BIOSOCIAL CORRELATES OF IDENTITY DISTURBANCE AMONG SUICIDAL YOUTH

by

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A thesis submitted to the faculty of
The University of Utah
in partial fulfillment of the requirements for the degree of

Master of Science

Department of Psychology

The University of Utah

August 2014

The University of Utah Graduate School

STATEMENT OF THESIS APPROVAL

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ABSTRACT

The current study was designed to examine biosocial correlates of identity disturbance in a sample of suicidal youth at high risk for borderline personality disorder compared with community controls. We used a multimethod, multi-informant design to examine vulnerability and risk for identity disturbance, including biological assessments, self- and informant-report. Participants' electrodermal responding (EDR), respiratory sinus arrhythmia (RSA), and fundamental frequency were collected during a mother-child discussion task regarding adolescents' personality characteristics. We predicted (1) suicidal adolescents would endorse greater overall identity distress across more domains compared with community controls, and (2) that biological vulnerabilities (e.g., EDR, RSA) and contextual risks (e.g., parent emotional arousal assessed with digital signal processing) would interact to predict higher self-reported identity distress among suicidal adolescents. Results indicate significant differences on identity scales for control and self-injuring adolescents. However, indices of biological and contextual risk did not interact to predict identity problems. Methodological limitations of the current study are discussed, along with implications for future research.

To my many mentors who have encouraged my pursuit of science and the study of the vulnerable populations.

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ACKNOWLEDGMENTS

I would like to express my appreciation for my advisor, Dr. Sheila Crowell, who has guided me through this research. I would also like to thank my committee members, Drs. Patricia Kerig and Brian Baucom, who have challenged me through thought provoking questions. I have the deepest appreciation for their generosity with their time and professional guidance. Finally, I would like to thank the research participants and the many undergraduate research assistants without whom this study would not have been possible.

INTRODUCTION

Borderline personality disorder (BPD) is one of the most costly and debilitating mental conditions (Trull, Distel, & Carpenter, 2011). The diagnosis is characterized by marked disturbances in self-concept and persistent interpersonal, emotional, cognitive, and behavioral dysfunction (American Psychiatric Association [APA], 2000). BPD is the most common personality disorder (PD), affecting around 2% of community adults, 10% of outpatients, and 20% of inpatients (Lenzenweger, Lane, Loranger, & Kessler, 2007; Trull, Jahng, Tomko, Wood, & Sher, 2010; Widiger & Trull, 1993). Over half of those with BPD engage in repetitive self-inflicted injury (SII) and as many as 10% eventually commit suicide (APA, 2006; Selby, Bender, Gordon, Nock, & Joiner, 2012). Although there are very few prospective studies of borderline personality development, self-injuring adolescents are one population that may be at elevated risk for the adult diagnosis (Crowell, Beauchaine, & Linehan, 2009).

BPD is defined as a disorder that typically emerges in late adolescence or early adulthood (APA, 2000). Although research on childhood borderline pathology (BP) developed in tandem with adult literature, existing research with youth is very limited in scope (Crowell, Kaufman, & Lenzenweger, 2012). This is disappointing since earlier identification of those at risk could lead to targeted intervention and prevention efforts. Indeed, many BPD features appear prior to age 18, including impulsive behaviors, repetitive self-inflicted injury, poor self-concept, and extreme emotional lability

(Crowell, et al., 2012; Kernberg, 1990; Shiner, 2009). All of these features are under-examined as risk factors for the adult condition, in spite of a growing interest in the etiology and pathogenesis of borderline traits (see Lenzenweger & Cicchetti, 2005). In particular, identity disturbance, or a "markedly and persistently unstable self-image or sense of self" has received relatively little empirical attention in the clinical literature, despite its inclusion as one of the nine diagnostic criteria for BPD (APA, 2000). Some scholars assert that identity disturbance is a "core" feature of BPD, making its under-examination even more surprising (Meares, Gerull, Stevenson, & Korner, 2011; Wilkinson-Ryan & Westen, 2000). Diagnostic criteria for BPD were designed specifically for adults. However, establishing a coherent identity has long been considered a normative developmental task undertaken during adolescence (Erikson, 1950; Erikson, 1968). Sense of self appears to develop much earlier, by the age of 6 or 7 (Davies, 2010). Therefore, it seems logical to study youth during these developmental time points in order to elucidate difficulties in the identity formation process.

Developmental theories of identity disturbance and borderline personality highlight the interactive effects of child vulnerabilities and contextual risk factors (Crowell, et al., 2009; Linehan, 1993). Biological vulnerabilities, such as trait impulsivity, may lead to more severe psychopathology for youth raised within high-risk environments (Beauchaine, Klein, Crowell, Derbidge, & Gatzke-Kopp, 2009). In contrast, families, schools, and communities that adapt and provide support may be protective for vulnerable youth, leading to especially good developmental outcomes (Boyce & Ellis, 2005; Rutter, 2006). Research on family context indicates that risk for psychopathology is elevated when vulnerable youth are raised in high-conflict environments (Beauchaine,

et al., 2009; Crowell et al., under review). These biology × environment interactions not only shape child behaviors, but may also affect internal processes such as identity development (Linehan, 1993).

Research examining the biological correlates of BPD has also emerged recently. For example, measures of autonomic nervous system (ANS) functioning are associated with some of the core vulnerabilities that confer risk for BPD, including trait impulsivity and emotion dysregulation (Beauchaine, Katkin, Strassberg, & Snarr, 2001; Crowell et al., 2005). These traits can be indexed through sympathetic and parasympathetic nervous system responding when the experiment and stimulus conditions are controlled carefully (Beauchaine, 2012; Crowell et al., 2012; Crowell, et al., 2005; Thorell, 2009). Despite increasing research on biological and psychosocial correlates of borderline personality development, no one has examined the relation between identity disturbance and psychophysiological responding, much less during parent-child conflict.

Adolescent Self-Injury and Risk for BPD

One behavioral marker of BPD that has received considerable attention is self-inflicted injury (SII), which can be divided into injury with and without suicidal intent (Zlotnick, Mattia, & Zimmerman, 1999). SII has traditionally been studied by suicide researchers, yet it may also be a developmental precursor to BPD (Crowell et al., 2009; Lamph, 2011). BPD and SII share many biological and contextual vulnerabilities, personality traits, and coping strategies (see Crowell, Kaufman & Lenzenweger, in press for a review). Thus, although SII and BPD are distinct clinical issues (Centers for Disease Control and Prevention [CDC], 2009; Nock et al., 2008; Zanarini, Laudate, Frankenburg,

Reich, & Fitzmaurice, 2011), they may derive from a common etiology (Crowell et al., in press). In fact, Crowell and colleagues have proposed that SII and BPD may represent two points along a heterotypically continuous borderline trajectory (Crowell, Derbidge, & Beauchaine, in press), *and* that SII increases vulnerability to other BPD features (Crowell et al., 2009).

Trait impulsivity and emotional sensitivity are early-emerging biological vulnerabilities that confer risk for SII and BPD and co-aggregate in families of those affected by these conditions (Crowell, et al., 2009; Crowell, Kaufman, et al., in press; White, Gunderson, Zanarini, & Hudson, 2003). These traits may be related to other important risk factors like identity disturbance, which occurs earlier in development and likely precedes BP. Since self-injurious behaviors typically arise in adolescence (CDC, 2008), studying families of these at-risk youth could elucidate whether biological vulnerabilities and contextual risks (e.g., family dynamics) interact to predict higher identity distress among suicidal adolescents.

Identity Disturbance and Risk for BPD

Despite the dearth of empirical evidence, there is a rich theoretical literature outlining the importance of identity disturbance in borderline personality development. Psychodynamic theorists (e.g., Kernberg, 1975; 2005), claim that *identity diffusion* in BPD derives from a "splitting" of a purely positive (idealized) and a purely negative (persecutory or paranoid) self-representation. The person fails to integrate various aspects of the self into a meaningful whole (Fonagy, Luyten, & Strathearn, 2011; Kernberg, 2005). As a result, individuals with BPD develop a vague and chaotic view of the self,

with abrupt discontinuities and rapid changes, disjointed thinking, and a sense of inner emptiness (Adler & Buie, 1979; Buie & Adler, 1982; Kernberg, 2006). Empirical studies conducted by Westen and colleagues lend some validation to this conceptualization (Westen & Cohen, 1993; Westen, Lohr, Silk, Gold, & Kerber, 1990). They devised a coding system and analyzed responses to projective tests from adolescents with BP features. These youths struggled to differentiate themselves from others and also described self-other relationships as malevolent, victimizing, and unempathic. They often responded in an "all-good" or "all-bad" fashion to prompts and expressed unstable, severely negative, self-representations. Mahler, Pine, and Bergman (1994) hypothesize that this splitting process begins within the early child-caregiver relationship.

In fact, many identity-related problems among persons with BPD have been conceptualized as arising within the family context. Taking a developmental approach, Sroufe (e.g., 1990) and Sander (1975) conceptualize the self as stemming from the infant-caregiver relationship, where dyadic regulation precedes self-regulation abilities (see also Hughes, Crowell, Uyeji, & Coan, 2012). Autonomy and ownership of the self arise through the gradual formulation of an inner framework of attitudes, expectations, and feelings based on social, interactive experiences with the caregiver (see Sroufe, 1990 for a review of self-development during early life stages). Carlson, Byron, and Sroufe (2009) linked attachment problems during infancy with eventual self-concept disruption and later BP features in adulthood in a low-income community sample. Further, they found that a better self-representation in childhood and adolescence mediated the relation between attachment disorganization (assessed in infancy) and BPD symptoms in adulthood. Thought distortions common to BPD are also thought to begin within the

primary attachment relationship. Persons with BPD appear to have distorted beliefs concerning others' perceptions of them and/or a diminished capacity to conceptualize the way others experience them (King-Casas et al., 2008). Fonagy hypothesizes that we learn about who we are when we see ourselves through another's perspective (Fonagy, Steele, Steele, & Moran, 1991). Children who are vulnerable to later BPD may have difficulty seeing themselves through the eyes of others, which may affect their ability to develop a coherent sense of identity.

Similarly, Linehan claims that the process of identity formation requires self-observation and observing other's reactions to your behavior. In order to develop a coherent sense of self, individuals require emotional consistency and predictability over time and across similar situations (Heard & Linehan, 1993). According to Linehan's theory, identity disturbance and BPD itself develop within an emotionally invalidating environment (1993). An invalidating environment is one in which a child's expressions of private emotional experiences are dismissed or rejected. Extreme emotional expressions may be intermittently reinforced, and the child learns that he should cope with emotional experiences alone. The invalidating environment often leads to erratic emotional lability in the child, which interferes with identity development by leading to unpredictable patterns of behavior and incongruent cognitions. Further, the child often fails to develop the skills necessary to understand, label, regulate, or tolerate emotional responses. If the child's interpretation of events is never judged as "correct" by those around him, then he may also develop an overdependence on others, further impeding identity formation.

To summarize, Westen and Cohen (1993) have outlined key components of identity

disturbance in BPD. These include (1) inconsistent investment in goals, values, ideals, and relationships; (2) temporary hyperinvestments in roles, value systems, world views, and relationships; (3) dramatically inconsistent behavior over time and across situations; (4) difficulty integrating multiple self-representations; (5) an incoherent life narrative or sense of continuity; and (6) discontinuity of relationships that leaves the person with a past that is replete with people who are no longer part of their life, and, therefore, missing the shared memories that help to define the self over time. Given that identity distress may be a key feature of BPD and other maladaptive outcomes, research in this area could benefit from the development of prevention efforts targeting at-risk youth. Researchers should utilize young samples since identity consolidation takes place largely during adolescence (Erikson, 1968).

Identity disturbance appears to be a multifaceted and multiply determined construct. Based on current theories, the processes that disrupt healthy identity formation may overlap with those that shape emotional and behavioral control (Heard & Linehan, 1993). Perhaps an interaction between biological and contextual risks will predict identity-related problems, as is the case with emotion dysregulation and impulsivity (Beauchaine, Hinshaw, & Pang, 2010). Biologically vulnerable youth raised in high-conflict environment may be at especially high risk for disturbed/lack of identity.

Psychophysiological Correlates

Psychophysiological measures of ANS functioning have been linked to behavioral features that confer risk for BPD (Crowell, et al., 2012). Electrodermal and cardiac measures are among the most commonly used indices. Electrodermal responding (EDR)

is the product of eccrine sweat gland activation, which is almost exclusively triggered by the sympathetic nervous system (SNS). EDR is considered a reliable index of SNS responding to affective stimuli, and the neural pathways that control EDR have been explored across several animal and human studies (Roy, Sequeira, & Delerm, 1993; Sequeira & Roy, 1993; Shields, MacDowell, Fairchild, & Campbell, 1987; Wallin, 1981; Williams et al., 2000). EDR is correlated with brain activation across regions that assess the significance of the stimuli (e.g., the anterior cingulated, the ventromedial prefrontal cortex, and the right inferior parietal region), and when the stimulus has an emotional valence, the amygdala and orbitofrontal cortex are also activated. This often results in a more pronounced electrodermal response. Eccrine glands are less responsive to thermal changes in the environment, making EDR a more reliable marker of psychological processes like arousal and emotion. This is particularly true when the experiment is well controlled and stimulus conditions are designed to effectively elicit emotional responses (Dawson, Schell, & Filion, 2007).

Low skin conductance and reduced EDR reactivity have been found among those with both SII (for a meta-analysis, see Thorell, 2009) and BPD (Ebner-Priemer et al., 2005; Herpertz, Kunert, Schwenger, & Sass, 1999; Schmahl et al., 2004). Self-injuring adolescents exhibit lower resting EDR than both a depressed and typical control groups (Crowell et al., 2012). Researchers have also consistently found that attenuated EDR is a biomarker for deficits in inhibitory capacity, which is a key symptom of BPD (Beauchaine, 2001; Crowell et al., 2012; Fowles, 1988). These patterns of low EDR among those with BPD and SII is consistent with known deficits in biological systems governing behavioral inhibition — specifically serotonergic dysfunction (5HT; Arango,

Huang, Underwood, & Mann, 2003; Paris et al., 2004). Serotonergic signals stemming from the raphe nuclei have effects on brain regions including the amygdala and septo-hippocampal system. These structures interact to inhibit prepotent behaviors when a person faces competing motivational goals (Brenner, Beauchaine, & Sylvers, 2005; Fowles, 2000). For example, persons who self-injure often feel unable to stop their behavior, despite the negative consequences associated with SII (e.g., interpersonal conflict, scarring, or death; Crowell et al., 2012). Low EDR is also a reliable biomarker of poor behavioral inhibition among those with severe externalizing disorders (Beauchaine, 2001; Beauchaine et al., 2001; Crowell et al., 2006; Lorber, 2004).

Parasympathetic influences on the body are often assessed through cardiac activity. Respiratory sinus arrhythmia (RSA) is a frequently used measure of heart rate (HR) variability that is mediated by the vagus nerve (Beauchaine, 2001). This nerve applies an inhibitory effect on HR during low stress conditions, maintaining a flexible regulatory state within the body. HR is relatively slow and consistent during these periods. Vagal control is withdrawn during periods of stress (i.e., in the presence of threatening stimuli). In these situations, HR increases so the person can meet environmental demands. Once the provoking stressor is removed, vagal activity should return to a tonic inhibitory state and HR should return to baseline. High RSA is typically associated with high attentional and self-regulatory capacity among young adults (Porges, 2007). Low RSA and more pronounced decreases in RSA during exposure to stressors are often observed among clinical samples and under conditions that provoke emotion dysregulation (Beauchaine, 2001; Crowell et al., 2005).

Family Process

Developmental psychopathology researchers have theorized that BP features arise from failing important early childhood tasks that are shaped within the family context, including attachment, self-regulation, and self-development (Macfie, 2009; Macfie & Swan, 2009; Sroufe, Egeland, Carlson, & Collins, 2005). BP features such as aggression, emotional dysregulation, and emotional lability are often promoted and maintained through family processes characterized by emotional invalidation and conflict escalation (Beauchaine, Gatzke-Kopp, & Mead, 2007; Crowell et al., under review). Both parents and children may contribute to the dysfunctional family patterns. Children with biological predispositions for challenging behaviors may elicit poor reactions from caregivers, escalating risk for developing more severe problems (e.g., O'Connor, Deater-Deckard, Fulker, Rutter, & Plomin, 1998).

Families may fall into a pattern where coercive interactions frequently occur, impacting the development and maintenance of internalizing and externalizing problems among youth (Patterson, 2002; Snyder, Edwards, McGraw, & Kilgore, 1994; Snyder, Schrepferman, & St. Peter, 1997). Coercive interactions are driven by principles of negative operant reinforcement. One family member uses aversive tactics in an attempt to reduce unpleasant or unwanted behaviors of other family members. An example would be a mother yelling at her child to lower his voice. These families may learn that the most successful way to end a disagreement is to escalate the conflict. In this way, the other family member is motivated to escape and the conflict is temporarily resolved. However, eventually the child in the previous example may raise the conflict himself by yelling over his mother. The mother has a choice to either abandon the disagreement (reinforcing

the child's response), or to up the intensity of the conflict by engaging in an even more aversive behavior (such as spanking the child). Intermittent success of these behaviors makes it difficult for families to alter or discontinue their patterns. Family processes and biological vulnerabilities that contribute to BPD's emergence are just beginning to be examined, and hold great promise for identifying at risk youth. Thus, using physiological measures in conjunction with direct assessments of family interactions could elucidate developmental antecedents to BPD.

The Current Study

The purpose of the current study is to examine biosocial correlates of identity disturbance within a sample of suicidal youth at high risk for borderline personality disorder. We will also examine patterns of identity dysfunction in this sample as compared with typical community controls. We will use a multimethod, multi-informant design to examine vulnerability and risk for borderline pathology, including biological assessments, self- and informant-report, and diagnostic interviews. We have two hypotheses. First, suicidal adolescents will endorse greater overall identity distress across more domains compared with community controls. Second, biological vulnerabilities (e.g., EDR, RSA) and contextual risks (e.g., parent emotional arousal assessed with digital signal processing) will interact to predict higher self-reported identity distress among suicidal adolescents

METHOD

Participants

Thirty 14-17-year-old community adolescents and 30 adolescents who have recently attempted suicide (i.e., within 2 months prior to study participation) were invited to participate with their biological mothers (see Table 1 for demographic information). Inclusion criteria for suicidal adolescents will include a minimum threshold of (1) moderate lethality and (2) some suicidal intent on the *Lifetime Suicide Attempt Self-Injury Interview (L-SASII)*, described below. Our lethality threshold was represented by a minimum score of 3 on the SASII (e.g., overdose on 11-50 pills; deep cuts anywhere but neck; igniting flammable substance on limb). Our intent threshold for inclusion was represented by a score of 4 or higher on the SASII (e.g., I was thinking about it and was somewhat serious).

Suicidal adolescents with mental retardation, psychosis, or a schizophrenia spectrum diagnosis were excluded as the etiology and function of suicide attempts may be distinct within these populations (APA, 2000). Control participants were excluded if they had a history of any Axis I or Axis II diagnosis, or any suicidal behavior. Persons in both groups were excluded if they have a history of epilepsy, seizures, heart disease, or asthma, or if they were taking major tranquilizers, tricyclics, antihistamines, or beta blockers, as these may have interfered with physiological measures.

Suicidal participants and their mothers were recruited from both outpatient and inpatient psychiatry at a local neuropsychiatric hospital, adolescent medicine, and online classifieds (e.g., Criagslist). Eligible participants recruited from the community or outpatient clinics were screened over the phone or during a convenient time. Trained graduate and undergraduate research assistants conducted inpatient recruitment on the unit several times a week. Parents were called for permission to screen their children, when in-person permission could not be easily obtained. Adolescents were approached for study screening during appropriate times (e.g., unstructured free time and visitation). The screening interview consisted of the L-SASII (described below), inclusion/exclusion criteria, and demographic survey. Because hospitalized adolescents and their families were often distressed while on the unit, lab-based visits were scheduled to occur post-hospitalization. Community controls were recruited through fliers distributed to households in the community, online community postings, and word of mouth. Households for direct mailers were selected by a mailing service that identifies addresses for families with children within the target age range. Participants were compensated with $40 for their time, or $50 if they arrived with a total of four family members to complete a larger study protocol. This study was approved by the Institutional Review Board at the University of Utah.

Measures

Screening

The Lifetime Suicide Attempt Self-Injury Interview (L-SASII; formerly the Lifetime Parasuicide Count; Linehan & Comtois, 1996) is a 20-minute interview that captures the

frequency, lethality, suicidal intent, and level of medical care for all lifetime self-injurious acts. Internal consistency on the subscales of the SASII range from excellent to fair (α = .93 for suicide intent; α = .63 for suicide communication). Interrater reliability has also been reportedly high using this instrument (Mdn = .956, range = .871 to .978).

Adult Report on Child Psychopathology and Personality Traits

Mothers completed the NEO Five Factor Inventory-3 (NEO-FFI-3) Form R (observer rating) Adolescent version. The NEO-FFI-3 is a 60-item instrument that provides a quick, reliable, and accurate measure of five domains of personality (neuroticism, extraversion, openness, agreeableness, and conscientiousness). Mothers filled out the observer rating form about their adolescent who recently attempted suicide (if recruited from the inpatient unit) or an age matched control (if recruited from the community). Internal consistency coefficients for the NEO-PI-3 form R range from .78 to .88, and 2-week test-retest reliability coefficients range from .86 to .90. Evidence of good to excellent convergent and discriminant validity have also been established (see McCrae & Costa, 2010 for a summary of available evidence).

Diagnostic Interviews

Borderline personality symptoms were assessed using the Structured Clinical Interview for DSM-IV personality disorders (SCID-II; First, Spitzer, Gibbon, & Williams, 1996). The SCID-II is a widely used semistructured interview with excellent reliability. Barnow and colleagues (2006) used the BPD criteria section of the interview and found a κ of 0.83 for the interrater agreement between the two independent

interviewers.

Self-Report Questionnaires

The Child Depression Inventory (CDI) is a 27-item measure of depressive symptoms that comprises five subscales, including negative mood, interpersonal problems, ineffectiveness, and negative self-esteem (Kovacs, 1992). Psychometric properties of the CDI are adequate (α values ranging from .61 to .91 for internal consistency and test-retest reliability; Gadow et al, 2002).

The Positive and Negative Affect Schedule (PANAS) is a trait measure of positive and negative affectivity scored on a 5-point Likert scale (Watson, Clark, & Tellegen, 1988). The PANAS consists of 10 negative affect items (e.g., "irritable," "guilty") and 10 positive affect items (e.g., "proud," "enthusiastic") and participants are asked to rate how much they feel/have felt these emotions in a specified period of time. For this study, adolescents completed two versions of the PANAS. One that inquires about their affect over the previous 2 weeks, and another that inquires about their current affect. The PANAS has good test-retest reliability (.79-.81) and high internal consistency with α values ranging from .85 to .90 (Watson et al., 1988).

The Difficulties in Emotion Regulation Scales (DERS) is a self-report measure to assess difficulties in emotion regulation across multiple dimensions (Gratz & Roemer, 2004). The DERS has high internal consistency ($\alpha = .93$), good test-retest reliability ($\rho_I = .88$, $p < .01$), and adequate construct and predictive validity. Adolescents also completed the NEO Five Factor Inventory-3 (NEO-FFI-3) Form S (self-report) Adolescent version (described above).

Finally, participants completed the Self-Concept and Identity Measure (SCIM), which assesses identity disturbance (Kaufman, Cundiff, & Crowell, under review). Internal consistency of the scale is excellent (Cronbach's $\alpha = .89$). Test-retest reliability is also excellent ($\alpha = .93$, $r = .88$) with an intraclass correlation coefficient (ICC) of .88. The SCIM has three subscales: consolidated identity, disturbed identity, and lack of identity. It assesses the core aspects of identity such as self-concept and role continuity across environments and with different persons, consistencies in values and interests, self-worth, self-differentiation, and self-cohesion (summarized in Table 2).

Psychophysiological Measures

EDR and RSA were collected using Mindware hardware and scored using the Mindware EDA v. 3.0.9 and Mindware HRV 3.0.10 software packages. This equipment can time link the stimulus presentation, physiological recording, and participant facial expressions for behavioral coding and behavior-physiology concordance. EDR data were acquired with two standard 0.8-cmAg- AgCl electrodes attached to the thenar eminence of the participant's nondominant hand with adhesive electrode washers and a 0.05 molar NaCl solution. Nonspecific skin conductance responses were scored as fluctuations exceeding 0.05 μS. Change scores were calculated for EDR reactivity by subtracting baseline values from those obtained during the task. RSA was calculated using spectral analysis at a sampling rate of 1000 hz.

Digital Signal Processing

Emotional arousal during a family discussion task was measured though nonverbal, paralinguistic properties of speech using digital signal processing (DSP). During speech production, vocal folds in the larynx create patterns of vibration, measured in Hertz (Hz). The listener perceives this vibration as the pitch of a given sound (faster vibration corresponds to higher pitch). DSP uses computer algorithms to extract parameters from digital waveforms from recorded speech (Baucom, Atkins, & Christensen, 2009; Owren & Bachorowski, 2007). When examining emotional arousal, these algorithms focus on measuring the fundamental frequency (f_0) of family member's speech from audio recordings. F_0 refers to the lowest frequency harmonic (or overtone) of vocal patterns of vibration (Juslin & Scherer, 2005). Higher f_0 levels have been linked to higher levels of emotional arousal (see Scherer, 2003 for a review). Audio files were analyzed using Praat, which produces mean, minimum, and maximum f_0 values that are needed to calculate range of f_0 for mothers during a family discussion task (Boersma & Weenink, 2005).

Procedure

During the lab-based procedure, adolescents and their mothers completed their respective assessment materials independently on secure computers in private rooms. Trained graduate and undergraduate research assistants conducted diagnostic interviews and risk assessment protocols. Adolescents and their mothers each completed a copy of the PANAS to assess their affect over the past 2 weeks. Following these procedures, participants were asked to fill out The NEO-FFI-3, rating the adolescent's personality

traits on a Likert scale. Research assistants compared adolescent and parent responses to identify the item with the most disagreement (the largest discrepancy in selected responses to the same item) and the item with the greatest agreement (the most convergence between the 3 individuals' responses). When multiple items were rated equally discrepantly or consistently, discussion topics were chosen based on which were most likely to produce a lengthy discussion consistent with the purpose of each task. For example, agreement items were chosen such that their discussion would surround adolescents' positive qualities. Disagreement items were selected with the purpose for promoting moderate conflict.

Family dyads then engaged in a discussion task where they were instructed to discuss their reasoning for selecting their own response to the discrepant NEO item. EDR, RSA, and nonverbal, vocal responses were measured for mother adolescent pairs over the course of the discussion. Following the discussion, participants filled out a copy of the PANAS to assess their current affective experience. This process was then repeated for the convergent NEO item.

Analytic Plan

Our first hypothesis, "suicidal adolescents will endorse greater overall identity distress across more domains compared with community controls," was examined with a Multivariate Analysis of Variance (MANOVA), comparing the high-risk group and control group on total and subscale scores from the SCIM.

Our second hypothesis is that biological vulnerabilities (e.g., EDR, RSA) and contextual risks (mother's emotional arousal assessed with digital signal processing) will

interact to predict higher self-reported identity distress among suicidal adolescents. In order to test this hypothesis, we ran two multiple linear regression models. The first examined the interactive and main effects of adolescent RSA and mother f_0. RSA and EDR values were calculated by subtracting participants' mean resting baseline values from their mean responses across the 5-minute disagree task. The variable mother f_0 represents the mean of mother f_0 ranges during the disagreement portion of the discussion task. The second model will examine the interactive and main effects of mother f_0 and EDA on adolescent SCIM total score. To test for interactions, we regressed the dependent variable (SCIM total score) on the two predictors for each equation (RSA, mother f_0; EDR, mother f_0) and on the Predictor × Predictor Product vector (i.e., RSA × mother f_0, EDR × mother f_0). An interaction model is supported when the product vector is significant, regardless of the significance of the main effects.

Table 1

Participant Demographics.

	Control		Clinical	
	Mothers	**Adolescents**	**Mothers**	**Adolescents**
Age *M*(*SD*)	42.03(5.43)	15.47(1.04)	40.89(5.76)	15.76(1.21)
Gender				
Female	30(100.0%)	17(56.7%)	30(100.0%)	22(73.3%)
Male		13(43.3%)		8(26.7%)
Ethnicity				
Hispanic	3(10.0%)	4 (13.3%)	2(6.7%)	3(10.0%)
Non-Hispanic	26(86.7%)	26 (86.7%)	25(83.3%)	26(86.7%)
Decline			3(10.0%)	
Missing	1(3.3%)			1(3.3%)
Race				
Asian		1(3.3%)		
Black		1(3.3%)		
Caucasian	28(93.3%)	25(83.3%)	27(90.0%)	26(86.7%)
Native Hawaiian or Pacific Islander	1(3.3%)			
Other		3(10.0%)	2(6.7%)	2(6.7%)
Missing	1(3.3%)			1(3.3%)
Decline to answer			1(3.3%)	1(3.3%)
Sexual Orientation				
Heterosexual	28(93.3%)	22(73.3%)	30(100.0%)	13(43.3%)
Lesbian		1(3.3%)		
Gay				1(3.3%)
Bisexual				6(20.0%)
Other		1(3.3%)		5(16.7%)
Unsure	1(3.3%)	2(6.7%)		1(3.3%)
Decline to answer		4(13.3%)		3(10.0%)
Missing	1(3.3%)			1(3.3%)

Table 2

Central Identity-Related Terms.

Term	Description	Implications
Identity consolidation	Individuals begin to make commitments to others and take on roles they internalize as self-defining. They experience themselves as consistent over time and across contexts, and demonstrate stable beliefs, attitudes and values. (Erikson, 1968; Marcia, 1994; Westen, 1985)	A functioning identity allows the person to navigate major life tasks, achieve intimacy with others, and find a place in society.
Identity crisis	A transitory period when identity is no longer in sync with past self-concept (Erikson, 1956).	This period of change often results in an inconsistency between how those who are close to the adolescent view him or her, and how the individual views him or herself
Identity diffusion	Pathological in nature and manifests as sustained incoherence or confusion about who one is, difficulty committing to typical roles, and a tendency to acquire the thoughts, feelings, and beliefs of others in place of establishing one's own (Erikson, 1956; Kernberg, 2006; Westen & Heim, 2003; Wilkinson-Ryan & Westen, 2000).	May lead to an incapacity for intimate relationships, indecision about major life choices, and a sense of inner emptiness (Erikson, 1956; Kernberg, 2006)
Self-concept differentiation	The process by which a person learns to behave differently in different contexts.	Higher levels of SCD have been linked with poor psychological adjustment (Donahue et al., 1993).
Identity fragmentation	When persons fail to integrate their various social experiences into a core self (Donahue, Robins, Roberts, & John, 1993).	Higher levels of have been linked with poor psychological adjustment (Donahue et al., 1993).

Table 2 Continued

Term	Description	Implications
Self-complexity	The adaptive form of the identity differentiation process (Lutz & Ross, 2003). Adolescents may create several 'identities' in order to conform with expectations from different relationships and effectively enact their social roles.	Opposing self-attributes may cause internal conflict (especially during mid-adolescence), yet these should diminish and the individual should become more integrated over time (Harter, Bresnick, Bouchey, & Whitesell, 1997).
The false-self	The false-self can develop as a result of taking on contradictory attributes in various social roles (Harter, 1997, 2006; Harter et al., 1997; Harter & Monsour, 1992). The differentiation process can incur doubt about one's true self, or which identity is authentic. False-self behaviors can develop, where an individual acts in ways that are inconsistent with how the individual truly views him or herself.	Low self-esteem combined with false-self behavior are predicative of depressive symptoms (Harter, 1998; Harter, Marold, Whitesell, & Cobbs, 1996)
Self-concept clarity (SCC)	The extent to which beliefs about the self are clearly defined, consistent with self-knowledge, and temporally stable (Campbell et al., 1996). There is a demonstrated link between SCC and global-self esteem (Campbell, 1990; Campbell, Chew, & Scratchley, 1991; Campbell & Fehr, 1990).	Improvements to SCC and self-esteem may play a role in alleviating identity disturbance among BPD clients (Roepke et al., 2011).
Self continuity	Stability of identity across persons and environments.	Has been consistently linked to psychological wellbeing among Western cultures (Campbell, Assanand, & Di Paula, 2003; Diehl, Hastings, & Stanton, 2001; Erikson, 1968; Lutz & Ross, 2003; Sheldon, Ryan, Rawsthorne, & Ilardi, 1997)

RESULTS

In order to characterize our sample, participant means and standard deviations on clinical scales and fundamental frequency are reported in Table 3. One-way ANOVAs comparing means by group on these scales are also reported. Since the SCIM is a novel measure, we performed an independent samples *t*-test to examine potential differences in adult and adolescent SCIM total scores. There was a significant difference in mother (M=54.78, SD=16.09) and adolescent scores, (M=90.48, SD=32.66); $t(116)$=-7.53, p = 0.00, with adolescents receiving higher scores than mothers. This finding was replicated when clinical families were excluded, $t(57)$=-3.68, p = 0.02; however, there were no significant differences in total SCIM scores among mothers and adolescents in the clinical group only, $t(57)$=-9.83, p = 0.21.

In order to assess the effectiveness of the discussion task for evoking emotional arousal, we examined PANAS and NEO scores by group, across task phases (baseline, agree, and disagree). A MANOVA indicated mother and adolescent scores did not differ significantly on NEO reports (i.e., mother and adolescent reports of adolescent personality factors did not differ significantly across either the control or clinical group; see Table 4). Clinical and control group participants did differ on positive and negative affect ratings at all three task stages (see MANOVA results in Table 5); however, only control participants' PANAS ratings appear to have changed across discussion task

phases (see ANOVA results in Table 6).

Adolescent total and subscale SCIM scores were examined with a MANOVA to compare the high-risk self-injuring and control groups. Results of evaluation of assumptions of normality and homogeneity of variance-covariance matrices all were satisfactory. Most research on parent-child interaction tasks with self-injuring adolescents has only included female participants. As we recruited both male and female participants, we chose to control for the effects of sex. A one-way analysis of variance (ANOVA) demonstrated there were no significant differences in the number of males and females by group, $F(1, 59) = 2.61, p > .05$; therefore, it was deemed acceptable for adolescent sex to be covaried out of our model. This procedure ensured results are not better attributable to effects of participant sex. MANOVA results demonstrated significant effects by group for our overall model (Wilks' Lambda = .421, multivariate effects F (2, 59) = 24.729), SCIM total score $F(1, 59) = 56.40, p = .00, \eta_p^2 = .50$, and each of the three subscales (SCIM stable subscale; $F(1, 59) = 26.33, p = .00, \eta_p^2 = .32$; SCIM unstable; $F(1, 59) = 25.18, p = .00, \eta_p^2 = .31$; SCIM lack of identity; $F(1, 59) = 75.79, p = .00, \eta_p^2 = .58$). Effect sizes ranged from moderate to large with SCIM total and SCIM lack of self scales producing the largest effects. These findings indicate there are differences on the SCIM by group status and provide evidence in favor of our first hypothesis (see Table 3).

We ran two multiple linear regression equations to assess the effects of adolescent psychophysiology, mother fundamental frequency, and their interaction. Predictors were mean centered and evaluation of assumptions of normality, linearity, and homoscedasticity were satisfactory for both tests. The main and interactive effects of mother f_0 and adolescent RSA during the disagree portion of the discussion task on

adolescent SCIM scores were tested with a linear multiple regression model. The main effects for mother f_0, F (3, 50) = 0.04, p > .05, and adolescent RSA, F (3, 50) = .15, p >.05 were not significant. Their interactive effect was also nonsignificant, F (3, 50) = -0.05, p > .05 with an R squared value of .001. The main and interactive effects of mother f_0 and adolescent EDA during the disagree portion of the discussion task on adolescent SCIM scores were also tested with a linear multiple regression model. The main effects for mother f_0, (F (3, 40) = 0.13, p > .05), and adolescent EDA, (F (3, 40) = -0.63, p >.05) were not significant. Their interactive effect was also nonsignificant, F (3, 40) = 0.07, p > .05 with an R squared value of .01. These results indicate the interactive effects of mother f_0 and child psychophysiology did not predict adolescent SCIM scores.

Table 3

Clinical Scales and Fundamental Frequency by Group.

	n	Mother *M*(*SD*)	*n*	Adolescent *M*(*SD*)	*n*	Mother *M*(*SD*)
CDI raw scores	N/A	N/A	30	5.2(4.90)	N/A	N/A
SCIM Total	29	50.79(12.48)	23	67.77(21.57)	30	58.63(18.34)
SCIM Stable	29	21.31(5.40)	23	25.80(7.21)	30	23.70(5.00)
SCIM Unstable	29	19.45(5.20)	30	30.37(12.62)	30	22.23(8.84)
SCIM Lack of identity	29	10.03(4.97)	30	11.60(6.34)	30	12.70(6.91)
DERS Total	29	66.35(17.79)	30	64.57(18.56)	30	75.03(19.85)
DERS Non-acceptance	29	10.86(4.20)	30	9.23(4.24)	30	11.33(3.46)
DERS Goals	29	11.04(4.37)	30	10.10(4.26)	30	12.23(4.32)
DERS Impulse	29	9.45(3.56)	30	8.97(3.20)	30	10.10(3.94)
DERS Awareness	29	13.10(5.14)	30	15.17(5.67)	30	16.57(5.12)

n	Adolescent *M*(*SD*)	Adolescent ANOVA *F*(significance)	Mother ANOVA *F*(significance)
29	26.83(8.82)	136.66(0.00)*	N/A
18	113.97(24.56)	59.04(0.00)*	3.66(0.06)
18	38.14(10.36)	28.34(0.00)*	3.11(0.08)
29	46.00(11.25)	25.17(0.00)*	2.16(0.15)
29	29.83(9.06)	80.63(0.00)*	2.88(0.10)
29	121.52(22.85)	110.82(0.00)*	3.13(0.08)
29	19.00(6.72)	44.91(0.00)*	0.22(0.64)
29	18.83(4.09)	64.35(0.00)*	1.12(0.29)
29	17.38(5.89)	46.19(0.00)*	0.44(0.51)
29	21.41(5.54)	18.31(0.00)*	6.73(0.01)*

Table 3 Continued

	n	Mother *M*(*SD*)	*n*	Adolescent *M*(*SD*)	*n*	Mother *M*(*SD*)	*n*	Adolescent *M*(*SD*)	Adolescent ANOVA *F*(significance)	Mother ANOVA *F*(significance)
DERS Strategies	29	11.52(4.70)	30	10.13(4.68)	30	12.73(4.45)	29	24.86(5.87)	113.90(0.00)*	1.04(0.31)
DERS Clarity	29	8.52(2.94)	30	9.20(2.85)	30	9.93(3.17)	29	16.10(4.90)	44.14(0.00)*	3.16(0.08)
SCID BPD (9-27 scale)	29	12.00(3.82)	30	10.33(1.95)	30	14.50(4.34)	30	17.45(4.87)	199.53(0.00)*	5.61(0.02)*
SCID MDD (9-27)	30	12.63(4.45)	30	10.87(2.75)	30	16.97(3.70)	30	20.40(3.38)	77.77(0.00)*	16.81(0.00)*
Self-inflicted injury (yes or no)	30	N/A	30	N/A	30	N/A	30	N/A	188.50(0.00)*	16.52(0.00)*
F0 mean across discussion	28	144.65(23.12)	27	150.55(42.73)	29	136.16(26.97)	29	167.48(39.11)	2.40(0.13)	1.68(0.20)

Table 4

NEO Subscale Scores for Adolescent Personality Factors by Group.

	Control			Clinical				
	Mother Report of Adolescent *M*(*SD*)	Adolescent Report *M*(*SD*)	Difference *M*(*SD*)	Mother Report of Adolescent *M*(*SD*)	Adolescent Report *M*(*SD*)	Difference *M*(*SD*)	One-way ANOVAs (comparing factors by group)	MANOVA by group *F*-value (significance)
Neuroticism	2.70(0.37)	2.63(0.37)	0.38(0.25)	3.22 (0.49)	3.24 (0.24)	0.43 (0.30)	0.53(0.47)	0.53 (0.47)
Extroversion	3.32(0.28)	3.29(0.22)	0.28(0.19)	3.00 (0.36)	3.13 (0.34)	0.38 (0.29)	2.47(0.12)	2.47 (0.12)
Contentiousness	3.32(0.32)	3.46(0.24)	0.28(0.31)	3.07 (0.34)	3.11 (0.39)	0.38 (0.23)	1.69(0.20)	1.69 (0.20)
Agreeableness	2.79(0.38)	2.78(0.34)	0.36(0.26)	2.89 (0.45)	2.93 (0.47)	0.44 (0.30)	1.12(0.30)	1.12 (0.30)
Openness	3.07(0.26)	3.14(0.23)	0.29(0.23)	3.01 (0.33)	3.07 (0.30)	0.31 (0.23)	0.14(0.71)	0.14 (0.71)

Table 5

PANAS means, standard deviations, and MANOVA results comparing clinical and control participants.

	Control		Clinical			
	Mother *M*(*SD*)	Adolescent *M*(*SD*)	Mother *M*(*SD*)	Adolescent *M*(*SD*)	MANOVA by group *F*-value (significance)	Effect size
PANAS Baseline*						
Positive	39.57(8.54)	45.33(8.12)	31.83(7.35)	26.28(9.75)	69.32(0.00)**	0.37
Negative	24.80(6.96)	21.77(5.81)	34.20(11.80)	40.69(13.00)	59.53(0.00)**	0.34
PANAS Disagree						
Positive	30.67(11.96)	29.23(13.02)	26.57(9.63)	22.72(7.81)	7.27(0.01)**	0.06
Negative	16.23(2.39)	18.17(3.02)	20.03(7.57)	22.48(8.48)	13.49(0.00)**	0.10
PANAS Agree						
Positive	33.47(11.50)	29.70(13.19)	27.97(9.64)	26.59(9.56)	4.90(0.03)**	0.04
Negative	16.33(3.88)	17.13(4.42)	17.27(3.67)	18.48(6.51)	1.82(0.18)**	0.02

Table 5 Continued

		Control Adolescent *M*(*SD*)	Clinical Mother *M*(*SD*)	Adolescent *M*(*SD*)	MANOVA by group *F*-value (significance)	Effect size
Change score Disagree task						
Positive	-8.90(10.86)	-16.10(11.24)	-5.27(9.79)	-3.55(11.59)	16.31(0.00)*	0.12
Negative	-8.57(7.07)	-3.60(6.27)	-14.17(10.80)	-18.21(13.57)	30.94(0.00)*	0.21
Change score agree task						
Positive	-6.10(9.56)	-15.63(11.10)	-3.87(9.35)	0.31(8.62)	22.93(0.00)*	0.16
Negative	-8.47(8.23)	-4.63(6.10)	-16.93(12.09)	-22.21(12.37)	49.03(0.00)*	0.29

Table 6

One-way ANOVAs Comparing Baseline PANAS Scale to Agree and Disagree PANAS Scores.

		Control *F*-value (significance)	Clinical *F*-value (significance)
PANAS agree			
	Positive	1.79(0.06)	1.10(0.40)
	Negative	2.63(0.00)*	0.74(0.80)
PANAS Disagree			
	Positive	2.43(0.01)*	0.70(0.824)
	Negative	1.10(0.39)	0.877(0.64)

DISCUSSION

The current study aimed to investigate biosocial correlates of identity disturbance within a sample of suicidal youth and community controls. Our first hypothesis that identity dysfunction ratings would vary by group was supported, as there appear to be significant differences on SCIM total and subscale scores for control and self-injuring adolescents. Additionally, adolescents in the control condition received higher SCIM scores than control mothers (indicating more identity-related problems). These results are consistent with developmental literature, which claims a certain degree of identity distress is developmentally normative among adolescents, and should subside by adulthood (Erikson, 1956; Harter, Bresnick, Bouchey, & Whitesell, 1997). However, our results also demonstrate self-injuring adolescents are struggling above and beyond their age matched peers. The SCIM has previously been validated among adults (Kaufman et al., under review), and these preliminary findings indicate it may also be useful for identifying identity problems among youth.

Our second hypothesis that child biological vulnerabilities would interact with environmental stressors to predict SCIM scores was not supported. This may be a valid finding, however, several methodological limitations may also have contributed to this outcome. First, the discussion task may not have been poignant enough to elicit sufficient emotional arousal or coercive family processes. Previously validated parent-child

interaction tasks often employ discussion topics that are more conflictual and evocative than NEO-FFI-3 items. For example, Crowell et al. (2008) found physiological differences between self-injuring and control adolescents when discussing items rated as highly contentious for mother/child dyads on topics such as chores and curfew. Such topics are likely to be more salient than many NEO items as they typically arise with some frequently. Per our observation, families rarely discussed disagreement or agreement items for the allotted time (5 minutes) before straying to other subjects or becoming silent. Additionally, few families exhibited observable symptoms of distress during the disagreement task (raised voices, negative affect, etc.), lending further evidence to the hypothesis that the task failed to produce adequate emotional reactions. Further, many dyads made similar item ratings (e.g., within one or two likert options as opposed to opposite ends of the scale), making it challenging to identify "disagree" discussion topics. In fact, our results indicate mother and adolescent scores did not differ significantly on NEO reports (see Table 4). Occasionally, adolescents did not understand the content of a selected item (e.g., misunderstanding the term "egocentric"), rendering the discussion task invalid. Our results also show that although control and clinical participants differed on their self-report experiences of positive and negative affect across the discussion task, only control participants' PANAS ratings *changed* across discussion task phases (see Tables 5-6). Had this study utilized a previously validated instrument in mother-child interaction tasks, we may have found group differences on biological and environmental measures.

Small sample size coupled with missing physiological data could also have contributed in part to our null results. Electrodermal responding and respiratory sinus

arrhythmia values were compromised for several participants. This could be due to several reasons, including researcher error (e.g., poor electrode placement), participant characteristics (e.g., obesity), and behaviors (e.g., medication usage, excessive fidgeting). Given that our clinical sample was largely recruited from an inpatient setting, many of these participants were taking multiple medications in moderate to heavy doses. Although we excluded participants taking medications with well-documented effects on psychophysiological responding (e.g., beta-blockers), many participants were taking a combination of medications that could have influenced our results.

The results of the present study did little to elucidate the mechanisms by which clinically significant identity disturbance emerge. However, our findings point to the importance of assessing identity-related outcomes among youth. Suicidal adolescents are more likely to experience identity problems across multiple domains compared to age matched controls. Further, these symptoms appear to accompany other important markers of behavioral and emotional dyscontrol (see Table 3). Further research on identity disturbance across the developmental lifespan is sorely needed. Identity-related research has flourished for decades, yet important questions remain unanswered. The distinction between normative identity-related struggles (e.g., crisis) and pathological identity disturbance is largely unexamined and warrants investigation. Future research should examine how early in the developmental trajectory these problems surface, how responsive these individuals are to identity interventions (e.g., cite), and what proportion of these individuals will go on to experience clinical problems in adulthood. Identity and identity dysfunction are important constructs for mental health practitioners and researchers interested in personality, psychopathology, and emotional development.

Longitudinal research is needed to establish where identity problems fall developmentally in a borderline trajectory.

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