

# Neuroticism and Suicidal Behavior: Conditional Indirect Effects of Social Problem Solving and Hopelessness

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**Abstract** Individuals with problem solving deficits, and higher levels of neuroticism and hopelessness, are at increased risk for suicide, yet little is known about the interrelationships between these vulnerability characteristics. In a sample of 223 low-income, primary care patients, we examined the potential mediating role of hopelessness on the relation between neuroticism and suicidal behavior, and the potential moderating role of social problem solving ability. Participants completed self-report questionnaires: Suicidal Behaviors Questionnaire-Revised, Social Problem Solving Inventory-Revised, Beck Hopelessness Scale, and NEO Five Factor Inventory. Models were tested using bootstrapped moderated mediation techniques. There was a significant indirect effect of neuroticism on suicidal behavior through hopelessness, and this indirect effect was moderated by social problem solving ability. Patients with greater neuroticism also manifest greater levels of hopelessness and, in turn, more suicidal behavior, and these relations are strengthened at lower levels of social problem solving. Interventions that increase social problem solving ability and reduce hopelessness may reduce suicide risk.

**Keywords** Suicidal behavior · Neuroticism · Hopelessness · Social problem solving · Primary care

In the United States, suicidal behavior is a significant public health concern, with death by suicide ranked as the 10th leading cause of death (American Association of Suicidology [AAS] 2012). In 2011, 8.3 million adults (approximately 3.7 % of the U.S. population) endorsed having thoughts about suicide, and 1 million adults attempted suicide (Center for

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Disease Control and Prevention [CDC] 2011). Development of effective intervention and prevention efforts for suicide is predicated on the ability of researchers to understand the multifaceted nature of suicidal behavior, and requires attention to a variety of social and psychological variables as potential risk and protective factors.

At the intrapersonal level, a well-established risk factor for suicide, neuroticism, is conceptualized as a stable, and often pervasive, personality trait that contrasts adjustment and emotional stability (i.e., low neuroticism) with maladjustment and emotional instability (i.e., high neuroticism). Individuals high in neuroticism have an increased propensity for experiencing negative affect, including feelings such as anxiety, anger, envy, and guilt (McCrae and Costa 2004), with increased likelihood of depression and suicidal behavior (Quilty et al. 2009).

Another negatively-valenced, intrapersonal risk factor that, arguably, plays a central role in suicidal behavior, and which may evolve from neurotic personality tendencies, is hopelessness (Chang et al. 2010). Hopeless individuals often believe that “nothing will turn out right for them; they will never succeed at what they attempt to do; their important goals can never be obtained; and, that their worst problems will never be solved” (Beck and Steer 1988, p.1). Across samples and age groups, hopelessness is a robust predictor of suicidal behavior and death by suicide (Hirsch and Conner 2006; Klonsky et al. 2012).

At the interpersonal level, deficits in social problem solving ability contribute to suicide risk while, at the same time, adaptive problem solving may be protective. Social problem solving is conceptualized as a purposeful coping strategy focused on overcoming “everyday” challenges that occur in home, school, and/or work environments (D’Zurilla and Nezu 1982, 1990). Social problem solving includes cognitive, emotional, and interpersonal processes, and involves a conscious effort to solve real-world problems, including interpersonal conflicts and subjective personal challenges (D’Zurilla and Nezu 1982, 1990). Resolving problems may occur as a result of use of strategies such as: 1) problem definition, 2) generation of alternative responses, 3) decision making, and 4) evaluating the effectiveness of the chosen solution (D’Zurilla et al. 2002).

Across samples, problem solving deficits are associated with suicidal behavior and differentiate between suicide attempters and non-attempters (McAuliffe et al. 2006; Roškar et al. 2007). For instance, suicide attempters exhibit impaired problem solving ability and increased passivity and avoidance in their approach to problem solving (Pollock and Williams 2004), and problem-solving deficits may play a role in the progression from ideation to attempts (Speckens and Hawton 2005). On the other hand, adaptive problem solving is associated with lower risk for negative outcomes including depression, hopelessness, and suicidal behavior (Becker-Weidman et al. 2010; Hirsch et al. 2012).

Despite their independent contributions to suicide risk, the interrelationships between neuroticism, hopelessness, social problem solving and suicidal behavior have not been previously examined. Yet, there is some evidence that meaningful associations exist. For instance, individuals high in neuroticism tend to have poor coping skills, including reduced problem solving ability and a negative problem orientation (D’Zurilla et al. 2011; Huband et al. 2007), and poor problem solving is related to both hopelessness and suicidal behavior (D’Zurilla et al. 1998).

In the current study, at the bivariate level, we hypothesized that neuroticism and hopelessness would be significantly positively associated with suicidal behavior, and that overall social problem solving ability would be negatively related to suicidal behavior, hopelessness, and neuroticism. At the multivariate level, we hypothesized that hopelessness would mediate the relationship between neuroticism and suicidal behavior, such that higher levels of neuroticism

would be associated with increased hopelessness and, in turn, to greater suicidal behavior. Further, we hypothesized that this mediating effect would be moderated by social problem solving.

## Method

### Participants

Two hundred and twenty three adults (137 females, 61.2 %; 82 males, 36.6 %; 1 transgendered, 0.4 %) were recruited from a primary care clinic serving low-income, uninsured patients. Participants in this Institutional Review Board-approved study had a mean age of 44.08 years (standard deviation [SD] = 12.11), and 86.2 % were Caucasian ( $n = 193$ ), 7.1 % African American ( $n = 16$ ), 3.1 % Hispanic ( $n = 7$ ), 0.9 % American Indian ( $n = 2$ ) and 0.4 % Asian American ( $n = 1$ ).

Of importance, primary care clinics are important locations for detecting and preventing suicidal behavior (Hirsch et al. 2009). Approximately 62 % of people who die by suicide made contact with a primary care provider within 1 year of their death (Bryan and Rudd 2011; Luoma et al. 2002) and depression, a concomitant of neuroticism and a common risk factor for suicide, occurs in 5–10 % of primary care patients (Nimalasuriya et al. 2009).

### Measures

Suicidal behaviors were evaluated using the *Suicidal Behaviors Questionnaire-Revised* (SBQ-R) (Osman et al. 2001), which has 4 questions designed to assess suicidal behavior including: 1) lifetime history of ideation and attempts, 2) suicide ideation in past year, 3) communication of suicidal intent, and 4) likelihood of future attempts. Each question is scored on a 5-point to 7-point Likert-type scale from 1 (no/never) to 7 (very likely); items are summed for a total score, with higher numbers indicating greater severity (Osman et al. 2001). Across samples, the SBQ-R has good internal consistency ( $\alpha = .76-.88$ ) (Osman et al. 2001) and distinguishes between suicidal and non-suicidal inpatients. A cutoff score of 7 for non-clinical samples (sensitivity .83; specificity .96) and 8 for clinical samples (sensitivity .87; specificity .93) has been determined. In this study, internal consistency was good ( $\alpha = .85$ ).

Social problem solving ability was assessed via the *Social Problem Solving Inventory-Revised Short Form* (SPSI-R-SF) (D’Zurilla et al. 2002), a 25-item scale that is scored using a 5-point Likert-type scale ranging from 0 (*not at all true of me*) to 4 (*very true of me*). The SPSI-R-SF yields a total score comprised of five subscale scores: positive problem orientation (PPO), rational problem solving (RPS), negative problem orientation (NPO), impulsive/careless style (ICS), and avoidant style (AS) (D’Zurilla et al. 2002).

The PPO subscale is described as a constructive, problem solving-set that involves viewing problems as challenges and as solvable, whereas the NPO subscale is a negative and/or dysfunctional cognitive set that involves viewing problems as threats and doubting problem solving ability (D’Zurilla et al. 2002). In addition, the SPSI-R-SF assesses three problem solving styles: RPS, a rational, deliberate, skillful, and systematic approach to problem solving involving the application of adaptive problem solving techniques; ICS, characterized by active attempts to solve problems, but which are enacted in an impulsive, hurried, careless, and incomplete fashion; and AS, marked by passivity, inaction or avoidance, procrastination, and

dependency on others to make decisions (D’Zurilla et al. 2002). Negative subscales are reverse-scored, and higher scores indicate increased problem solving ability. In collegiate, clinical, and community samples (Hawkins et al. 2009; Spence et al. 2002), the SPSSI-R-SF demonstrates good internal consistency ( $\alpha = .79$ ) and test-retest reliability over a three-week time period ( $r = .91$ ). In this study, internal consistencies for the total and subscale scores for the SPSSI-R-SF were good ( $\alpha = .77-.85$ ).

The NEO-Five Factor Inventory (NEO-FFI) (McCrae and Costa 2004) is a 60-item measure assessing five domains of personality: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. Each domain is comprised of 12 questions; however, only the neuroticism subscale was used in the current study, given its strong association with suicidal behavior and hopelessness (Duberstein et al. 2000), with higher scores indicating greater neuroticism (McCrae and Costa 2004). The neuroticism subscale had good internal consistency ( $r = .86$ ) and adequate test-retest reliability over three years ( $r = .62$ ) in an adult community sample (McCrae and Costa 2004), and has been used successfully in primary care (Chapman et al. 2007). In our sample, internal consistency was good ( $\alpha = .83$ ).

The Beck Hopelessness Scale (BHS) is a 20-item measure designed to assess the extent of negative attitudes about the future (Beck et al. 1974). The measure consists of true (0) or false (1) items, with scores ranging from 0 (no hopelessness) to 20 (extreme hopelessness). Scores ranging from 0 to 3 = minimal hopelessness, 4 to 8 = mild hopelessness, 9 to 14 = moderate hopelessness, and 15 to 20 = severe hopelessness. In diverse samples, the BHS exhibits good internal consistency and test-retest reliability, distinguishes suicide attempters from non-attempters (Beck et al. 1993), and is consistently a stronger predictor of suicidal behavior than depressive symptoms (Brown et al. 2000). Internal consistency in this study was excellent ( $\alpha = .94$ ).

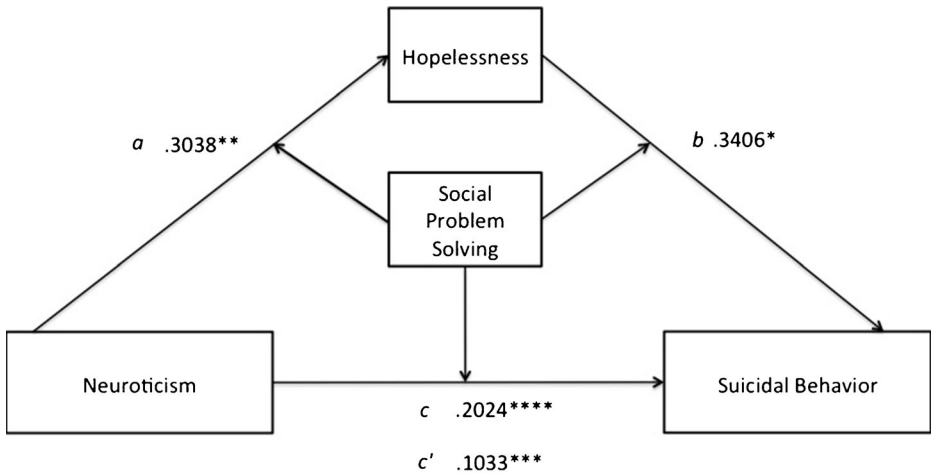
## Statistical Analyses

Pearson correlation coefficients were calculated to examine independence of, and associations between, study variables. Mediation, otherwise known as an indirect effect, occurs when the relation between an independent variable ( $X$ ) and a dependent variable ( $Y$ ) is explained, or partially explained, by the presence of a third variable ( $M$ ) (Preacher et al. 2007). We utilized a bootstrapping method, which involves repeated random samples of observations (Shrout and Bolger 2002), and which estimates path coefficients and generates confidence intervals for total and specific indirect effects of  $X$  on  $Y$  through the mediator variable  $M$ .

Additionally, however, it may be important to determine whether a mediating relationship remains constant across levels of a given variable. For example, “the strength of an indirect effect may depend linearly upon the value of a moderator ( $W$ )” (Preacher et al. 2007, p. 186). Thus, moderated mediation analyses were conducted using a publicly available SPSS syntax file, “PROCESS” (Hayes 2013), which implements a *post-hoc* bootstrap resampling process to determine conditional indirect effects at particular values of the moderator (Preacher and Hayes 2008). Covariates in all models included age, sex, and race (Fig. 1).

## Results

In our primary care sample, twenty percent ( $n = 86$ ) reported moderate hopelessness, and 18.5 % ( $n = 42$ ) reported severe hopelessness. Fifty-five percent ( $n = 123$ ) reported lifetime



$p \leq .05$ ; \*\*  $p \leq .01$ ; \*\*\*  $p \leq .001$ ; \*\*\*\*  $p \leq .0001$

**Fig. 1** Conditional indirect and direct effects of social problem solving on the associations between neuroticism, hopelessness, and suicidal behavior. Illustration of a conditional indirect effect model. A *total effect* ( $c$ ) occurs if there is a relationship between the IV and DV without accounting for the MV. That is, neuroticism affects suicidal behavior without accounting for hopelessness. A *direct effect* ( $c'$ ) occurs if there is a relationship between IV and DV after accounting for the MV. An *indirect effect* ( $ab$ ) occurs if the MV plays a role in the relationship between the IV and DV. That is, neuroticism affects suicidal behavior through hopelessness. *Conditional indirect effects* occur if the relationship between the IV and the MV, and the MV and DV, differ at levels of the moderating variable. That is, the relationship between neuroticism and hopelessness and between hopelessness and suicidal behavior differs at levels of social problem solving ability. A *conditional direct effect* occurs if the relationship between the IV and DV differs at levels of the moderating variable. Adapted from Preacher and Hayes (Preacher and Hayes 2008)

suicidal ideation, and 38.1 % ( $n = 85$ ) reported ideation during the past 12 months; 10 % ( $n = 22$ ) had communicated to another person that they felt suicidal, and 8.1 % ( $n = 18$ ) reported that they would attempt suicide in the future (See Table 1).

In bivariate analyses, neuroticism was significantly positively associated with hopelessness ( $r = .60, p < .001$ ) and suicidal behavior ( $r = .50, p < .001$ ), and hopelessness was positively associated with suicidal behavior ( $r = .56, p < .001$ ). Social problem solving ability was

**Table 1** Sample descriptives and bivariate correlations of study variables

	Mean	SD	SPSI- Total	NEO-FFI Neuroticism	BHS	SBQ-R
Age	44.08	12.15	-.06	.03	.13	.03
Social Problem Solving Ability (SPSI) – Total Score	12.01	3.67	-	-.65***	-.63***	-.40***
NEO-FFI Neuroticism Subscale	27.32	9.22	-	-	.60***	.50***
Beck Hopelessness Scale (BHS)	7.41	6.32	-	-	-	.56***
Suicidal Behavior (SBQ-R)	6.16	3.70	-	-	-	-

Neuroticism = NEO Five Factor Inventory; Suicidal Behavior = Suicidal Behaviors Questionnaire-Revised Total Score; Hopelessness = Beck Hopelessness Scale; Social Problem Solving = Social Problem Solving Inventory-Revised Total Score; \*\*\* =  $p < .001$

negatively associated with neuroticism ( $r = -.65, p < .001$ ), hopelessness ( $r = -.63, p < .001$ ), and suicidal behavior ( $r = -.40, p < .001$ ).

At the multivariate level, hopelessness significantly mediated the relation between neuroticism and suicidal behavior (IE lower 95 % CI = .05, upper 95 % CI = .63). Further, social problem solving ability significantly moderated the relations between neuroticism and hopelessness (95 % CI = .03 to .13) and between hopelessness and suicidal behavior (95 % CI = .01 to .10), indicating conditional indirect effects. Additionally, social problem solving ability significantly moderated the relation between neuroticism and suicidal behavior (95 % CI = .02 to .19), a conditional direct effect.

Post-hoc analyses confirmed the statistically significant presence of conditional indirect effects across percentiles of the moderator: 10th (95 % CI = .03 to .15), 25th (95 % CI = .03 to .11), 50th (95 % CI = .02 to .10), 75th (95 % CI = .01 to .10), and 90th (95 % CI = .01 to .10). Statistically significant conditional direct effects were also found at each percentile: 25th (95 % CI = .03 to .18), 50th (95 % CI = .05 to .18), 75th (95 % CI = .05 to .21), and 90th (95 % CI = .04 to .23), except the 10th percentile.

## Discussion

In our sample of low-income, primary care patients, we examined the associations between neuroticism, hopelessness, social problem solving, and suicidal behavior. In bivariate analyses, supporting hypotheses, neuroticism was positively associated with hopelessness and suicidal behavior, and social problem solving was negatively associated with neuroticism, hopelessness, and suicidal behavior. Also supporting hypotheses, in moderated mediation analyses, hopelessness mediated the relation between neuroticism and suicidal behavior, such that greater neuroticism was associated with more hopelessness and, in turn, to suicidal behavior. Social problem solving moderated these relations such that the relationships between neuroticism and hopelessness, between hopelessness and suicidal behavior, and between neuroticism and suicidal behavior, were stronger at lower levels (10th and 25th percentiles), and weaker at higher levels (50th, 75th, and 90th percentiles), of problem solving ability.

Our results support the well-established linkage between neuroticism and suicidal behavior, and highlight a potential mechanistic pathway – the role of hopelessness. In general, individuals with greater neuroticism experience distorted and maladaptive cognitive-emotional functioning and are at increased risk for negative outcomes, such as hopelessness (McCann 2010). This combination of low mood and lack of positive future orientation, as suggested by escape-based theories of suicide, may make suicide appear to be a viable coping solution (Baumeister 1990; Chioqueta and Stiles 2005).

We also confirmed the association between hopelessness and suicidal behavior. Similar to Beck et al.'s (1985) argument that hopelessness serves as the link between depression and suicide, we found that hopelessness serves as the link between neuroticism and suicide. Regardless of etiology, whether situation-specific, depression-based or stemming from neuroticism, hopelessness is an important suicide risk factor for suicide to be addressed in future research and prevention efforts (Beck et al. 1985).

Importantly, we identified social problem solving ability as a critical, potential point of intervention. The direct relation between neuroticism and suicidal behavior and the indirect effect of neuroticism on suicidal behavior via the mediator of hopelessness was stronger for individuals with less ability to solve problems. Given that neuroticism is often associated with

a perceived inability to cope with life's challenges, neurotic individuals may view problems as threats and employ passivity, impulsivity, or avoidance as problem solving efforts (D'Zurilla et al. 2011; Huband et al. 2007), engendering hopelessness (Speckens and Hawton 2005). Additionally, neuroticism was negatively related to adaptive problem solving in our sample, including rational problem management, suggesting the difficulty persons with a neurotic personality style may have engaging in adaptive coping.

Yet, our study indicates that for individuals who maintain a positive, rational and goal-oriented method toward stressor resolution, vulnerability is reduced, consistent with previous research indicating problem solving strengths are associated with less suicidal behavior (Becker-Weidman et al. 2010; Hirsch et al. 2012). Although a neurotic personality style may increase instability across interpersonal and socioemotional functioning and, whether directly or indirectly, may contribute to suicide risk, our results suggest that patients who have problem solving strengths are at less risk.

Our results should be interpreted in the context of minor limitations, including use of cross-sectional data, which precludes examination of causality. Our sample was also comprised largely of middle-aged, female, White individuals, which may limit generalizability. Future prospective, longitudinal research utilizing diverse samples is needed to confirm our findings. As well, other variables not considered in our models may contribute risk for or protection from suicide, and should be addressed in future research; for instance, lack of positive affect, a component of extraversion, is often more predictive of hopelessness and suicidal behavior than neuroticism (Duberstein et al. 2001). We also found that the relation between neuroticism and suicidal behavior was not moderated at low levels of problem-solving (i.e. 10th percentile), perhaps due to small cell sample size. Finally, use of self-report questionnaires may result in underreporting of suicidal behavior, perhaps due to demand characteristics such as social desirability. However, given the high rates of suicidal behavior in our sample, which were higher than in other primary care studies (Heisel et al. 2010; Wintersteen 2010), underreporting is unlikely.

Despite limitations, our results may have clinical implications for suicide prevention efforts within primary care settings. Although some studies suggest that universal screening has only a minimal impact on detecting or reducing suicidal behavior (O'Connor et al. 2013), given the high rates of ideation and attempts in our sample, screening for suicidal ideation may still be beneficial (Bostwick and Rackley 2012). For patients who endorse thoughts of suicide, an integrated approach to treatment that targets feelings of hopelessness and increases problem solving skills may be in order. Cognitive-behavioral interventions, such as restructuring negative automatic thoughts or environmental behavioral engagement (Brown et al. 2005; Stanley et al. 2009), or approaches that allow improvement of social problem solving ability, such as Problem Solving Therapy and Interpersonal Therapy (Neacsiu et al. 2010; Warmerdam et al. 2010), may result in decreased suicidal behavior (Stewart et al. 2009).

Finally, although neuroticism is a stable and pervasive personality trait, suggesting that it may be less malleable to change, the aforementioned interventions may ameliorate many of the negative characteristics often associated with neuroticism. For instance, cognitive-behavioral strategies such as reframing, or cognitive restructuring, may be helpful in challenging seemingly-hopeless situations, and Problem Solving Therapy techniques, such as goal adjustment, may bolster adaptive problem solving (Beck 2011; Stewart et al. 2009). Similarly, techniques such as mindfulness, or strategies from Dialectical Behavior Therapy, might be used to improve emotional dysregulation and reduce likelihood of engaging in maladaptive problem solving efforts, which would otherwise be risk factors for suicide (Amstadter 2008; Stanley et al. 2007).

In conclusion, we found that greater levels of neuroticism were related to more hopelessness and, in turn, to increased suicidal behavior. Furthermore, the indirect relationship between neuroticism and suicidal behavior, through hopelessness, and the direct relationship between these constructs were moderated by social problem solving ability. Primary care physicians, behavioral health consultants, and nursing staff may be better able to detect and treat suicidal ideation and prevent suicide attempts among their patients by: 1) screening for suicide risk, 2) assessing for levels of hopelessness and problem solving deficits and 3) utilizing brief, evidence-based treatments to improve social problem solving skills and reduce hopelessness.

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