	-.125	-.123		
8. Lethality	-.103	-.128	.092	.170	-.008	.127	.016	

*Note: *=p<.05, **=p<.01, [+]=Spearman's Rank correlation computed. [++]=Point Biserial correlation computed*[1].

[1]Eta values were also calculated in order to understand the relationship between marital status, categorized as married, single, or other, and other attempt characteristic, demographic and trait variables. In alignment with information provided by the Point Biserial correlations, which were calculated using a dichotomized version of marital status, marital status, when categorized as married, single, or other, explained little of the variance in any variable in either group.

Table 4. *Goodness-of-fit Statistics for Test of Invariance between Groups*

Model Description	Comparison Model	X^2	*df*	*Change* X^2	*Change df*	*Statistical Significance*
Revised Baseline Model (Model 1)		13.10	16			
Revised Baseline Model with structural paths between impulsivity and suicidal behavior (i.e., prior attempts and lethality) constrained equal	Model 1	21.05	18	7.95	2	p =.019
Revised Baseline Model with structural path between objective planning and high-lethality suicidal behavior constrained equal	Model 1	13.54	17	0.44	1	*ns*

Figure 1. *Hypothesized Model*

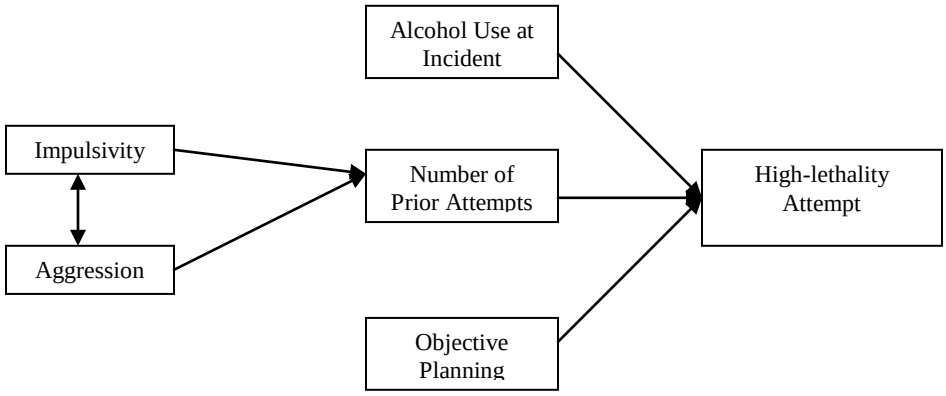
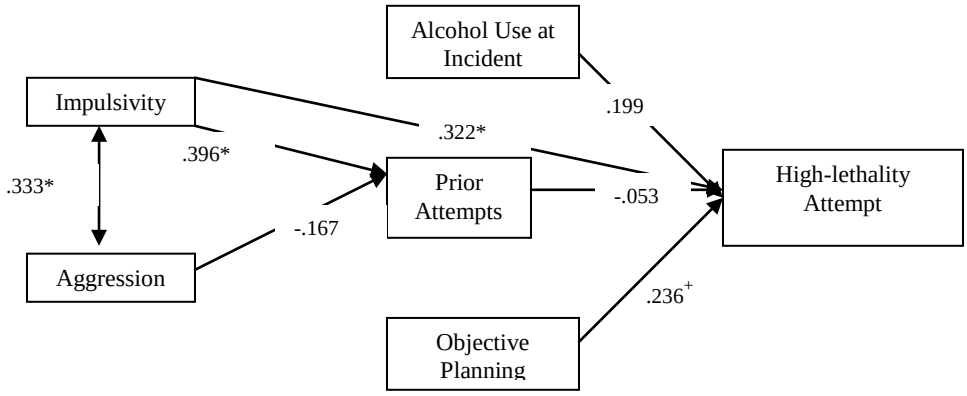


Figure 2. *Revised Baseline Model and Regression Weights for BPD Group*



Note: $^{+}$=*p*=.10, *=*p*<.05, **=*p*<.001. *All path estimates are standardized.*

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